

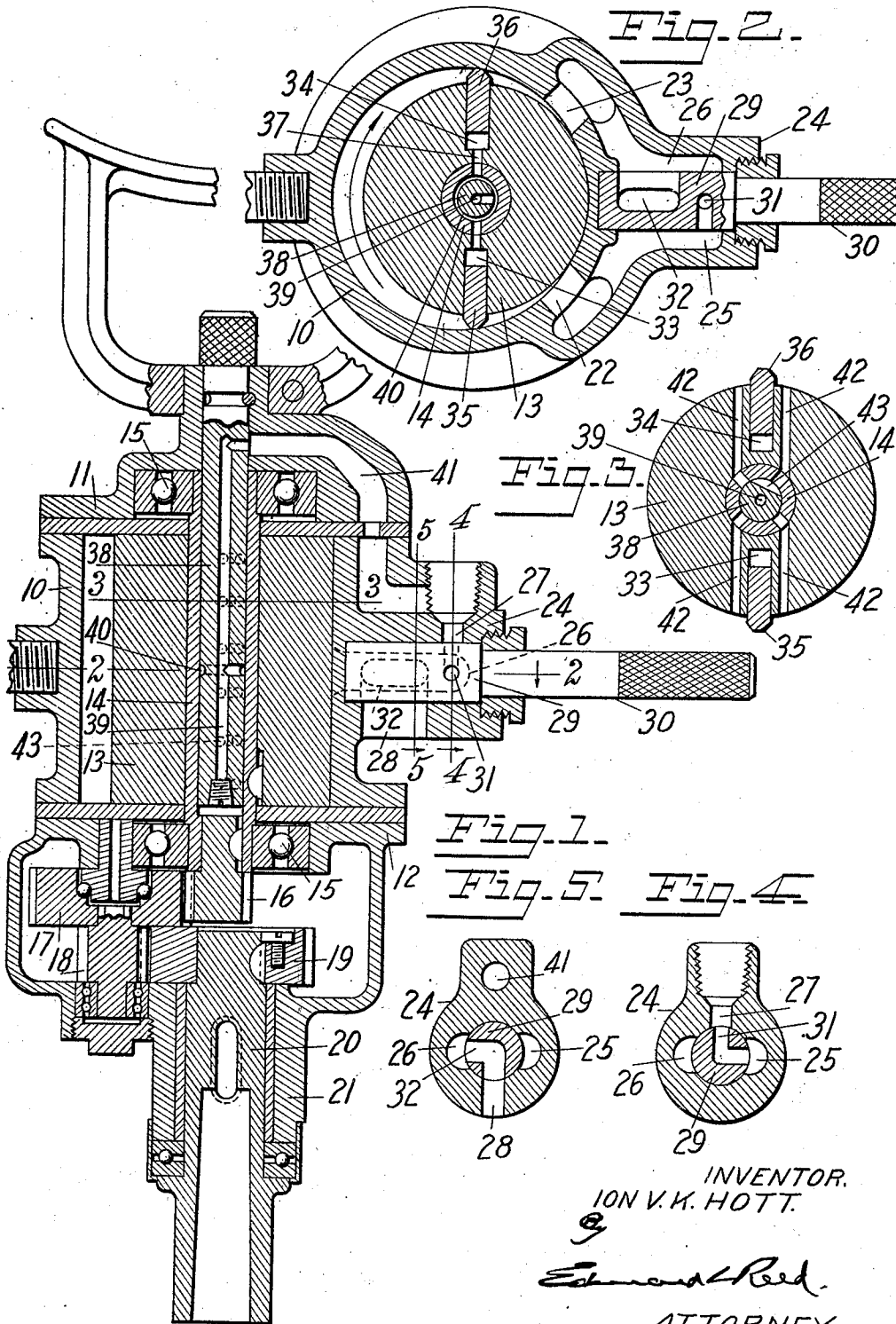
June 16, 1931.

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1,810,176

AIR MOTOR

Filed Oct. 4, 1927



UNITED STATES PATENT OFFICE

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AIR MOTOR

Application filed October 4, 1927. Serial No. 223,993.

This invention relates to an air motor and more particularly to a reversible air motor of the portable type.

One object of the invention is to provide a motor of this kind which will be simple in its construction, efficient in operation and which can be quickly and easily reversed by the manipulation of a single valve.

A further object of the invention is to provide improved means for yieldably retaining the piston blades in their extended positions by air pressure.

A further object of the invention is to provide means for automatically relieving the compression of the air behind the forward piston as the latter approaches the exhaust port, thus preventing back pressure on the piston.

Other objects of the invention will appear as the apparatus is described in detail.

In the accompanying drawings Fig. 1 is a vertical sectional view taken centrally through a motor embodying my invention; Fig. 2 is a transverse section taken on the line 2—2 of Fig. 1; Fig. 3 is a transverse section taken through the piston and the controlling member on the line 3—3 of Fig. 1; Fig. 4 is a section taken on the line 4—4 of Fig. 1; and Fig. 5 is a section taken on the line 5—5 of Fig. 1.

In these drawings I have illustrated one embodiment of my invention and have shown the same as comprising a casing 10 having a cylindrical body portion provided with heads 11 and 12. This casing has within the same a work chamber which is here shown as cylindrical in shape but which may, if desired, depart from a true cylindrical form. Rotatably mounted within this work chamber is a cylindrical piston 13 which is of a diameter somewhat less than the diameter of the work chamber and is mounted eccentrically therein and so arranged that it will contact with the circumferential wall of the work chamber at one side thereof only, the contact between the piston and the wall of the chamber being limited to a relatively narrow portion of the wall. This piston is carried by a hollow shaft 14 which is journaled in the upper and lower cylinder heads and may, if

desired, be provided with anti-friction bearings 15. The lower end of this shaft extends downwardly below the lower bearing 15 and is provided with a pinion 16 which meshes with a gear 17. The gear 17 has secured thereto a pinion 18 which meshes with a second gear 19 rigidly secured to an operating shaft 20 journaled in a bearing 21 in the lower portion of the head 12, this head being hollow to provide a housing within which the gearing is located. The arrangement of the gearing is such that the operating shaft is in axial alinement with the motor shaft but is connected therewith through the gear train to reduce the speed of rotation.

The circumferential wall of the work chamber is provided with an inlet port 22 and an exhaust port 23 these ports being arranged on the respective sides of but adjacent to that portion of the wall which is engaged by the piston. The main casing 10 also has a valve chamber and, in the present instance, this valve chamber is shown as formed integral with the cylindrical body portion of the casing. Preferably the body portion of the casing has a laterally extending projection or hollow boss 24 within which the valve chamber is formed and which is provided on opposite sides of that chamber with conduits 25 and 26 communicating respectively with the inlet port 22 and the exhaust port 23. The casing is also provided with an inlet opening 27 leading to the valve chamber and adapted to be connected with a suitable conduit, such as a flexible hose, leading to a source of supply for air under pressure. This inlet opening is here shown on the upper side of the valve chamber and is arranged between the conduits 25 and 26. Leading from the lower side of the chamber is an exhaust opening or port 28 which is also arranged between the conduits 25 and 26. Rotatably mounted within the valve chamber is a valve member 29 connected with which is a rod or handle 30 extending beyond the valve chamber to provide means for rotating the valve. The valve member 29 is provided with an inlet passageway which is of such a character that when the valve member is in one position the inlet

opening 27 will be connected with the conduit 25 and when the valve member is in another position the inlet opening will be connected with the conduit 26. In the present instance, this passageway is angular in form, as shown at 31, and the ends thereof open through the wall of the valve member at substantially right angles one to the other. The valve member also has an exhaust passageway 32 which is similar in shape to the inlet passageway and is so arranged that when the inlet opening 27 is connected through the passageway 31 of the valve member with the conduit 25 the exhaust opening 28 will be connected through the passageway 32 with the conduit 26 and when the valve is turned to connect the inlet opening with the conduit 26 the conduit 25 will be connected with the exhaust opening.

The piston is provided with yieldable blades which engage the circumferential wall of the work chamber and constitute abutments against which the air acts. Preferably these blades are radially arranged and, as here shown, the piston is provided on opposite sides thereof with longitudinally extending radial channels or guideways 33 and 34 and blades 35 and 36 are slidably mounted in these guideways for radial movement, each blade extending for the full length of the piston. Each of the channels 33 and 34 is provided at its inner edge with a port 37 leading to the interior of the hollow shaft 14. Mounted in the hollow shaft is a controlling member or rod 38 which is preferably supported in the upper head 11 of the casing and which has a longitudinal bore 39 extending lengthwise thereof. Further, this controlling member has a circumferential groove 40 which communicates at all times with the passageways or ports 37 leading to the channels 33 and 34. At its outer end the bore 39 of the member 38 communicates with a conduit 41, in the present instance formed in the body of the casing, which leads to the inlet opening 27 and is at all times in open communication therewith. Consequently air under pressure is introduced into the bore 39 and through the groove 40 and ports 37 to the channels 33 and 34 and the blades 35 and 36 are yieldably pressed into engagement with the circumferential wall of the work chamber.

When the valve 29 is in the position shown in the drawings the air enters the work chamber through the conduit 25 and port 22 and acts on the blade 35 to rotate the piston in a clockwise direction, as shown in Fig. 2, and escapes through the port 23 and the conduit 26. As the piston rotates the air is confined between the converging walls of the piston and the chamber and is compressed to such an extent that unless this compression is relieved it will offer more or less resistance to the rotation of the piston, thus

decreasing the efficiency of the motor. In order to relieve the pressure and expedite the exhaust of the air I have provided means for by-passing the air about the blade which is approaching the exhaust port. Each by-pass is normally closed to prevent the passage of air about the blades but is automatically opened as the blade approaches the exhaust port. The by-passes may take various forms and may be controlled in various ways but I prefer to provide the piston, adjacent to each blade, with two passageways 42, which are here shown as substantially parallel with the blade, which communicate with the work chamber on the opposite sides of the blade, and which are connected at their inner ends with the interior of the hollow shaft 14. There are preferably a plurality of pairs of passageways associated with each blade and spaced apart lengthwise thereof. The rod or controlling member 38 has formed therein a series of peripheral ports or chordwise recesses 43 arranged in line with the inner ends of the several sets of passageways 42. Each peripheral port or recess is of such a length that it will bridge the space between the inner ends of two of the passageways and thus connect those passageways and open the by-pass. The peripheral ports or recesses are so arranged that they will open the by-passes about each blade a short distance in advance of the exhaust port and, as here shown, these ports are arranged on radial lines somewhat in advance of the exhaust port. The controlling member or rod 38 maintains the by-passes of each blade closed until that blade reaches a predetermined position with relation to the exhaust port, at which time the recesses 43 bridge the inner ends of the respective pairs of passageways 42 associated with that blade and thereby permit the air to escape from the chamber in the rear of the blade to the front of the blade, thereby expediting the exhaust of the air and relieving the pressure which would otherwise be created. The controlling member or rod 38 is normally stationary but is capable of rotation to permit the recesses 43 to be moved into positions adjacent to the inlet port 22, when the motor is reversed. It will be understood that when the valve 29 is rotated through a quarter rotation, to shift the positions of the inlet and exhaust passageways, the air will be admitted to the work chamber through the conduit 26 and the port 23, which then becomes the inlet port and the port 22 becomes the exhaust port, and by shifting the position of the controlling member 38 the air back of the blade will be gradually exhausted on the reverse operation in the same manner as it is exhausted on the forward operation. It is not necessary to the operation of the device in a reverse direction that this relieving or gradual exhaustion of the air should be provided for on

the reverse operation because as high a degree of efficiency is not necessary on the reverse operation as on the forward operation.

5 While I have shown and described one embodiment of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

10 Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a portable air motor, a casing having
15 a work chamber, a hollow shaft journaled in said casing and extending through said chamber, a piston carried by said shaft within said chamber and having radial guideways, blades mounted in said guideways for
20 radial movement, said shaft having ports connecting said guideways with the interior thereof, a normally stationary member mounted in said hollow shaft and having a longitudinal bore and also having a circumferential groove connected with said bore
25 and communicating with said ports to deliver air to said guideways at the inner edges of said blades, means for connecting said bore with a source of supply for air under
30 pressure, and means for admitting air under pressure to and exhausting the same from said work chamber.

2. In a portable air motor, a casing having
35 a work chamber, a hollow shaft journaled in said casing and extending through said chamber, a piston carried by said shaft within said chamber and having radial guideways, blades mounted in said guideways for
40 radial movement, said shaft having ports connecting said guideways with the interior thereof, a normally stationary member mounted in said hollow shaft and having a longitudinal bore and also having a circumferential groove connected with said bore and
45 communicating with said ports to deliver air to said guideways at the inner edges of said blades, said casing having a valve chamber and inlet and exhaust openings therefor and having a conduit leading from said inlet
50 opening to the bore in said stationary member, conduits connecting said valve chamber with said work chamber, and a valve member to control the admission and exhaust of air to and from said work chamber.

3. In a portable air motor, a casing having
55 a work chamber, a piston mounted for rotation in said chamber and arranged to engage a relatively narrow portion of the circumferential wall of said chamber at one side
60 thereof only, said wall having inlet and exhaust ports at the respective sides of and adjacent to said portion thereof, yieldable blades carried by said piston and engaging
65 said wall, and means controlled by the position of said piston for connecting that por-

tion of said chamber which is in the rear of one of said blades with that portion of said chamber which is between said blade and said exhaust port as said blade approaches
70 said exhaust port.

4. In a portable air motor, a casing having
75 a work chamber, a piston mounted for rotation in said chamber and arranged to engage a relatively narrow portion of the circumferential wall of said chamber at one side
80 thereof only, said wall having inlet and exhaust ports at the respective sides of and adjacent to said portion thereof, yieldable blades carried by said piston and engaging
85 said wall, said piston having normally disconnected passageways communicating with said chamber in front of and in the rear of each of said blades, and means for connecting
90 said passageways as said blade approaches said exhaust port.

5. In a portable air motor, a casing having
95 a work chamber, a piston mounted for rotation in said chamber and arranged to engage a relatively narrow portion of the circumferential wall of said chamber at one side
100 thereof only, said wall having inlet and exhaust ports at the respective sides of and adjacent to said portion thereof, yieldable blades carried by said piston and engaging
105 said wall, said piston having by-passes formed therein and extending about the respective
110 blades, and means controlled by the position of said piston to normally close said by-passes and to open the same as the respective
115 blades approach said exhaust port.

6. In a portable air motor, a casing having
120 a work chamber, a piston mounted for rotation in said chamber and arranged to engage a relatively narrow portion of the circumferential wall of said chamber at one side
125 thereof only, said wall having inlet and exhaust ports at the respective sides of and adjacent to said portion thereof, yieldable blades carried by said piston and engaging
130 said wall, said piston having a longitudinal bore and having passageways arranged on the respective sides of each of said blades and extending from the outer surface of said piston to said bore, and a member mounted in the longitudinal bore of said piston to normally
135 close the inner ends of said passageways but to connect said inner ends of the passageways about each blade as said blade approaches said exhaust port.

7. In a portable air motor, a casing having
140 a work chamber, a piston mounted for rotation in said chamber and arranged to engage a relatively narrow portion of the circumferential wall of said chamber at one side
145 thereof only, said wall having inlet and exhaust ports at the respective sides of and adjacent to said portion thereof, yieldable blades carried by said piston and engaging
150 said wall, said piston having a longitudinal bore and having passageways arranged on

the respective sides of each of said blades and extending from the outer surface of said piston to said bore, and a normally stationary member arranged in the longitudinal bore of said piston to normally close the inner ends of said passageways, said member having a port at that side thereof adjacent to said exhaust port to connect the inner ends of the passageways about said blade as said blade approaches said exhaust port.

8. In a portable air motor, a casing having a work chamber, a piston mounted for rotation in said chamber and arranged to engage a relatively narrow portion of the circumferential wall of said chamber at one side thereof only, said wall having inlet and exhaust ports at the respective sides of and adjacent to said portion thereof, yieldable blades carried by said piston and engaging said wall, said piston having a longitudinal bore and having passageways arranged on the respective sides of each of said blades and extending from the outer surface of said piston to said bore, and a normally stationary member arranged in the longitudinal bore of said piston to normally close the inner ends of said passageways, said member having a port at that side thereof adjacent to said exhaust port to connect the inner ends of the passageways about each blade as said blade approaches said exhaust port, said member being rotatable to move said port into a position adjacent to the inlet port when said piston is rotated in a reverse direction.

9. In a portable air motor, a casing having a work chamber, a piston mounted for rotation in said chamber and arranged to engage a relatively narrow portion of the circumferential wall of said chamber on one side thereof only, said wall having inlet and exhaust ports at the respective sides of and adjacent to said portion thereof, said piston having radial channels extending lengthwise thereof, blades slidably mounted in said channels, said piston also having an axial bore and having associated with each of said blades a plurality of pairs of passageways, the passageways of each pair being arranged on the respective sides of said blade and arranged to connect said work chamber with the bore of said piston, a normally stationary rod mounted within the bore of said piston and having in one side thereof a plurality of peripheral recesses arranged adjacent to the inner ends of the respective pairs of passageways and adapted to connect said inner ends of said passageways about that blade which has been moved to a position adjacent to said exhaust port.

10. In a portable air motor, a casing having a work chamber, a piston mounted for rotation in said chamber and arranged to engage a relatively narrow portion of the circumferential wall of said chamber on one side thereof only, said wall having inlet and

exhaust ports at the respective sides of and adjacent to said portion thereof, said piston having an axial bore and also having longitudinally extending radial channels communicating with said bore, blades slidably mounted in said channels, said piston also having a pair of passageways arranged on the respective sides of each of said blades and adapted to connect said bore of said piston with said chamber in front of and in the rear of said blade, a normally stationary controlling member mounted in the bore of said piston and having an axial bore and also having a circumferential groove communicating with said axial bore and with said radial channels, said controlling member also having a peripheral port so arranged that as said piston rotates above said member said peripheral port will connect the inner ends of the passageways of each blade one with the other as said blade approaches the exhaust port, and means for connecting the axial bore of said controlling member with a source of supply of air under pressure.

In testimony whereof, I affix my signature hereto.

ION V. K. HOTT.

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