Dec. 15, 1942. E. G. EPPENS 2,304,903

MOTOR

Filed July 29, 1941 2 Sheets-Sheet 1

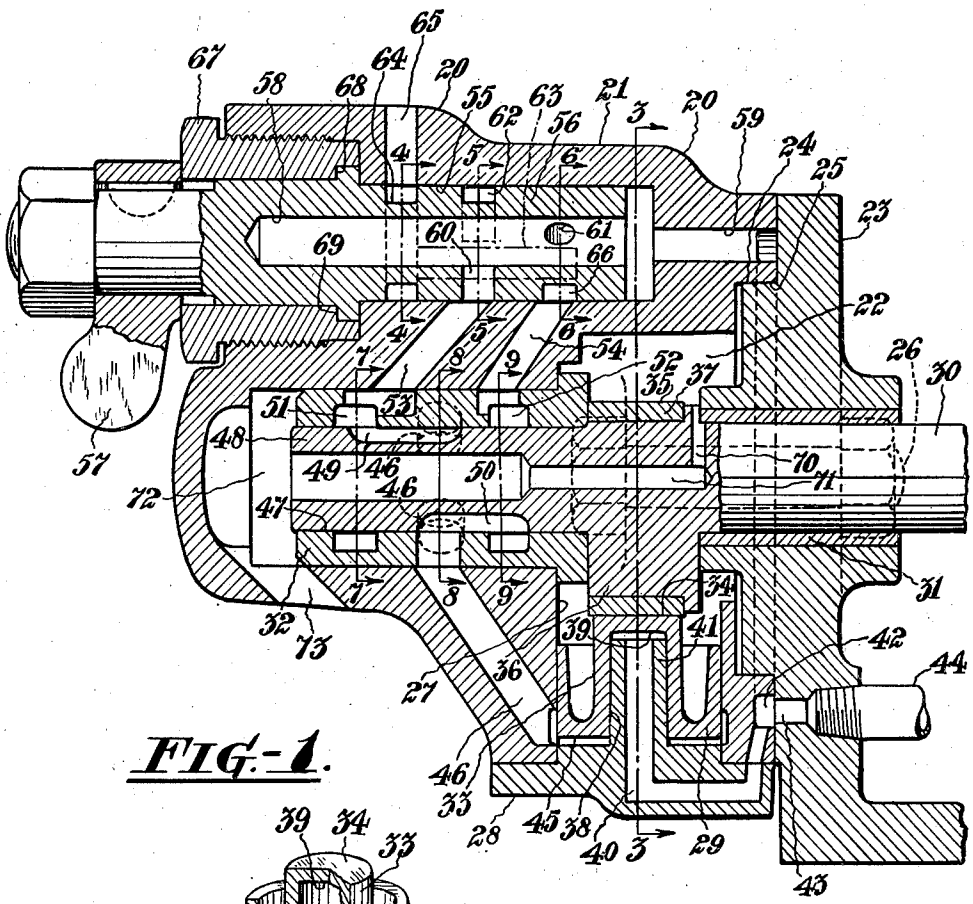

FIG.-1.

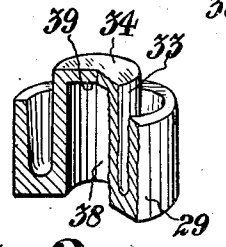

FIG.-2.

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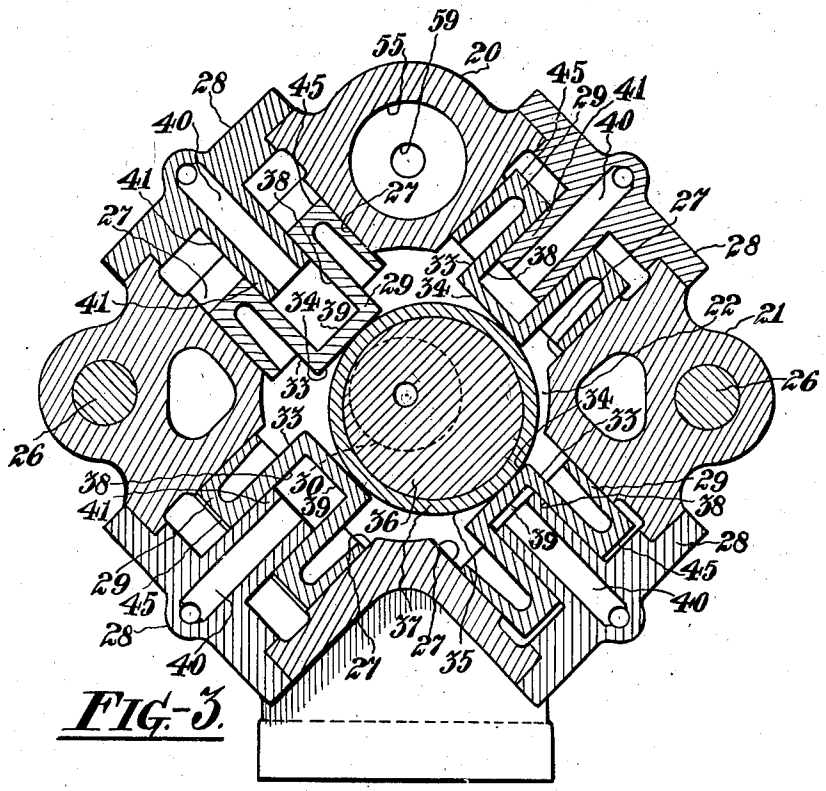

FIG.-3.

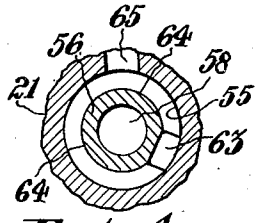

FIG.-4.

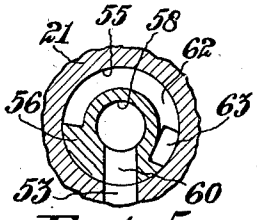

FIG.-5.

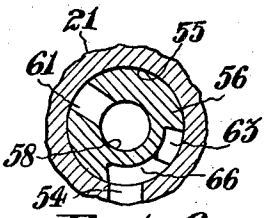

FIG.-6.

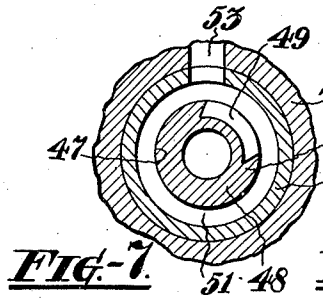

FIG.-7.

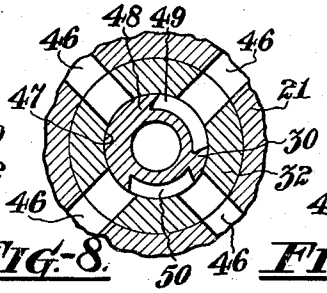

FIG.-8.

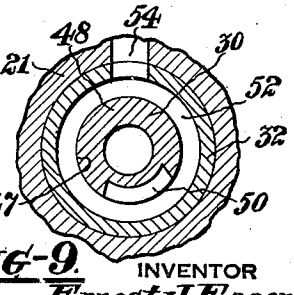

FIG.-9.

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Patented Dec. 15, 1942

2,304,903

UNITED STATES PATENT OFFICE

2,304,903

MOTOR

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Application July 29, 1941, Serial No. 404,470

5 Claims. (Cl. 121—121)

This invention relates to motors, and more particularly to a motor employing a plurality of reciprocatory pistons for imparting movement to a rotary member.

One object of the invention is to minimize the cost of constructing motors of this type.

Another object is to provide a rugged and compact motor having a minimum number of parts that may be cheaply maintained and replaced.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawings accompanying this specification and in which similar reference numerals refer to similar parts,

Figure 1 is a longitudinal elevation, partly broken away, of the motor constructed in accordance with the practice of the invention,

Figure 2 is a perspective view, partly broken away, of a detail, and

Figures 3, 4, 5, 6, 7, 8, and 9 are transverse views taken through Figure 1 on the lines 3—3, 4—4, 5—5, 6—6, 7—7, 8—8, and 9—9, respectively.

Referring more particularly to the drawings, the motor designated in general by 20 and shown, by way of example, as being of the pressure fluid actuated type, comprises a casing 21 having a crank chamber 22 at one end which is closed by a plate 23. A boss 24 on one end of the plate extends into a recess 25 in the casing to maintain the casing and the plate 23 in coaxial relationship with each other. The plate 23 may be secured to the casing 21 in any suitable manner, as for example by bolts 26.

In the form of the invention illustrated, the casing 21 is provided with a plurality of radial bores, four in the example shown, forming piston chambers 27 that open with their inner ends into the crank chamber 22 and are sealed at their outer ends by cover plates 28. Within each piston chamber is a reciprocatory piston 29 for actuating a rotary shaft 30 journaled in bushings 31 and 32 arranged in the plate 23 and in the casing 21, respectively.

The pistons 29 are of the free-floating type, that is to say, they are capable of movement within the piston chambers 27 relatively to the shaft 30. Within the pistons are stems 33 that preferably project beyond the skirts of the pistons and have seating surfaces 34 on their free ends.

The seating surfaces 34 are shown as being flat and engage the peripheral surface 35 of an eccentric 36 on the shaft 30 and lying in the crank chamber 22. As a preferred arrangement, the eccentric 36 is encircled by a band 37 that may be attached to the eccentric in any suitable manner to provide a renewable bearing surface for the seating surfaces 34 of the pistons.

The stems 33 are coaxial with the piston chambers 27 and their longitudinal axes extend through the axis of rotation of the shaft 30. They are hollow, having cylindrical bores 38 the end surfaces of which constitute pressure surfaces 39 that are subjected to pressure, preferably fluid pressure, for holding the seating surfaces 34 constantly in engagement with the surface 35 of the eccentric. The pressure fluid serving this purpose is conveyed into the recesses 38 by passages 40 in tubular projections 41 on the inner surfaces of the cover plates 28 and extending into the recesses 38.

The passages 40 lead through the cover plates 28 and the casing 21 and open into an annular supply groove 42 in the end surface of the casing 21. The plate 23 serves as a cover for the supply groove 42 and has a passage 43 that communicates with a supply conduit 44 connected to the plate 23.

The outer end surfaces of the pistons 29 constitute actuating surfaces 45 which are subjected intermittently to power medium, as for example compressed air, and are sealed from the pressure surfaces 39 by the tubular projections 41 which cooperate with the walls of the recesses 38 to prevent communication between said recesses and the piston chambers 27. Such power medium is conveyed to the piston chambers 27 by passages 46 in the casing 21 and the bushing 32 and opening into the bore 47 containing the rearward end of the shaft 30, which, in the form of the invention shown, constitutes a valve 48 for controlling the flow of power medium to and the exhaust of fluid from the piston chambers 27.

The valve 48 is provided in its periphery with a pair of longitudinally extending grooves 49 and 50 each of which may serve to valve pressure fluid to the piston chambers or to control the exhaust of pressure fluid from the piston chambers, depending upon the direction of rotation of the shaft 30. The pressure fluid supply for the grooves 49 and 50 is, however, supplied to said grooves by different channels. To this end the groove 49 opens into an internal annular groove 51 located in the bushing 32 rearwardly of the passages 46 so that when the groove 51 is serving as a supply groove pressure fluid flows therefrom through the groove 49 into the inlet passages 46.

The groove 50 serves a similar function and affords communication between the inlet passages 46 and an annular internal groove 52 in

the bushing 32 located forwardly of the passages 46. Thus, when it is intended to operate the shaft 30 in the opposite direction, pressure fluid passes from the groove 52 through the groove 50 into the inlet passages 46.

The pressure fluid used for actuating the pistons 29 is conveyed to the grooves 51 and 52 by passages 53 and 54, respectively, leading from a throttle valve chamber 55 and are controlled by a throttle valve 56 in the chamber 55. The throttle valve 56 is of the rotatable type, having a lever 57 whereby it may be shifted to the different controlling positions. A bore 58 extending part way through the throttle valve opens into the inner end of the chamber 55 and is in direct communication with the annular supply groove 42 through a passage 59 leading from the throttle valve chamber to said annular groove 42.

Communication is afforded between the bore 58 and the passages 53 and 54 by ports 60 and 61, respectively, in the wall of the throttle valve and lying in different radial planes. The throttle valve is, moreover, provided in its periphery with a partly annular groove 62 that lies in the same transverse plane as the port 60 and opens into a longitudinally extending groove 63 in the periphery of the throttle valve. The groove 63 opens at its rearward end into an annular external groove 64 in the throttle valve and the latter groove is in constant communication with a free exhaust port 65 in the casing 21. The forward end of the groove 63 opens into a partly annular groove 66 in the transverse plane of the port 61 to afford communication with the passage 54 and the free exhaust port 65.

The throttle valve may be held in the chamber 55 in any suitable manner, as for example by an externally threaded sleeve 67 threaded into the casing 21 and having an internal shoulder 68 to seat against a collar 69 on the periphery of the throttle valve.

In order that the crank chamber 22 will be constantly vented the shaft is provided with a radial passage 70 that communicates constantly with the crank chamber 22 and with a passage 71 extending rearwardly through the shaft 30. The passage 71 opens into a space 72 in the casing 21 rearwardly of the bushing 32 and the space 72 is in communication with the atmosphere through a port 73 in the casing.

The operation of the device, briefly described, is as follows: With the movable parts of the motor positioned, for example, as shown in the drawings, pressure fluid will flow from the annular supply groove 42 through the throttle valve, the port 60 and the passage 53 into the annular groove 51, thence through the longitudinally extending groove 49 and one or both of the passages 46 of the two uppermost piston chambers 27, it being understood that the groove 49 is of sufficient width to communicate simultaneously with two of the passages 46.

The pressure fluid thus admitted into these piston chambers will actuate the associated pistons 29 to impart thrusts against the eccentric member 36 for rotating the shaft 30. During such admission of pressure fluid to the uppermost piston chambers 27 the groove 50, which is also of sufficient width to simultaneously communicate with two passages 46, will establish communication between one or both of the lowermost passages 46 and the annular groove 52. The fluid in the lower piston chambers 27 will then escape through the associated passages 46, the grooves 50 and 52, the passage 54, the grooves 66, 63, 64 and the exhaust port 65 to the atmosphere. The lowermost piston will, however, be held firmly against the eccentric member 36 by the pressure fluid acting against the pressure surfaces 39.

During the subsequent rotation of the shaft the groove 49 will successively communicate the passages 46 with the annular grooves 51 for charging the piston chambers, and the groove 50 will successively communicate the passages 46 with the annular groove 52 for exhausting the fluid from the piston chambers to the atmosphere. This is the mode of operation of the parts for causing the shaft 30 to rotate in a clockwise direction as Figure 1 is viewed from the left hand end.

If it be intended to operate the shaft 30 in a counterclockwise direction and with the parts in the positions shown in the drawings, the throttle valve 56 is rotated to bring the port 61 into registry with the passage 54 and to move the port 60 out of registry with the passage 53 and at the same time to bring the partly annular groove 62 into communication with the passage 53. In the new position of the throttle valve pressure fluid will flow through the passage 54, the annular groove 52 and through the longitudinally extending groove 50 into the two lower piston chambers 27.

Such pressure fluid acting against the associated pistons 29 will cause the shaft 30 to rotate and the fluid in the upper piston chambers 27 will be expelled through the associated passages 46, the grooves 49, 51 and the passage 53 into the partly annular groove 62, whence it passes, through the grooves 63 and 64 and the exhaust passage 65, to the atmosphere.

While I have, in this application, specifically described a form of the invention employing pressure fluid, such as compressed air, as the power medium, it will readily be understood by those skilled in the art that the invention may be readily modified for use as the power element of an internal combustion motor without departing from its spirit or the scope of the appended claims.

I claim:

1. A motor, comprising a casing having a plurality of piston chambers, a rotary member having a portion located eccentrically thereon, pistons of the free-floating type reciprocable in the piston chamber seating against the said portion, a pressure surface on each piston constantly subjected to power medium for holding each piston against the said portion, an actuating surface on each piston intermittently subjected to power medium for imparting driving movement to the pistons for actuating the rotary member, and separate power medium supply passages for the pressure surface and the actuating surface.

2. A motor, comprising a casing having a plurality of piston chambers, a rotary member having its axis of rotation extending through the longitudinal axes of all the piston chambers, means on the rotary member presenting a surface located eccentrically with respect to the axis of rotation of the member, pistons of the free-floating type reciprocable in the piston chambers seating against the surface, a pressure surface on each piston constantly subjected to power medium for holding each piston against the first mentioned surface, an actuating surface on each piston intermittently subjected to power medium for imparting driving movement to the pistons for actuating the rotary member, and sep-

arate power medium supply passages for the pressure surface and the actuating surface.

3. A motor, comprising a casing having a plurality of piston chambers, a rotary member having its axis of rotation extending through the longitudinal axes of all the piston chambers, means on the rotary member presenting a surface located eccentrically with respect to the axis of rotation of the member, pistons of the free-floating type reciprocable in the piston chambers, a hollow extension on each piston to seat against the said surface, a pressure surface within each hollow extension, means for introducing power medium to the pressure surfaces for holding the extensions constantly against the first mentioned surface, and an actuating surface on each piston of larger area than the pressure surfaces and being intermittently subjected to power medium for imparting driving movement to the pistons to actuate the rotary member.

4. A motor, comprising a casing having a plurality of piston chambers, a rotary member having a surface located eccentrically with respect to the axis of rotation of said member, pistons of the free-floating type reciprocable in the piston chambers having portions to engage the said surface, pressure surfaces on the pistons constantly subjected to power medium for holding the pistons against the eccentrically located surface, actuating surfaces on the pistons, means cooperating with the piston for preventing communication between the pressure surface and the actuating surface, and valve means operated by the rotary member for effecting the distribution of power medium successively to the actuating surface to cause the pistons to impart thrusts to the first mentioned surface for rotating the rotary member.

5. A motor, comprising a casing having a plurality of piston chambers, a rotary member having a portion located with respect to the axis of rotation of said member, pistons of the free-floating type reciprocable in the piston chambers having seating surfaces to engage the peripheral surface of the said portion, a pressure surface on each piston constantly subjected to power medium for holding the pistons against said portion, an actuating surface on each piston, means cooperating with the piston for preventing communication between the pressure surface and the actuating surface, a valve operated by the rotary member for effecting the distribution of power medium successively to the actuating surface to cause the pistons to impart thrust to the said portion for rotating the rotary member, and means for controlling the direction of rotation of the rotary member.

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