Aug. 15, 1950 T. K. CORLESS 2,518,869

MUFFLER WITH ROTATABLE BAFFLE

Filed May 22, 1948 2 Sheets-Sheet 1

Fig. 1.

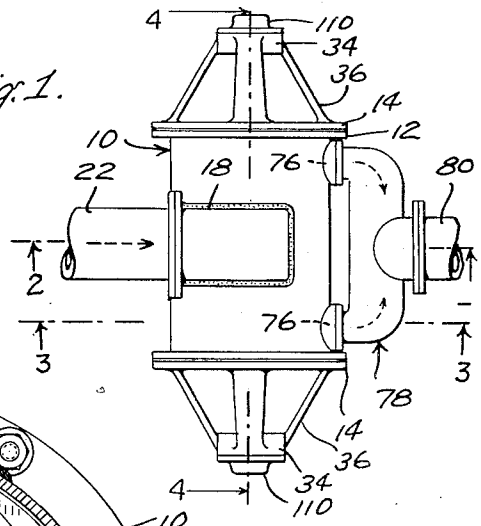
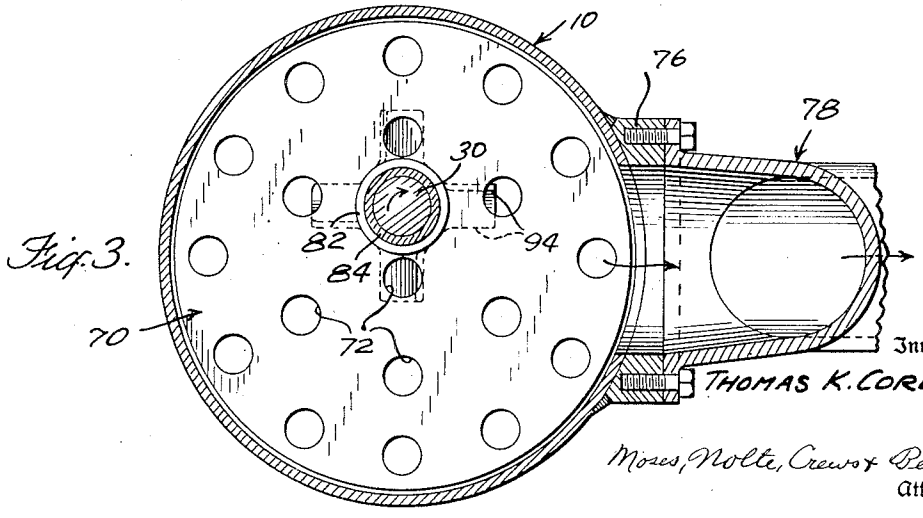


Fig. 2.

Fig. 3.



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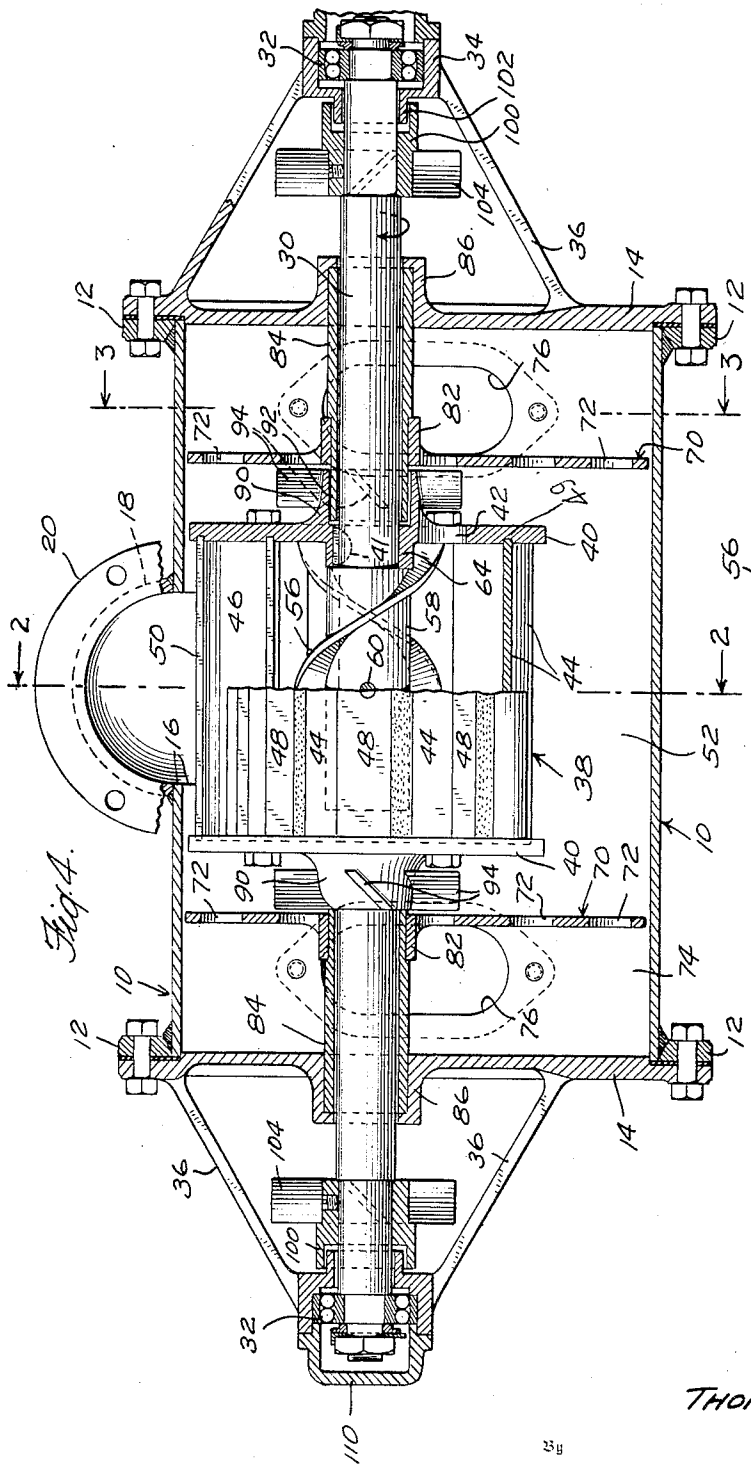


Fig. 4.

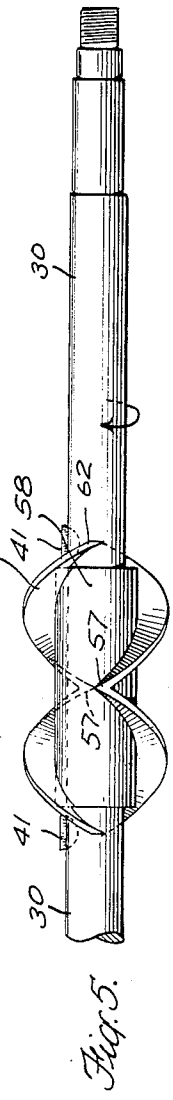


Fig. 5.

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MUFFLER WITH ROTATABLE BAFFLE

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13 Claims. (Cl. 181—64)

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This invention relates to mufflers for muffling the exhaust of internal combustion engines such as are used on automotive vehicles.

The principal object of the invention is to provide a muffler having a rotor therein which is caused to rotate at a high rate of speed by the passage of the exhaust gases through the muffler, the construction being such that a suction effect may be produced which tends to decrease the back pressure in the engine, thereby promoting economy of operation, which silences the exhaust and which creates a turbulence promoting complete combustion, thereby eliminating or reducing smoke or odors in the gases discharged from the muffler.

Another object of the invention consists in providing a highly durable muffler construction which may be economically manufactured, and in which the bearings for the rotary element of the muffler are so placed and constructed as to be maintained relatively cool, so that they may be maintained in effectively lubricated condition, and will provide a long period of usefulness without necessity for servicing.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings which illustrate a preferred embodiment of the invention.

The muffler of the present invention is an improvement upon that disclosed in my Patent No. 2,003,500, dated June 4, 1935.

In the accompanying drawings,

Figure 1 is a plan view of a preferred form of muffler;

Figure 2 is a transverse vertical section on lines 2—2 of Figs. 1 and 4;

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

Figure 4 is a longitudinal section on line 4—4 of Fig. 1, the rotor being shown partly in elevation and partly in section;

Figure 5 is a detailed elevation showing a part of the rotor axle with the helical blades thereon.

Referring to the drawings in detail, the muffler construction illustrated includes a casing 10, shown as cylindrical in form and provided with flanges 12 to which are bolted end plates 14. In the top of the casing is an inlet opening 16 over which is secured the inlet fitting 18. The latter may be secured to the top of the casing in any suitable manner, as for example by welding. The outer end of the inlet fitting is flanged as indicated at 20, and to this is bolted the pipe 22 coming from the exhaust manifold of the engine.

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The inlet fitting 18 is preferably made large enough to handle the exhaust from the maximum sized engine with which the muffler may be used. The same muffler with a slight change, to be described, may be used for engines of much smaller power than such maximum. In order to accomplish this result the opening 16 is preferably made somewhat shorter than the length of the intake fitting which is welded over it. This provides a baffle wall 24 cutting down the size of the inlet opening 16. In designing the muffler for a particular size engine, this baffle wall will be more or less extended, or cut away, and the size of the opening 16 more or less enlarged or reduced to fit the muffler to the particular case. When the muffler is fitted to an engine smaller than its maximum capacity, the opening 16 is cut down sufficiently so that the exhaust gases will still enter the muffler at a sufficiently high velocity to secure proper operation.

Extended eccentrically through the casing is a shaft 30 which is mounted to rotate in end bearings 32. Self aligning type ball bearings are preferably used to reduce friction. Where higher exhaust temperature is encountered, particularly in Diesel operation, distortion of machine parts from expansion stresses will be compensated for by these self aligning ball bearings. Bearings 32 are preferably mounted in housings 34 carried on struts 36 projecting from end walls 42. The bearings are thus spaced a considerable distance from the casing so that they do not become overheated, this result being enhanced by the fact that air may circulate freely around the bearings and between the struts 36.

Mounted on the shaft 30 is a rotor 38 which comprises a pair of end plates 40 provided with keys 41 securing the end plates 40 directly to the shaft 30. The end plates have holes 42 formed therethrough and carry a plurality of buckets 44. The buckets 44 are concavo-convex, being preferably of approximately semi-cylindrical form having concave faces 46 in which the gases are received and which reverse the direction of flow, thereby producing a reaction against the buckets which causes the rotor to rotate rapidly in a clockwise direction, as indicated by the arrow in Fig. 2. Each bucket also carries an extension or baffle plate 48 on its back, such baffle plate extending substantially tangentially to the outer part of the back of the bucket, and sloping inwardly so that the terminal edge of the baffle is substantially opposite to the center of concavity of the adjacent bucket. The gases in their reversal of flow in any particular bucket thus

have to pass around the baffle projecting from the back of the adjacent bucket. The fact that the baffles 48 are substantially tangential to the outer parts of the buckets near the leading edges 50 thereof, is important as it produces a form of bucket and baffle which is impinged upon by the gases entering through the inlet opening 16 such that a stream line effect is produced, causing the gases to be directed over the outside of the bucket adjacent to the leading edge and over the outside of the baffle plate 48 into the adjacent bucket so that at this point a smooth flow of gases into the bucket is obtained. It has been found that this construction results in a substantially silent action, as there is no siren effect produced by the rapidly moving buckets, such as has been found to occur when this formation at the outside of the bucket is not employed. Furthermore the gases are directed in an efficient manner, so that high speed of rotation of the rotor is secured.

The buckets and end plates may be joined in any suitable manner. As indicated the end plates are provided with recesses 49 shaped to fit the ends of the buckets, and the two end plates are held together tightly against the ends of the buckets by bolts 51.

The gases traveling around through the rotor are discharged centrifugally into the chamber 52 outside of the rotor which is of maximum width substantially opposite to the inlet opening. Part of the gases also pass out through the holes 42 in the end plates 40. The breaking up of the gases and this discharge endwise of the rotor is furthermore facilitated by the use of helical blades 56 formed on a sleeve 58 mounted on the shaft 30, and connected to rotate therewith, as by means of a pin 60. The blades are double right and left hand helices, each pair meeting at its apex 57 which is on the common center line of the rotor, see Fig. 5. The outer ends of the helical blades preferably extend slightly beyond the ends of the sleeve 58 as indicated at 62 and overlie inner hub portions 64 projecting from the inside surfaces of the end plates 40.

Mounted in the casing 10 at each side of the rotor are stationary diffuser plates 70 having a multiplicity of holes 72 therethrough. These diffuser plates separate the rotor chamber from the expansion chambers 74 which are between the diffuser plates 70 and the end walls 14 of the casing. The gases, after passing through the rotor which thoroughly mixes and churns up such gases, pass through the holes 72 into the expansion chambers 74 and leave the muffler through discharge openings 76, which may, if desired, be connected to a common discharge header 78 and to tail pipe 80. The plates 70 may be mounted in any suitable manner, but in order to avoid expansion stresses, are preferably not connected directly to the casing 10, but are mounted at their centers on flanges 82 which are mounted on sleeves 84 fitted in sockets 86 in the end plates 14. The inner diameters of the sleeves 84 are such as to permit the shaft 30 to pass freely through the same without friction, but clearance is kept as small as possible, and owing to the long length of the sleeves 84 practically no leakage of the gases will take place between the shaft and the sleeves. Leakage is further reduced by providing external hub flanges 90 on the outer surfaces of the walls 40, these flanges surrounding the projecting inner ends 92 of the sleeves 84. A narrow clearance is provided between the surfaces of 90 and 92 so as to obstruct the flow of gas, but not to create friction. In order to direct the gases out from the spaces between the parts 90 and 92 fan blades 94 may be formed on the outer surfaces of the flanges 90.

The construction of the parts is such that many parts may be formed by welding together standard shapes. For example, the casing 10 may be a large section of pipe to which the flanges 12 are secured by welding, the buckets 38 may be formed by welding flat plates forming the baffles 48 to curved half pipe sections constituting the buckets; the inlet fitting may be welded to the casing, as already described; and the fittings around the outlet openings 76 may be similarly applied if desired. The end plates 14 and struts 36 are shown as castings, but obviously may be otherwise fabricated if desired.

The bearings 34, being carried on the ends of struts 36 at a considerable distance from the ends of the casing, are easily maintained at a temperature below that which would interfere with proper lubrication. They are conveniently protected from dust, etc. coming from the exhaust, by means of flanged collars 100 mounted on the bearing casings. Fan blades 104 may be provided on the collars 100, these fan blades being pitched so as to draw cool air over the bearings and blow it towards the ends of the muffler. This keeps the dust and any hot exhaust gases which may be present away from the bearings. The bearings can be sufficiently lubricated by placing a suitable lubricant in the bearings, the outer ends of which are closed by caps 110.

By providing a muffler of the construction described with a freely rotating rotor therein, a high efficiency of operation of the engine is secured. At times when the speed of the engine decreases, or the throttle is closed, so that the volume of exhaust gas decreases, the rapidly revolving rotor, owning to its momentum, will apply a certain amount of suction to the engine exhaust which reduces back pressure and makes for most efficient operation under conditions of less than maximum power output. The action of the rotor in thoroughly agitating and stirring up the gases, followed by the expansion of the gases in the casing and through the diffuser plates 70 and into the expansion chambers 74 tends to promote complete combustion of the gases, the substantial elimination of smoke from the discharge, and reduction or elimination of noticeable odors from the discharge, particularly when the muffler is used with a Diesel engine. Substantially silent operation is also secured. The construction of the rotor and its mounting is also exceedingly durable and replacement or servicing of the parts is rarely required.

While I have illustrated and described in detail one preferred form of my invention, it is to be understood that changes may be made therein and the invention embodied in other structures. I do not, therefore, desire to limit myself to the specific constructions illustrated, but intend to cover my invention broadly in whatever form its principle may be embodied.

I claim:

1. A muffler for internal combustion engines, comprising a casing, a rotor mounted in said casing to rotate about an axis eccentrically located in the casing, an inlet port opening into the casing permitting the exhaust gases to enter the casing substantially tangentially of the rotor, a perforated diffusion plate mounted in the casing transverse to the axis of rotation of the rotor dividing off an expansion chamber in the casing from the rotor chamber of the casing, and a gas

discharge port opening into the expansion chamber.

2. A muffler for internal combustion engines including a casing having a tangential inlet port and an outlet port therein, and a rotor mounted for rotation in the casing, said rotor having a plurality of concavo-convex buckets therein, said buckets having baffles extending substantially tangentially from the convex sides thereof near the outer edges of said convex sides.

3. A muffler for internal combustion engines including a casing having a tangential inlet port and an outlet port therein, and a rotor mounted for rotation in the casing adjacent to said inlet port, said rotor having perforated end plates to provide gas discharge openings, and a plurality of concavo-convex buckets therein, said buckets having baffles extending substantially tangentially from the convex side thereof near the outer edges of said convex sides, said buckets being fixed between said end plates.

4. A muffler for internal combustion engines including a casing having a tangential inlet port and an outlet port therein, and a rotor mounted for rotation in the casing adjacent to said inlet port, said rotor having a plurality of concavo-convex buckets therein, said buckets having baffles extending substantially tangentially from the convex side thereof near the outer edges of said convex sides, said rotor being mounted for rotation about an axis eccentrically located in the casing nearer to the inlet opening in the casing than to the opposite side thereof.

5. A muffler for internal combustion engines comprising a casing, a pair of perforated diffusion plates mounted in the casing, and spaced from the ends thereof so as to divide the casing into a central chamber and two diffusion chambers, an inlet port opening into the central chamber, outlet ports opening into the diffusion chambers, and a rotor mounted to rotate in the central chamber adjacent to the inlet port, said rotor comprising end plates having large perforations therethrough for discharging gases into the spaces adjacent to said perforated diffusion plates, and concave buckets carried by and shrouded between said end plates.

6. A muffler for internal combustion engines, comprising a cylindrical chamber having end walls, bearings carried by the end walls mounted eccentrically with respect to the axis of the chamber, a shaft carried in said bearings and extending through the chamber, a pair of perforated diffusion plates carried by the end walls and spaced therefrom so as to provide diffusion chambers between said end walls and the respective diffusion plates, an inlet port opening into the chamber between the diffusion walls, an outlet port opening out of each diffusion chamber, and a rotor mounted on said shaft opposite to said inlet port, said rotor including a plurality of concave buckets adapted to receive exhaust gases entering the chamber through said inlet port, and end plates between which said buckets are enclosed, said end plates having large perforations therethrough for passage of the exhaust gases to the diffusion chambers.

7. A muffler for internal combustion engines comprising a chamber, a perforated diffusion plate spaced from one end thereof, a rotor mounted in said chamber adjacent to said diffusion plate for rotation about an axis at right angles to said plate, said rotor comprising end plates and buckets carried thereby, the end plate adjacent to said diffusion plate having a hub

thereon, means associated with said diffusion plate and hub forming a gas seal, and fan blades mounted on said hub.

8. A muffler for internal combustion engines comprising a casing, said casing including end plates and having inlet and outlet ports therein, bearings carried by the end plates, a shaft mounted in said bearings, a rotor carried by said shaft, a sleeve carried by each of said end plates in which said shaft is freely rotatable, and a diffusion plate mounted on each of said sleeves between the adjacent end plate and the rotor, said diffusion plates having holes therethrough and being supported by said sleeves with their marginal edges spaced from the inside of the casing.

9. A muffler for internal combustion engines comprising a casing, said casing including end plates and having inlet and outlet ports therein, bearings carried by the end plates, a shaft mounted in said bearings, a rotor carried by said shaft, a sleeve carried by each of said end plates in which said shaft is freely rotatable, a diffusion plate mounted on each of said sleeves between the adjacent end plate and the rotor, said diffusion plates having holes therethrough and being supported by said sleeves with their marginal edges spaced from the inside of the casing, said rotor comprising end plates and buckets extending therebetween, and helical vanes surrounding the shaft in the center of the rotor.

10. A muffler for internal combustion engines comprising a casing, said casing including end plates and having inlet and outlet ports therein, bearings carried by the end plates, a shaft mounted in said bearings, a rotor carried by said shaft, a sleeve carried by each of said end plates in which said shaft is freely rotatable, a perforated diffusion plate mounted on each of said sleeves between the adjacent end plate and the rotor, said rotor comprising end plates and buckets extending therebetween and helical vanes surrounding the shaft in the center of the rotor, said helical vanes comprising right hand and left hand portions meeting at the center.

11. A muffler for internal combustion engines comprising a casing having end walls and inlet and outlet ports in the casing, struts projecting from the end walls, bearings carried by said struts and spaced from said end walls, a shaft mounted in said bearings and passing through the end walls of the casing, a rotor mounted on said shaft adjacent to the inlet port in the casing, dust collars fixed on the shaft adjacent to said bearings, and fan blades carried by said dust collars.

12. A muffler for internal combustion engines comprising a casing having end walls and inlet and outlet ports in the casing, struts projecting from the end walls, bearings carried by said struts and spaced from said end walls, a shaft mounted in said bearings and passing through the end walls of the casing, a rotor mounted on said shaft adjacent to the inlet port in the casing, dust collars fixed on the shaft adjacent to said bearings, fan blades carried by said dust collars, perforated diffusion plates in the casing between the end walls thereof and the ends of the rotor, and spaced from said end walls and from said rotor, and fan blades carried by the rotor between the diffusion plates and the ends of the rotor.

13. A muffler for internal combustion engines, including a casing having a tangential inlet port and an outlet port therein and a rotor mounted for rotation in the casing, said rotor having a plurality of concavo-convex buckets therein of

substantially semi-circular dimensions, said buckets having baffles extending substantially tangential from the convex sides thereof near the outer edges of said convex sides, and terminating substantially in the planes of the mouths of the following buckets.

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