

May 12, 1931.

W. E. HOFFMAN

1,804,873

COMPRESSOR AND MEANS FOR CONVERTING FORD MOTORS INTO SAME

Filed May 28, 1927

2 Sheets-Sheet 1

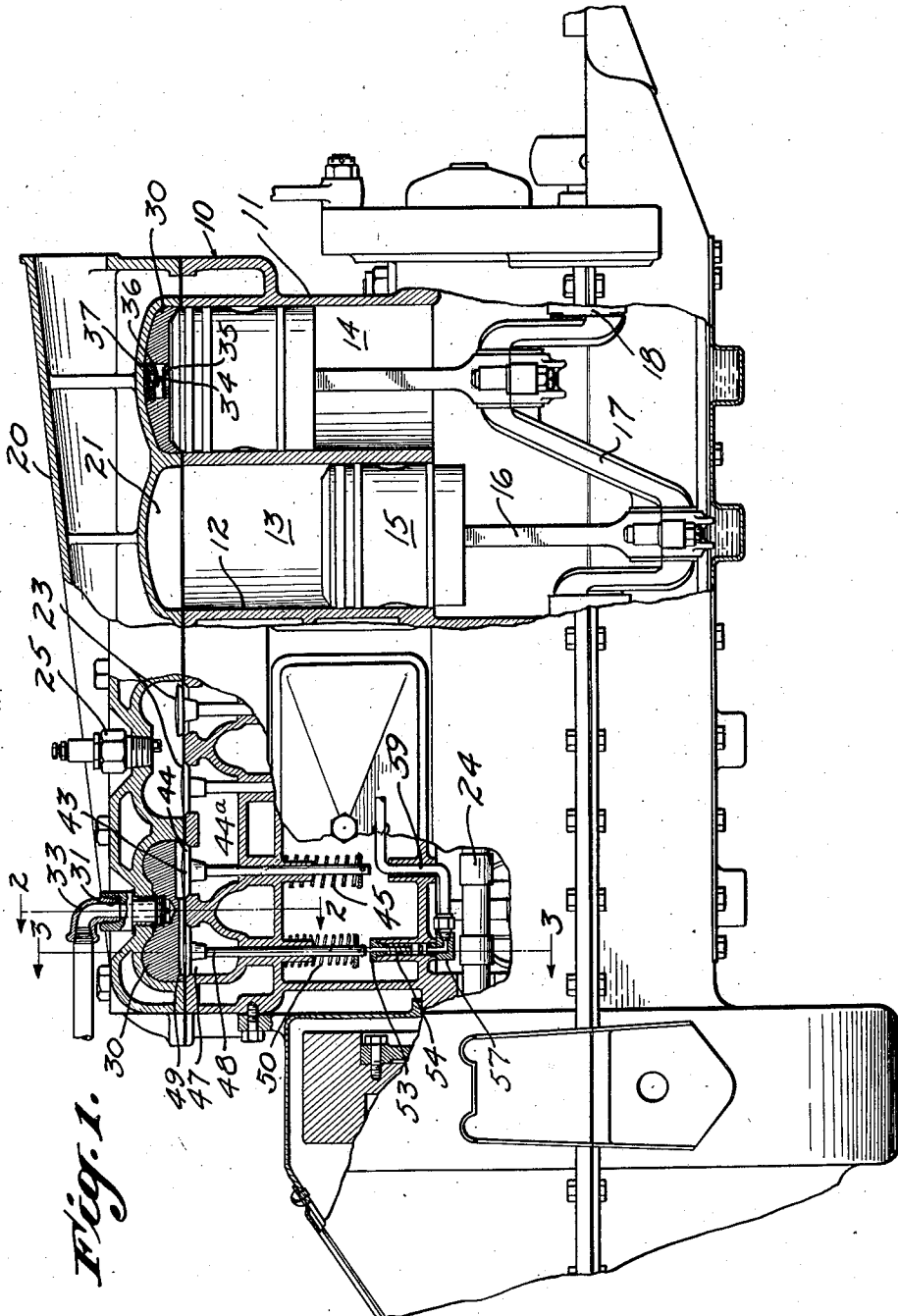


Fig. 1.

INVENTOR:
WILLIAM E. HOFFMAN
BY *Fred Hoffman*
ATTORNEY.

May 12, 1931.

W. E. HOFFMAN

1,804,873

COMPRESSOR AND MEANS FOR CONVERTING FORD MOTORS INTO SAME

Filed May 28, 1927

2 Sheets-Sheet 2

Fig. 2.

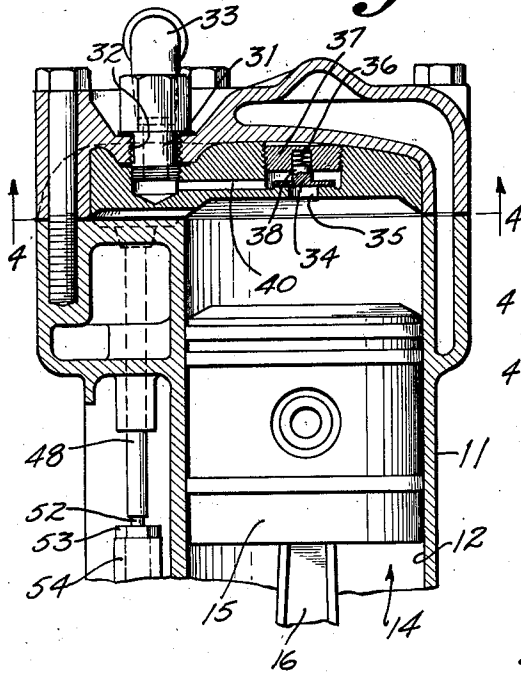


Fig. 3.

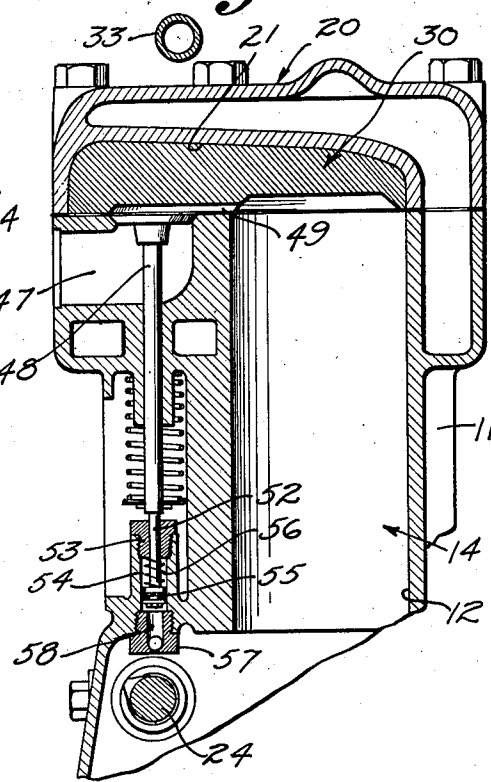
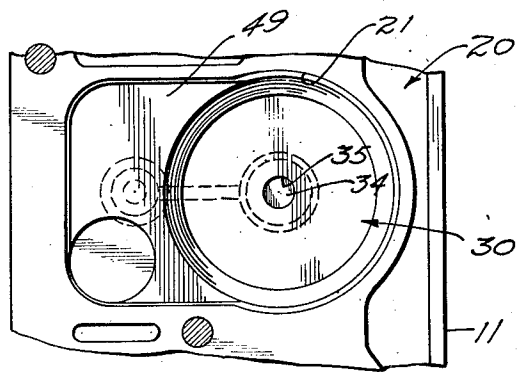


Fig. 4.



INVENTOR:
WILLIAM E. HOFFMAN
BY *Ford Davis*
ATTORNEY.

UNITED STATES PATENT OFFICE

WILLIAM E. HOFFMAN, OF LOS ANGELES, CALIFORNIA

COMPRESSOR AND MEANS FOR CONVERTING FORD MOTORS INTO SAME

Application filed May 28, 1927. Serial No. 194,994.

This invention relates to compressors, and it has for its broad object to provide a compressor which has the compressor and internal combustion drive engine combined in one block.

An object of the invention is to provide a method of converting an internal combustion engine into a combination engine and compressor.

Another object of my invention is to provide a method of converting an internal combustion engine into a compressor.

A further object of the invention is to provide a compressor which will not pump when there is a predetermined pressure on the pressure-side thereof.

Other objects and advantages of the invention will be made evident hereinafter.

Referring to the drawings in which I illustrate a preferred form of my invention:

Fig. 1 is an elevational view partly sectioned.

Fig. 2 is an enlarged cross section through the upper part of a compressor-cylinder of the invention, this view being taken as indicated by the line 2—2 of Fig. 1.

Fig. 3 is a similar section but is taken on the line 3—3 of Fig. 1.

Fig. 4 is a horizontal section taken as indicated by the line 4—4 of Fig. 2.

The form of the invention shown in the drawing is embodied in a motor having a motor body 10 of which a block 11 is a part. The motor body 10 provides a plurality of cylinders 12. The engine shown is a Ford motor, and the block 11 is provided with four cylinders 12. The two central cylinders are power-cylinders and will hereinafter be referred to by the numeral 13, and the two end cylinders are compressor-cylinders and will hereinafter be referred to by the numeral 14. Operating in each of the cylinders 13 and 14 is a piston 15 having a connecting-rod 16 connected thereto. The lower ends of the connecting-rods 16 are journaled on a crank-shaft 17. The crank-shaft 17 is supported by main bearings 18. Secured to the top of the block 11, and forming a part of the motor body 10, is a head part 20 which defines the upper wall of the cylinders 12 and provides compression-

spaces or chambers 21 above each of the pistons. The power-cylinders 13 have valve mechanism consisting of valves 23 which are operated by a cam-shaft 24, and associated mechanism for operating these parts. This construction is not a part of the invention and is at the present time part of the prior art. Each power-cylinder 13 is provided with a spark-plug 25 which is located in the compression-spaces thereof.

My invention as illustrated best in Figs. 2 and 3 provides an insert-member 30, one of which is placed in each compression-spaces 21 of the compressor-cylinders 14. The insert-members 30 are adapted to completely fill the compression-spaces so that when the piston reaches the upper end of its stroke there will be no clearance above it. It should be understood that the less the clearance at the upper end of the cylinder between the head of the cylinder and the piston, the greater will be the efficiency of the compressor. The insert-members 30 are each secured in place by a fixture 31 which is extended through the ordinary spark-plug port of the motor, as indicated by the numeral 32. Secured to each fixture 31 is an exhaust-pipe 33. Each member 30 is provided with an exhaust-valve 34 which closes an exhaust-port 35 in the central part of each insert-member. The exhaust-valve 34 of each insert-member 30 is resiliently retained against a seat by means of a spring 36 which is placed in a socket of a plug 37, between a guide 38 of the valve 34 and the bottom of the socket. When the piston of a compressor-cylinder is moved upward, the exhaust-valve 34 thereof is unseated so that the port 35 is connected to a passage 40, this passage 40 connecting to the fixture 31 and consequently to the exhaust-pipe 33.

As illustrated in Fig. 1 each power-cylinder 13 is provided with a valve 43. This valve 43 is the ordinary intake-valve of the engine and closes an ordinary intake-port thereof communicating with an ordinary intake manifold 44a. This valve 43, however, is not cam-operated but is held tightly seated by a resilient means in the form of a coil-spring 45.

Each compressor-cylinder 14 has a port 47 which is ordinarily the exhaust-port of this particular cylinder. In my invention I utilize this port as an intake and pressure-relief means and provide an intake-valve 48 for closing this port. The intake-valve 48 when seated closes a passage 49, which is connected to the upper part of one of the compressor-cylinders 14, from the atmosphere. A resilient means in the form of a weak spring 50 is provided for resiliently seating the valve 48. During the down stroke of a piston in a compressor-cylinder the suction created opens the intake-valve 48 and draws air thereinto.

As shown best in Figs. 1 and 3, the lower end of each of the intake-valves 48 of the compressor-cylinders engages a rod 52 which extends through a nut 53 screwed into the upper end of a tappet-guide 54 of the engine. The rod 52 is provided with a piston 55 which is adapted to operate in the tappet-guide 54. Between the piston 55 and a lower face of the nut 53 is a spring 56. The lower end of this tappet-guide 54 is closed by a nut 57 having a passage 58 formed therethrough. Connected to the nut 57 and in communication with the passage 58 is a pressure-line 59. The pressure-line 59 extends from a pressure-source or from where the pressure in the exhaust-line 33 may be stored. As an example, the pressure-line 59 may be extended to a compressor air-reservoir or may extend to a pressure-operated diaphragm.

The operation of this part of the invention is as follows:

The pressure which is produced by the compressor is transferred through the pressure-line 59 to the tappet-guide 54 and upward against the piston 55. When this pressure reaches a predetermined amount it is sufficient to lift the intake-valve 48 and to connect the passage 49 with the atmosphere. It will be seen that the compressor will then pump into the atmosphere and the air-reservoir or the pressure-side of the compressor will not be overloaded. In my invention I provide an intake and pressure-relief means of this character on both of the compressor-cylinders 14. In certain uses of the compressor it is not necessary to do this, but is sufficient to provide only one of the compressor-cylinders with a means of this character.

As previously explained, the engine shown is a Ford engine and has four cylinders. I convert two of these cylinders into compressor-cylinders and utilize the other two for power. The two central cylinders are utilized for power because of the fact that the explosion order in the different cylinders is 1, 2, 4 and 3. The Ford engine is converted from an engine which has a power-stroke twice a revolution to an engine having a power-stroke only once every revolution. It will, of course, be understood that my inven-

tion is not limited to a Ford motor but may be embodied in any motor regardless of the number of cylinders or regardless of the design.

The important features of the invention have been pointed out in the foregoing description, but as a résumé they will be briefly pointed out. In the first place, the invention provides a combined engine and compressor which is embodied in the same block and which utilizes but a single crank-shaft. The compressor-cylinders are readily adapted to the purpose of being utilized as a compression-means by a simple conversion, which consists of installing the insert-member, the exhaust-means, and the intake-means.

I claim as my invention:

1. In combination: a motor body having a power-cylinder and a compressor-cylinder including a head part providing chambers, one chamber being disposed at the upper end of each cylinder; an insert member disposed in one of said chambers at the upper end of said compressor-cylinder; a pair of pistons, one being in each of said cylinders; a crank-shaft carried by said motor body; a pair of connecting-rods, each being connected to one of said pistons and said crank-shaft; intake and exhaust mechanism for said power-cylinder; an intake-valve for said compressor-cylinder; an exhaust valve in said insert-member; and an exhaust-pipe fixture connected to said head part, and communicating with a passage closed by said exhaust-valve.
2. In combination: a motor body having a power-cylinder and a compressor-cylinder and including a head part providing chambers, one chamber being disposed at the upper end of each cylinder; an insert member disposed in one of said chambers at the upper end of said compressor-cylinder; a pair of pistons, one being in each of said cylinders; a crank-shaft carried by said motor body; a pair of connecting-rods, each being connected to one of said pistons and said crank-shaft; intake and exhaust mechanism for said power-cylinder; an intake-valve for said compressor-cylinder; an exhaust-valve in said insert-member; and an exhaust-pipe fixture connected to said head part, and communicating with a passage closed by said exhaust-valve, said insert member being retained in place by said exhaust-pipe fixture.
3. In combination: a motor body having a power-cylinder and a compressor-cylinder and including a head part providing chambers; an insert-member disposed in one of said chambers; a pair of pistons, one being in each of said cylinders; a crank-shaft carried by said motor body; a pair of connecting-rods, each being connected to one of said pistons and said crank-shaft; intake and exhaust mechanism for said power-cylinder; an intake-valve for said compressor-cylinder; an exhaust-valve for said compressor-

cylinder, said exhaust-valve being carried by said insert member; and an exhaust-pipe fixture connected to said head part, and communicating with a passage closed by said exhaust-valve.

4. In combination: an internal combustion motor body having a power-cylinder and a compressor-cylinder and including a head part providing chambers; an insert-member in one of said cylinders; a pair of pistons, one being in each of said cylinders; a crank-shaft carried by said motor body; a pair of connecting-rods, each being connected to one of said pistons and said crank-shaft; intake and exhaust mechanism for said power-cylinder; an intake-valve for said compressor-cylinder; an exhaust-valve in said insert-member; an exhaust-pipe fixture connected to said head part, and communicating with a passage closed by said exhaust-valve; and a pressure-relief means for said compressor-cylinder, said pressure-relief means being positioned in one of the original tappet-guides of said body.

5. In combination: an internal combustion motor body having a power-cylinder and a compressor-cylinder and including a head part providing chambers; an insert-member in one of said cylinders; a pair of pistons, one being in each of said cylinders; a crank-shaft carried by said motor body; a pair of connecting-rods, each being connected to one of said pistons and said crank-shaft; intake and exhaust mechanism for said power-cylinder; an intake valve for said compressor-cylinder; an exhaust-valve carried by said insert member; an exhaust-pipe fixture connected to said head part, and communicating with a passage closed by said exhaust-valve; and a pressure-relief means for said compressor-cylinder, said pressure-relief means being positioned in one of the original guides for valve-operating means formed in said body.

6. In combination: a motor body having a plurality of cylinders and a head part providing chambers thereover; a plurality of pistons in said cylinders; a crank-shaft carried by said motor body; a plurality of connecting-rods connecting said pistons to said crank-shaft; inlet and exhaust valves for said cylinders; and means inserted into one of said chambers to reduce the size of the compression space thereof and convert said cylinder into a compressor-cylinder.

7. An article of manufacture comprising an insert member constructed to be inserted in the head part of an internal combustion motor to materially decrease the compression space in a cylinder and thus permit said cylinder to be used as a compressor-cylinder.

8. An article of manufacture comprising an insert member constructed to be inserted in the head part of an internal combustion motor to materially decrease the compression

space in a cylinder and thus permit said cylinder to be used as a compressor-cylinder there being an exhaust opening in said insert member in alinement with a spark-plug opening formed in said head part.

9. In combination: a motor body having a power-cylinder and a compressor-cylinder; a pair of pistons, one being in each of said cylinders to provide compression-spaces in said cylinders; a crank-shaft; a pair of connecting-rods, each being connected to one of said pistons and to said crank-shaft; intake and exhaust valve mechanism for said power-cylinder; an intake-valve for said compressor-cylinder; an exhaust-valve for said compressor-cylinder; an insert-member positioned in the compression spaces of said compressor-cylinder to increase the amount of compression; and means extending through the conventional spark-plug port provided in said compressor-cylinder for holding said insert-member in place.

10. A combination as defined in claim 9 in which said spark-plug port is utilized as an exhaust passage, and in which said means includes an exhaust-pipe fixture extending through said spark-plug port.

11. In combination: an internal combustion motor body having a power-cylinder and a compressor-cylinder; a pair of pistons, one being in each of said cylinders to provide compression-spaces in said cylinders; a crank-shaft; a pair of connecting-rods, each being connected to one of said pistons and to said crank-shaft; intake and exhaust valve mechanism for said power-cylinder; an intake-valve for said compressor-cylinder; an exhaust-valve for said compressor-cylinder; and a pressure-relief means for said compressor cylinder, said means being positioned in one of the original tappet-guides of said body.

12. In combination: a motor body having a power-cylinder and a compressor-cylinder; an insert-member in said compressor-cylinder; a pair of pistons, one being in each of said cylinders; a crank-shaft rotatable relative to said motor body; a pair of connecting-rods, each being connected to one of said pistons and said crank-shaft; intake and exhaust valve mechanism for said power-cylinder; an automatic intake-valve for said compressor-cylinder operated by suction; an exhaust-valve in said insert-member; and an exhaust-pipe fixture communicating with said exhaust-valve.

13. In combination: an internal combustion motor body having a power-cylinder and a compressor-cylinder; a pair of pistons, one being in each of said cylinders; a crank-shaft rotatable relative to said motor body; a pair of connecting-rods, each being connected to one of said pistons and said crank-shaft; intake and exhaust valve mechanism for said power-cylinder; an intake-valve for

said compressor-cylinder; an exhaust-valve for said compressor cylinder; and a pressure-relief means for said compressor-cylinder, said pressure-relief means being positioned in one of the original guides for valve-operating means formed in said body, and operating in said guide to hold said intake-valve open when the pressure built up by said compressor-cylinder exceeds a given maximum.

14. In combination: a motor body of an internal-combustion engine, said body having a plurality of cylinders each of said cylinders having intake, exhaust, and spark-plug ports therein, means for permanently closing an intake port of one of said cylinders, such cylinder to be hereinafter termed a compressor-cylinder; means for utilizing said exhaust port of said compressor-cylinder as a compressor-cylinder intake port to intermittently supply a gas to said compressor-cylinder; a piston reciprocable in each of said cylinders, said piston in said compressor-cylinder compressing said gas therein; and means for discharging said compressed gas through said spark-plug port of said compressor-cylinder.

15. An article of manufacture comprising an insert-member insertable into the compression-space of a cylinder of an internal combustion engine to decrease the volume of this space, said member including an opening adjacent the spark-plug port of said cylinder, said opening receiving a fixture extending through said spark-plug port and into said opening in a manner to clamp said insert-member in place.

16. An article of manufacture comprising an insert-member insertable into the compression-space of a cylinder of an internal combustion engine to decrease the volume of this space, said member having a passage communicating between said cylinder and the spark-plug port of said cylinder.

17. An insert-member as defined in claim 16 which includes a valve therein, said valve controlling the flow of gas through said passage.

18. In combination: in an internal combustion motor body having a cylinder and a head; a piston in said cylinder; a crank shaft carried by said motor body; a connecting rod connecting said piston and said crank shaft, there being a compression space at the upper end of said cylinder; an insert-member in said compression space and clamped against said head; an exhaust valve in said insert-member; an exhaust pipe communicating with said exhaust valve; a valve port in said motor body; an intake valve operating in said valve port; a tappet guide in said motor body; and a pressure relief means situated in said tappet guide, said pressure relief means coacting with said intake valve.

19. Mechanism for use to convert a combustion

motor of the character described into a compressor, including: intake and discharge means associated with a cylinder of said motor for intake and discharge of a fluid medium; and an insert-member for reducing the volume of the compression space of said cylinder.

20. A compressor device, including: a combustion motor of the character described; and means equipping said motor for compressor utility, said means including intake and discharge means associated with a cylinder of said motor for intake and discharge of a fluid medium and an insert-member for reducing the volume of the compression space of said cylinder.

21. A compressor device, including: a combustion motor of the character described; and means equipping said motor for compressor utility, said means including intake and discharge means associated with a cylinder of said motor for intake and discharge of a fluid medium and an insert-member positioned against the upper wall of the compression space of said cylinder for reducing the volume of said compression space.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 21st day of May, 1927.

WILLIAM E. HOFFMAN.