L. M. G. DELAUNAY-BELLEVILLE.
MULTIPLE CYLINDER EXPLOSION MOTOR.
APPLICATION FILED MAR. 9, 1909.

1,051,866. Patented Feb. 4, 1913.

4 SHEETS—SHEET 1.

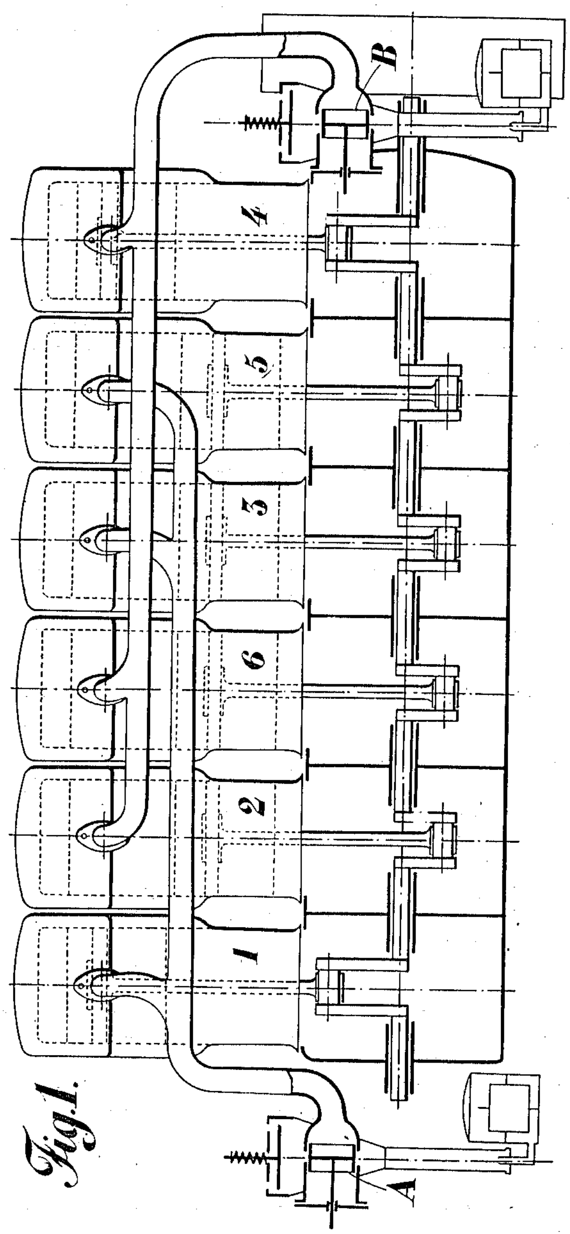

Fig.1.

Witnesses:

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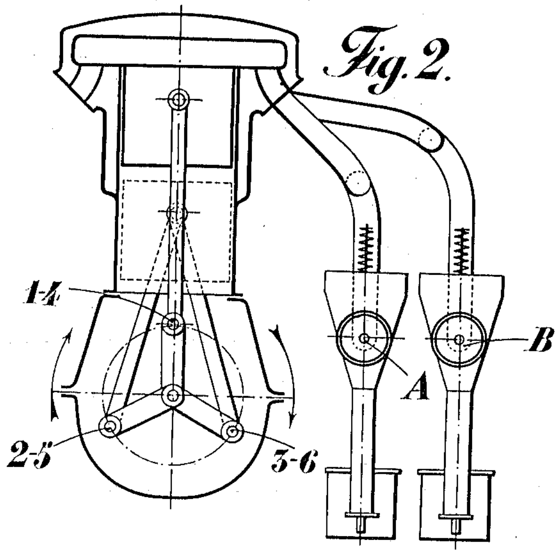
Fig. 2.



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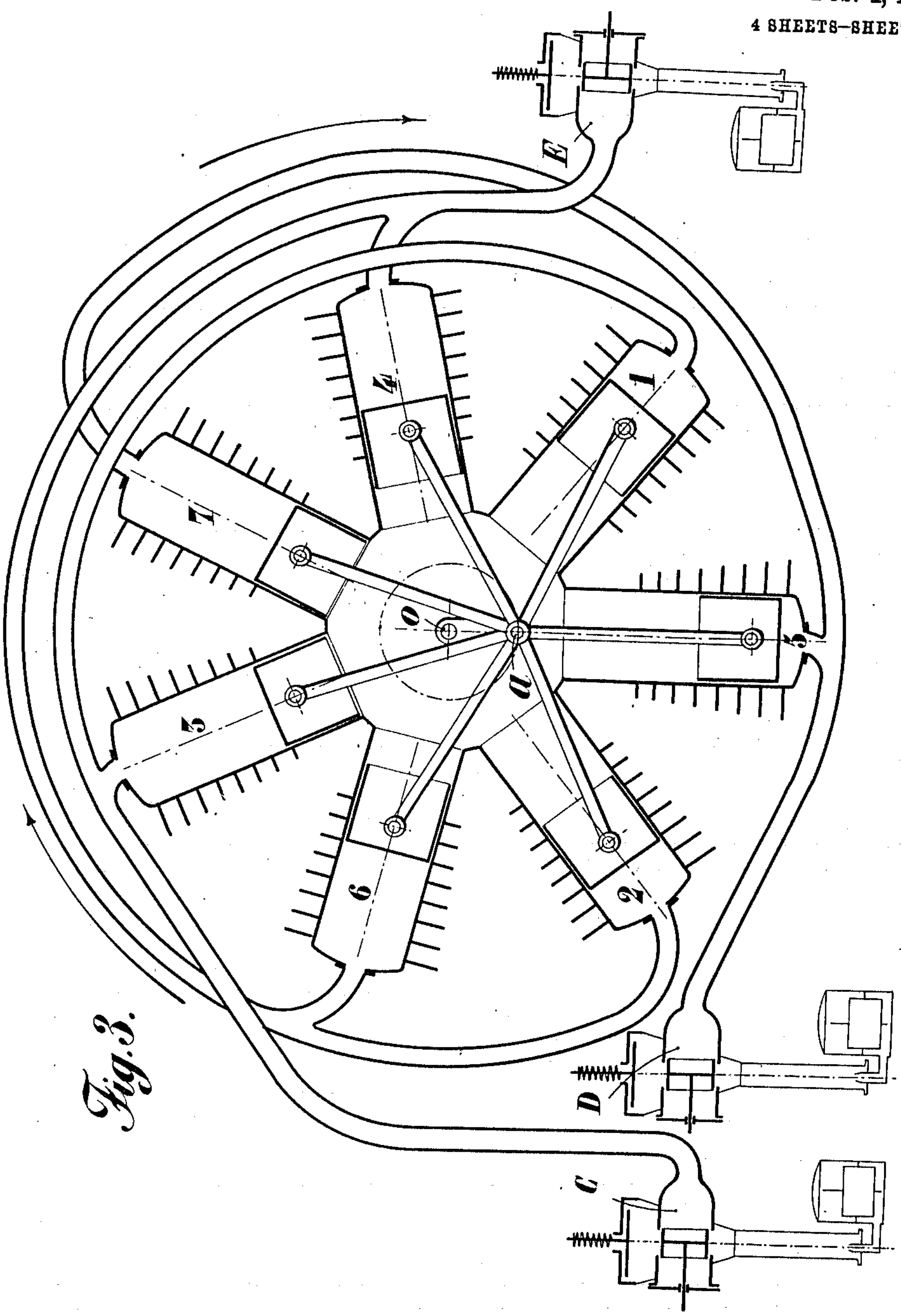

Fig. 3.

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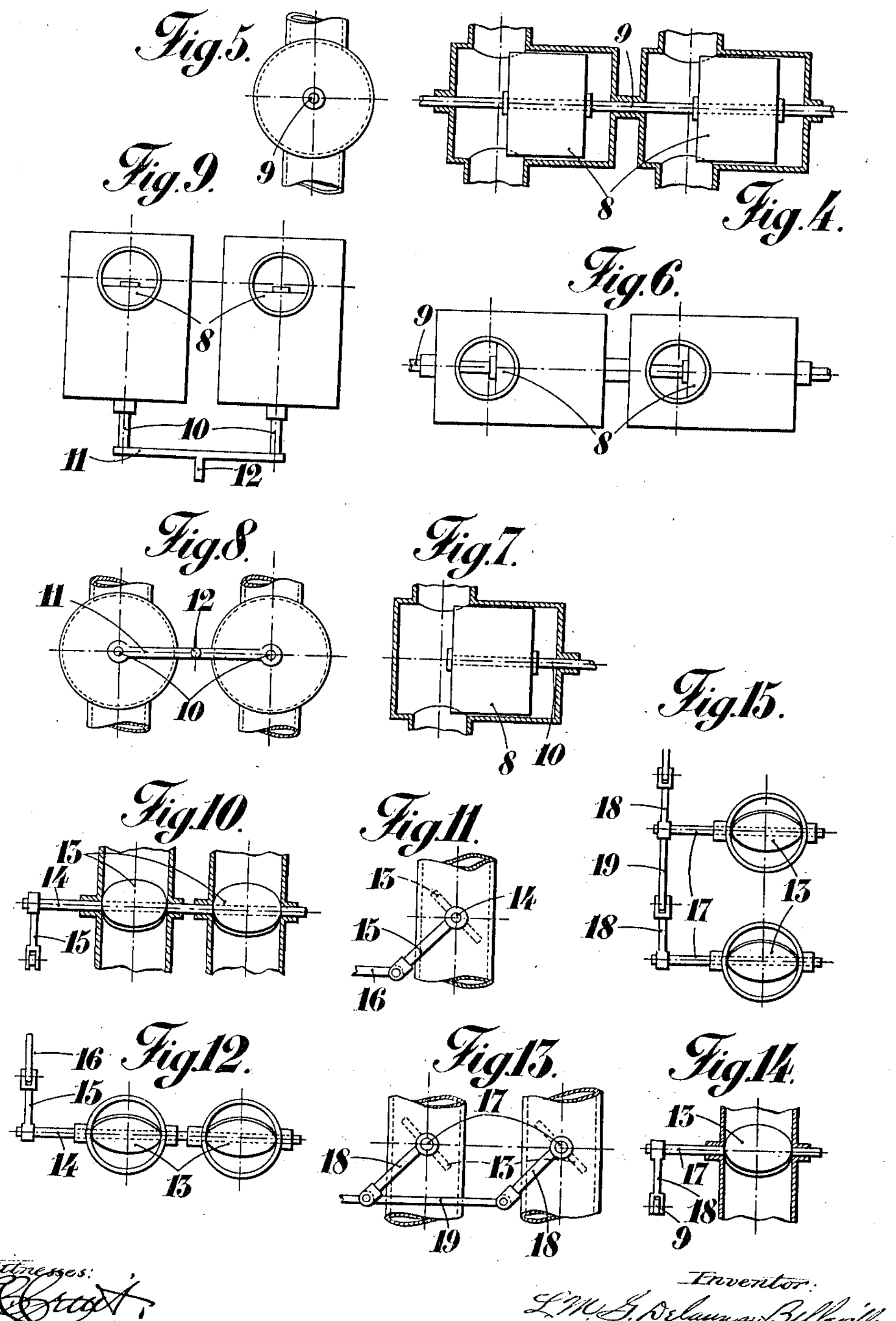

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UNITED STATES PATENT OFFICE.

LOUIS MARIE GABRIEL DELAUNAY-BELLEVILLE, OF PARIS, FRANCE, ASSIGNOR TO THE SOCIÉTÉ ANONYME DES AUTOMOBILES DELAUNAY-BELLEVILLE, OF ST.-DENIS, FRANCE, A CORPORATION OF FRANCE.

MULTIPLE-CYLINDER EXPLOSION-MOTOR.

1,051,866. Specification of Letters Patent. Patented Feb. 4, 1913.

Application filed March 9, 1909. Serial No. 482,268.

To all whom it may concern:

Be it known that I, Louis Marie Gabriel Delaunay-Belleville, citizen of the French Republic, residing at Paris, Department of the Seine, in France, have invented certain new and useful Improvements in and Relating to Multiple-Cylinder Explosion-Motors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In a multiple-cylinder explosion motor with a single carbureter when the suctions of two cylinders take place simultaneously during a fraction of a revolution, trouble arises in the flowing of the gases, the suction of one of the cylinders opposing the suction of the other during the period at which suction takes place simultaneously and the result of this is to reduce the efficiency of one or other of these cylinders or of both of them. The suction of a cylinder lasts practically during a stroke, that is to say while the motor effects a half-revolution, so that two suction periods are simultaneous when the angular interval between the commencements of these two suction phases is less than 180°.

The present invention has for its object to obviate this defect.

It consists in feeding fuel to the motor by means of two or more separate carbureters, each of them feeding a certain number of cylinders by means of independent piping, these cylinders being selected in such a manner that the suction periods of any two of these cylinders are not simultaneous or even partially and consequently the explosions of these cylinders succeed each other at angular intervals of at least 180°. Of course it is to be understood that I use the minimum number of carbureters which will realize the aforesaid conditions.

In the accompanying drawing:—Figures 1 and 2 are diagrammatic views showing one arrangement of carbureters in accordance with the invention, Fig. 1 being a view from the side and Fig. 2 an end view, Fig. 3 is a diagrammatic view of a modification wherein the cylinders are arranged radially instead of side by side, Figs. 4, 5 and 6 are a longitudinal section, a side elevation and a top plan view, respectively, of the connection between the valves of the carbureter ducts, Figs. 7, 8 and 9 are a vertical section, a side elevation, and a top plan view, respectively, of a modified form of connection between said valves, Figs. 10, 11 and 12 are a vertical section, side elevation, a top plan view, respectively, of a further modified connection of the valves of the carbureter ducts, and Figs. 13, 14 and 15 are a side elevation, vertical section, and top plan view respectively, of a still further modification of the arrangement shown in Figs. 4 to 6.

The engine illustrated in Figs. 1 and 2, by way of example, is a four-cycle motor with six vertical cylinders, the cranks of which are distributed at angular intervals of 120°. The cylinders are numbered in the order of their successive explosions (and not in accordance with their arrangement on the motor) and are designated 1, 2, 3, 4, 5, 6. In the case of a single carbureter, the explosion 2 is separated from the explosion 1 which precedes it and from the explosion 3 which follows it by an angular interval of 120°; the suction phases are therefore simultaneous during a period of 60° as regards the cylinders 2 and 1 and also as regards the cylinders 2 and 3; that is to say the suction stroke of the cylinder 2 is affected by the trouble due to the fact that the suctions take place simultaneously during the first and the last thirds of its development. The same applies to each of the other cylinders of the motor. If, on the other hand, as in the case represented in Figs. 1 and 2, the cylinders 1, 3, 5 are fed by a carbureter A and the cylinders 2, 4, 6 by another carbureter B, the two suction pipes being entirely independent, it follows that in each of these two groups the angular interval that separates the explosion of any one cylinder from the explosion that follows it, will be $120° \times 2 = 240°$. The suction periods thus remain entirely separate insuring the uniformity of carburization, the equal dynamic effect of the charges of the several cylinders and in short the efficient operation of the motor. With a motor comprising a different number of cylinders, the number of independent carbureters to be employed will be determined by the same condition, that is to say the suction periods of two cylinders grouped on one and the same carbureter follow each other at an angular interval equal to or greater than 180°. Thus in a four-cycle motor with "N" vertical cylinders, the cranks of these cylinders being distributed over equal angular distances, the angular interval between two successive explosions is

$$\frac{180\times4}{N}=\frac{720°}{N}.$$

When this amount is less than 180° cylinders separated by a number "m" of intervals should be grouped on a supply common to them all, in such a manner that

$$\frac{720\times m}{N}$$

may be equal to or greater than 180°. We therefore have $m=2$ up to 8 cylinders, $m=3$ from 9 to 12 cylinders, $m=4$ from 13 to 16 cylinders, etc. The number of carbureters to be employed and the grouping of the cylinders served by each carbureter, will readily be settled by analyzing the data in each case. Obviously the number of carbureters employed is the minimum number which will accomplish the above result.

Fig. 3 shows a motor with 7 cylinders arranged star fashion and fed by three carbureters. In this case the distribution of the cylinders between the three carbureters adapts itself to a number of modifications one only of which is represented. In Fig. 3 the seven cylinders have been equally arranged around the shaft and upon the same crank *o a* for facilitating the reading of the drawing. The natural order of the numerals indicates the order of the explosions; the carbureter C feeds the cylinders 1, 3; the carbureter D feeds the cylinders 5, 7 and the carbureter E supplies the cylinders 2, 4, 6.

Whatever the number of the carbureters may be, it is necessary to operate the throttle valve of each of them by one and the same operating lever and to regulate the controls for these valves in such a manner that they may all be controlled simultaneously and that at any moment, their apertures may all bear the same ratio to the total aperture.

The carbureter ducts may be provided with cylindrical valves 8 which slide laterally in suitable housings, as shown in Figs. 4 to 6, and said valves are shown as mounted upon the same spindle 9. The operating lever, (not shown) acts directly upon this spindle, and of course both valves will be moved similarly and through the same distance.

In the form shown in Figs. 7 to 9, the cylindrical valves 8 are mounted upon parallel spindles 10 connected by a cross piece 11. Said cross piece carries a rod 12 upon which the operating lever acts, both valves being operated similarly as before.

In some cases I may use flap valves 13, as shown in Figs. 10 to 12, in which case said valves are mounted upon a common spindle 14, said spindle being operated by a small rod 15, connected with the operating lever, (not shown) by a second rod 16. It is obvious that when this construction is employed, the valves will be given similar pivotal movements of the same amplitude, whereby similar controlling effects are produced in the carbureter ducts. It is also possible to mount the flap valves 13 on separate parallel spindles 17, (Figs. 13–15) to which arms 18 are connected, said arms being operated by a common operating rod 19, which, in practice, is actuated from the operating lever. It is obvious that these arrangements are given merely as examples, and that, of course, valve operating devices of different kinds may be used in connection with the same motor.

I claim:

1. The combination with an explosion motor having more than four cylinders, said cylinders being divided into groups such that the suction periods of the cylinders in each group do not overlap and such that an explosion occurs first in one group and then in another group, and one of said groups comprising at least three cylinders, a carbureter for each group of cylinders, and piping connecting each carbureter with all of the cylinders of its group.

2. The combination of an explosion motor having more than four cylinders, said cylinders being divided into groups such that the suction periods of the cylinders in each group do not overlap and one of which groups comprises at least three cylinders, a carbureter for each group of cylinders, piping connecting each carbureter with all of the cylinders of its group, throttling valves to control the respective carbureters, and a single means to operate said valves similarly and simultaneously.

3. The combination with an explosion motor having more than four cylinders, of a plurality of carbureters each of which supplies separately certain of said cylinders, at least one of said carbureters supplying at least three of said cylinders, the suction periods of the cylinders connected with the same carbureter being entirely distinct from each other, and said carbureters being of a minimum number sufficient to realize the aforesaid condition.

4. The combination with an explosion motor having at least six cylinders, of a plurality of carbureters each of which supplies separately at least three of said cylinders,

the cylinders connected to each carbureter being so chosen that their suction periods are entirely distinct from each other.

5. The combination of an explosion motor having more than four cylinders, in which the explosions occur in irregular order, a plurality of carbureters each of which supplies separately certain of said cylinders so chosen that the suction periods of the latter are entirely distinct from each other and that at least three of said cylinders are fed by the same carbureter, said carbureters being of a minimum number sufficient to realize the aforesaid condition, throttling valves to control the respective carbureters, and a single means to operate said valves similarly and simultaneously.

In testimony whereof I affix my signature, in presence of two witnesses.

LOUIS MARIE GABRIEL DELAUNAY-BELLEVILLE.

Witnesses:
H. C. COXE,
EMILE KLOTZ.