

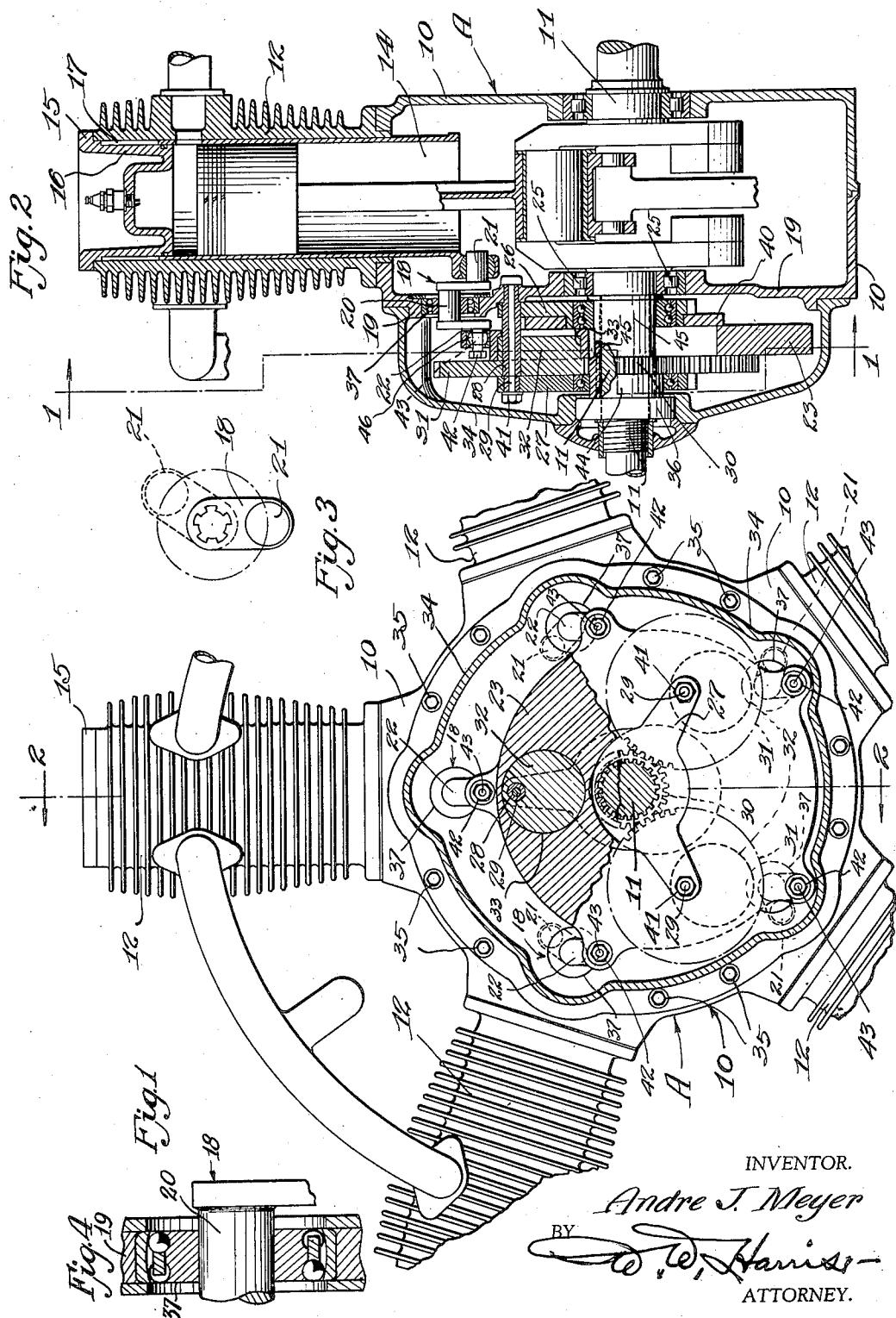
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ENGINE

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## ENGINE

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My invention relates to sleeve valve engines and more particularly to engines of the radial type and the sleeve valve driving means.

An object of my invention is to provide an engine of the aforesaid type having generally improved operating characteristics.

A further object of my invention is to provide an efficient, and reliable sleeve valve driving means that may be economically manufactured and readily assembled to the engine with a minimum of time and labor.

For a more detailed understanding of my invention, reference may be had to the accompanying drawing which illustrates one embodiment of my invention, and in which:

15 Fig. 1 is a fragmentary sectional view partly in elevation of a radial engine of the sleeve valve type and taken substantially on the line 1—1 of Fig. 2.

20 Fig. 2 is a vertical sectional view thereof taken substantially on the line 2—2 of Fig. 1.

Fig. 3 is a detail end view of the sleeve actuating crank, and

25 Fig. 4 is a detail view in section of a standard type of self-aligning bearing employed for supporting the sleeve actuating element.

In the illustrated embodiment of my invention I have shown my improved sleeve valve driving mechanism as being incorporated with a radial sleeve valve engine A of the type having a crank-

30 case 10, a crankshaft 11, and a plurality of cylinders 12 disposed radially about the crankshaft, said cylinders being suitably ported for intake and exhaust. Sleeve valve means are associated with each cylinder and for purposes of illustration I have shown a single sleeve valve 14 of the

35 Burt-McCollum type in which the sleeve is given a combined reciprocating and oscillating movement with respect to the sleeve and associated cylinder axes. Each cylinder has a cylinder head 15 secured thereto and preferably provided with a reentrant head portion 16 depending within the cylinder and spaced from the walls thereof to provide a sleeve pocket 17 for accommodating the outer or upper portion of the sleeve valve

40 means 14.

45 The sleeves are driven by mechanism supported within the engine crankcase, and preferably a sleeve actuating member is associated with each sleeve, said member preferably consisting of a double crank member 18 supported by the transverse crankcase wall 19. The illustrated sleeve actuator is provided with a bearing portion 20 and crank portions 21 and 22 carried by opposite ends of the actuator, one of the crank portions

operatively connected with the sleeve 14 while the other crank is connected to a common operating element 23, which operates all sleeve actuating members in unison.

This common operating element 23 is driven by eccentrics and caused to move in an orbital path 5 to impart a combined reciprocating and oscillating movement to the sleeve valves. This desired movement is accomplished in the following manner. The crankcase 10 includes a wall 19 offset to one side of the engine plane containing the sleeve and cylinder axes, the sleeve actuators being preferably supported by this wall. The wall carries suitable bearings 25 for supporting the crankshaft 11, which extends forwardly thereof. Spiders or brackets 26, 27 are carried by the 10 tubular members or studs 28, these studs being fastened to the wall 19 by suitable bolts 29. The end portions of the studs are preferably reduced in diameter with respect to the body portion, the brackets being preferably assembled to the 15 reduced portion and thereby fixed in spaced relation with each other. The crankshaft is provided with a crankshaft gear 30 keyed or otherwise secured thereto which drives a plurality of driving intermediaries consisting of a gear 31 20 meshing with the gear 30 and an eccentric 32. In the construction shown I have provided three such driving intermediaries, which are respectively supported for rotation on one of the studs 28. The operating member is provided with 25 openings 33 adapted for receiving the eccentrics 32 and thus as the engine is operated the operating member 23 is moved in an orbital path by means of these eccentrics.

A crankcase cover 34 encloses this sleeve valve 35 driving means and is preferably secured to the crankcase by bolts 35 or other suitable fastening devices. A bearing 36 carried by the cover supports the forward end of the crankshaft 11.

The sleeve actuating means or cranks are supported in self-aligning bearings 37, sometimes referred to as radial bearings, (see Fig. 4) that permit the alignment of said cranks with respect to the common operating element 23. During the operation of the engine, it may be noted that 40 it is very probable that the wall 19 will be subjected to different temperatures than the operating element 23 and thus the assembly of the sleeve actuating members or cranks in self-aligning or radial bearings in general of the type herein illustrated compensates for expansional variations or differences between the portions of the mechanisms to eliminate any tendency of said mechanism to bind.

A spacer 40 consisting preferably of a circular plate is interposed between the spider or bracket 26 and the operating element 23 to take the end thrust of said element and to locate same relative to the sleeve actuating means or crank, said plate being preferably supported on the flange 23' carried by spider or bracket 26.

It may be noted that the sleeve driving assembly may be readily removed from the engine and 10 may be removed as a unit on removing the cover 34. It will be noted that the said assembly may be removed as a unit if so desired by removing the nut 41 from bolt 29 and the nuts 42 from each of the extending stub shafts 43 of the crank 22. 15 The crankshaft gear 38 is preferably provided with an integral hub 44 extending forwardly of the gear and the rearwardly extending sleeve portion 45 having a flange 45' forming an abutment for the bearing 25 said integral hub, gear 20 and sleeve being preferably splined to the crankshaft. It may be noted that the stud shafts 43 extend through balls 46 carried by the operating element. Thus the entire driving assembly exclusive of the sleeve actuating cranks can be bodily attached or removed with respect to the 25 remainder of the engine structure.

It will be apparent to those skilled in the art to which my invention pertains that various modifications and changes may be made therein without departing from the spirit of my invention 30 or from the scope of the appended claims.

What I claim as my invention is:

1. In an engine having a crankshaft and a plurality of engine cylinders disposed radially 35 about the crankshaft, sleeve valve means associated with each cylinder, a sleeve operating element, and a plurality of driving intermediaries operatively connected with said crankshaft and with said sleeve operating element for actuating 40 said sleeve operating element.

2. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, a sleeve operating element, and a plurality of driving intermediaries operatively connected with said crankshaft and with said sleeve operating element for actuating 45 said sleeve operating element, whereby to impart to the sleeve valve means a combined reciprocating and oscillating movement.

3. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, and sleeve driving 50 means including a sleeve driving element and a plurality of eccentric driving intermediaries operatively connected with said crankshaft for actuating said sleeve driving element.

4. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, and sleeve driving means including a sleeve driving element, a crankshaft gear operatively connected with the crankshaft, 55 and a plurality of driving intermediaries driven by said crankshaft gear for actuating said sleeve driving element.

5. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, and sleeve driving means including a sleeve driving element, a crankshaft gear operatively connected with the crankshaft, 60 and a plurality of eccentric driving intermediaries driven by said crankshaft, and a plurality of eccentrics driven by said

crankshaft gear for actuating said sleeve driving element.

6. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, a sleeve valve associated with each cylinder and having a combined reciprocating and oscillating movement with respect to its axis, a sleeve valve operating element, means for connecting said operating element to each of said sleeve valves, and a plurality of driving intermediaries operatively connected with said crankshaft and with said operating element for moving said operating element in an orbital path whereby to impart the aforesaid movement to the sleeve valves. 10

7. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, a sleeve valve associated with each cylinder and having a combined reciprocating and oscillating movement with respect to its axis, a sleeve valve operating element, means for connecting said operating element to each of said sleeve valves, and a plurality of eccentrics operatively driven from the crankshaft and connected with said operating element for moving said operating element in an orbital path whereby to impart the aforesaid movement to the sleeve valve. 15

8. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, a sleeve valve associated with each cylinder and having a combined reciprocating and oscillating movement with respect to its axis, and sleeve driving means including an operating element provided with means for connecting the element to each of said sleeve valves and a three-point drive consisting of angularly spaced eccentrics for moving said operating element in an orbital path to impart the aforesaid movement to the sleeve valves. 20

9. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, a sleeve valve associated with each cylinder and having a combined reciprocating and oscillating movement with respect to its axis, a sleeve valve operating element, means for connecting the element to each of said sleeve valves and means for moving said element in an orbital path whereby to impart the aforesaid movement to the sleeve valves, said means including a driving element operatively connected with the crankshaft and a plurality of driving intermediaries connected with said sleeve valve operating element nested about and connected to said driving element. 40

10. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, a sleeve valve associated with each cylinder and having a combined reciprocating and oscillating movement with respect to its axis, a sleeve valve operating element, means for connecting the element to each of said sleeve valves, and means for moving said element in an orbital path whereby to impart the aforesaid movement to the sleeve valves, said means including a driving element operatively connected with the crankshaft and a plurality of eccentric driving intermediaries connected with said sleeve valve operating element and with said driving element. 45

11. In an engine having a crankcase, a crankshaft supported thereby, and a plurality of engine cylinders disposed radially about the crankshaft, a sleeve valve associated with each cylinder and having a combined reciprocating and oscillating 50

movement with respect to its axis, crank means for moving each sleeve valve supported by said crankcase, and a unitary crank operating mechanism including a common operating element, 5 means for connecting said element to said crank means, and means operatively connected with the crankshaft and with said operating element for moving said operating element in an orbital path whereby to impart the aforesaid movement to 10 the sleeve valves, said mechanism removably secured as a unit to the engine crankcase.

12. In an engine having a crankcase, a crankshaft supported thereby, and a plurality of engine cylinders disposed radially about the crankshaft, a sleeve valve associated with each cylinder and having a combined reciprocating and oscillating movement with respect to its axis, crank means for moving each sleeve valve supported by said crankcase, and a unitary crank operating mechanism including a common operating element and means operatively connected with the crankshaft for moving said operating element in an orbital path to impart the aforesaid movement to the sleeve valves, said mechanism including bracket means removably secured to the crankcase and provided with bearing means for supporting said crankshaft. 15

13. In an engine having a crankcase, a crankshaft supported thereby, and a plurality of engine cylinders disposed radially about the crankshaft, a sleeve valve associated with each cylinder and having a combined reciprocating and oscillating movement with respect to its axis, crank means for moving each sleeve valve supported by 20 said crankcase and a unitary crank operating mechanism including a common operating element and means operatively connected with the crankshaft for moving said operating element in an orbital path to impart the aforesaid movement to the sleeve valves, said mechanism including bracket means removably secured to the crankcase and provided with bearing means for supporting said operating element driving means. 25

14. In an engine having a crankcase, a crankshaft supported thereby, and a plurality of engine cylinders disposed radially about the crankshaft, a sleeve valve associated with each cylinder and having a combined reciprocating and oscillating movement with respect to its axis, sleeve actuating means, and driving means therefor including a common operating element operatively driven from the crankshaft and moved in an orbital path for imparting the aforesaid movement to the sleeve valves, and radial bearing means carried by the crankcase for supporting the sleeve actuating means to permit ready alignment of the operating element with respect to said sleeve actuating means. 30

15. In an engine having a crankcase, a crankshaft supported thereby, and a plurality of engine cylinders disposed radially about the crankshaft, a sleeve valve associated with each cylinder and having a combined reciprocating and oscillating movement with respect to its axis, sleeve actuating means extending through a portion of the crankcase and adapted for connection at one end to the sleeve valve, driving means therefor including a common operating element operatively driven from the crankshaft and moved in an orbital path for imparting the aforesaid movement to the sleeve valves, said operating element secured to the other end of said sleeve actuating means, and self-aligning bearing means carried by the crankcase portion for supporting the sleeve actuating means at a point intermediate the ends 35

thereof to permit ready alignment of the operating element with respect to said sleeve actuating means to compensate for expansional differences. 40

16. An internal combustion engine having a crankcase and comprising in combination, a crankshaft, a plurality of ported cylinders having their axes disposed radially about the crankshaft, pistons within said cylinders respectively connected with the crankshaft, a sleeve valve means for each cylinder provided with ports cooperating with the cylinder ports, a wall adjacent one end of the crankcase and offset to one side of the plane of the engine containing the cylinder axes, a plurality of sleeve valve actuating cranks extending through said wall, a common operating element operatively connected with said crankshaft and with said cranks, and self-aligning bearing means carried by said wall for supporting said sleeve valve actuating cranks to 15 compensate for expansional differences. 20

17. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, and sleeve driving means operatively connected with the crankshaft and including an element, and supporting means for 25 compensate for expansional differences in said sleeve driving means.

18. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, sleeve driving means operatively connected with the crankshaft and including an element, and supporting means for 30 compensate for expansional differences in said sleeve driving means. 35

19. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, sleeve driving means operatively connected with the crankshaft and including sleeve actuating cranks and an operating element connected with said cranks, and supporting means for said cranks adapted to 40 compensate for expansional differences between said operating element and crank supporting means. 45

20. In an engine having a crankcase and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, a sleeve valve operating element, means connecting the operating element to each of said sleeve valve means, and means for driving said operating element from 50 said crank shaft at three points spaced angularly about the crankshaft. 55

21. In an engine having a crankcase and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, a sleeve valve operating element, means connecting the operating element to each of said sleeve valve means, and means for driving said operating element from 60 said crankshaft consisting of a plurality of angularly spaced driving intermediaries operatively driven by said crankshaft. 65

22. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, a sleeve operating element, means operatively connecting said operating element with each of said sleeve valve means, and a plurality of driving intermediaries angularly spaced about the crank shaft for transmitting 70 75

the drive from the crankshaft to said sleeve valve operating element.

23. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, a sleeve operating element adapted for orbital movement in a plane substantially parallel to an engine plane containing the cylinder axes, means connecting said operating element with said sleeve valve means, and a plurality of eccentric driving intermediaries operatively connected with said crankshaft for actuating said sleeve operating element.

10 24. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, a crankcase structure including a wall portion extending substantially perpendicularly to said crankshaft, a sleeve operating element, means connecting said operating element with each of said sleeve valve means, and a plurality of eccentric driving intermediaries operatively connected with said crankshaft for actuating said sleeve operating element and supported by said wall portion.

20 25. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, a crankcase structure including a wall portion extending substantially perpendicularly to said crankshaft, a sleeve operating element, means connecting said operating element with each of said sleeve valve means, and a plurality of eccentric driving intermediaries

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angularly spaced about said crankshaft and operatively connected with said crankshaft for actuating said sleeve operating element, said driving intermediaries rotatably supported by said wall portion.

26. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, a crankcase structure including a wall portion extending substantially perpendicularly to said crankshaft, a sleeve operating element, means connecting said operating element with each of said sleeve valve means, a plurality of sleeve operating element eccentric driving intermediaries angularly spaced about said crankshaft and connected by gearing to said crankshaft, and individual supports carried by said wall portion for rotatably supporting said driving intermediaries.

27. In an engine having a crankshaft and a plurality of engine cylinders disposed radially about the crankshaft, sleeve valve means associated with each cylinder, a crankcase structure including a wall portion extending substantially perpendicularly to said crankshaft, a sleeve operating element, means connecting said operating element with each of said sleeve valve means, a plurality of sleeve operating element eccentric driving intermediaries angularly spaced about said crankshaft and connected by gearing to said crankshaft, and studs carried by said wall portion and angularly spaced about the crankshaft for supporting said driving intermediaries.

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