Aug. 2, 1938. G. A. KINGSLEY 2,125,449

MUFFLER

Filed April 5, 1935

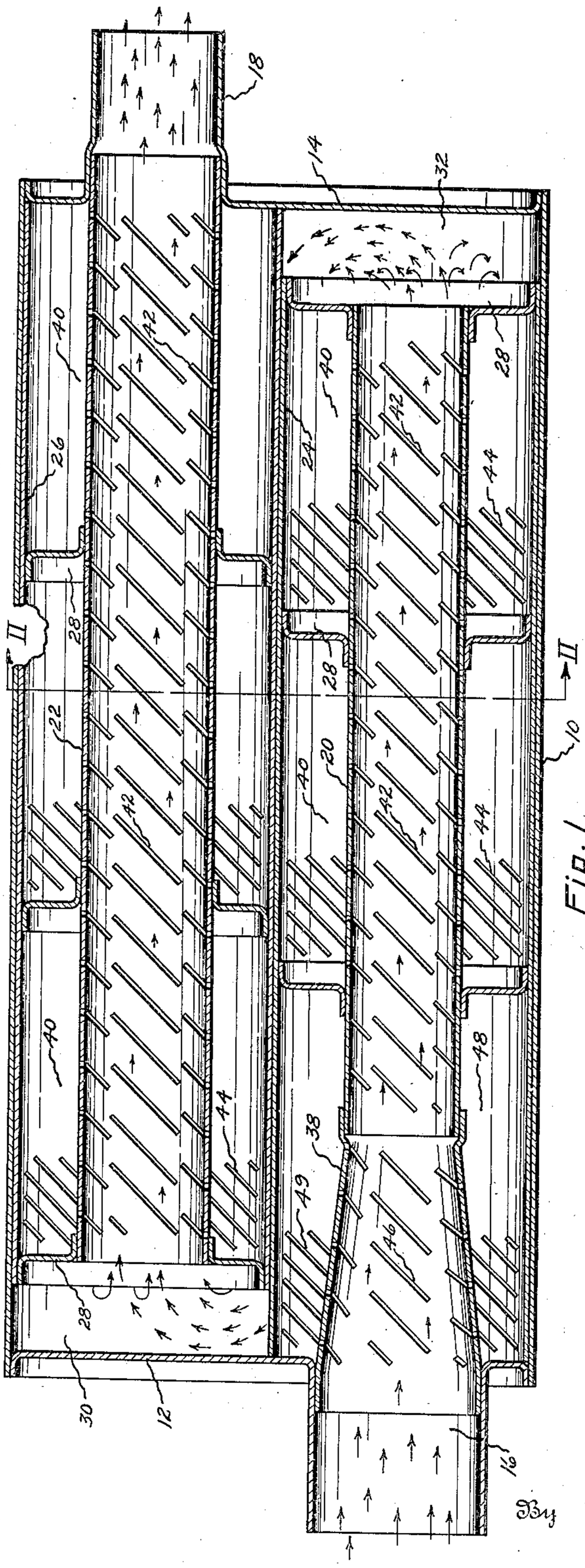

Fig. 1

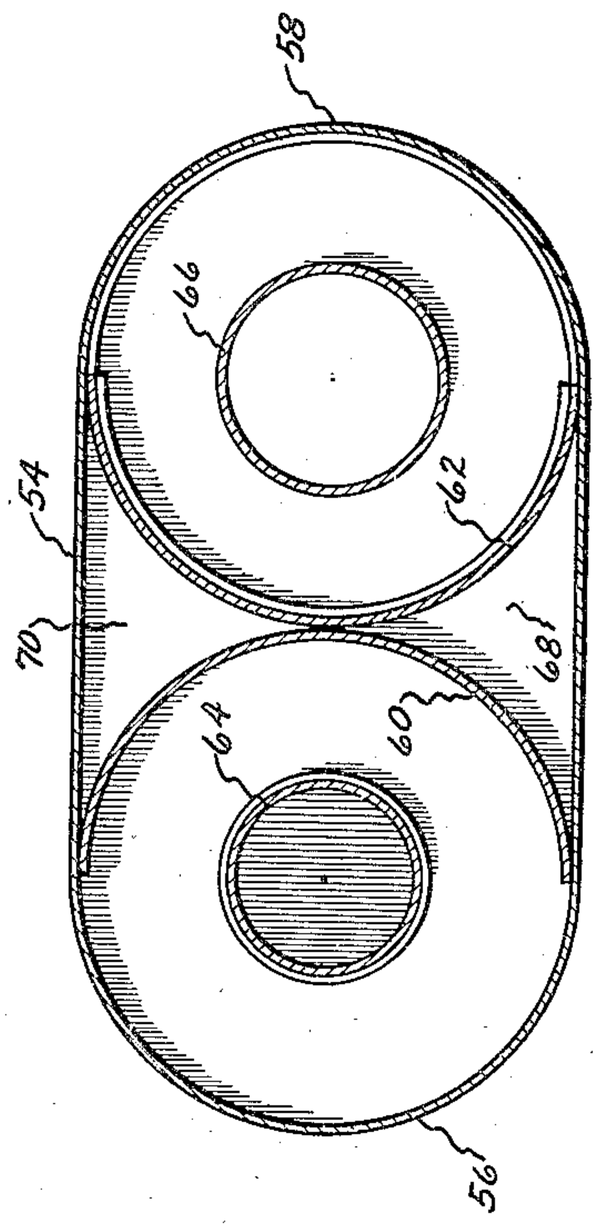

Fig. 3

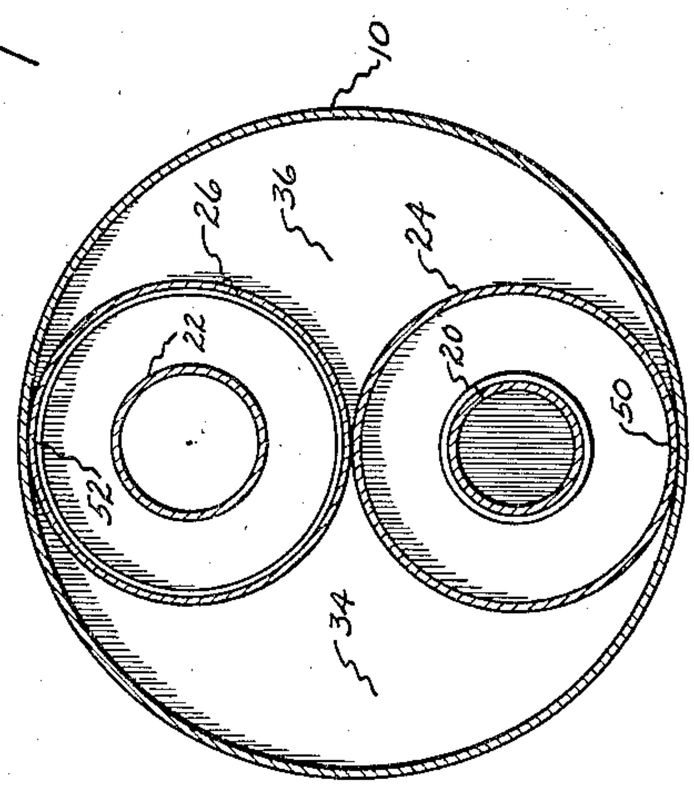

Fig. 2

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Patented Aug. 2, 1938 2,125,449

UNITED STATES PATENT OFFICE

2,125,449

MUFFLER

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Application April 5, 1935, Serial No. 14,850

8 Claims. (Cl. 181—54)

The present invention relates to improvement in muffler structure for internal combustion engines and having particular reference to mufflers of the general type illustrated by U. S. Patent No. 1,931,736 to Noblitt et al.

In mufflers of the above mentioned type to obtain compactness of structure the gases are passed back and forth through the muffler casing between the inlet and discharge openings. The design of the muffler is such that the gases have a relatively free passage through the muffler casing avoiding the creation of objectionable back pressure yet at the same time the muffler is characterized by its silencing efficiency.

It is an object of the invention to simplify and thus reduce the cost of manufacture of the above type of muffler and at the same time enhance the silencing efficiency thereof.

Another object is to provide a muffler which is strong and durable and particularly designed to resist destruction by backfire.

A still further object is to produce a muffler in which deceleration noises are avoided as well as high pitch noises or "whistling" at time of high gas velocity.

In the specific embodiment shown in the above mentioned patent three separate tubes are provided in the muffler casing for a triple passage of the gases. According to the present invention a triple passage of the gases through the casing is possible with a pair of tubes; the muffler casing acting as a conduit for the gases from one end of the muffler casing to the other and for interconnecting such tubes. In the preferred form, these main tubes, through which the main flow of gases pass, are each concentrically supported within intermediate tubes which define a chamber about each tube separating the same from the muffler casing. These chambers are divided up by partitions into separate chambers arranged longitudinally of each tube. The main tubes are perforated to effect communication with the chamber surrounding the same. In the silencing of the exhaust gases of certain engines perforations may also be advantageously provided in the intermediate tubes to effect a diffusion or short circuiting of the gases into the conduit defined by the muffler casing.

In the accompanying drawing wherein two forms of the invention are illustrated,

Fig. 1 is a cross-sectional view through the muffler casing,

Fig. 2 is a cross-sectional view taken on line II—II of Fig. 1, and

Fig. 3 is a view similar to Fig. 2 of a modified form of the invention.

In the muffler illustrated in Figs. 1 and 2, the cylindrical outer casing 10 is closed at opposite ends by headers 12 and 14 having inlet and discharge openings 16 and 18, respectively. Tubes 20 and 22 constituting main conduits for the flow of gases between the inlet and outlet openings are concentrically supported within intermediate tubes 24 and 26 by baffle members 28. These pairs of concentrically associated tubes are located in overlapping relation within the casing 10 to provide chambers 30 and 32 communicating with longitudinally extending chambers 34 and 36 defined within the casing 10. The tube 20 is shown communicating with the inlet 16 through a conical connector 38.

The tubes 20 and 22 are shown as perforated to effect communication with the chambers 40 which act as acoustic wave filters or resonator in a manner well known. Preferably the perforations in the tubes 20 and 22 take the form of angularly disposed elongated slots 42 as such a configuration has been found to eliminate the creation of high pitch noises or "whistling" in the muffler due to the passage of the gases across the same, all as fully discussed and treated in my copending application Serial No. 14,348, filed April 5, 1935. These chambers 40 may be closed in some instances and in others it has been found advantageous to perforate the same in some suitable manner such as with slots 44 which permits a diffusion or short circuit of a portion of the gas flow out of the intermediate tubes 24 and 26 into the chambers 34 and 36 or from the intermediate tube 24 through the chambers 34 and 36 into the intermediate tube 26 and hence into the tube 22 into the discharge flow. The size and number of perforations in the chambers 40 may be varied at will to regulate the back pressure in the muffler. Also this diffusion of the gas flow between the intermediate tubes is of assistance in noise suppression as the sound waves from the inlet and discharge tubes 24 and 22 meet and cancel each other.

It is to be noted that the connection 38 is shown as provided with perforations 46 similar to those in the tubes 24 and 22 permitting a portion of the gases to flow into the chamber 48 and hence into the chambers 34 and 36 through perforations 49. By regulating the perforated area in the connection 38 the same muffler structure is adaptable to different engines with controlled back pressure. Obviously by short circuiting a portion of the gas flow the diameter

of the inlet tube 20 can be substantially less in diameter than the exhaust pipe leading to the muffler without building up back pressure. Thus the chambers 40 surrounding the tube 20 are of maximum volume which enhances the noise suppression properties of the same and makes it possible to reduce the diameter of the casing 10 to a minimum.

At the present time it is my theory that the angularly disposed slots 42 impart a whirling action to the gases flowing along the inlet and discharge tubes 20 and 22 and that a similar action is imparted to the gases filling and passing through the chambers 40. This whirling action of the gases is thought to be at least in part responsible for the improved sound suppression characteristic of my improved muffler. Another important feature of the present invention contributing to the silencing effectiveness of the invention resides in the double wall made up of the casing 10 and the intermediate tubes 24 and 26 as at 50 and 52 in Fig. 2. This prevents or decreases so called "shell noise". A further silencing feature resides in having a large chamber made up of the chambers 30, 32, 34 and 36 between the inlet and discharge tubes making a balanced circuit. This large chamber as located acts to obviate deceleration noises instead of agitating the same as in the usual case with a chamber in a circut, especially in the more restricted type of muffler. This large chamber acts as a conducting passage between the inlet and discharge tubes 20 and 22 opening into and leading from the chambers 32 and 30, respectively. It also acts to expand and cool the gases and as a general diffusion chamber when the chambers 40 are perforated.

In the modified embodiment of the invention shown in Fig. 3, the outer casing 54 is oblong with semi-cylindrical portions 56 and 58 which together wih longitudinal split tubes 60 and 62 define tubes corresponding to the intermediate tubes 24 and 26. Inlet and discharge tubes 64 and 66 are concentrically supported within the semi-cylindrical portions 56 and 58. The arrangement of these tubes may be the same as in the structure shown in Fig. 1 with opposite ends thereof communicating with the chambers 68 and 70 corresponding to the chambers 34 and 36. The structure shown in Fig. 3 has the advantage that the outer casing defines in part the intermediate tubes and permits the use of two half tubes in lieu of two whole tubes as in the structure shown in Figs. 1 and 2.

As many changes may be found necessary in the muffler structure shown and disclosed to meet particular engine requirements without departing from the scope of the invention, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense. For the most part these changes will be confined to variations in proportions of parts, the perforations and configuration of the conductors for the gases, and the position of the associated tubes relative to each other. For example, the tubes 20 and 22 need not be concentrically located within the tubes 24 and 26. Installation of the muffler may require that such tubes be eccentrically associated. Other changes will readily occur to those skilled in the art.

Having described my invention what I desire to protect by Letters Patent and claim is:

1. A muffler comprising a casing having inlet and discharge openings at opposite ends thereof, an inlet conduit for conducting gases from one end of said casing and discharging the same into the interior of the casing at the opposite end thereof, a second conduit for conducting gases from the interior of said casing at the inlet end of the same to said discharge opening, and means restricting the flow of gas adjacent the inlet end, said first conduit having means for short circuiting a portion of the gas flow therethrough into the interior of said casing adjacent the inlet end.

2. A muffler comprising a casing having inlet and discharge openings, inlet and discharge tubes communicating with said openings, said tubes being located in said casing in offset relation and constituting conduits for the free passage of exhaust gases from one end of said casing to the other, said tubes at opposite ends of said casing opening into the interior thereof, and an expansion chamber through which communication is established between said tubes, said inlet tube being of less cross-sectional area than said inlet opening, said inlet tube having means for short circuiting a portion of the gas flow therethrough into the interior of said casing adjacent the inlet end.

3. A muffler comprising an elongated cylindrical outer casing closed at both ends except for inlet and discharge openings, inlet and discharge cylindrical tubes located within said casing and communicating with said openings, said tubes being disposed in offset relation and extending throughout substantially the length of said casing affording an unobstructive free passage of the gases therethrough, intermediate cylindrical tubes within which said first tubes are supported and defining a chamber therewith, said intermediate tubes having an inside diameter of approximately one-half the diameter of said outer casing whereby said intermediate tubes are closely fitted thereto to provide a double wall structure for said first tubes, said first tubes being perforated along their length and at opposite ends opening into opposite ends of the interior of said casing.

4. A muffler comprising an elongated casing having inlet and discharge openings at opposite ends, inlet and discharge tubes in offset relation communicating with said openings and defining free passageways for the flow of gases longitudinally of said casing, intermediate tubes within which said first tubes are supported to define chambers, perforations in said first tubes communicating with said chambers, said first tubes opening into the interior of said casing at opposite ends thereof, said casing and intermediate tubes defining an expansion chamber for the gases and a conduit through which communication is effected between said first tubes.

5. A muffler comprising an elongated casing having inlet and discharge openings at opposite ends thereof, means defining passageways for the free flow of gases back and forth longitudinally of said casing between said openings, and means located adjacent said inlet opening for restricting the flow of gases passing toward said passageways, said passageways having means for short circuiting a portion of the restricted gases from one to another thereof.

6. A multiple muffler comprising an elongated casing having inlet and discharge openings at opposite ends thereof, offset means defining passageways for the free flow of gases from and toward said openings, an expansion chamber and passageway defined by said means and cas-

ing communicating with said means through which the gases flow in a counter-direction to the flow in said means, and means defining a passage adjacent said inlet opening for short circuiting a portion of the flow of gases.

7. A multiple gas muffler comprising an outer casing, inlet and discharge headers therefor, means with said headers defining chambers at opposite ends of said casing, a perforated inlet tube for conducting gases longitudinally of said casing and opening into one of said chambers, a perforated discharge tube for conducting gases longitudinally of said casing leading from the other of said chambers, means defining a series of longitudinally arranged resonance chambers with each of said tubes, said last means and casing defining an elongated chamber constituting a return between said first chambers.

8. A multiple gas muffler comprising an outer casing, inlet and discharge headers therefor, means with said headers defining chambers at opposite ends of said casing, a perforated inlet tube for conducting gases longitudinally of said casing and opening into one of said chambers, a perforated discharge tube for conducting gases longitudinally of said casing leading from the other of said chambers, and means defining a series of longitudinally arranged resonance chambers within each of said tubes, said last means and casing defining an elongated chamber constituting a return between said first chambers.

GEORGE A. KINGSLEY.