Nov. 14, 1933. O. M. GROSS 1,935,503

COMPOUND OSCILLATING ENGINE

Filed March 25, 1933

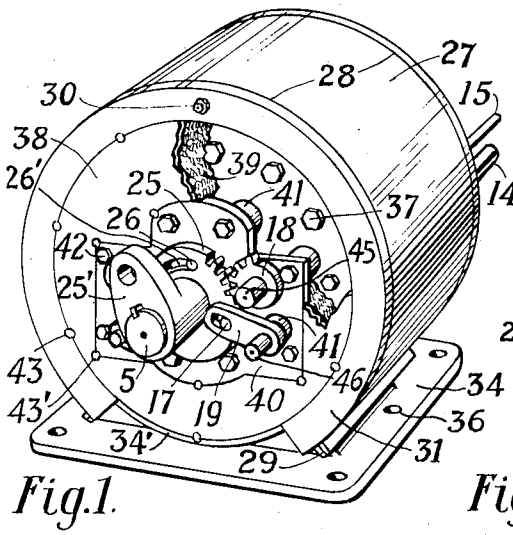


Fig.1.

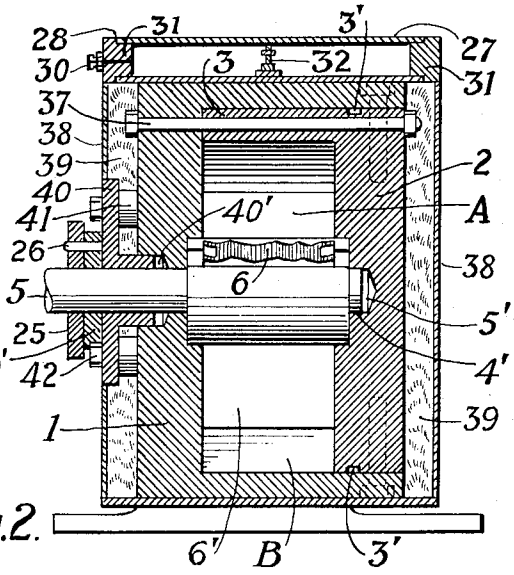


Fig.2.

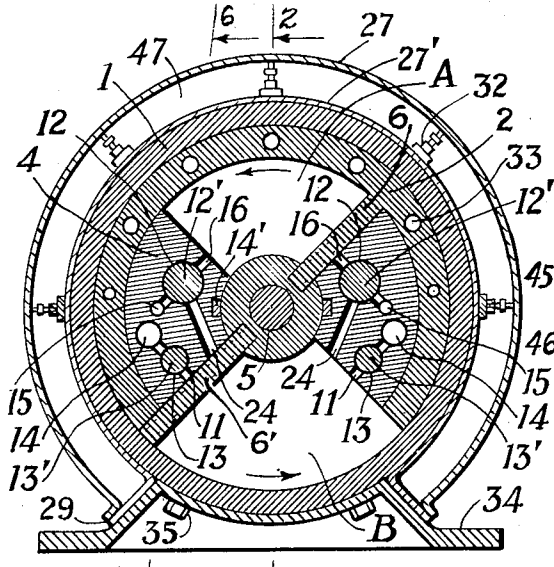


Fig.5.

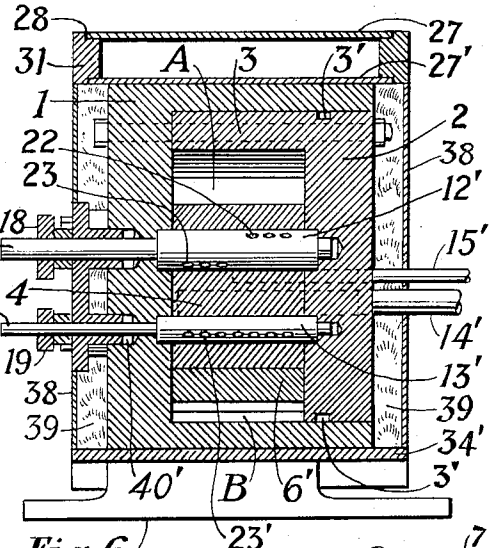


Fig.6.

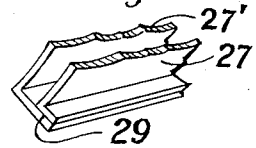


Fig.7.

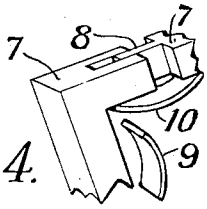


Fig.4.

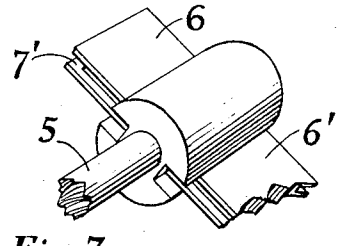


Fig.3.

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COMPOUND OSCILLATING ENGINE

Oswald Maximillian Gross, Detroit, Mich.

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4 Claims. (Cl. 121—99)

This invention relates to steam engines and particularly to an engine of the compound oscillating type.

It has for its object the provision in an engine of the class described of means for minimizing the atmospheric heat leakage and thereby obtaining the optimum thermal efficiency of operation.

Another object of the invention is to obtain simplification in the construction and assemblage of an engine of this type.

Other objects of the invention will appear as the following description of a preferred and practical embodiment thereof proceeds.

In the drawing which accompanies and forms a part of the following specification and throughout the several figures of which the same characters of reference have been employed to designate identical parts.

Figure 1 is a perspective view of the oscillating engine, showing the vacuum casing;

Figure 2 is a cross section taken along the line 2—2 of Figure 5, the rotor being shown solid, and the vane broken away;

Figure 3 is a fragmentary perspective view of the rotor vanes;

Figure 4 is a fragmentary perspective view of the packing for the rotor vanes;

Figure 5 is a longitudinal cross section through the engine in a plane perpendicular to its axis of rotation;

Figure 6 is a cross section taken along the line 6—6 of Figure 5, the valves being shown solid; and

Figure 7 is a perspective view in detail of the welded joint at the base of the vacuum casing of the engine.

Referring now in detail to the several figures, the engine comprises an annular outer member 1 secured in fluid-tight manner to an end member 2, the latter member having a flange 3 which extends inwardly into coincidence with the outer member 1 and being provided with a circumferential packing groove 3' which may be packed with any suitable steam or pressure resisting packing.

The flange 3 is discontinuous for a purpose which will hereinafter appear, and at diametrically opposite points adjacent the end portions of said flange and secured thereto, are the valve chests 4 defining together with said flange a high pressure chamber A. Due to the discontinuity of the flange 3, a low pressure chamber is defined between the valve chests 4 and the outer member 1, diametrically opposite the high pressure chamber and being of a larger capacity than said high pressure chamber.

A shaft 5 passes through the end wall of the outer member 1, said shaft having a bearing 4' within a recess 5' formed on the inner surface of the end member 2. The shaft as is shown in detail in Figure 3 is provided with diametrically arranged vanes 6 and 6'. These vanes are of a width to fit against the side and circumferential walls of the high and low pressure chambers, with working tolerance, and said vanes are preferably formed on their side and end faces with grooves 7' in which suitable packing is seated which expands in fluid-tight manner against the side wall and circumferential wall of said chamber. A detail of such packing is shown in Figure 4, which indicates that there are two packing members 7, substantially L-shaped with a telescoping joint 8 between them in the end face of the vane. In the grooves 7' back of said packing members are springs 9 and 10 which bias said packing members against the respective side and circumferential walls of the respective high and low pressure chambers within the engine.

It will be understood that the shaft 5 oscillates with the vanes 6 and 6' and on the outer end of the shaft is a crank 25', adapted to be operatively connected by a pitman to the device or machine operated by the engine.

The valve mechanism is directly operated by the oscillation of the shaft 5, by means of a collar 25 secured to said shaft. The valves which are shown in Figures 5 and 6 are solid cylindrical members 12' and 13' oscillatably mounted in respective bores 12 and 13 formed in the valve chests 4. There are two inlet and two exhaust valves for each valve chest. The inlet valves are provided in separate longitudinal portions with receiving ports 22 and transfer ports 23. The valve chests are also provided with ports 16 registrable with the receiving ports for admitting steam to the high pressure chamber and with ports 24 registrable with the transfer ports 23 for transferring steam from the high pressure chamber to the low pressure chamber. The exhaust valves 13' are provided with a series of through ports 23' registrable on the one hand with ports 11 communicating with the low pressure chamber and with the exhaust passages 14. The valve chests are provided with packing grooves 14' forming a sealing joint between the valve chests and the hub of the vanes 6 and 6', thus preventing direct leakage of steam from the high to the low pressure chamber.

The valves 12' and 13' are provided with stems

45 and 46, respectively, which project through packed bores in the end face of the outer member 1. The valve stems 45 which belong to the inlet valves are each furnished on the outside of the engine with a segmental gear 18 meshing with teeth on the disc 25, thus as the shaft 5 oscillates, its oscillating movement is communicated simultaneously to the stems of both the inlet valves, although of course said valves are so oriented as to be simultaneously in different phases of operation. The exhaust valve stems 46 are connected by means of links 19 with the disc 25 through the instrumentality of pins 17 fixed on said disc and playing in slots in said links. Thus the exhaust valves will be oscillated through the movement of the shaft 5. The disc 25 is formed with a slot 26' through which extends a pin 26 made fast to disc 28' which is keyed to shaft 5. This pin contacts slot 26' on disc 25 timed by segment of gear teeth and pin 17 admitting steam to the ports 16 before vane 6 and 6' reach their respective objectives making a smooth reversal of the direction of the vanes.

The outer member 1 of the engine is surrounded circumferentially by a vacuum jacket 47 having outer and inner wall members 27 and 27', respectively, welded to front and back rings 31 and butt-welded as indicated at 29, resting on base 34.

The reference numeral 30 indicates a valve for connecting the space within said jacket to suitable vacuum producing apparatus. In order to prevent collapse of the outer wall 27, spacer studs 32 are arranged at intervals circumferentially about the engine and within the jacket 47.

The outer member 1 and inner member 2 are held together by bolts 37 passing through suitable bores 33 arranged in said members and suitable apertures 36 are formed in the base member 34 by means of which the engine may be secured to a foundation. The engine is secured to the base by bolts 35 shown in Figure 5. The valve mechanism passes through a plate 40 which forms the outer flange of a stuffing gland by means of which the packing 40' is compressed. Said plate is secured to the front of the engine by suitable bolts 42, and spacer ring 41 between plate 40 and member 1 gives ample space for packing around valves.

The ends of the engine are insulated with layers 39 of asbestos held in place by plates 38 substantially secured to the rings 31 as by spot-welding. The plate 38 on the front of the engine has an aperture in its central portion made to conform closely to the edge of the plate 40. The spot-welds by means of which the plate 38 is secured to the ring 31 and to the plate 40 are indicated at 43 in Figure 1.

The operation of the engine is as follows: Steam entering by way of the inlet pipe 15' enters the port 15 of the steam chest on the right hand side, Figure 5, passes through port holes in the valve chest, through the valve 12', out of the valve chest port holes 16, applying pressure against the vane 6, pushing said vane in the direction of the arrow shown in Figure 5, and filling the high pressure chamber A with steam under high pressure.

The valve 12' of the left hand valve chest and which has been previously closed is now opened through the oscillation of the shaft 5, to receive steam from an intake pipe not shown, by a duplicate of the pipe 15'. This applies pressure to the vane 6 in the opposite direction. By this time, however the valve 12' of the right hand valve chest has moved into position for transferring steam through the port holes 23 and through the valve chest port holes 24 to the low pressure chamber against the face of the vane 6', driving the vane toward the left at the same time the vane 6 is moving toward the right.

The vane 6 is now back to its original position, and the chamber A filled with high pressure steam from the left hand inlet valve, while the chamber B is filled with steam at low pressure. On the next movement of the vane 6 in the direction of the arrow the low pressure steam in the chamber B will be exhausted through the right side valve chest port 11 through the exhaust valve 13' and port 23' and into the exhaust port hole 14 in the right hand valve chest, and thence out of the engine by way of the exhaust pipe 14'.

While I have in the disclosure described a preferred and practical embodiment of my invention, it is to be understood that the inventive concept is not limited by the specific details of construction as shown, but is sufficiently broad to be exemplified in other equivalent constructions and arrangements of parts.

What I claim is:

1. An engine of the compound oscillating type comprising inner and outer end members each having a circumferential flange telescopically arranged, diametrically arranged valve chests within said inner flange defining with the structure enclosing them high and low pressure chambers, an oscillating shaft, vanes carried by said shaft and arranged in said respective chambers in fluid-tight relation with the walls thereof, means for admitting elastic fluid under pressure automatically to opposite sides of said vane in said high pressure chamber, means for transferring said fluid after expansion in said high pressure chamber to said low pressure chamber, and means for exhausting the expanded fluid alternately from the opposite sides of the low pressure chamber, all of said fluid controlling means being actuated from said chest, the flange of said inner end member being discontinuous through the angular extent of said low pressure chamber, making the volume of said low pressure chamber greater than that of said high pressure chamber.

2. An engine of the compound oscillating type comprising inner and outer end members, said members having circumferential flanges telescopically arranged, and the inner flange being discontinuous through a substantial angle, exposing the inner peripheral wall of a part of said outer flange, means secured to said inner member constituting valve chests arranged diametrically and adjacent the ends of said inner flange, the walls of said means being substantially radial, defining between said end members and the exposed portions of said inner and outer flanges, respectively high and low pressure chambers of different radial dimensions, the capacity of the low pressure chamber being greater than that of the high pressure chamber by virtue of its greater radial dimension, a shaft extending co-axially through said end members, vanes on said shaft oscillatable in fluid-tight contact with the walls of said respective high and low pressure chambers, said vanes having radial dimensions corresponding to the respective radial dimensions of said pressure chambers, admission valves in said valve chests for admitting elastic fluid under pressure alternately to opposite sides of said high pressure chamber, said admission valves being constructed to transfer expanded fluid from said

high pressure chamber to said low pressure chamber alternatingly with the admission periods, exhaust valves in said valve chests for exhausting the expanded fluid alternately from the opposite sides of said low pressure chamber, and means operatively connecting all of said valves to said shaft.

3. An engine as claimed in claim 2, said valves comprising ported cylinders seated in ported bores in said valve chests, said admission valves including admission ports and transfer ports in different longitudinal zones, stems for said valves extending to points outside of one of said end members and means on said valve stems cooperating with means on said shaft for transmitting oscillatory movement from said shaft to said valves.

4. An engine of the compound oscillating type comprising inner and outer end members, said members having circumferential flanges telescopically arranged, and the inner flange being discontinuous throughout a substantial angle, exposing the inner peripheral wall of said outer flange, means constituting valve chests arranged diametrically and adjacent the ends of said inner flange, defining between said end means and the exposed portions of the inner and outer flanges respectively, high and low pressure chambers having different radial dimensions, the capacity of the low pressure chamber being greater than that of the high pressure chamber by virtue of its greater radial dimension, a shaft extending co-axially through said members, vanes on said shaft oscillatable in fluid-tight contact with the walls of said respective high and low pressure chambers, admission valves in said valve chests for admitting elastic fluid under pressure alternately to opposite sides of said high pressure chamber, said admission valves being constructed to transfer expanded fluid from said high pressure chamber to said low pressure chamber alternatingly with the admission periods, exhaust valves in said valve chests for exhausting the expanded fluid alternately from the opposite sides of said low pressure chamber, and means operatively connecting all of said valves to said shaft, said valves comprising ported cylinders seated in ported bores in said valve chests, said admission valves including admission ports and transfer ports in different longitudinal zones, stems for said valves extending to points outside of one of said end members and means on said valve stems cooperating with means on said shaft for transmitting oscillatory movement from said shaft to said valves, said valve operating means comprising a gear oscillating with said shaft, gears on the stems of said admission valves meshing with said first named gear, and pin and link connections between said exhaust valves and said gear.

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