

June 8, 1937.

E. C. HORTON

2,083,516

MUFFLER

Filed April 26, 1935

2 Sheets-Sheet 1

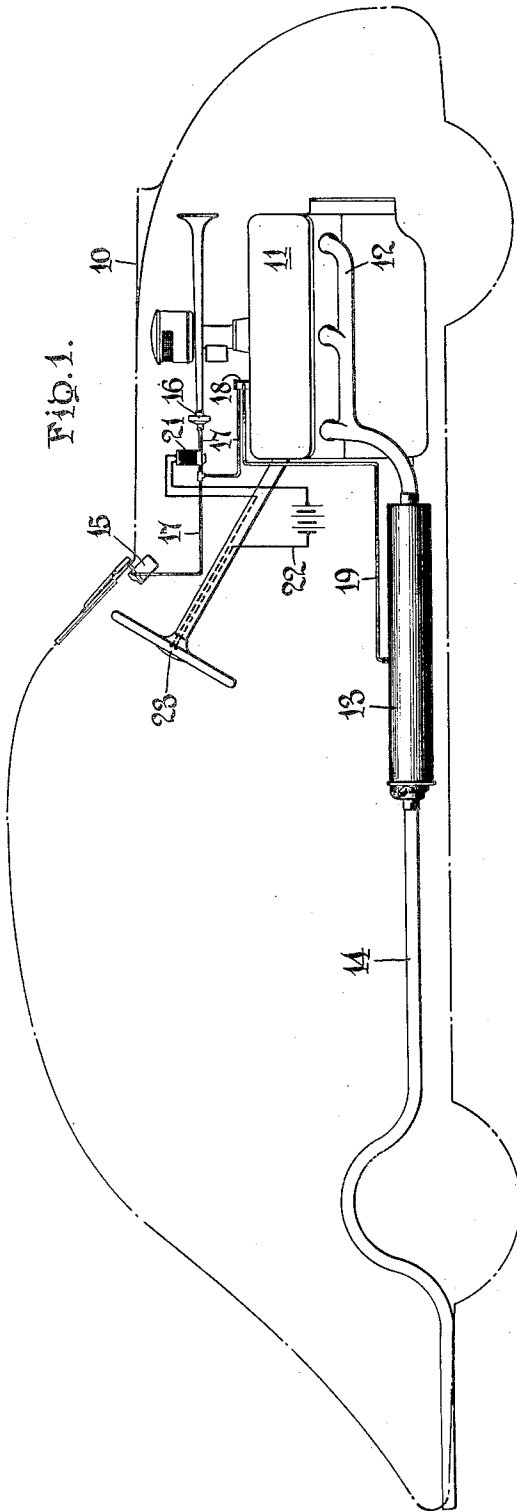
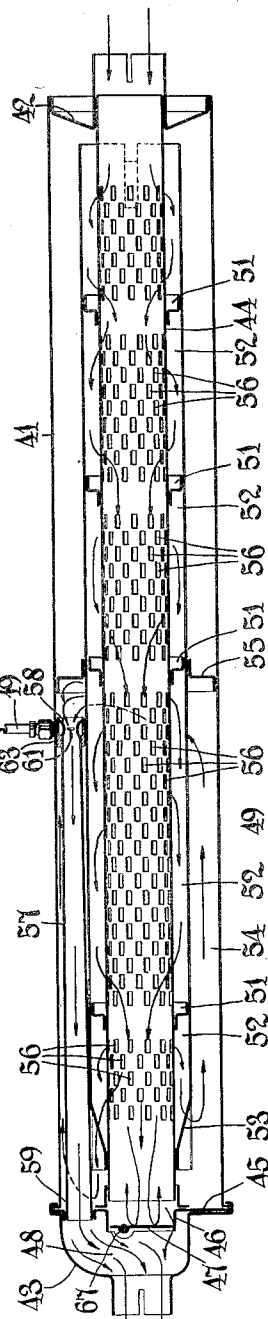


Fig. 2.



INVENTOR
Erwin C. Horton
BY
Beau, Brooks, Buckley & Beau,
ATTORNEYS

June 8, 1937.

E. C. HORTON

2,083,516

MUFFLER

Filed April 26, 1935

2 Sheets-Sheet 2

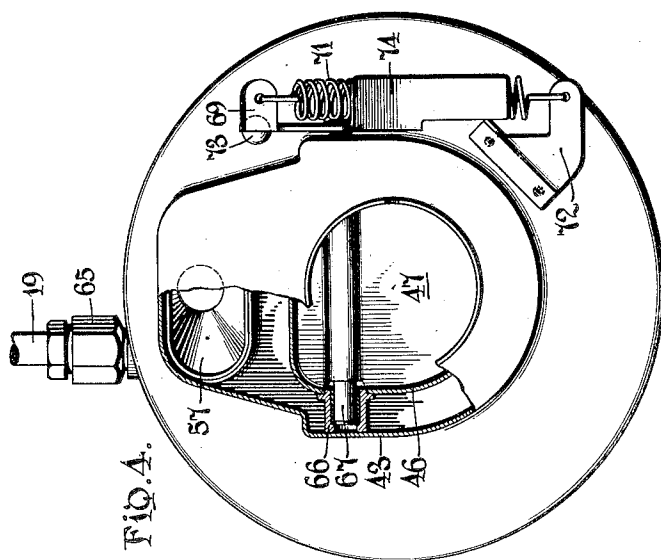


FIG. 4.

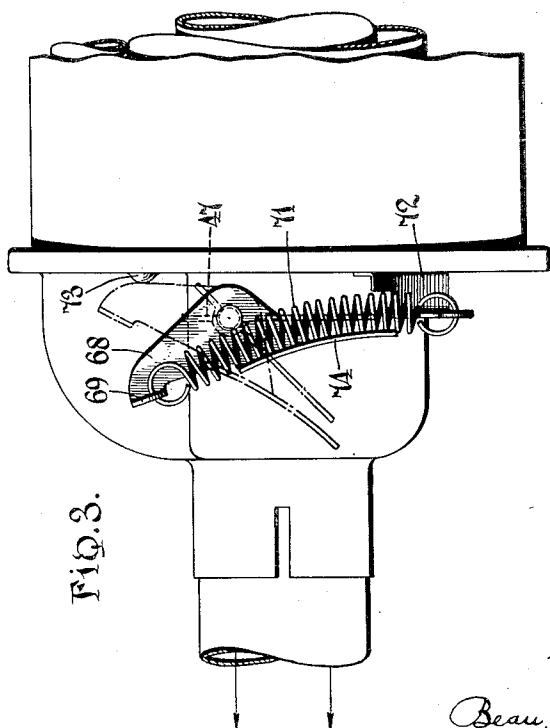


FIG. 3.

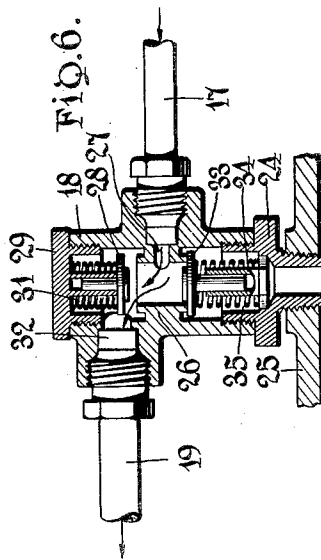


FIG. 6.

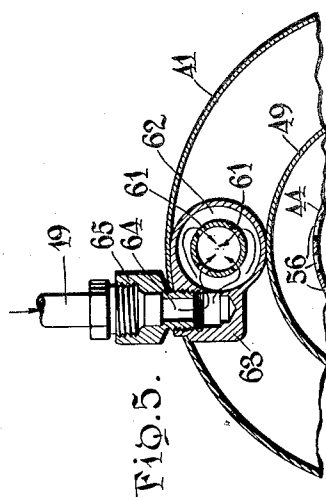


FIG. 5.

INVENTOR
Erwin C. Horton
 BY
Beau, Brooks, Buckley & Beau.
 ATTORNEYS

UNITED STATES PATENT OFFICE

2,083,516

MUFFLER

Erwin C. Horton, Hamburg, N. Y., assignor to
Trico Products Corporation, Buffalo, N. Y.

Application April 26, 1935, Serial No. 18,475

10 Claims. (Cl. 181-65)

This invention relates to a muffler for an internal combustion engine, and particularly to a muffler construction having suction producing means incorporated therewith.

5 According to the invention, the muffler casing encloses a perforated tube through which exhaust gases pass, the perforations leading to and from expansion chambers around the perforated tube, so that the gases may expand into the
10 chambers and return to effect a muffling action. A Venturi tube suction producing device, also enclosed within the casing receives exhaust gases from one of the expansion chambers and discharges into an outlet chamber into which the
15 perforated tube also discharges. A pressure responsive valve at the outlet end of the perforated tube is closed when pressure within the tube is low, in order that adequate flow of exhaust gases through the venturi is assured, but is opened
20 when the pressure increased beyond a predetermined degree in order to avoid excessive back pressure in the engine exhaust system.

The pressure responsive valve is controlled by spring means so arranged that greater pressure,
25 of exhaust fluid within the muffler, is required to effect initial opening of the valve than is required to return the valve in opened position. By this means, the valve will not partially open by reason of relatively slight increases in pressure
30 not sufficient to maintain it opened, and thus the number of movements of the parts is reduced.

These and other objects and advantages of the invention, including those inherent in the details of the arrangement of parts, will become apparent from the following description, which is
35 made with reference to the accompanying drawings, wherein:

Fig. 1 is a diagrammatic view of a motor vehicle, showing the muffler of the present invention associated with the vehicle engine and suction accessory system;

Fig. 2 is a vertical section taken longitudinally through the muffler;

Fig. 3 is a fragmentary side elevation showing the valved, or outlet, end of the muffler;

Fig. 4 is an end view of the muffler;

Fig. 5 is a fragmentary vertical cross-section taken on a plane passing through the restricted throat of the venturi; and

50 Fig. 6 is a vertical sectional view of valve means shown mounted upon the engine in Fig. 1.

As shown in Fig. 1, the vehicle 10 has an internal combustion engine 11 with exhaust manifold 12, muffler 13, and exhaust pipe 14. The
55 vehicle also has suction-operated accessories in-

cluding windshield cleaner 15 and trumpet 16, connected by conduits 17 to a valve fitting 18 mounted on the engine intake manifold which constitutes a source of suction. A conduit 19 extends from the Venturi suction producing means
5 of the muffler to the valve fitting 18. Operation of the trumpet 16 is controlled by electromagnetic valve 21 in the trumpet branch of conduit 17, the valve 21 in turn being controlled by an electrical circuit 22 which includes a button type
10 circuit breaker 23 mounted on the steering wheel or steering column of the vehicle.

The valve fitting 18 comprises a hollow casing connected by nipple 24 to the intake manifold
15 25. The casing has an interior tubular portion 26 into which opens passage 27 from the conduit 17, and the upper and lower ends of which constitute valve seats. Valve 28, guided by casing closure 29, is normally pressed against the upper
20 valve seat by spring 31 to close communication between conduit 17 and the passage 32 through which conduit 19 opens into the upper portion of the valve casing. Another valve, 33, guided by a tubular guide member 34 in the lower portion
25 of the valve casing, is normally pressed against the lower valve seat by spring 35.

It will be understood readily that when the degree of suction maintaining within manifold 25 is slightly greater than that in conduit 19, valve 33 will be opened by reason of the pressure differential on the opposite faces thereof, and that
30 valve 28 will be closed for a like reason. Thus fluid (atmospheric air) will be drawn from the accessories 15, 16, during their operation, through conduit 17 into the intake manifold. But
35 when the degree of suction within conduit 19 exceeds, by a predetermined amount, that maintaining in the intake manifold, the resulting pressure differentials on the faces of the valves will cause valve 28 to open and valve 33 to close,
40 so that during operation of the accessories 15, 16 fluid will be drawn through conduit 17 into conduit 19.

Muffler 13, which embodies means for producing the suction that is effective through conduit
45 19, comprises a tubular casing 41 with inlet and outlet end walls 42 and 43, respectively, provided with nipples for connection to exhaust manifold 12 and exhaust pipe 14. Extending longitudinally through casing 41 is a tube 44 connected at one
50 end to wall 42 to receive all gases coming from manifold 12, and connected at its opposite end to a partition wall 45 adjacent end wall 43. Partition wall 45 has a tubular portion 46 in alignment with and constituting an extension of tube
55

44, and a valve 47 in portion 46 separates the interior of the tube 44 from the space between walls 43 and 45 which is designated outlet chamber 48.

Surrounding tube 44 and terminating short of walls 42 and 45 is a second tube, 49. Substantially annular wall members 51 at spaced intervals along the tubes serve to separate the latter and to support the tube 49. Thus a series of expansion chambers, designated 52, are formed around tube 44. Multiple perforations 56 through tube 44 are so arranged that exhaust gases may pass from the tube interior into chambers 52 or return therefrom. The end of tube 49 nearest wall 45 is slitted longitudinally and portions 53 thereof are deformed to engage the tube 44. This construction provides enlarged openings between the endmost chamber 52 and the chamber designated 54, between the outer surface of tube 49 and the casing 41 and between wall 45 and an annular wall 55. The latter, in the illustrated construction is approximately midway between walls 42 and 45, and serves to provide additional support for tubes 44 and 49.

Arranged longitudinally within chamber 54 is a Venturi tube 57, having its inlet orifice 58 spaced from annular wall 55 and its discharge end 59 extending through wall 45 to discharge into outlet chamber 48. Adjacent the inlet orifice of the Venturi tube is a restricted portion having apertures 61 communicating with a suction chamber 62 formed in a fitting 63. The latter surrounds and supports the inlet end of the Venturi tube and has a passage 64 connecting conduit 19 with chamber 62 (Fig. 5). A nipple 65 serves to join conduit 19 to fitting 63.

Mounted on tubular portion 46 of wall 45 are opposed bearings 66 for pintle 67 upon which valve 47 is carried. As shown in Fig. 4, the bearings 66 may be retained in place by abutment against end casing wall 43. One end of pintle 67 extends through wall 43 and carries a lever arm 68, to the free end 69 of which is fastened a coiled tensioned spring 71. The opposite end of the spring is fastened to a bracket 72 which constitutes a stationary part of the muffler casing.

As shown in Fig. 3 the arm 68 is so related to valve 47 and spring anchorage 72 that when the valve is in open position (as shown by broken lines in Fig. 3) the line of pull of the spring approaches the axis of pintle 67, or, in other words, the arm 68 approaches dead center position with respect to the spring. Accordingly as the valve approaches closed position, the leverage of the spring is increased.

A stationary stop 73 prevents the arm 68 from reaching full dead-center position, so that the spring 71 is always effective to some extent in urging closing movement of the valve. Closing movement of the valve is limited and determined by movable stop 74. The latter, in the illustrated embodiment, is a part of arm 68, and of course is movable with the arm and valve. By means of this movable stop, cessation of closing movement of the valve is cushioned and the spring is not relieved entirely of its tension.

In operation of the muffler, exhaust gases or fluids will enter tube 44 moving in the direction of the arrows in Fig. 1. Pulsations of the gases, causing alternate increase and decrease of the fluid pressure in the tube 44, will effect alternate expansion of the gases through apertures 56 into expansion chambers 52 and return into tube 44. Such action will tend to decrease the pressure

pulsations in tube 44 and will serve to muffle the accompanying noise.

Upon reaching the exhaust end of tube 44, if the valve 47 is closed, the gases will pass from the endmost chamber 52 through openings 53 into chamber 54 and thence through the Venturi tube 57 and outlet chamber 48 into the exhaust pipe, as indicated by arrows in Fig. 2. Passage of the gases through the Venturi tube will, of course, effect reduction of static pressure at the restricted portion thereof with the result that fluid will be drawn from chamber 62 through the apertures 61, thus providing the source of low pressure or suction for the operation of accessories 15, 16.

When engine operation is at a low rate, so that the quantity of exhaust fluid is slight, the mode of operation will be as described above. When, however, this quantity is increased, with resultant increase in the pressure within tube 44, the valve 47 which is off-set relative to the axis of pintle 67, may be opened against the resistance of spring 71 to thereby relieve excessive back pressure (pressure within tube 44). By reason of the dead-center relationship of arm 68 and spring 71 when the valve is open, the degree of back pressure necessary to initially open the valve is substantially greater than that necessary to retain the valve opened, and, accordingly, the valve will not be subjected to such frequent opening and closing movement as it might otherwise.

It will be understood that the apparatus herein described is merely illustrative of the inventive principles involved, and that the latter may be embodied in other physical formations without departing from the scope or spirit of the invention.

What is claimed is:

1. In a muffler, a perforated tubular member open at one end for receiving exhaust gases, a pressure responsive valve at the other end of said tubular member for opening in the presence of more than a predetermined pressure within said tube, a second tube surrounding the first-mentioned tube and spaced therefrom by plural wall members at spaced intervals along the tubes, a muffler casing extending about said tubes and valve and defining an outlet chamber beyond the valve and a chamber around the second tube, the end of said last-mentioned chamber adjacent the valve being in communication with the space between tubes, and a Venturi tube having a suction take-off arranged longitudinally within the last-mentioned chamber and having its discharge opening into said outlet chamber.

2. In a muffler, a perforated tube open at one end for receiving exhaust gases, a pressure responsive valve at the other end of said tubular member for opening in the presence of more than a predetermined pressure within said tube, an outlet chamber for receiving gases passing by the valve, a plurality of chambers about said perforated tube whereby exhaust gases may pass from the tube through its perforations into said last mentioned chambers and return therefrom through the perforations, and a Venturi tube having a suction take-off, said Venturi tube having its inlet opening communicating with one of said plurality of chambers and its outlet opening communicating with said outlet chamber.

3. In a muffler, an elongated tubular casing with an exhaust gas inlet at one end and an outlet at the other end, a wall near the outlet and defining with the casing an outlet chamber, a tube extending from said inlet into the outlet chamber, said tube being perforated, a second

tube within the casing surrounding the first tube for defining therewith an expansion chamber, an opening in the second tube adjacent said wall whereby exhaust gases may pass from the expansion chamber into the space between the second tube and the tubular casing, and a Venturi tube substantially parallel to said tubes disposed in said space and having its inlet end remote from said wall and its outlet end extending through the wall into said outlet chamber, said Venturi tube having an opening at the restricted throat portion thereof and a suction conduit communicating with said opening.

4. In a muffler, an elongated tubular casing with an exhaust gas inlet at one end and an outlet at the other end, a wall near the outlet and defining with the casing an outlet chamber, a tube extending from said inlet into the outlet chamber, said tube being perforated, a second tube within the casing surrounding the first tube for defining therewith an expansion chamber, an opening in the second tube adjacent said wall whereby exhaust gases may pass from the expansion chamber into the space between the second tube and the tubular casing, a Venturi tube substantially parallel to said tubes disposed in said space and having its inlet end remote from said wall and its outlet end extending through the wall into said outlet chamber, said Venturi tube having an opening at the restricted throat portion thereof and a suction conduit communicating with said opening, and a pressure responsive valve at the outlet chamber end of the first-mentioned tube for opening in the presence of pressure within the tube of greater than a predetermined degree.

5. In a suction producing muffler, a casing having a passage and a by-passage between its inlet and outlet ends, a venturi with a suction take-off in one of said passages, a butterfly valve in one of said passages, off-center pivot means pivoting the valve to the casing, whereby a predominating pressure on one face of the valve will urge the latter to open, a lever arm connected to the valve, and tension spring means connected at one end to the free end of the lever arm and at the other end to a part of the casing, said part being on the opposite side of the axis of the pivot means from the lever arm and being so disposed relative to the pivot means and lever arm that the free end of the arm and said part will approach alignment with the pivot means when the valve is in open position.

6. In a suction producing muffler, a casing having a passage and a by-passage between its inlet and outlet ends, a venturi with a suction take-off in one of said passages, a valve in one of said passages, off-center pivot means pivoting the valve and the casing, whereby a pressure-differential on opposite faces of the valve will urge the valve to open, a lever arm connected to the valve, and spring means connected to the lever arm for urging the valve to closed position, said lever arm approaching dead center position

with respect to the direction of pressure of the spring means when the valve is in open position, whereby a materially lesser pressure differential will retain the valve opened than is required to initially open it.

7. In a muffler, a casing having a passage for exhaust gases, a butterfly valve in the passage, pivot means offset from the center of the valve pivoting the valve to the casing, a lever arm connected to the valve, and a tension spring connected to the free end of the lever arm and to a point on said casing, said point on the casing being on the opposite side of the pivot means from the free end of the lever arm and approaching alignment with the pivot means and said free end when the valve is in open position, and a stop member movable with the lever arm and engageable with the spring when the valve approaches closed position.

8. In a muffler, a casing having a passage for exhaust gases, a butterfly valve pivoted to the casing for closing said passage, the pivot for the valve being off-center whereby a pressure differential on opposite faces of the valve will urge the valve to open, a lever arm connected to the valve, and a spring connected to the lever arm for urging the valve to closed position, said lever arm approaching dead center position with respect to the spring means when the valve is in open position, whereby a materially lower pressure differential will retain the valve opened than is required initially to open it, and a stop member movable with the lever arm for engaging against the spring to limit the movement when the valve approaches closed position.

9. In a muffler, a casing having a passage for exhaust gases, a butterfly valve for said passage pivoted to said casing, the pivot being offset from the center of the valve whereby a predominating pressure on one face of the valve will urge opening movement of the latter, a lever arm connected to the valve, and tension spring means connected to the free end of the lever arm and to a part of said casing, said part of the casing being on the side of the pivot opposite to the free end of the lever arm and so disposed that when the valve is in open position said part is in substantial alignment with said free end of the lever arm and the valve pivot.

10. In a muffler, a casing having a passage for exhaust gases, a butterfly valve pivoted to the casing for closing said passage, the pivot for the valve being off-center whereby a pressure differential on opposite faces of the valve will urge the valve to open, a lever arm connected to the valve, and spring means connected to the lever arm for urging the valve to closed position, said lever arm approaching dead-center position with respect to the direction of pressure of the spring means when the valve is in open position, whereby a materially lesser pressure differential will retain the valve opened than is required to initially open it.

ERWIN C. HORTON.