R. HUFF.

INTERNAL COMBUSTION MOTOR.

APPLICATION FILED MAY 11, 1911.

1,006,095.

Patented Oct. 17, 1911.

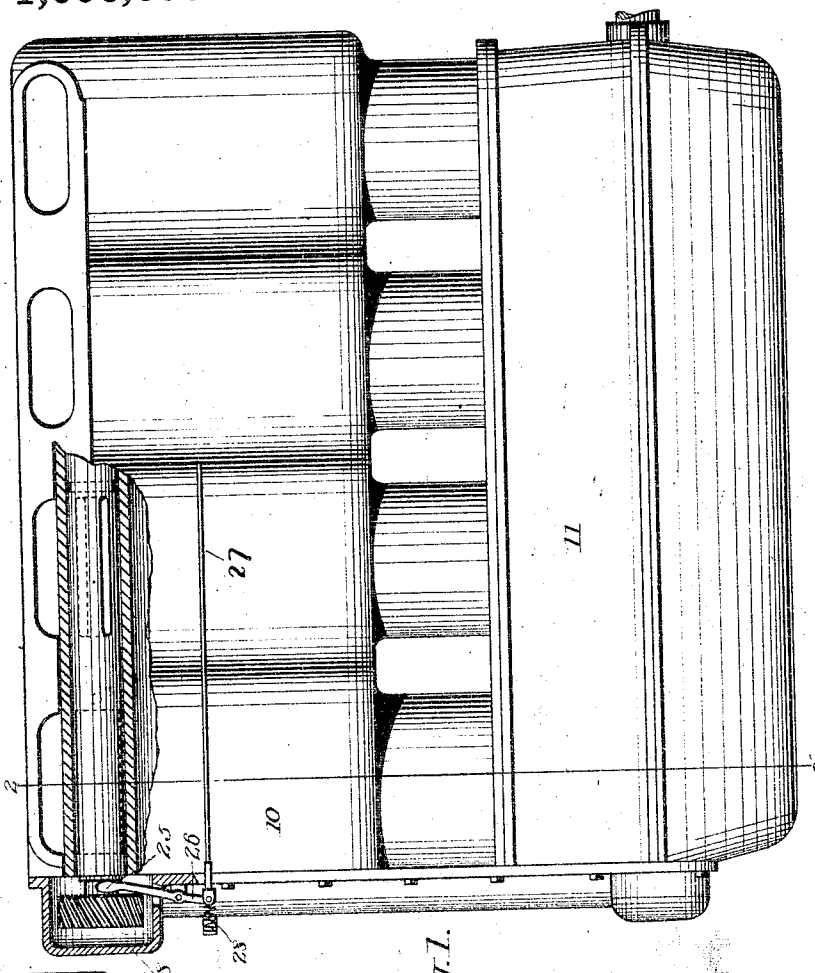

Fig. 1.

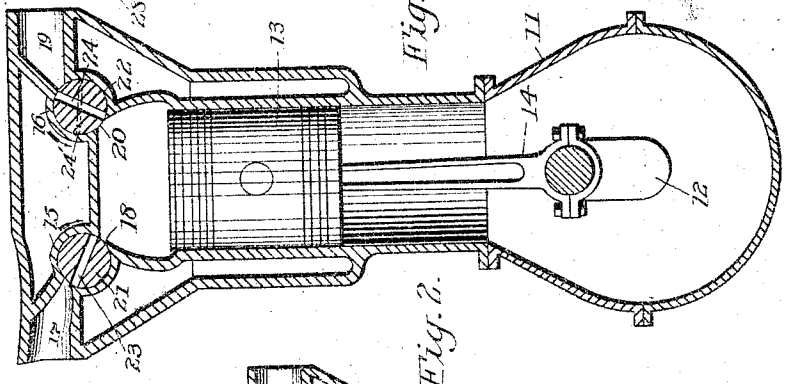

Fig. 2.

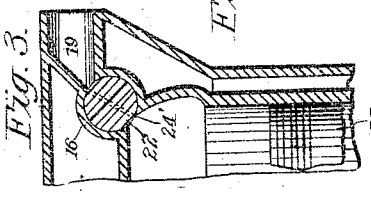

Fig. 3.

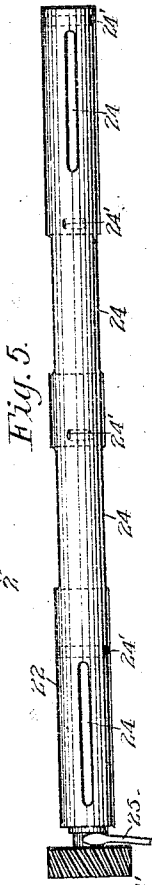

Fig. 5.

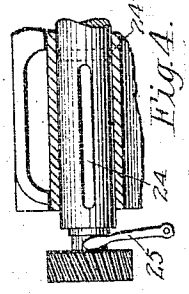

Fig. 4.

Witnesses
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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION MOTOR.

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To all whom it may concern:

Be it known that I, RUSSELL HUFF, a citizen of the United States, and resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Internal-Combustion Motors, of which the following is a specification.

This invention relates to internal combustion motors and particularly to motors of this type having rotary valves.

Most hydrocarbon motors which are used for motor vehicles and motor boats at the present time are designed so that they may be started by hand, *i. e.*, the first turn of the shaft is given by the operator to start the motor on its proper cycle of operation. In the larger motors of this class some difficulty is experienced in compressing the charge by thus turning the crank shaft by hand, and various devices are in use for relieving the cylinder pressure during the compression stroke of the motor. In a four stroke cycle motor it is desirable that the cylinder be open to the atmosphere to relieve the pressure during a part only of the compression stroke and during the remainder of this stroke and the other three strokes of the piston is should be closed.

An object of the present invention is to so construct a multi-cylinder motor of the above referred to type that the compression of each cylinder may be relieved at the proper time in the cycle, and the mechanism for doing so may be of simple construction and easily controlled by the operator.

The invention is shown as adapted to a motor employing independent rotary inlet and exhaust valves and the compression relief referred to is obtained by providing an auxiliary port in the rotary exhaust valve that is adapted to be inoperative during the normal operation of the motor and the exhaust valve is adapted to be moved axially for the purpose of temporarily bringing this auxiliary port into register with the cylinder exhaust port to facilitate starting by hand or by some mechanical means which may be inadequate for starting the motor on full compression.

Other objects of the invention will be apparent from the following description taken in connection with the drawings, in which, Figure 1 is a side elevation and part section of a four cylinder motor embodying this invention; Fig. 2 is a vertical section approximately on the line 2—2 of Fig. 1. Fig. 3 is a sectional view of a fragment of the cylinder shown in Fig. 2 and illustrating the exhaust valve in another position; Fig. 4 is a fragmentary view showing the exhaust valve in position to relieve compression; and Fig. 5 is a detail view of the rotary exhaust valve.

Referring to the drawings the cylinders 10 of the four cylinder motor shown in Fig. 1 are preferably cast in a block and mounted on the 2-part crank case 11 in which are arranged the bearings for the crank shaft 12. The piston and connecting rod are shown at 13 and 14 respectively.

The cylinder head is formed with two cylindrical bores 15 and 16 arranged parallel to each other and to the crank shaft the full length of the block casting. The inlet passage 17 and inlet port 18 for each cylinder enters the bore 15, and the exhaust passage 19 and exhaust port 20 enter the bore 16, as shown particularly in Fig. 2.

Fitted carefully to the bores 15 and 16 are the inlet valve 21 and exhaust valve 22 which are adapted through suitable mechanism to be rotated by the crank shaft at the rate of one revolution to four of the crank shaft. These rotary valves are provided with diametric through ports 23 and 24 for each cylinder which ports are adapted to connect passage 17 and port 18 and passage 19 and port 20, respectively, twice during each revolution of said valves. It will be understood that these valves are rotated at a suitable angle to each other so that the exhaust valve is open during the entire up stroke of the piston following the firing stroke and the inlet valve is open during the downward stroke of the piston following the exhaust stroke. Neither of the valves is open during the compression and firing strokes. Either of these valves may be provided with the pressure relief mechanism about to be described but preferably the exhaust valve is used for this purpose. Also this compression relief mechanism, embodying as it does an auxiliary port in one of the valves which is adapted to be brought into operation by manually shifting the exhaust valve endwise, may be employed for other purposes than relieving the compression in the cylinder, without departing from the spirit and

remaining within the scope of this invention.

Adjacent each of the exhaust ports 24 in the exhaust valve 22, and in that part of the valve which is normally covered during the entire cycle of the motor, is an auxiliary port 24′, shown as a diametric through port. This port is arranged at such an angle to the exhaust port 24 that it will follow the exhaust port in registering with the cylinder exhaust port 20, and this latter register will take place during approximately the first half of the up stroke of the piston following the intake stroke which is usually denominated the compression stroke. It will be understood that this registering of the auxiliary port 24′ with the cylinder exhaust port 20 can take place only when the exhaust valve 22 has been moved axially to the position in which it is shown in Fig. 4. The valve 22 may be so moved by an arm 25 of a lever 26, which lever may be operated manually by a connecting rod 27 or equivalent means. A spring 28 for maintaining the valve 22 in the normal position shown in Fig. 1 may be provided at a suitable point.

In Fig. 2 the exhaust valve is shown as just closed and the inlet valve is about to open, the piston being at the top of the exhaust stroke. The auxiliary port 24′ is shown in dotted lines and, of course, is not in register with the cylinder exhaust port 20. In Fig. 3 the piston 13 is shown as being about half way up on the compression stroke and the auxiliary port 24′ is just closing, having relieved the cylinder compression so that it is easy to crank the motor. Fig. 5 shows the relative arrangement of the ports in the exhaust valve in a 4-cylinder motor.

Having thus described my invention, what I claim is:

1. In a hydrocarbon motor, the combination with a rotary exhaust valve, of means in said valve for relieving the cylinder pressure during a part of the compression stroke.

2. In a hydrocarbon motor, the combination with a rotary exhaust valve, said valve having a main exhaust port and an auxiliary port, of means for normally maintaining said auxiliary port inoperative, and means for bringing said auxiliary port into operation.

3. In a hydrocarbon motor, the combination with a rotary exhaust valve, said valve having a main exhaust port and an auxiliary port, of means for normally maintaining said auxiliary port inoperative, and means for shifting said valve to bring said auxiliary port in a registering plane with the cylinder port.

4. In a hydrocarbon motor, the combination with the cylinder having main intake and exhaust ports and a valve mechanism controlling said ports and including a rotary valve, said rotary valve having an auxiliary port therein, means for maintaining said auxiliary port normally inoperative, and manually controlled means for bringing said auxiliary port into operation.

5. In a hydrocarbon motor, the combination with the cylinder having main intake and exhaust ports, and a valve mechanism controlling said ports including a rotary valve having a main port adapted to register with said exhaust port and having a normally inoperative auxiliary port therein at an angle to said main port, of means for rotating said valve from the crank shaft, and means for shifting said valve to bring said auxiliary port into operation.

6. In a multi-cylinder hydrocarbon motor, the combination with the cylinders having separate inlet and exhaust ports, of a rotary valve for the inlet ports and a rotary valve for the exhaust ports, said rotary exhaust valve being adapted to be moved longitudinally from its normal running position to starting position and having a relief port for each cylinder adapted to be brought into operative relation with the cylinder exhaust ports when the pistons are on their respective compression strokes and when said exhaust valve is in said starting position only, and means for shifting said exhaust valve manually.

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

RUSSELL HUFF.

Witnesses:
W. H. FINCKEL, Jr.,
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