No. 813,203. PATENTED FEB. 20, 1906.

G. E. FRANQUIST.

MUFFLER.

APPLICATION FILED SEPT. 13, 1905.

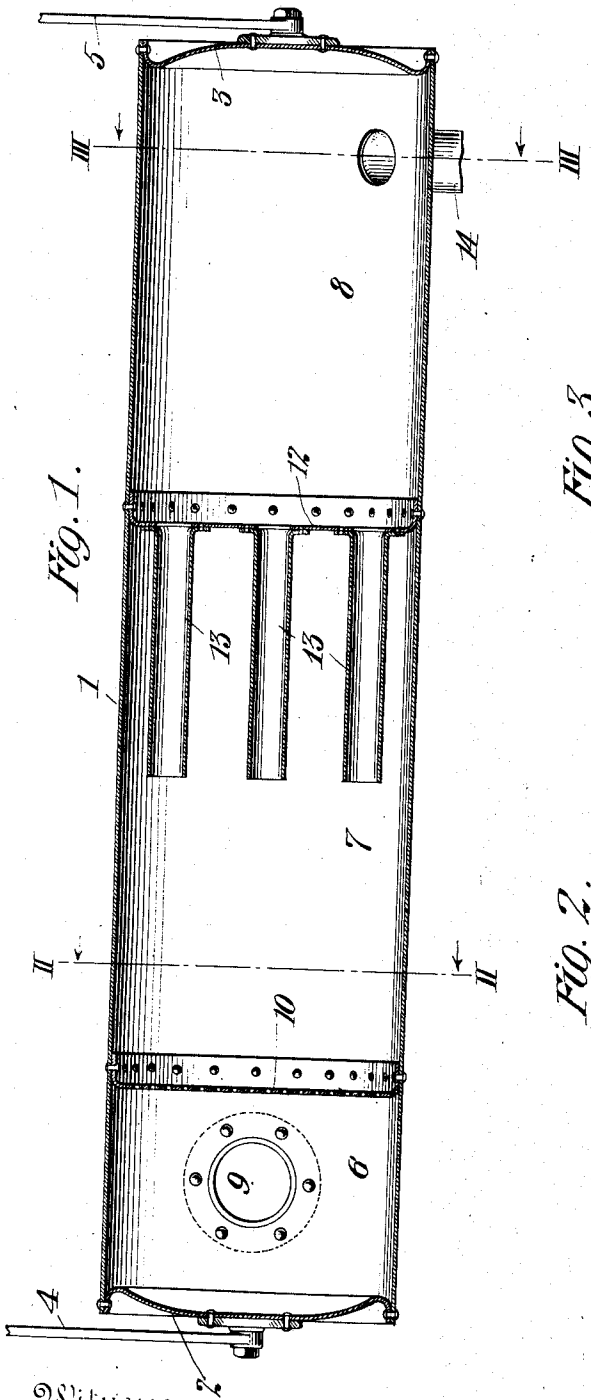

Fig. 1.

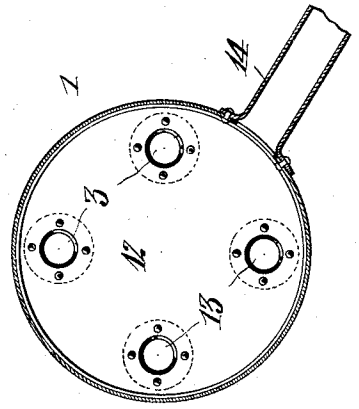

Fig. 3.

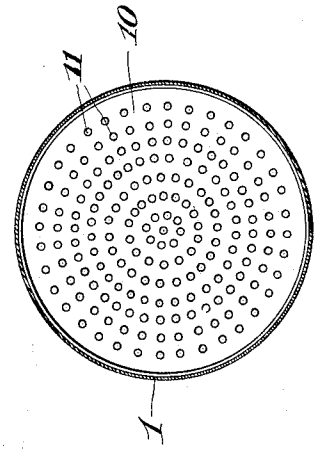

Fig. 2.

Witnesses
Frank S. Adams
Waldo M. Chapin

Inventor
Gustave E. Franquist
By his Attorneys
Rosenbaum & Stockbridge

UNITED STATES PATENT OFFICE.

GUSTAVE E. FRANQUIST, OF NEW YORK, N. Y.

MUFFLER.

No. 813,203. Specification of Letters Patent. Patented Feb. 20, 1906.

Application filed September 13, 1905. Serial No. 278,267.

To all whom it may concern:

Be it known that I, GUSTAVE E. FRANQUIST, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Mufflers, of which the following is a full, clear, and exact description.

My invention relates to mufflers for hydrocarbon-engines.

The provision of a muffler which shall absorb the shock and noise of an exhaust without appreciably increasing the back pressure of the engine is exceedingly difficult to attain in practice on account of the manner in which the discharge travels outward through the exhaust-pipe. The discharge of a hydrocarbon-engine is so sudden and abrupt as to take all the characteristics of a sound-wave traveling with the velocity of sound. It is not sufficient to merely throttle the passage through which this wave travels unless throttling is carried to such an extent as to unduly raise the back pressure. In my present invention I secure the efficient dampening of the sound-wave without materially increasing the back pressure of the engine.

A further object of the invention is to provide a muffler which shall be simple and easy to construct, compact in appearance, and of light weight, so as to be adaptable to the purposes of motor-vehicles.

With these and other objects in view my invention consists in the construction, combination, location, and arrangement of parts, all as will be more fully hereinafter described, as shown in the accompanying drawings, and finally particularly pointed out in the appended claims.

In the drawings, Figure 1 is a longitudinal sectional view of a muffler embodying the principles of my invention. Fig. 2 is a cross-sectional view on the line II II of Fig. 1 looking in the direction of the arrows. Fig. 3 is a similar view on the line III III of Fig. 2 looking in the direction of the arrow.

The principle which I employ in damping the sound-wave of the exhaust without increasing the back pressure is in constraining the escaping gases to proceed in a regular and uniform wave at a certain portion of their travel and in neutralizing this wave by causing it to be reflected upon itself.

Referring to the drawings, and to the various views and reference-signs appearing thereon, in which like parts are designated by the same reference-sign wherever they occur, 1 designates a drum or casing of any suitable size, proportions, and material, but preferably a long sheet-metal cylinder having closed ends 2 and 3.

4 and 5 indicate supports which are bolted to the ends 2 3, so as to support the muffler in any desired relation.

The interior of the drum or casing 1 is divided into three parts or chambers which I have respectively designated as 6, 7, and 8 in the drawings. The chamber 6, which I shall term the "receiving-chamber," has an inlet-pipe 9 in communication with the usual exhaust-valve. This chamber is of comparatively small size, occupying in my preferred construction less than one-quarter of the drum or casing 1. From this chamber the gases, however, immediately escape in a manner which will be more particularly understood by reference to Fig. 2 of the drawings.

It will be seen that the partition 10, which separates the chamber 6 from the remainder of the muffler, is perforated with a plurality of circular apertures 11, and the disposition of these apertures is such that the gases which arrive in the chamber 6 at high pressure immediately issue in myriad jets through the apertures 11, all substantially symmetrically and uniformly directed axially into the chamber 7, which I term the "equalizing-chamber." By reason of the uniform and symmetrical character of the myriad jets all projecting axially into the chamber 7 the exhaust-wave is transferred from its original somewhat irregular character into a perfect homogeneous wave, which progresses in a forwardly-moving plane toward the remote end of the chamber 7, which is located at a considerable distance from the diaphragm 10. In this movement the wave of course travels with the velocity of sound and striking the wall 12 is reflected therefrom exactly in the same way as sound-waves are reflected from the closed end of an organ-pipe. The result is a wave interference at the center of the chamber 7, and, as is well known, the wave will continue to be reflected back and forth within the chamber 7, gradually expending its radiant energy in molecular friction. In this action the pressure continues to fluctuate widely and with great rapidity at the nodal points 10 and 12; but at the region of the center of the chamber 7 there is no fluctuation in pres-

sure, but merely the rapid movement of the vibrating gases. Accordingly if a pipe is inserted into the chamber 7 with its orifice somewhere in the central region thereof there will be no tendency of the wave to be concentrated thereinto and escape into the air, as it would do if the outlet-orifice were a mere throttling or restriction of the exhaust-pipe or if it were situated at any point in the muffler where violent fluctuations of the pressure took place. Such an outlet-pipe would, however, perfectly accommodate the gradual rise in pressure due to the increasing volume of gases within the chamber. In other words, such an outlet-pipe would serve to wholly shut off the shock and noise due to the wave vibration, but would perfectly permit the passage of the gases which it is the purpose of the muffler to carry away.

In carrying out my invention I provide such an outlet-orifice located somewhere in the region of the center of the chamber 7, and for this purpose I have shown four simple tubes 13, which extend through the wall 12 into the exit-chamber 8. Through these tubes the gases pass in streams which do not partake at all of the character of sound-waves, but are nevertheless more abrupt than is desirable to be admitted into the outside air. Accordingly the exit-chamber 8 is provided, which is capable of transforming the discharges from the tubes 13 into a very low continuous pressure, which escapes through the outlet-pipe 14 in an even, continuous, and absolutely noiseless stream.

While I have shown the muffler above described having certain size and general proportions and mechanical structure, I do not, of course, desire to be limited or restricted thereto, since the particular form and proportions of the chambers are not essential and can be widely modified in practice and secure equally advantageous results. For example, the disposition and length of the tubes 13 is wholly immaterial, since these could enter the chamber 7 from any point whatever and could project in any direction either at the center of the chamber or at points quite remote therefrom, it being merely essential that an outlet-orifice be made in the chamber 7 at any point not closely adjacent to the end walls thereof.

What I claim is—

1. A muffler comprising a drum or casing having a perforated diaphragm transverse to the drum or casing and a wall whereby the same is divided into a receiving-chamber, an equalizing-chamber and an exit-chamber, and tubes for connecting the exit-chamber with the equalizing-chamber at a point in the region of the center of the latter.

2. In a muffler, a receiving-chamber having a diaphragm with a multitude of perforations therein, an equalizing-chamber in which said perforations are axially directed, said chamber having an end wall substantially opposite said perforations, and an exit-chamber in communication with the equalizing-chamber in the region of its center.

3. In a muffler, a receiving-chamber having a perforated diaphragm, an equalizing-chamber having a plurality of tubes extending into its central portion and directed toward said diaphragm, and an exit-chamber with which said tubes communicate.

4. In a muffler, a plurality of chambers separated by perforated diaphragms, the central chamber being arranged to reflect the exhaust-wave upon itself and produce wave interference, and an outlet near the central region of said chamber.

5. In a muffler, a receiving-chamber having a diaphragm with a multitude of perforations uniformly distributed over the face thereof, and formed to transmit an exhaust-wave in a forwardly-progressing plane, a wall in the path of said wave arranged to reflect the same upon itself, and a tube forming an outlet at a loop of the resulting wave interference produced.

6. In a muffler, a drum or casing having an inlet connection, a diaphragm whereby the exhaust-wave is transformed into a forwardly-progressing uniform wave, a wall in the path of said wave arranged to reflect the same upon itself, and a plurality of outlet-tubes having their inlet-orifices between the said diaphragm and wall.

7. In a muffler, a drum or casing of substantially cylindrical form having a diaphragm near one of its ends provided with a multitude of circular perforations directed axially of the drum, an inlet connection into the chamber thus formed, a second wall having a plurality of tubes projecting toward said diaphragm and arranged at a considerable distance therefrom whereby a wave is formed which impinges against said wall, and an exit-chamber in communication with said tubes and forming the final end of said drum or casing and in communication with the atmosphere.

In witness whereof I subscribe my signature in the presence of two witnesses.

GUSTAVE E. FRANQUIST.

Witnesses:

FRANK S. OBER,

WALDO M. CHAPIN.