The disclosure is of horizontally disposed in tandem, single Wankel diesel engine-compressor arrangements, with compressor determining height and width dimensions, and whereby the compressed air from moving compression space in engine driven compressor passes through substantially horizontally or laterally disposed transfer port means into oppositely moving engine compression space for fuel injection and ignition to occur therein, whereby products of combustion pass back into compressor, through substantially horizontally or laterally disposed transfer port means, substantially vertically spaced from said first transfer port means, into compressor expansion space to abet compressor rotation into communication with exhaust discharge; the engine drive shaft being exteriorly adapted to drive the compressor shaft in opposite clock direction, as aforesaid. The arrangement of engine and compressor in horizontal tandem relationship, with air inlet into compressor, followed by ported intercommunication into, and back from engine, and finally by discharge from compressor, providing combinations adapted for substitution into conventional vehicle power plants, thus requiring less headroom than required by conventional Wankel diesel engine-compressor combinations.
SINGLE WANKEL DIESEL ENGINE-COMPRESSION IN CROSS-PORTED HORIZONTAL TANDEM

The invention sets out to take the Wankel principles as shown employed in cross-ported intercommunication, and in horizontal tandem, rather than in vertical, as employed in Popular Science, Page 80, February 1971 issue; Wankel U. S. Pat. No. 3,139,072 issued June 30, 1964, being a relatively recent disclosure of a Wankel construction, with other patents preceding and following. Thus, by this invention, combinations are provided that can be substituted into conventional vehicle power plants so constructed as to require less headroom than is required by conventional Wankel diesel engine-compressor combinations.

It is thus a primary object of this invention to provide arrangement of single Wankel diesel engine-compressor combinations in horizontal tandem, along with the required porting arrangement entailed, whereby such combinations may be substituted into conventional vehicle power plants that permit less headroom than is permitted by conventional Wankel diesel engine-compressor combinations.

It is also an object of this invention to provide a single Wankel diesel engine-compressor combination of the class described whereby the engine and compressor are tandem connected horizontally in tandem with engine drive disposed at right angles to compressor drive.

It is another object of the invention to provide a single Wankel diesel engine-compressor combination of the class described whereby the engine and compressor are tandem connected with drive axes in co-axial alignment, and with diesel engine and compressor width and elevation in substantial correspondence.

It is yet another object of this invention to provide a single Wankel diesel engine-compressor combination of the class described whereby compressor communication with the diesel engine is through lateral porting through compressor forward wall.

It is also another object of this invention to provide a single Wankel diesel-compressor combination of the class described whereby compressed air transfer porting from compressor to engine, and combustion transfer porting back from engine to compressor both extend substantially horizontally and are substantially vertically spaced apart.

Other and further objects will be apparent when the specification is considered in connection with the drawings, in which:

FIG. 1 is an isometric view of a single Wankel diesel engine-compressor combination connected horizontally in tandem with drive axes in co-axial alignment; transmission bell housing flange being omitted;

FIG. 2 is a plan view of the diesel engine-compressor combination shown in FIG. 1; transmission bell housing flange being shown;

FIG. 3 is a transverse sectional elevation through compressor, taken substantially along line 3—3 of FIG. 2;

FIG. 4 is a transverse sectional elevation through engine, as taken along line 4—4 of FIG. 2;

FIG. 5 is a plan view, part in section, and partially diagrammatic, showing engine drive shaft and compressor driven shaft relationships, with rotation having advanced 90° from condition shown in FIGS. 3 and 4;

FIG. 6 is an isometric view of another arrangement of single Wankel diesel engine-compressor combination connected horizontally in tandem with respective drive axes at right angles; transmission bell housing flange being omitted;

FIG. 7 is a plan view of the combination in FIG. 6; transmission bell housing flange being shown;

FIG. 8 is a sectional plan view, partially diagrammatic, taken along line 8—8 of FIG. 6, showing products of combustion discharge into compressor and exhaust therefrom; also water as circulated about compressor and through water jacket parallel to, into and out of diesel engine housing, and from water jacket;

FIG. 9 is a transverse elevational view taken along line 10—10 of FIG. 7, showing details of compressor front closure plate construction;

FIG. 10 is an enlarged, fragmentary, sectional elevational view, partially diagrammatic, as taken along line 10—10 of FIG. 7, showing engine rotor and housing with sealing contact maintaining means, and showing fuel injection port relationship; and

FIG. 11 is an enlarged, fragmentary, sectional plan view, partially diagrammatic, as taken along line 11—11 of FIG. 10, with rotor having revolved to place vane and end seal member in passage over fuel injection port.

Referring now in detail to the drawings in which like reference numerals are applied to like elements in the various views, a Wankel diesel engine-compressor combination 10 is shown in FIG. 1, with diesel engine 11 forwardly disposed and compressor 12 to the rear thereof, with a hollow engine drive shaft 13 being shown, extending centrally forwardly from the front wall 14 of the engine 11 and having a bevel gear 15 formed on the forward end thereof.

A spacing water jacket or hollow partition 16 is shown disposed between engine 11 and compressor 12, and aligned sleeves 17a, 17b and 17c are formed on top, sides and bottom of engine, water jacket and compressor, respectively, so that bolts 18 may be passed through drilled holes through lugs 14a on front wall, through respective, aligned sleeves 17a, 17b and 17c, through drilled holes through lugs 19a on rear wall 19 of compressor, and through lugs 20a the forward flange 20 of say, a vehicle transmission housing 21 (FIG. 2), these bolts 22 threaded upon the threaded, rearward ends of the bolts 18, thus to assemble engine, spacing water jacket, compressor and transmission in co-axially aligned relationship. The compressor shaft is not shown in FIGS. 1 and 2, but a transmission shaft 23 may be seen extending rearwardly from the transmission housing 21, and indicated by considering FIGS. 1 and 2 together, to be in co-axial alignment with the hollow engine drive shaft 13, and correspondingly indicated as being connected to be driven in co-axial alignment with the compressor shaft, not shown, but to be hereinbelow described. Note that for purposes of clarity no forward flange 20, as shown in FIG. 2, is shown rearwardly of the compressor rear wall 19, and the transmission housing 21 to the rear of the compressor rear wall 19, may optionally provide smaller dimensioned means, not shown in FIG. 1, by which it may be connected to the compressor rear wall 19.

As shown in FIGS. 1 and 2, an air intake fitting 24 is shown belted or connected by machine screws to the left top side of the compressor 12, and a fuel injection fitting 25 is indicated as being threadably connected into the left side of the engine 11, slightly below the horizontal central plane thereof, as will be hereinbelow.
In FIGS. 6 and 7 the drive gear 33 is indicated as driving through a stalwart idler pinion 39 which extends diagonally outwardly from an axle 39a mounted on the outer face of the diesel engine housing 30a, the idler pinion 39 to rotate upon the upper, reduced diameter end of the axle 39a. The compressor or driven gear 40 has its shaft 41 passed through, and journaled in, a large bore 41a centrally through the forward closure plate 31c of the compressor housing 31b, the direction of rotation of the driven gear 40 indicated in FIG. 6 as being counter-clockwise in correspondence with the direction of rotation indicated in this view for the drive gear 33, as driven by the diesel engine 30, in manner to be hereinbelow described. Correspondingly, as indicated diagrammatically in FIG. 5, the driven or compressor shaft 41 may be journaled within or about anti-friction means not shown, but indicated for the shaft 13 in FIG. 5.

In FIGS. 6 and 7 an air inlet fitting 24a, is shown in the top right of the compressor housing 31b, for compressor air to be drawn in therethrough to pass, as intake air, to be compressed within the compressor 31. The driven shaft 41 is indicated as continued on through the transmission bell housing 21 for connection to transmit drive on to further mechanism. An exhaust port or pipe 26a is shown extending rearwardly from the compressor 31 to exhaust products of combustion as the last step of inlet air and injected fuel usage.

Considering FIG. 7 in connection with the sectional elevation of compressor demonstrating its cycle, as shown in FIG. 3, a “glow” plug 42 is shown with a glow filament 43 extending therefrom into a cavity in the outer portion of the rear closure plate 31c of the compressor 31. Such cavity communicates through a small opening 44 in the compressor rear closure plate 31c with the interior of the compressor housing 31b.

As will be hereinbelow described, the opening (44, FIG. 8), 44a, FIG. 3, communicates a glow wire or filament 43 (FIG. 8), with the products of combustion within the respective successive spaces B, A, C, FIG. 3, as they pass thereby comprising lower expansion chambers. Although the primary purpose of the glow wire 43 may be that of assisting or insuring the starting of the engine, especially in cold weather conditions, another most important service that can be obtained from a glow wire located in this position, is the causing of a secondary burning of the products of combustion on their way to communication with their exhaust outlet 26, FIG. 3, or 26a, FIG. 8. This second ignition results in an increase of the power pulse effective upon the compressor rotor to be hereinbelow described.

Considering FIG. 9 in relation to FIGS. 6, 7 and 8, the compressor forward closure plate 31a, is shown having peripheral lugs 38b therearound through which pass the aforesaid assembly bolts 37. Two vertically spaced apart ports or openings 45a, 45b, are shown spaced a bit to the right of the left edge of the closure plate 31a, and these serve to let cooling water from around the compressor unit pass through matching holes 36b in common connection plate 36, by which water jacket 29 and diesel engine 30 are connected to the compressor forward closure plate 31a. Further to the right, in the compressor forward closure plate 31a, two substantially vertically aligned, lateral ports 46a, 46b, are provided, with compressed air from an air inlet chamber into the compressor 31 passing through upper

The water jacket 29, hollow inside, is connected to the diesel engine unit 30 by means of bolts 35a in holes pass through sleeves 35c, formed peripherally about the housing 30b and through sleeves 35b, formed peripherally about the water jacket 29, conventional nuts 34a, being threaded onto the bolt ends outwardly of the water jacket 29. Water jacket 29 and diesel engine housing 30a are connected at their inner ends to a common flange or connection plate 36 which seats upon the forward closure plate 31a which closes the forward end of the compressor 31.

Bolts 37 pass through holes in lugs 36a extending from the common flange 36, through holes in lugs 38a about the periphery of the closure plate 31a, through holes in sleeves 38b formed in the periphery of the compressor housing 31b, through holes through lugs 38b in the rear closure plate 31c of the compressor 31, and in FIG. 7 through holes through lugs 20a formed about the periphery of the connection flange 20 at the forward end of the conventional transmission bell housing of a motor vehicle. When nuts are tightened on the threaded rear ends of these bolts 37, the common flange 36, forward closure plate 31a, compressor housing 31b, rear closure plate 31c, and forward flange 20, (not shown in 6), of the transmission bell housing 21, are firmly assembled together.

described. Also in FIGS. 1 and 2 an exhaust or discharge pipe 26 is shown extending rearwardly, as from the lower left corner of the compressor 12, as will be hereinbelow described.

Now considering FIGS. 3, 4, and 5 in conjunction with FIG. 2, please note that the view of FIG. 3 is described as being taken substantially along line 3—3 of FIG. 2. However, within the housing 12a of the compressor 12, a substantially oval shaped chamber enclosure 12b is provided with a forward closure plate 12c being indicated for the chamber enclosure 12b, as in dotted lines in FIG. 2. Also note that transfer ports 27a and 27d, substantially vertically aligned, are indicated in phantom lines in FIG. 3, and thus forwardly of the compressor rear wall 19, and correspondingly through the forward closure plate 12c, FIG. 2, and in elevational and transverse alignment with corresponding respective transfer ports 27b, 27c, in the rear closure plate 11b of a substantially oval shaped chamber enclosure 11a provided spaced within diesel engine housing 12a, FIG. 4. The chamber enclosure plate 11b is also indicated in dotted lines in FIG. 2, with connection pipes or sleeves 28a, 28b, also shown in dotted lines in FIG. 2, indicating respective transfer of communication between respective transfer ports 27a, 27b, and respective transfer ports 27c, 27d, the pipes or sleeves 28a, 28b, thus passing through the water jacket 16.

Now considering the diesel engine-compressor arrangement shown in FIGS. 6 and 7, a Wankel type compressor 31 is shown disposed at right angles to a Wankel type diesel engine 30 which has a hollow water jacket 29 on the left side thereof. The construction of the diesel engine drive shaft 32 and drive gear 33 is in correspondence with the construction of drive shaft 13 and drive gear 15 shown in FIGS. 2 and 5 as to outer proportions, except that the shaft 32 need not be hollow. In this case, the inner end of the shaft 32 may be journaled in the rear wall 30b of the diesel engine housing 30a, within or about conventional anti-friction means, not shown, but in general correspondence with such means shown in FIG. 5.

The water jacket 29, hollow inside, is connected to the diesel engine unit 30 by means of bolts 35a in holes pass through sleeves 35c, formed peripherally about the housing 30b and through sleeves 35b, formed peripherally about the water jacket 29, conventional nuts 34a, being threaded onto the bolt ends outwardly of the water jacket 29. Water jacket 29 and diesel engine housing 30a are connected at their inner ends to a common flange or connection plate 36 which seats upon the forward closure plate 31a which closes the forward end of the compressor 31.

Bolts 37 pass through holes in lugs 36a extending from the common flange 36, through holes in lugs 38a about the periphery of the closure plate 31a, through holes in sleeves 38b formed in the periphery of the compressor housing 31b, through holes through lugs 38b in the rear closure plate 31c of the compressor 31, and in FIG. 7 through holes through lugs 20a formed about the periphery of the connection flange 20 at the forward end of the conventional transmission bell housing 21 of a motor vehicle. When nuts are tightened on the threaded rear ends of these bolts 37, the common flange 36, forward closure plate 31a, compressor housing 31b, rear closure plate 31c, and forward flange 20, (not shown in 6), of the transmission bell housing 21, are firmly assembled together.
port 46a, through a matching hole or port 36a in the common connection plate 36, to be further compressed by diesel engine rotation, as indicated by the upper, counter-clockwise arrow on the diesel engine 30, FIG. 6.

To the right of the ports 46a, 46b, FIG. 9, are shown two vertically aligned studs 47 which pass through holes in the common connection plate 36, and have nuts 47a installed thereon, as indicated in FIG. 6, the diesel engine 30 and water jacket 29 being connected to this common plate 36, as aforesaid. Finally, centrally of the compressor forward closure plate 31a, a bore 41a is shown through which passes with rotational clearance, the driven shaft 41, FIGS. 6 and 7, which drives the compressor rotor within the compressor, and passes drive on through the transmission bell housing 21 to mechanism to be driven, as aforesaid.

Referring back now to FIGS. 3 and 4, it may be stated that the relative rotor and housing interior relationships are the same for compressor and diesel engine as in the respective compressor and diesel engine shown in FIGS. 6, 7 and 8. Notably, the compressor rotor 50, FIG. 3, as it rotates with end sealing, and three vane side sealing relationship with the interior surface of the compressor chamber 12b, compresses the air that has entered into an inlet space A, as its seal vane D passes counterclockwise on past the air inlet passage 49, and this compressor space A is reduced in volume, whereby compression of the inlet air is obtained. As shown in FIG. 3, this compressor space A is defined within the compressor 12 (30), between the outer surface of the compressor rotor 50, the seal vane D and E, and the inner surface of the compressor chamber 12b, (FIG. 3).

As the rotor 50 turns counter-clockwise, as will be hereinbelow described, with its successive seal vanes E, D, F; and F, D; respectively, closing the spaces A, B and C in their progress, the inlet air that has entered the space A is forced in greater part through the port 27a, (phantom lines, FIG. 3), in the forward compressor closure plate 12c, FIG. 2, via the conduit 28a through the water jacket 16, and via the port 27b, in the engine chamber 11b rear closure plate 11c (FIGS. 2 and 4), into the space G within the diesel engine chamber 11b, as defined by the clockwise moving engine rotor 51, the inner surface of the chamber 11b, and the moving leading and following seal vanes L and K, respectively.

Referring now to FIG. 4, it is noted that immediately in advance of the space G, a space H is defined by the rotor 51, the inner surface of the engine chamber 11b, and the moving leading and trailing seal vanes M, L, respectively. As shown in FIG. 4, the fuel injection fitting 25 is in communication with the space H, after it has previously injected fuel to fire the now expanded space J, as defined by the inner surface of the engine chamber 11b, the rotor 51, and the respective leading and trailing seal vanes K, M. The fuel injection fitting is coordinated, by conventional means, to inject fuel to be fired as each successive space thereafter has been moved so that the injection fitting 25 is substantially equidistant from the leading and trailing vanes of the respective spaces.

Thus in FIG. 4, the fired space J is shown as occupying a much larger volume than the spaces G, L, and H, right, thereafter. Also, the space J is shown in FIG. 4 as being in communication with the port 27c in the rear closure wall 11c of the diesel engine chamber 11b, whereby the gases of combustion may pass rearwardly therefrom via the conduit 28b through the water jacket 16, and through the port 27d in the forward closure plate 12c of the compressor 12 into the compressor space B, as determined by the compressor rotor 50, the inner surface of the compressor chamber 12b, and the leading and trailing seal vanes F, E, as aforesaid. As the compressor rotor 50 continues rotation in counterclockwise direction, it uncovers the port 44a, thus establishing communication into the glow wire or filament 43 for secondary ignition. Then the leading seal vane begins to uncover the passage to the discharge port 26, and the twice burned gases begin to be vented or discharged.

Thus the successive compressor spaces A, C, and B, are moved counterclockwise, successively into communication with air inlet; then into communication with both port 27a to engine and air inlet; then into communication along with port 27a to engine; then into communication with return port 27d from engine; then into communication with glow wire 43 and return port 27d from engine; then into communication with exhaust 26. As to the successive diesel engine spaces G, J and H, at a time the compressor space A is in communication with both port 27a and air inlet, the diesel engine space G is receiving air via compressor port 27a through diesel engine port 27b; and in clockwise rotation the engine spaces G, J and H follow the following succession of relationships comprising: communication with engine port 27b occluded; inlet from fuel injection fitting 25 uncovered, but no injection; injection and ignition when the respective leading and trailing seal vanes are approximately equidistant from the fuel injector; expansion under early ignition prior to the uncovering of the engine port 27c for gas return back to compressor, engine port 27c uncovered for gas return back through compressor port 27d into compressor; and occlusion of engine port 27c coincident with the beginning of uncovering of engine port 27b.

The details of compressor operation may best be understood by a consideration of FIGS. 1–3, and 5. A planetary pinion 48 is attached with relation to the rotor 50, as to the compressor rear wall 19. A planetary gear 52 is fixed to the rear side of the wall of the compressor rotor 50 with the inner diameter of the ring, from which the planetary gear teeth extend radially inwardly being about the same as the diameter of the bore or opening through the rotor 50. Forwardly of the planetary gear 52, within the bore or opening through the rotor 50, there is disposed from the drive shaft 23 an eccentric lobe 53 which may be seen in FIG. 3 as occupying a space within the rotor bore ninety degrees in rotation after the position shown in FIG. 3.

As to the diesel engine rotor 51, it also has a planetary gear 54, of the same diameter and construction as the compressor planetary gear 52, which is fixed thereto to extend longitudinally over and mesh with part of the planetary pinion 55, which is affixed to extend forwardly from the front face of the rear closure plate 11c of the diesel engine chamber 11b. The rear end of the engine drive shaft 13 extends with slight clearance through the planetary pinion 55 and is axially counterbored from its rear end, to receive ball bearing assemblies 56 therein which have their outer races press-fitted into the aforesaid counterbored end of the engine drive shaft 13, and which have their inner races press-fitted upon the compressor drive shaft or drive transmission shaft 23. Just forwardly of the forward
face of the planetary pinion 55 is disposed the rear face of an eccentric lobe 57, which is upwardly in FIG. 4, and which is formed integrally with the diesel engine drive shaft 13. In FIG. 5 this lobe 57 is shown advanced 90° in clockwise rotation from the position in which it is shown in FIG. 4.

The view of FIGS. 3 and 4, having been hereinabove described as being at least partially diagrammatically, in view of the well known Wankel construction, the operation of the compressor rotor 50 about its lobe 53, and within its particular shaped chamber 12b, and the operation of the engine rotor 51 about an eccentric lobe 54 on the diesel engine shaft 13, within its particularly shaped chamber 11b, may be set forth in cursory detail. As is done conventionally shaft 23 is rotated by a starter motor in predetermined direction of rotation, and carries on to the engine motion, as indicated as being clockwise in FIG. 4. First explosion in an engine space occurs when the engine eccentric lobe 57 within the rotor 51, reaches closest spatial proximity to the fuel injector 25. This point of fuel injection, with relation to the dispositions of elements shown in FIG. 4, would be when the space H had advanced say substantially 30° from position shown, the lobe 57 having advanced substantially 90°, as aforesaid.

The explosion pressures are applied against the rotor 51, which in turn is pressed against the eccentric lobe 57, forcing it downwardly. The movement of the rotor 51 is constrained by the inter-meshing of the planetary gear 54, (fixed to the rotor 51), with the planetary pinion 55, fixed to a stationary part of the fixed engine housing. Thus the rotor 51 follows the inner surface of the well known Wankel engine or compressor chamber, defined as of centrally pinched, modified ellipsoid configuration, or of the inner configuration of a two lobed epitrochoid. Thus rotor movement, as constrained by gear emmeshment, and under impulse of successive space explosions, determines the continuously changing special relationships within the engine chamber 11b.

When the transfer shaft 23 is indicated as being the shaft that is set in counter-clockwise rotation by a starting motor or means, not shown, the rotation of the shaft 23 is transmitted, by a bevel gear 15 affixed thereto, by way of idlers 58a, 58b, suitably mounted, as by brackets 59a, 59b, which extend from the engine front wall 14, which drive the aforesaid engine drive gear 15 to rotate the engine shaft 13 in clockwise direction. These relationships are best indicated in FIG. 5.

The driven or compressor shaft 23, which includes or carries its eccentric lobe 53, rigidly affixed thereto, around therewith in counter-clockwise direction, as aforesaid, has the forces of the expansion of gases in an ignited engine space imparted thereto by the cross-transferred gases and these urge against the compressor rotor 50, to urge against the compressor eccentric lobe 53. Meantime the forces obtained by secondarily burning gases entering an advanced space from the result of an engine space ignition, results in the application of whatever forces are thus generated by this means against the compressor rotor 50, thus to be transmitted on to the compressor shaft eccentric lobe 53. Meanwhile, the movement of the rotor 50 is constrained, or rather directed, by the interfitment of the teeth of the fixed planetary pinion 48 and the teeth of the planetary gear 54 carried by the compressor shaft 23. Thus the compressor rotor 50 also follows, in correspondence with the engine rotor 51, the corresponding inner surface of the well known Wankel compressor chamber, also defined as of centrally pinched, modified ellipsoid configuration, or as the configuration of a two lobed epitrochoid. Thus, as in the case of the engine rotor 51, the movement of the compressor rotor 51 is constrained or directed by the emmeshment of the teeth of the planetary pinion 48, fixed in the compressor chamber 12b, with the teeth of the planetary gear 52, carried by the compressor shaft 23 together with its eccentric lobe 53.

The method of sealing the chambers with relation to their separation from each other, and with relation to their sealing with relation to the end closures or side walls, is best shown at least partially diagrammatically in FIGS. 10 and 11. In this case a sealing vane M of the engine is taken for illustration as conditions illustrate in the engine 30, FIGS. 6, 7 and 8. The sealing vane M is shown in contact with the pinched or inwardly projecting surface 60a that is provided in the engine chamber 11b shown just adjacent to the fuel injection opening 25a of the fuel injector 25, FIGS. 6 and 7.

The vane M is indicated as working in a slot 61 in substantially a respective apex 62 of the rotor 51. Cylindrical recesses are formed in the opposed ends of the rotor 51 adjacent the apices thereof, and a modified cylinder 63a is shown in section in such a recess in FIG. 10; also modified cylinders 63a and 63b are shown in FIG. 11; the cylinders being slotted to receive the radially inwardly portion of the vane M, and additionally slotted at outer ends to receive therethrough respective end seal members 64a, 64b, which are tapered to abut the correspondingly tapered vane end surfaces along approximately 45° surfaces. A leaf spring 65 bears centrally in the bottom of the slot 61 and near its outer ends against the respective inner corners of the vane M, and at its outer ends it bears against under-cut corners of the respective end seal members 64a, 64b. Thus the seal members are urged against the walls to the side of each, and directly outwardly against the respective vane, along the beveled surfaces of abutment.

The side sealing of the respective changing spaces A, B, in the compressor, and H, G, J, in the engine, is accomplished by slitting the respective rotors 50, 51, and installing in slots 67, (corresponding generally with rotor configuration, but not shown in FIGS. 3 and 4 for purposes of clarity), substantially rigid sealing sheet or band material 66a, 66b in the slots on either side of the respective rotors, to bear sealably against the respective forward and rearward, or respective outer and inner closures for compressor or engine, as the case may be. The seal members 66a, 66b are kept urged outwardly by cramped leaf spring members 68 at the bottoms of the aforesaid rotor shaped slots 67. Also, the cylinders that receive the vanes have strong three-quarter turn leaf or coil springs 69 that urge against their inner bases to urge them outwardly.

As hereinabove described, each space, as it advances through the Wankel cycle, is completely or substantially sealed off from adjacent leading and trailing spaces. Thus each cycle of events through the substantially identical successive stages is substantially the same. These arrangements thus make it practical to obtain all of the advantages of performance of the diesel Wankel within the long established and conventional
limitations of space now established by motor vehicle and aircraft practice. Space is gained by these particular types of tandem arrangements by way of compaction through disposition of engine-compressor relationships.

In the type of tandem arrangement shown in FIGS. 1-5, inclusive, cooling water enters a cooling water inlet 71, passes through the water jacket space 72 surrounding the compressor chamber 12b, and then circulates through the water jacket space 73, finally to pass out the cooling water discharge conduit 74 shown in phantom lines in FIG. 4, as this element is behind the section line 4-4 in FIG. 2.

In the type of tandem arrangement shown in FIGS. 6-8, inclusive, the cooling water enters an inlet 71a as shown diagrammatically in FIG. 8, and is circulated through the water jacket space 72a around the compressor chamber 75, to enter through ports 45a, 45b, into the water jacket 29, part passing through port 76a into water jacket space 77 around the engine, and returning through port 76b back into the water jacket 29, with all circulated cooling water discharging out the water discharge conduit 71b. The discharge conduit 71b is thus shown discharging in separate directions, only by way of illustration, in FIGS. 6 and 8, respectively.

The ratios of pitch diameters, or teeth, between planetary gears and planetary pinions, are diagrammatic as shown, or merely illustrative, it being known that in Wankel type engines and compressors, the chamber inner periphery and configuration also enters into the design. Thus the planetary gear-pinion ratios disclosed with relation to chamber configurations and peripheries are illustrative only, and are not by way of limitation.

Also, the invention does not set out to perform any theoretical changes in the operation and functions of the well known Wankel cycles, other Wankel type disclosures being in U.S. Pat. Nos. 3,116,722; 3,127,095; and 3,142,439, herewith made of record; except that those structural changes are claimed as inventive, as they apply to the cross-porting.

The invention, dependent upon arrangement by way of compaction through disposition, is not limited to the forms of arrangements and structural combinations set forth in the drawings and hereinafore described in detail. Rather the broad spirit of the invention should encompass other forms of compacting arrangements in tandem, while the appended claims are by way of illustration.

I claim:

1. A Wankel type, single diesel engine-compressor combination with compressor determining height and width dimensions, and with respective engine-compressor chambers disposed in horizontal tandem and having respective fixed pinions therein, and with compressor chamber providing inlet port means thereinto, and also discharge port means therefrom, the combination being provided for substitution in conventional vehicle power plants to require minimal elevation under the hood, each chamber having a triangular rotor therewithin carrying therein a planetary gear, said planetary gears meshing with said respective fixed pinions, and respective rotors in rotation providing continuously moving respective engine and compressor expansion and compression spaces in said respective chambers, an engine drive shaft having a drive gear outwardly thereon and an engine eccentric lobe thereon within said engine chamber, said compressor having a driven shaft having a driven gear outwardly thereon and a compressor eccentric lobe thereon within said compressor chamber, idler means provided between said gears to drive said driven gear in opposite clock direction from said drive gear, substantially vertically spaced apart compressed air and exhaust lateral transfer port means provided between said chambers, inlet air being compressed in front of compressor eccentric lobe rotation to pass through said compressed air transfer port means into engine compression space, a fuel injector conventionally, externally timed to inject fuel into engine compression space for explosion, and explosion driving said engine rotor in forceful contact with said engine eccentric lobe to cause aforesaid drive shaft rotation, explosion exhaust passing from said engine chamber through said exhaust transfer port means into compressor chamber expansion space to abet compressor rotor rotation in moving expansion space into communication with said discharge port means, said driven shaft extending from said compressor for connection to a device to be driven, the drive shaft of said engine and the driven shaft of said compressor being disposed with axes co-axial for the extent of the engine shaft axis, and said compressor shaft passing axially through said engine shaft and carrying its eccentric lobe thereon rearwardly of said engine shaft eccentric lobe, said diesel engine-compressor combination having water jacket means to communicate cooling water with said chambers, with cooling water circulation first passing around said compressor chamber and in cooling communication with said engine prior to discharge, said lateral transfer port means extending from rear of said engine chamber through said water jacket means into the front of said compressor.

2. The combination as claimed in claim 1, in which said compressor chamber provides secondary ignition means therein to communicate a secondary burn to the explosion exhaust passed back into said compression chamber.

3. The combination as claimed in claim 1, in which the ratio of effective diameters of planetary pinion and planetary gear is approximately 1:3.

4. A Wankel type, single diesel engine-compressor combination with compressor determining height and width dimensions, and with respective engine-compressor chambers disposed in horizontal tandem and having respective fixed pinions therein, and with compressor chamber providing inlet port means thereinto, and also discharge port means therefrom, the combination being provided for substitution in conventional vehicle power plants to require minimal elevation under the hood, each chamber having a triangular rotor therewithin carrying therein a planetary gear, said planetary gears meshing with said respective fixed pinions, said respective rotors in rotation providing continuously moving respective engine and compressor expansion and compression spaces in said respective chambers, an engine drive shaft having a drive gear outwardly thereon and an engine eccentric lobe thereon within said engine chamber, said compressor having a driven shaft having a driven gear outwardly thereon and a compressor eccentric lobe thereon within said compressor chamber, idler means provided between said gears to drive said driven gear in the same direction as said drive gear, substantially vertically.
3,742,917

11 spaced apart compressed air and exhaust lateral transfer port means provided between said chambers, inlet air being compressed in front of compressor eccentric lobe rotation to pass through said compressed air transfer port means into engine compression space, a fuel injector conventionally, externally timed to inject fuel into engine compression space for explosion, and explosion driving said engine rotor in forceful contact with said engine eccentric lobe to cause aforesaid drive shaft rotation, explosion exhaust passing from said engine chamber through said exhaust transfer port means into compressor chamber expansion space to abet compressor rotor rotation in moving expansion space into communication with said discharge port means, said driven shaft extending from said compressor for connection to a device to be driven, the drive shaft of said engine and the driven shaft of said compressor being disposed with axes normal to each other, said diesel engine-compressor combination including water jacket means to communicate cooling water with said chambers, with cooling water circulation first passing around said compressor chamber and in cooling communication with said engine prior to discharge, said lateral transfer port means extending sidewardly adjacent water jacket means and directly between a side of said engine chamber into a front portion of said compressor chamber.

5. The combination as claimed in claim 4, in which said compressor chamber provides secondary ignition means therein to communicate a secondary burn to the explosion exhaust passed back into said compression chamber.

6. The combination as claimed in claim 4, in which the ratio of effective diameters of planetary pinion and planetary gear is approximately 1:3.

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