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MUFFLER ARRANGEMENT FOR MULTICYLINDER INTERNAL COMBUSTION ENGINES.

APPLICATION FILED APR. 13, 1912.

1,196,382. Patented Aug. 29, 1916.

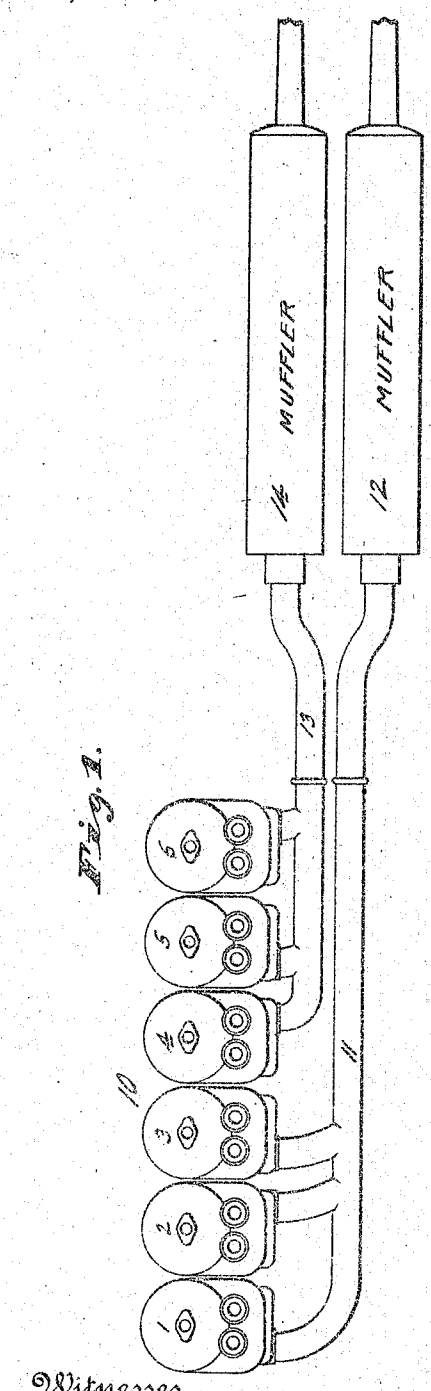

Fig. 1.

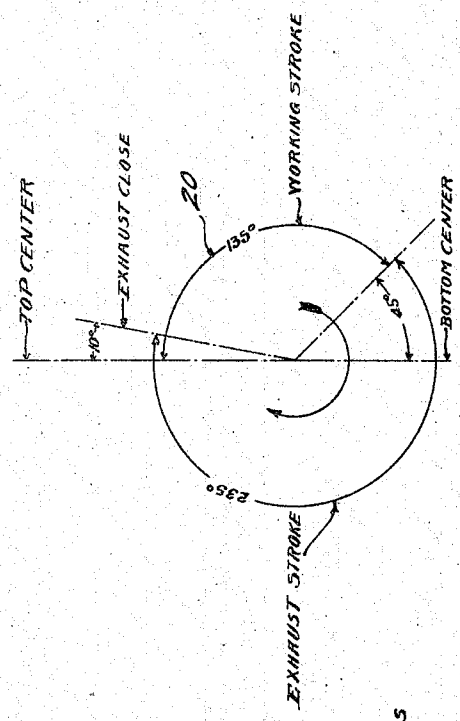

Fig. 3.

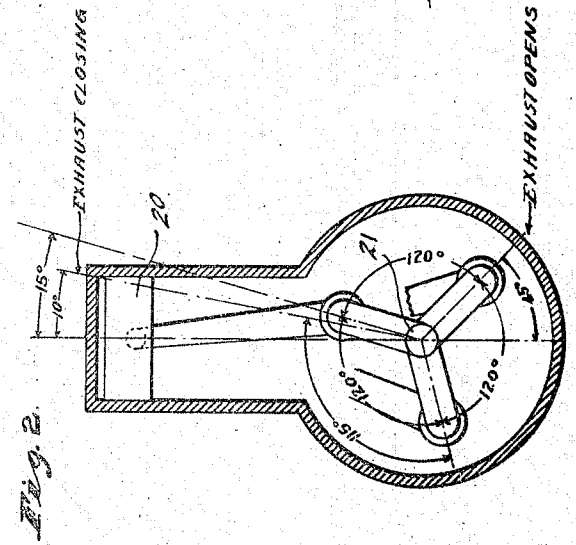

Fig. 2.

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UNITED STATES PATENT OFFICE.

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MUFFLER ARRANGEMENT FOR MULTICYLINDER INTERNAL-COMBUSTION ENGINES.

1,196,382. Specification of Letters Patent. Patented Aug. 29, 1916.

Application filed April 13, 1912. Serial No. 690,487.

To all whom it may concern:

Be it known that I, JOHN C. MOORE, a citizen of the United States, residing at Connersville, in the county of Fayette, and State of Indiana, have invented a new and useful Muffler Arrangement for Multicylinder Internal-Combustion Engines, of which the following is a specification.

My invention relates to multi-cylinder internal combustion engines with muffled exhaust.

I have found that when the exhausts of the various cylinders of a multi-cylinder internal combustion engine are connected in common to the same muffler, there is a dilution of the explosive mixture in the engine cylinders by burnt gases which are forced or held back in such cylinders. This is due to the fact that the exhaust ports of the cylinders are open for more than 180° of crank shaft movement, so that at the opening of the exhaust ports for each cylinder two or more cylinders are connected through the exhaust manifold. On account of the resistance of the muffler, the pressure of the exhaust just beginning forces or holds the burnt gases back in the cylinder from which the exhaust is nearly completed. According to my invention, this dilution of the explosive mixture is prevented by the use of a plurality of mufflers, two usually being sufficient. These mufflers are connected to the engine cylinders so that successively exhausting cylinders exhaust through different mufflers.

The various novel features of my invention will appear from the description and drawings and will be particularly pointed out in the claims.

In the drawings, Figure 1 is a semi-diagrammatic view of a six cylinder engine exhausting through two mufflers in accordance with my invention; Fig. 2 is a diagrammatic vertical cross-section through such an engine as shown in Fig. 1; and Fig. 3 is a diagram showing the relation between the working stroke, the exhaust, and the crank shaft movement.

The six cylinders of the engine 10 exhaust in any desired sequence, it being assumed herein that the sequence is the usual one, namely, 1—4—2—6—3—5. Each set of alternately exhausting cylinders is connected to a separate exhaust manifold and muffler, the cylinders 1, 2, and 3 being connected to the exhaust manifold 11 and through it to the muffler 12, and the cylinders 4, 5, and 6 being connected to the exhaust manifold 13 and through it to the muffler 14. As shown in Fig. 3, the usual working stroke of the piston 20 in each cylinder is substantially 135° of the movement of the crank shaft 21, the working stroke being completed before the completion of the down stroke of the piston. Upon the completion of the working stroke, the exhaust valves are opened so that the burnt gases in the cylinder may escape into the muffler, the exhaust valves remaining open until the piston has reached the end of its down stroke and has made the complete up stroke, and usually until it has started again on its down stroke, or about 235° of the movement of the crank shaft. In the six cylinder engine connected as shown, where successively exhausting cylinders have their pistons spaced 120° apart on the crank shaft, the exhaust valves of a cylinder should remain open for less than twice such spacing, or less than 240° degrees.

In the operation of the engine connected as shown, any two cylinders which exhaust successively, such as 1 and 4, 4 and 2, 2 and 6, 6 and 3, 3 and 5, and 5 and 1, discharge into different ones of the two mufflers 12 and 14. Thus the exhaust pressure from a cylinder cannot force or hold the burnt gases back in the cylinder next previously exhausting. Because the exhaust valves are open for less than twice the angle of spacing of the pistons on the crank shaft, no two cylinders are open to the same exhaust manifold at the same time, so that the pressure from the exhaust of one cylinder cannot force or hold the burnt gases back in the second previously exhausting cylinder. Thus dilution of the explosive mixture is completely prevented.

While I have shown my invention as applied to a six cylinder engine of the four

cycle type, it may be applied to engines of other types and with a greater or less number of cylinders. I therefore aim to cover all modifications which do not involve a departure from the spirit and scope of my invention, as set forth in the following claims.

What I claim as new is:

1. In combination, a multi-cylinder internal combustion engine having more than two cylinders and in which the exhaust periods of successively exhausting cylinders overlap, a plurality of independent mufflers less in number than the number of cylinders of the engine, said mufflers having separate discharge openings to the atmosphere, and connections between the exhausts of the several engine cylinders and the mufflers whereby successively exhausting cylinders are connected to different mufflers.

2. In combination, a multi-cylinder internal combustion engine having a composite number of cylinders and in which the exhaust periods of successively exhausting cylinders overlap, a plurality of independent mufflers the number of which is an aliquot part of the number of engine cylinders, said mufflers having separate discharge openings to the atmosphere, and connections between each muffler and a plurality of, but less than all of, the engine cylinders, successively exhausting cylinders being connected to different mufflers.

3. In combination, a multi-cylinder internal combustion engine having more than two cylinders and in which the exhaust periods of successively exhausting cylinders overlap, two independent mufflers having separate discharge openings to the atmosphere, and connections between each muffler and alternately exhausting cylinders of the engine.

4. In combination, a six-cylinder internal combustion engine, and two independent mufflers respectively connected to the exhaust sides of alternately discharging cylinders of said engine, having separate discharge openings to the atmosphere.

5. In combination, a multi-cylinder internal combustion engine having more than two cylinders and in which the periods of opening of the exhaust valves of a plurality of cylinders overlap, a plurality of independent mufflers less in number than the number of cylinders of the engine, said mufflers having separate discharge openings to the atmosphere, and connections between the exhausts of the several engine cylinders and the mufflers so that any two cylinders of which the periods of opening of the exhaust valves overlap are connected to different mufflers.

6. In combination with the cylinders of a multi-cylinder internal combustion engine having more than two cylinders the exhaust periods of some of which overlap with those of others, a plurality of independent conduits having separate discharge openings to the atmosphere, each conduit being connected to the exhaust ports of cylinders whose exhaust periods do not overlap at any time.

7. In combination, a multi-cylinder internal combustion engine having more than two cylinders and in which successively exhausting cylinders have exhaust strokes overlapping in time, a plurality of independent mufflers less in number than the number of cylinders of the engine and as great in number as the greatest number of cylinders which are exhausting at any one time, said mufflers having separate discharge openings to the atmosphere, and connections between the exhausts of the several engine cylinders and the mufflers whereby cylinders whose exhaust strokes overlap in time are connected to different mufflers.

8. In combination, a multi-cylinder internal combustion engine having more than two cylinders and in which the exhaust periods of successively exhausting cylinders overlap, a plurality of independent mufflers less in number than the number of cylinders of the engine, said mufflers having separate discharge openings to the atmosphere, and connections between each muffler and a plurality of, but less than all of, the engine cylinders, successively exhausting cylinders being connected to different mufflers.

9. In an internal combustion engine having a plurality of cylinders and arranged so that one cylinder shall exhaust before the other has completed its exhaust stroke, a passage communicating with the exhaust ports of a part of said cylinders, a passage communicating with the exhaust ports of the rest of said cylinders, said cylinders being arranged to exhaust into said passages so that the cylinders exhausting at the same time shall exhaust into different passages, and said two passages having separate discharge openings to the atmosphere.

10. In an internal combustion engine having a plurality of cylinders any one of which exhausts during the exhaust stroke of some other of said cylinders, a plurality of passages which communicate with the exhaust ports of different said cylinders, said cylinders being arranged to exhaust into said passages so that the cylinders exhausting at the same time shall exhaust into different passages, and said passages having separate outlets to the atmosphere.

11. In an internal combustion engine having a plurality of cylinders any one of which exhausts during the exhaust stroke of some other of said cylinders, a plurality of passages which communicate with the exhaust ports of different cylinders, said cylinders being arranged to exhaust into said passages so that the exhaust ports of any cylinder

connected with any one of said passages shall be open only when the exhaust ports of all other cylinders connected with the same passage are closed, and said passages having separate outlets to the atmosphere.

In witness whereof, I have hereunto set my hand and seal at Connersville, Indiana, this 9th day of April, A. D. one thousand nine hundred and twelve.

JOHN C. MOORE. [L. S.]

Witnesses:
HARRY S. JOHNSON,
FREDERIC I. BARROWS.