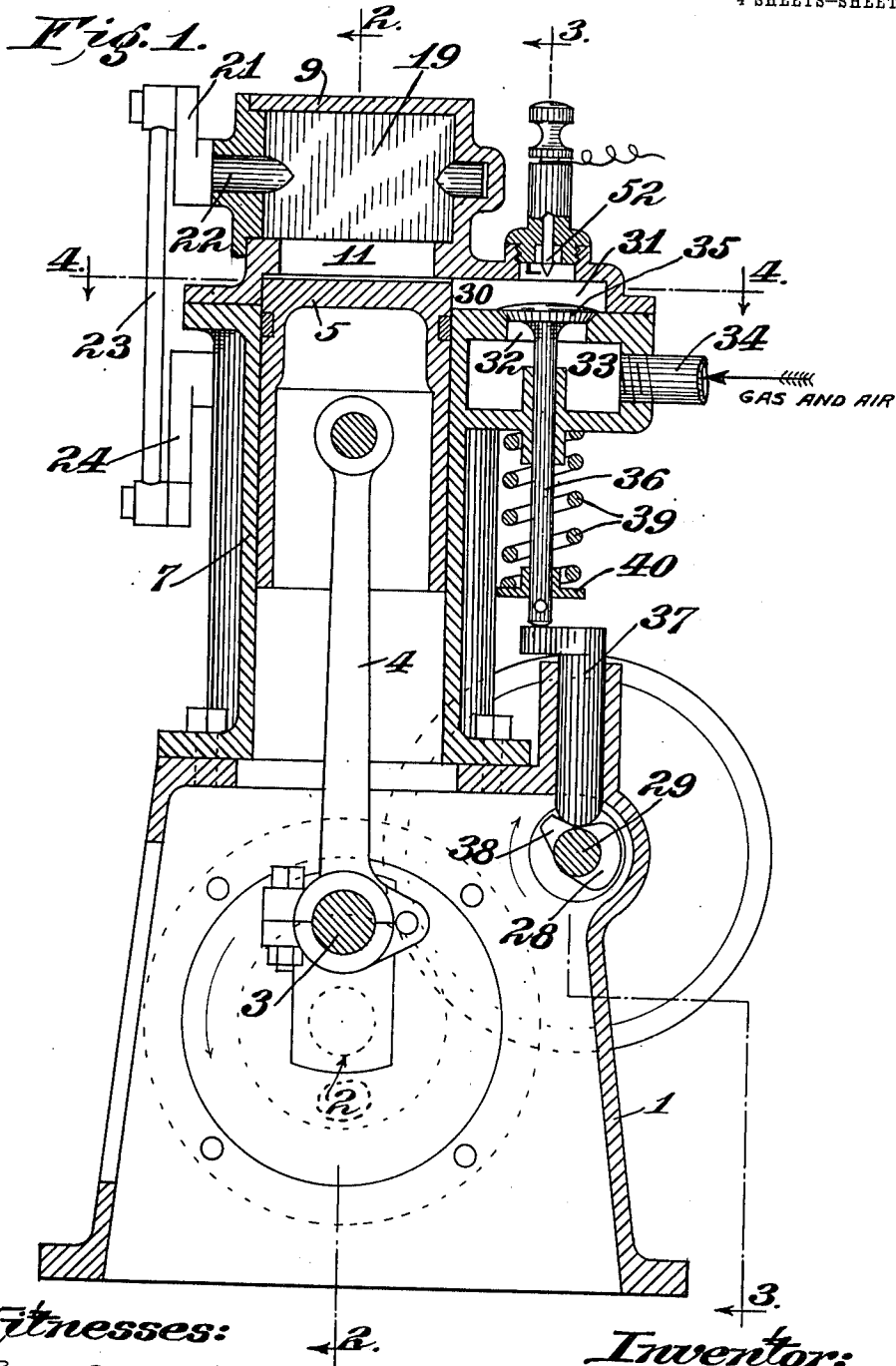


B. BRAZELLE.
INTERNAL COMBUSTION MOTOR.
APPLICATION FILED SEPT. 29, 1909.

1,022,177.

Patented Apr. 2, 1912.

4 SHEETS—SHEET 1.



Witnesses:

G. A. Pennington
Edgar T. Farmer.

Inventor:

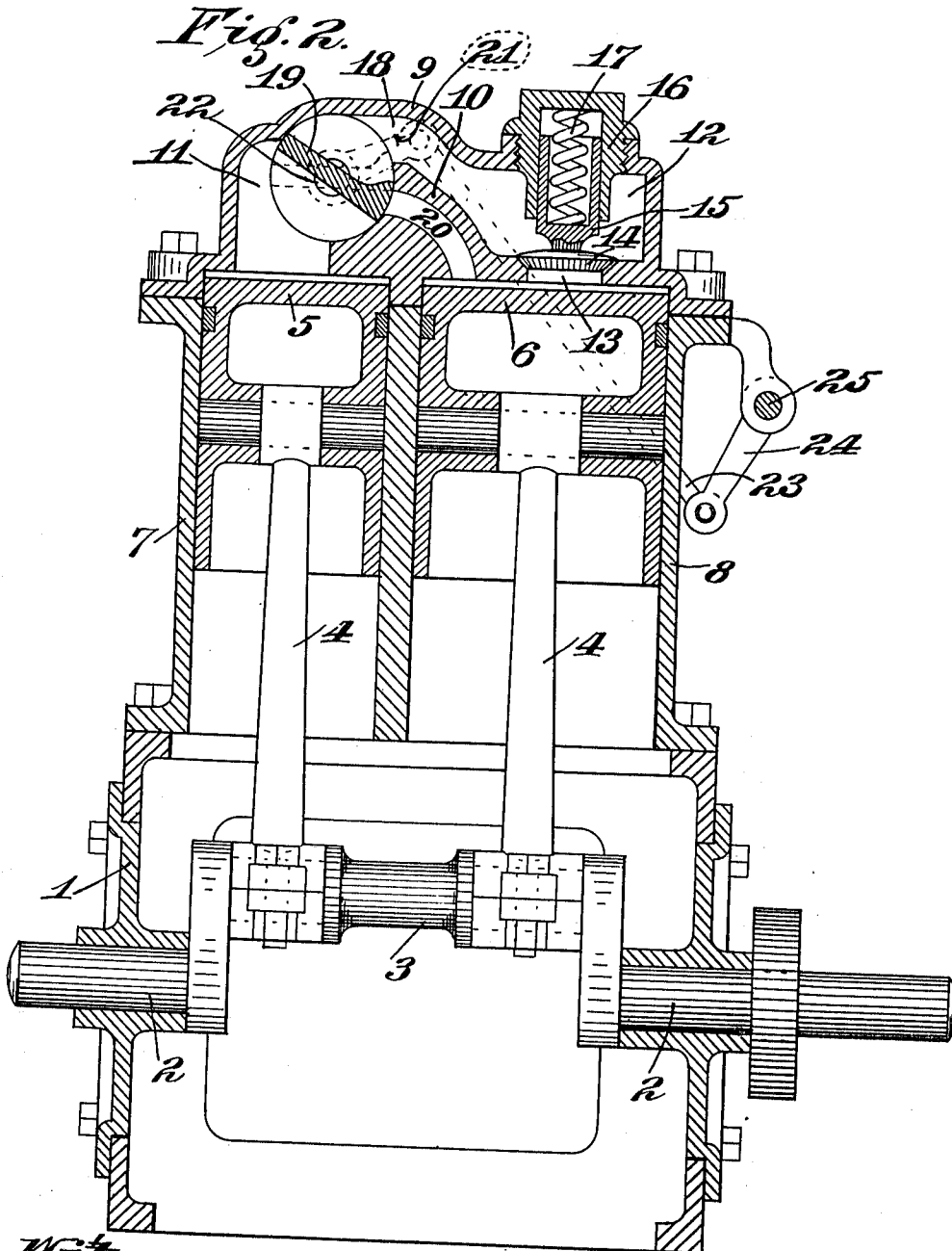
Benjamin Brazelle,
By *Carroll D. Ann*,
Attys.

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Witnesses:

*G. A. Pennington
Edgar T. Farmer.*

Inventor:

*Benjamin Brazelle,
By ~~Carroll~~ Carr,
attys.*

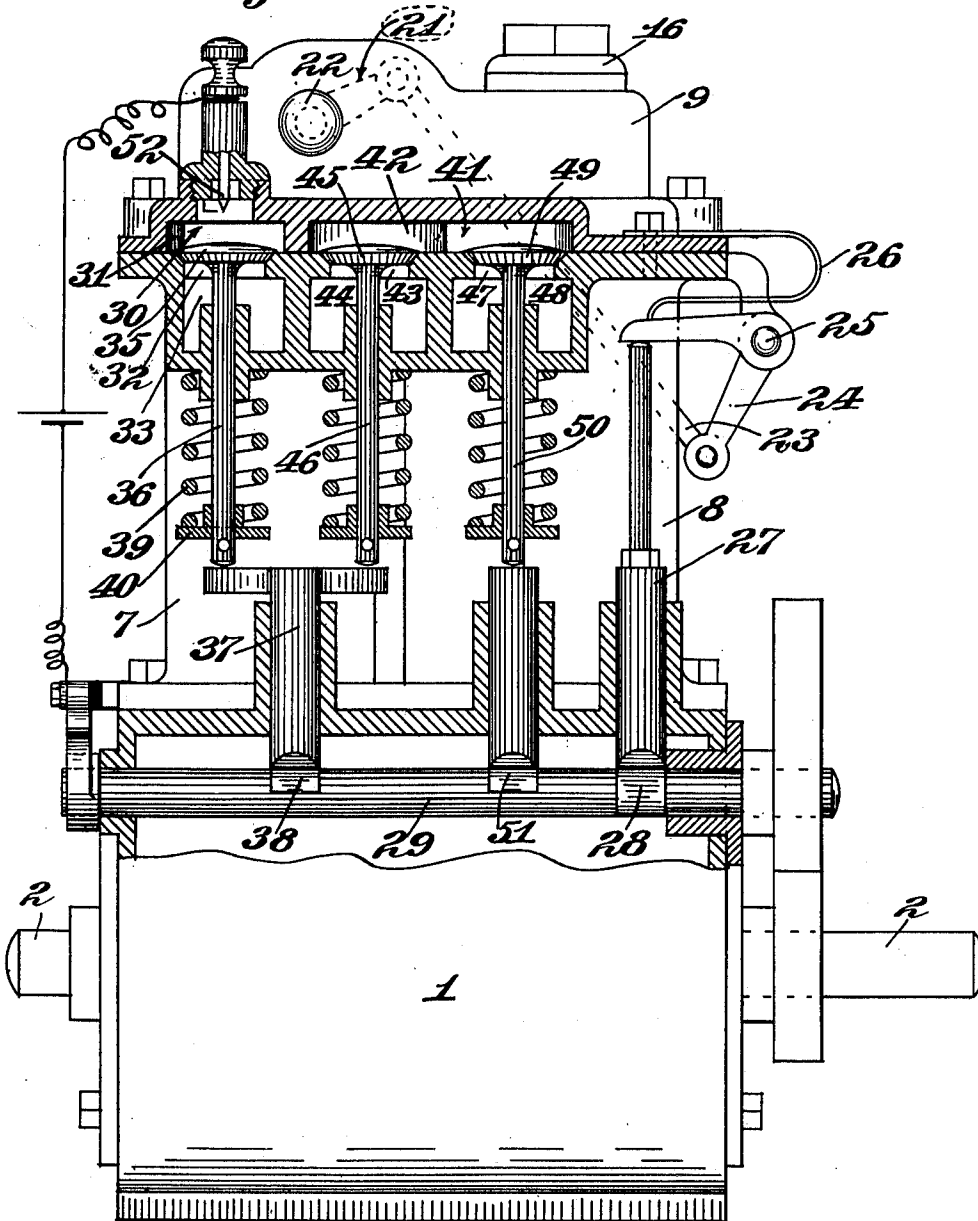
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4 SHEETS-SHEET 3.

Fig. 3.



Witnesses:

*G. A. Pennington
Edgar T. Farmer.*

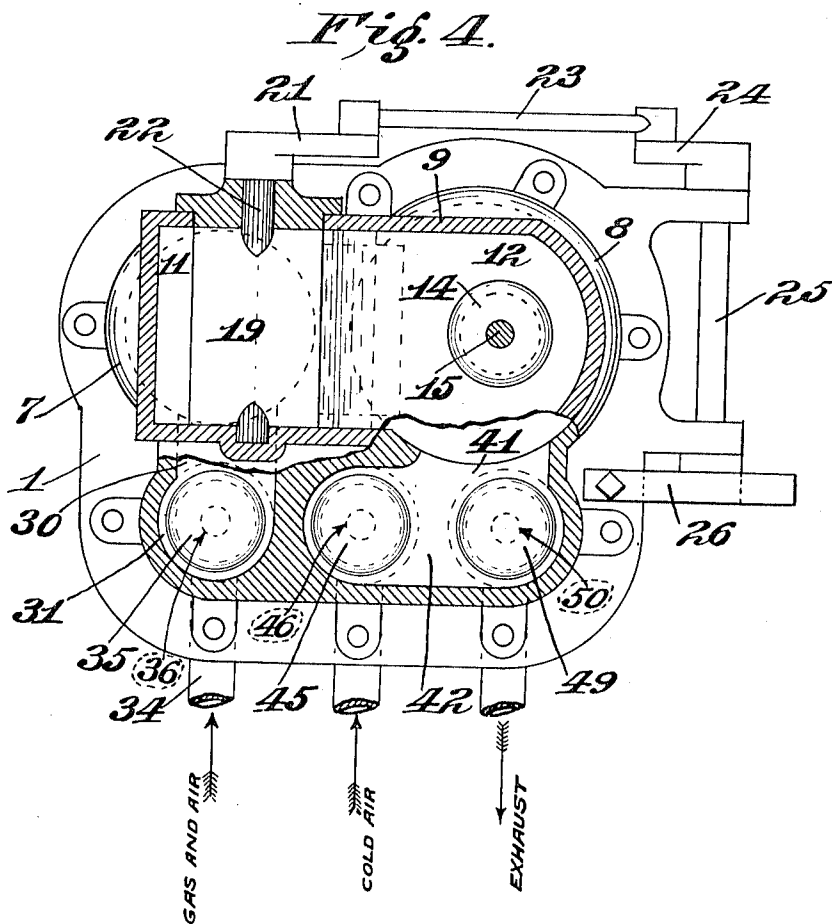
Inventor:

*Benjamin Brazelle,
By Carver & Carver,
Attys.*

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4 SHEETS—SHEET 4.



Witnesses:

G. A. Pennington
Edgar T. Farmer.

Inventor:

Benjamin Brazelle,
By *Conrad Damm,*
Attys.

UNITED STATES PATENT OFFICE.

BENJAMIN BRAZELLE, OF KIRKWOOD, MISSOURI, ASSIGNOR TO BRAZELLE MOTOR COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF MISSOURI.

INTERNAL-COMBUSTION MOTOR.

1,022,177.

Specification of Letters Patent.

Patented Apr. 2, 1912.

Application filed September 29, 1909. Serial No. 520,084.

To all whom it may concern:

Be it known that I, BENJAMIN BRAZELLE, a citizen of the United States, and a resident of Kirkwood, county of St. Louis, and State of Missouri, have invented a certain new and useful Improvement in Internal-Combustion Motors, of which the following is a specification.

My invention relates to internal combustion motors. In the operation of such motors, a very high temperature is generated in the combustion chamber; and in motors of the common type, a large portion of the heat is communicated to the walls of the combustion chamber and thence dissipated by devices specially provided for the purpose. The heat thus dissipated not only represents a loss of energy but involves mechanical difficulties that must be considered in designing the motor.

It is the object of the present invention to minimize such loss of energy and to avoid the mechanical difficulties arising from the excessive heat.

The invention consists principally in means whereby the gaseous products of combustion may be diluted with a large volume of air or inert gas of lower temperature immediately after explosion, whereby the heat due to ignition may be distributed throughout the increased volume of gases.

It also consists in the parts and in the combinations and arrangements of parts hereinafter described and claimed.

In the accompanying drawing, which forms part of this specification, and wherein like symbols refer to like parts wherever they occur, Figure 1 is a vertical cross section of an internal combustion motor embodying my invention; Fig. 2 is a vertical longitudinal section of said motor on the line 2—2 of Fig. 1; Fig. 3 is a vertical longitudinal section on the line 3—3 of Fig. 1; and Fig. 4 is a horizontal cross section on the line 4—4 of Fig. 1.

In the base or framework 1 is mounted a horizontal shaft 2 provided with a crank arm 3. Pivottally mounted on this crank arm are two parallel piston rods 4 of equal length, which are connected, respectively, to a smaller piston 5 and a larger piston 6 which are adapted to reciprocate in vertical piston chambers or cylinders 7, 8. The upper ends of said piston chambers or cylinders are closed by a hollow head 9 which is

divided by a transverse partition 10 into two main chambers. One of these main chambers 11 is opposite the end of the smaller cylinder and communicates therewith at all times, constituting, in effect, a part thereof. The other chamber 12 is opposite the end of the larger cylinder and communicates therewith through an opening 13 in the wall of the hollow head. This opening is controlled by a check valve 14 whose stem 15 is adapted to slide in a vertical recess provided therefor in a tubular housing 16 which is screw-threaded and has a spiral spring 17 therein. The upper end of said spring bears against the end of the housing and its lower end bears against the valve so as to normally hold it against its seat and thereby close the opening 13 in the lower wall of the head 9. The two chambers in the head communicate through a passageway 18 which is controlled by a butterfly valve 19. The chamber 11 at the end of the smaller cylinder 7 also communicates with the larger cylinder 8 by means of a passageway 20 which extends through the transverse partition 10 and has one end permanently open to the larger cylinder. The other end of said passageway 20 is controlled by the end of said butterfly valve 19. In the normal position of the butterfly valve, its end wall closes said passageway 20 and the body portion of the valve shuts off communication through the passageway 18 between the chambers in the head so that the smaller chamber communicates only with the small cylinder. The butterfly valve has a crank arm 21 on its shaft 22 which is connected by a link 23 to an arm 24 of a rock shaft 25. This rock shaft is held in normal position by a spring 26 and is actuated by means of a tappet 27 which receives its motion from a cam or eccentric 28 on a countershaft 29. This countershaft is provided with a series of cams arranged to actuate the valves as hereinafter described.

The lower ends of the cylinders 7, 8 are open. Near the upper end of the smaller cylinder is an inlet opening or port 30 which communicates with a chamber 31 at the side thereof. The bottom of this chamber has an opening 32 therethrough which opens into a second chamber 33 which is provided with a pipe 34 adapted to supply mixed gas or vapor and air thereto. The upper edge of the wall of said opening 32 is beveled or

countersunk to form a seat for a check valve 35 whose stem 36 extends through the bottom of the chamber 33, in position to rest upon a vertically movable tappet 37 in position to cooperate with a cam 38 provided therefor on the countershaft 29. The check valve 35 is normally seated by means of a coiled spring 39 surrounding the stem thereof, and with its upper end bearing against the under side of said chamber 33 and with its lower end bearing against a collar or projection 40 on the valve stem.

Near the top of the larger cylinder 8 is a port 41 which opens into a chamber 42 whose bottom is provided with a passageway 43 opening into a second chamber 44 which in turn is open to the atmosphere. Said opening 43 is provided with a spring actuated check valve 45 whose stem 46 bears against the tappet 37, the arrangement being similar to the arrangement for supplying the mixture of air and vapor above described. The chamber 42 which communicates with the larger cylinder has a second opening 47 in its bottom which communicates with a chamber 48 that is likewise open to the atmosphere. This last mentioned opening is also controlled by a spring actuated valve 49 whose stem 50 is in position to be actuated by a second cam 51 on the countershaft 29 so as to control the release or exhaust from the motor. The motor is likewise provided with any suitable igniting device 52 adapted to effect the explosion of the charge of mixed air and vapor above the smaller piston 5 at the proper time, in conformity with common practice.

The operation of the device is as follows: In the normal position of the parts all of the valves are closed. When the countershaft is rotated, the cam 38 thereon raises the tappet 37 and thereby lifts the valves 35, 45 from their seats so as to admit the explosive charge into the small cylinder 7 and a charge of air into the larger cylinder 8. Thereupon, the springs close said valves as the pistons begin their upward stroke. During the upward stroke of the pistons, the explosive charge is compressed in the chamber at the end of the smaller cylinder, while the charge of air is forced through the check valve 14 and compressed and confined in the intermediate chamber 12 above the larger cylinder 8. Thereupon, the igniting device effects the explosion of the charge at the end of the small cylinder 7 substantially simultaneously with the turning of the butterfly valve 19 to uncover the passageway 20 leading to the large cylinder 8 and open communication between the intermediate chamber 12 and the chamber 11 at the end of the small cylinder 7. In consequence of these conditions, the large volume of compressed air is forcibly and rapidly intermingled with the explosion gases. On ac-

count of the intimate mixture of the combustion gases and the air, the heat is dissipated throughout the entire combined volume of gas thereby reducing the temperature in inverse proportion to the respective volumes. The temperature is further reduced by the expansion of the gases, so that at the point of exhaust, it is comparatively little above atmospheric temperature. Incidentally, if there should be an excess of vapor in the explosive charge, such excess is simultaneously consumed with the air of the non-explosive charge. As the turning of the butterfly valve 19 opens communication between the two cylinders 7, 8, the pressure of the gases is exerted against both pistons. The pistons are thereby driven forward, the release port is opened and on the return stroke of the piston, the gases are driven out therefrom, whereupon the cycle of operation is renewed. Assuming that the mass of air in the intermediate chamber 12 is equal to three times the mass of explosion gases, the temperature of the mixture would be little more than one fourth of the temperature of the explosion gases. So, too, the pressure of the mixture would be of little more than one-fourth of the entire pressure of the explosion gases. It is to be noted, however, that the pressure of a given volume of gas increases with its temperature and consequently that, by utilizing the heat of combustion to heat the cold air, my engine utilizes energy that is commonly wasted in heating the walls of the cylinder and radiating therefrom and also by exhausting the gases at a high temperature. It is also noted that by reason of the comparatively low temperature secured by my construction, it is feasible to lubricate the cylinders internally and thereby minimize the loss of energy due to friction. It is also noted that by reason of such low temperature, conditions are obtained approximating those prevailing in steam engine practice, which are far more advantageous and economical than those heretofore prevailing in the use of internal combustion motors.

Obviously, the construction and arrangement of parts hereinbefore described admits of considerable modification without departing from my invention and I do not wish to be limited to the details thereof. Thus, while the drawings illustrate a four-cycle engine, the invention is applicable to two-cycle engines and engines of other types. So, too, while the larger cylinder in the engine above described takes a fresh charge of cool air for each explosion, it is feasible to use a portion of the gaseous products of combustion of the previous explosion or obtain the non-explosive charge from a different source.

I do not claim herein the method of keeping down the temperature of internal com-

bustion engines and of utilizing heat commonly wasted in such engines, as I expressly reserve such matter for another application.

What I claim herein is:

5 1. An internal combustion motor comprising a cylinder, a piston therein, a shaft operatively connected to said piston, means for charging said cylinder with an explosive mixture, means for igniting said
10 charge, an inclosed chamber having a large normally closed communication with said cylinder at the head end thereof arranged to make said chamber substantially continuous with said cylinder, a normally closed
15 valve for controlling such communication, and means operatively connected to said shaft for opening said valve substantially simultaneously with ignition of said charge whereby said chamber in effect increases the
20 volume of said cylinder.

2. An internal combustion motor comprising two cylinders having a passageway connecting them and an intermediate chamber communicating with said cylinders, a
25 check valve controlling the outlet from one cylinder into said chamber and means for controlling the communication between said chamber and the other cylinder and simultaneously opening the passageway between
30 said cylinders.

3. An internal combustion motor comprising two cylinders of different sizes having a passageway connecting them and an intermediate chamber communicating with said
35 cylinders, a check valve controlling the communication from the larger cylinder into said chamber and means for controlling the communication between said chamber and the smaller cylinder and simultaneously

opening said passageway between said cylinders. 40

4. An internal combustion motor comprising two cylinders of different sizes having a passageway connecting them and an intermediate chamber communicating with
45 said cylinders, means for charging the smaller cylinder with an explosive mixture, means for charging the larger cylinder with air, a check valve controlling the outlet from the larger cylinder into said chamber, means
50 for igniting said explosive charge, and means for opening communication between said chamber and the smaller cylinder and opening the passageway between said cylinders substantially simultaneously with
55 such explosion.

5. An internal combustion motor comprising two cylinders of different sizes having a passageway connecting them and an intermediate chamber communicating with said
60 cylinders, means for charging the smaller cylinder with an explosive mixture, means for charging the larger cylinder with a non-explosive gas, means for igniting the explosive charge, a check valve controlling the
65 outlet from the larger cylinder into said chamber, and means for controlling the communication between said chamber and the smaller cylinder and opening the passageway between said cylinders, substantially
70 simultaneously with such ignition.

Signed at St. Louis, Missouri, this 22nd day of September, 1909.

BENJAMIN BRAZELLE.

Witnesses:

G. A. PENNINGTON,
J. B. MEGOWN.