

July 8, 1941.

R. MIKSITS

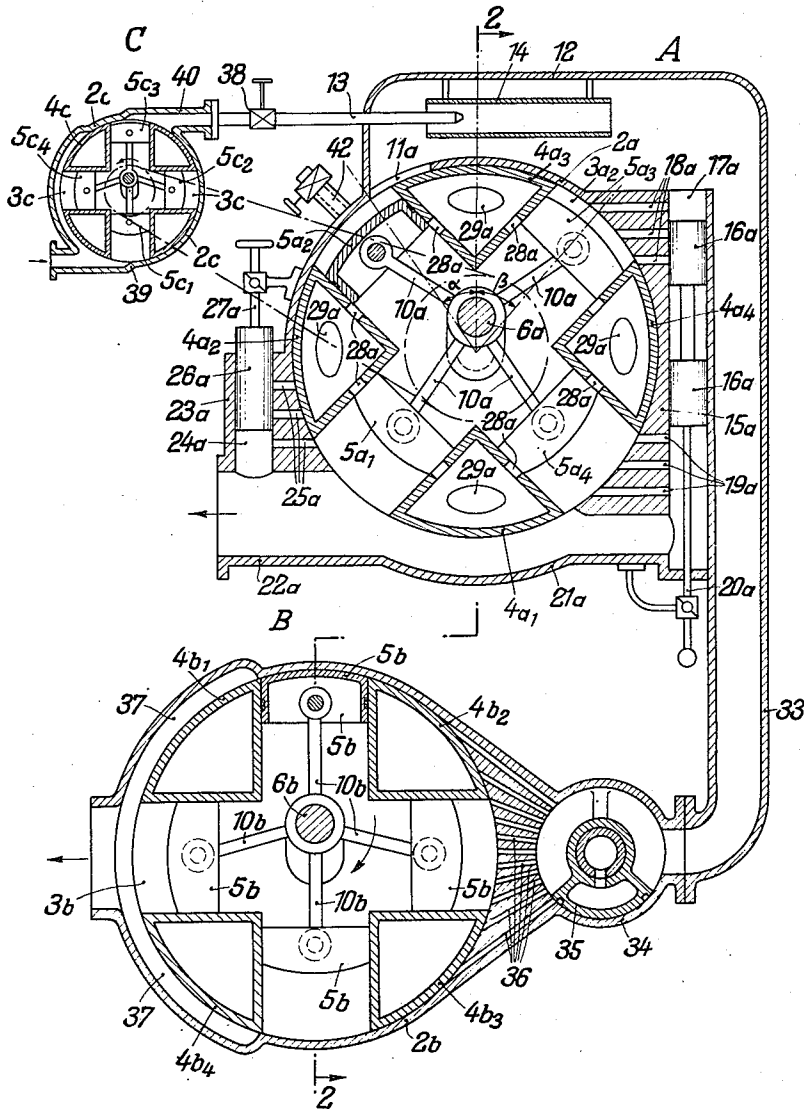
2,248,639

ROTARY PISTON MACHINE

Filed Sept. 22, 1937

4 Sheets-Sheet 1

Fig. 1



Inventor:

Reinhold Miksits

By
Stone, Boyden & Mack.
Attorneys.

July 8, 1941.

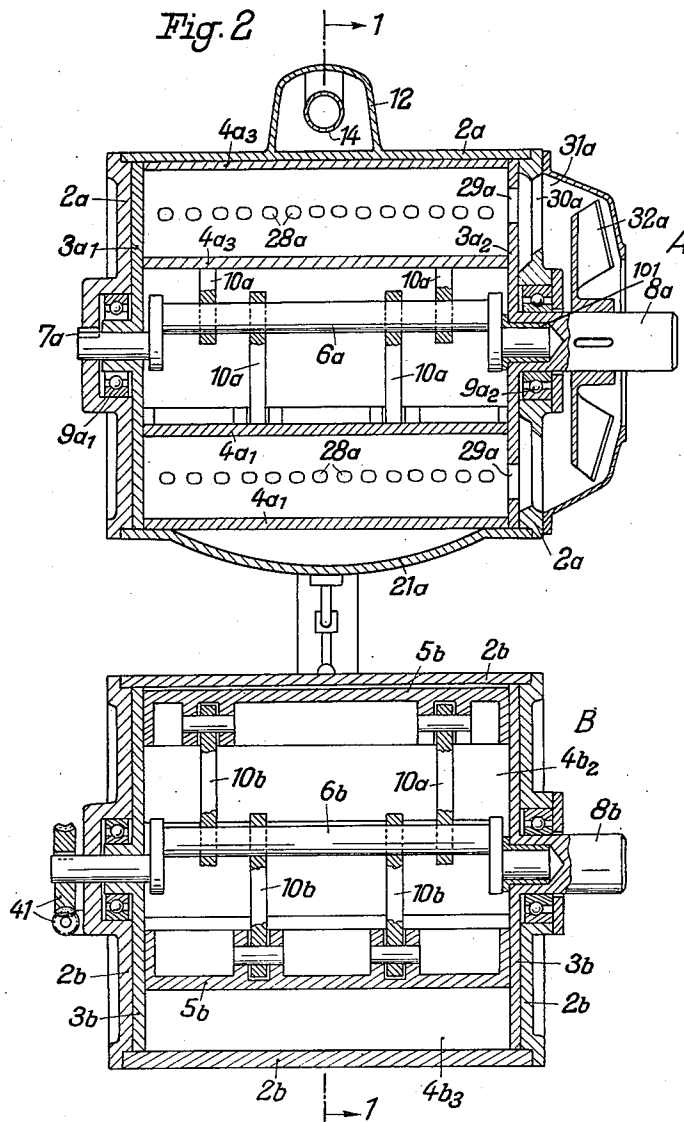
R. MIKSITS

2,248,639

ROTARY PISTON MACHINE

Filed Sept. 22, 1937

4 Sheets-Sheet 2



Inventor:
Reinhold Inkseto.
By Stone, Boyden & Mack.
Attorneys.

July 8, 1941.

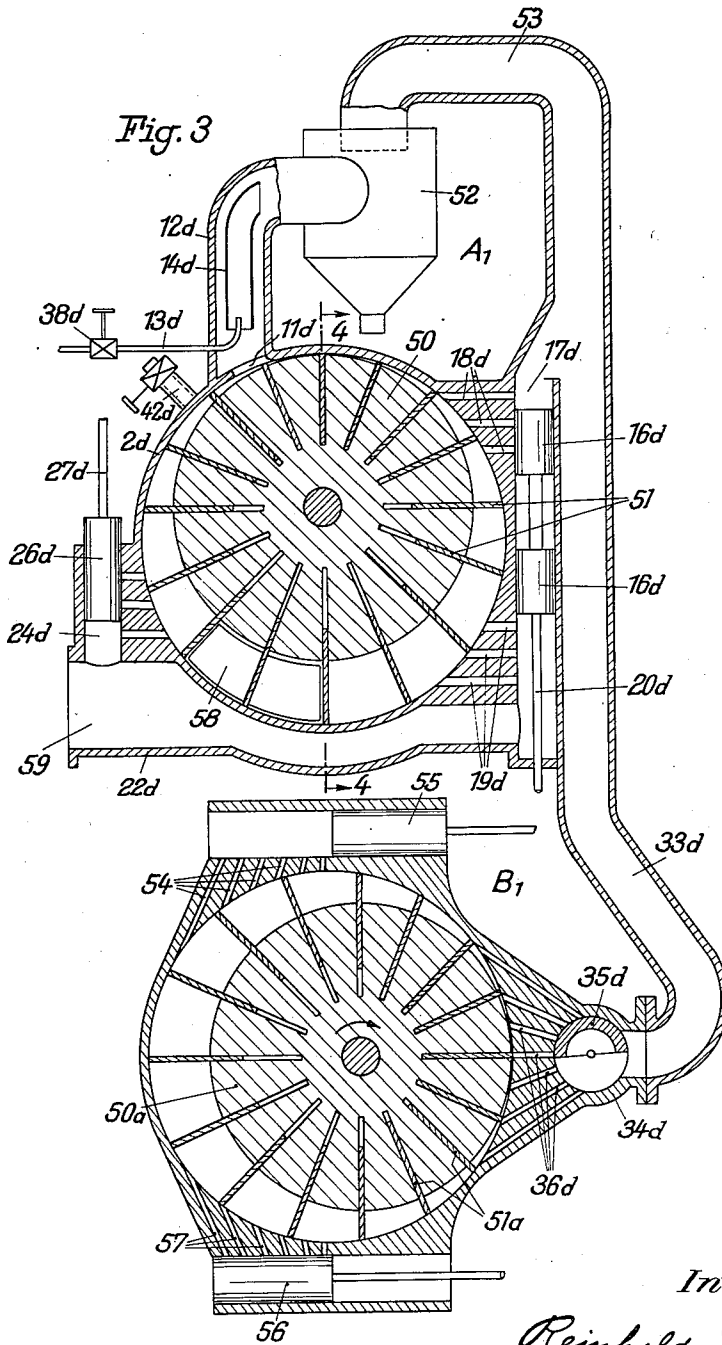
R. MIKSITS

2,248,639

ROTARY PISTON MACHINE

Filed Sept. 22, 1937

4 Sheets-Sheet 3



Inventor:

Reinhold Miksits.

By Stone, Boyden & Mack.
Attorneys.

R. MIKSITS

ROTARY PISTON MACHINE

Filed Sept. 22, 1937

4 Sheets-Sheet 4

Inventor:

Reinhold Imktsits.

Bay
Stone, Boyden & Inack,
Attorneys.

UNITED STATES PATENT OFFICE

2,248,639

ROTARY PISTON MACHINE

Reinhold Miksits, Berlin, Germany

Application September 22, 1937, Serial No. 165,197
In Germany January 4, 1935

2 Claims. (Cl. 60—44)

This invention relates to rotary piston machines and engines and to a working process therefor. This is a continuation in part of my application for patent Serial No. 57,414, filed January 3, 1936, Rotary piston machines, since abandoned.

It is an object of this invention to attain high economy in the production of energy.

Another object of my invention is to render possible an efficient thermodynamic operation and regulation.

Another object of this invention is to render the engine adaptable to a wide range of different working conditions.

Still another object of this invention is to reduce the cost of manufacturing such an engine.

My novel principle of operation is to be used in rotary piston machines and engines and comprises the following steps taking place simultaneously: compression of air, discharge of the same into a passage chamber which connects the compression part or chamber with the expansion part or chamber, production of heat in the passage chamber, charging the combustion gases into the expansion part or chamber, expansion, removal of the gases and charging with fresh air.

In piston engines of the conventional type, the volume at the commencement of the compression corresponds approximately to the volume at the termination of the expansion. According to a special feature of my invention the volume at the termination of the expansion may be increased over the volume at the commencement of the compression. Then, due to the continued expansion, energy is gained and the working process improved. The utilization of the heat input becomes particularly favourable, if the expansion is conducted about as far as the initial pressure of the compression.

An output regulation or control may be attained according to this invention by changing the compression of the fresh air and/or charge and expansion, while the feed of fuel is adjusted accordingly.

My novel working process per se can be applied within any range of pressures or temperatures which are admissible for the machine. In order to reduce the thermal stresses upon the moving parts it is advisable to carry out the working method at moderate temperatures.

By the application of moderate temperatures preferably not beyond 1000° C. in carrying out my novel process or by the use of a considerable excess of air it is possible to reduce the loss of

heat due to the heat radiation from the intermediate or passage chamber. According to a special feature of the invention the combustion is effected in the central part of the cross section of the passage channel only, so that the passage portions near the wall receive very little heat only due to the combustion and the temperature difference between the walls of the passage channel and the exterior air is reduced.

The rotary piston engine may also be operated with coal dust or a mixture of coal dust with liquid fuel. In order to avoid the wear due to the residues and ash, I contemplate the use of a cyclone separator or other device for cleaning the combustion gases before they enter the expansion part of the machine.

The rotary piston engine may also be operated with gaseous fuel.

According to this invention the rotary piston engine may also be used for supplying compressed air or combustion gases for driving any machines or tools. To this end a portion of the compressed air and/or of the combustion gases is taken from my engine.

A further modification of my novel engine comprises two aggregates which are not coupled with each other and only one of which is used for the compression work, while the second one is connected with the machine to be driven and produces the real useful output. Accordingly, the expansion is subdivided in this case.

My invention moreover comprises a particular design of a rotary piston machine.

The invention will be better understood by reference to the following detailed description in connection with the accompanying drawings, showing by way of example and schematically some embodiments of the invention, viz.—

Figure 1 is a vertical section through an engine according to this invention including auxiliary devices designed according to the invention.

Figure 2 is a vertical section on line 2—2 of Figure 1.

Figure 3 is a vertical section through a modification of the machine shown in Figure 1.

Figure 4 is a vertical section on line 4—4 of Figure 3.

Figure 5 is a vertical section through an alternative construction of the mechanism shown in Fig. 1.

Referring to Figures 1 and 2, item A is an internal combustion engine, B is a motor operated by a driving medium produced in the engine A, and C is a compressor for fuel gas.

In the aggregate A, 2a designates a casing sub-

stantially in the form of a hollow cylinder; 3a₁ and 3a₂ are two discs adapted to rotate within the casing 2a and connected with one another by hollow bodies 4a₁, 4a₂, 4a₃ and 4a₄ in the shape of sectors, for instance by welding or screws (not shown). Pistons 5a₁, 5a₂, 5a₃, 5a₄, which are radially movable and have a considerable length, are provided in the spaces between a pair of the said sectors 4a₁, 4a₂, 4a₃, 4a₄, respectively. A shaft 6a is excentrically mounted in the casing 2a and secured therein against rotation by a wedge 7a. The right hand end of the excentric shaft 6a is rotatably mounted in the disc 3a₂, by a bearing bushing 101. The disc or plate 3a₂ in turn is mounted in the casing 2a by means of a journal 8a and a ball bearing 9a₂. The plate 3a₁ is mounted in the left hand side wall of the casing 2a by means of a further ball bearing 9a₁. The pistons 5a are linked or jointed to the excentric shaft 6a by means of piston rods 10a, the piston rods of the single pistons being displaced relatively to each other. Each piston is connected with the shaft 6a by means of two piston rods. If the plates or discs 3a₁, 3a₂ including the sectors 4a₁, 4a₂, 4a₃, 4a₄ are rotated, the pistons 5a follow this movement and are radially moved by the excentric shaft 6a and the piston rods 10a. By an aperture 11a the interior of the casing 2a is connected with an exterior space 12. Moreover, the fuel feeding pipe 13, which is surrounded by a tubular member 14, fixed in the casing 12 in a suitable manner, is introduced into the casing 12. Connected with the casing 2a is moreover a member 15a, in a cylindrical bore 17a of which a twin or double piston 16a is adjustably mounted. The cylindrical bore 17a is connected with the interior space of the casing 2a by means of apertures or channels 18a, 19a. By means of a rod 20a the pistons 16a can be held in predetermined positions. An extension 21a of the casing 2a is connected with an egress 22a. It will be seen that the spaces above the pistons 5a are not closed by the casing at this point. A further block 23a has a cylindrical bore 24a, which is connected with the interior space of the casing 2a by means of channels 25a. A piston 26a is adjustably mounted in this cylindrical bore 24a and held in its position by a rod 27a. Apertures 28a are provided in the sectors 4a₁, 4a₂, 4a₃, 4a₄ and alternately covered and opened by the respective pistons 5a₁, 5a₂, 5a₃ or 5a₄, respectively. The interior spaces of the sector members 4a₁, 4a₂, 4a₃, 4a₄ are apertured by bores in the disc 3a₂ as at 29a. By means of apertures 30a in the casing 2a, fresh air can be admitted from a fan 32a in a space or chamber 31a and introduced into the sectors 4a₁, 4a₂, 4a₃, 4a₄ through the apertures 29a.

Corresponding parts in the aggregates B and C are designated by the same reference numerals as in the aggregate A, the letter b or c, respectively, being added. Aggregate A is connected with the casing 34 of aggregate B by a tube or conduit 33. By a rotary slide valve 35 in the casing 34 the channels 36 can be more or less closed or connected with the tube 33. In the position of the member 35 shown in the drawings the upper channels 36 are open, while in its opposite position the lower channels 36 would be open. The casing 2b encloses and partly engages the discs 3b including the sector members 4b₁, 4b₂, 4b₃, 4b₄. The portion 37 of the casing 2b is so shaped that the cylindrical circumference of the rotary parts is not engaged by the walls of this portion 37. In a similar manner the cas-

ing 2c of the aggregate C only partly engages the circumference of the discs and of the sectors 4c.

The operation of the arrangement described is as follows:

In the aggregate C a gaseous fuel is compressed in a manner to be hereinafter described. This compressed fuel is introduced into the chamber 12 through valve 38 and pipe 13. The disc 3a₂, when rotated by a starter acting on the journal 8a (not shown), causes the sectors 4a₁—4a₄, the disc 3a₁ and the pistons 5a₁—5a₄ to follow this rotation. At the same time, the pistons reciprocate towards, and away from, the wall of the casing 2a. Assuming that air is in the space above the piston 5a₁, this air will be compressed when the sector 4a₁ has reached the front or leading edge of the block 23a provided that all channels 25a are closed by the piston 26a. If one or more channels 25a are open, the compression will start only after the respective open channels have been closed by the front or leading edge of the sector 4a₁. Thus, the degree of compression can be changed. When the sector 4a₁ reaches the position shown at 4a₃, its rear edge (relative to the direction of movement) has established connection between the space above the piston 5a₂ and the aperture 11a, so that the compressed air is discharged into the chamber 12 as the piston is further moved. Accordingly a mixture of fuel and air is produced in the chamber 12, which may be ignited for instance by the heat generated by the compression. The combustion is effected within the tube 14 so that the part of the compressed air sweeping around the pipe 14 mixes with the combustion gases and reduces the temperature of the combustion gases entering at 17a to an amount not essentially exceeding 1000° C. The combustion gases may be delivered depending on the position of the piston 16a, through the cylindrical bore 17a and the channels 18a into the space in which the piston 5a₃ is movable and thus drive this piston. The passage of gas into the said piston space is finished when the front edge of the following or succeeding sector 4a₃ has closed the last channel 18a which has been left open by the piston 16a. Then the expansion takes place in the space above the piston 5a until the edge of the sector 4a₄, which is in front of the piston 5a in the direction of movement, reaches the first channel 19a, which is not closed by the lower piston 16a.

It will be understood that the degree of filling and expansion and so the output of the engine can be regulated within wide limits by means of the twin piston 16a.

In order to be operative the engine must be provided to produce an output by charge and expansion work on the right hand side of the aggregate A which is greater than the input due to the compression work to be produced on the left hand side of the engine. To this end, the working pistons are provided to be through a longer angular path on the charge and expansion side from the dead centre position, under action of the pressure of the combustion chamber than on the compression side. This is represented in Figure 1 by the angles alpha and beta. The angle alpha must be smaller than the angle beta. Alpha is the angle between the dead centre and the front or leading edge of the egress 11a for the compressed air. Beta is the angle determined by the dead centre position and the rear-most edge of the first inlet channel 18a. This

angle beta becomes the greater, the more channels or ports 18a are connected with the conduit 17a. The expanded combustion gases are discharged through the ports 19a, the conduit 21a and the outlet 22a. The fresh air is charged into the sectors 4a₁—4a₄ by the fan 32a (Figure 2) through the openings 30a, 29a under the pressure of the fan. When the piston 5a₄ is so far moved towards its inner dead centre after the expansion that the ports 28a are set free, air passes from the adjacent sectors into the space between the piston and the inner wall of the casing 2a, blows the combustion gases out of this space and fills it with fresh air. The charge of the fuel and so the output of the machine can be regulated for instance by the valve 38. The gas must be so far compressed in the aggregate C that the fuel is forced into the chamber 12 against action of the pressure in this chamber.

Referring to the aggregate C it has been assumed that the fuel enters in a gaseous form in the direction of the straight arrow. This aggregate C may be driven by any source of power, such as an electric motor, belt drive or gear coupling with a motor or the like and rotates in the direction of the curved arrow. As soon as the casing has closed the space above the piston 5c₁ at the point 39 and the piston moves towards the inner wall of the casing, compression takes place, so that compressed gas gets into the discharge pipe 40 of the aggregate C. During their further movement, the single pistons suck in further gas in moving inwardly and then compress it in the manner described. In case of liquid fuels a simple liquid pump may be used instead of the aggregate C.

It will be noted that only a part of the power produced in the aggregate A is required for driving this aggregate. According to the invention the excess of power is charged to an engine outside the aggregate A. As shown in Figure 1, the excess of the driving medium produced in the chamber 12 is fed, through the conduit 33, into the chamber 34 of the rotary slide 35. Since the upper ports 36 have been set free, the driving medium is introduced into the spaces above the pistons in such a manner that the engine rotates in the direction of the curved arrow. The produced power or output may then be derived or received from the journal 8b in a manner not shown in the drawings. In Figure 2, a worm gear 41 is shown on the left hand side of the motor aggregate B, which renders it possible to turn the shaft 6b by 180°. If this is done after the ports 36 have first been closed perfectly by the rotary slide 35 and if the rotary slide is then set to its opposite position, so that the lower ports 36 are connected with the pipe 33, the aggregate will rotate in a direction opposite to that indicated by the curved arrow. The output of the motor aggregate B can be determined by the number of ports 36 which are opened. The exhaust gases are discharged in the direction of the arrow from the chamber 37. In addition, a pipe 42, that can be closed by a valve, is shown in Figure 1. This pipe 42 serves for branching off a portion of the air which is compressed in the machine, if desired, for any purposes where compressed air is desired.

The twin or tandem piston 16a is so arranged that all ports 19a are open when one of the ports 18a is open, that is to say only a small share of the combustion gases is used in the aggregate A and the expansion is terminated very soon.

When the twin piston 16a is displaced, a greater quantity of combustion gas is used for producing power in the aggregate A and the time of expansion is extended accordingly. It will be understood that no controlled parts, such as valves, are required, which are moved when the engine rotates, but the engine operates without such controlled parts.

The torque of aggregate B can be controlled by adjusting the charges by means of the rotary piston 35 closing more or less ports 36, while the same amount of driving medium is admitted and the speed is changed. Therefore, this aggregate is particularly suitable for devices liable to great changes of the rotary moment, such as automobiles, motor lorries and the like.

In the embodiment shown in Figures 3 and 4, a rotor 50 is provided, in which pistons 51 in the form of slides are provided. These slides are moved outwardly by rotation of the member 50 due to their centrifugal force.

The reference numerals in Figures 3 and 4 provided with the letter d correspond to the respective parts in Figures 1 and 2 designated by the same numeral. In this case, the fuel enters the chamber 12d or the pipe 14d through a pipe 13d. Compressed air is admitted through the port 11d to the combustion place at the end of pipe 13d. It has been assumed in this case that a solid fuel in the form of dust or a liquid fuel mixed with coal dust is used. In order to remove the solid residues of the combustion occurring in this case, a cyclone separator 52 has been provided. The conduit 12d enters this cylindrical chamber 52 tangentially, so that a whirling movement occurs in this chamber 52 and the solid particles are separated by centrifugal effect and fall down while the purified combustion gases enter the machine through pipe 53.

After expansion of the gases, the air delivered from the air chamber 31d (Figure 4) enters the spaces between the pistons 51, through a port 58 (Figures 3 and 4). The combustion gases are discharged through the opening 19d in the wall 2d and the conduit 59 (Fig. 4), so that the spaces between the pistons are filled with fresh air when the compression begins.

The rotary slide 35d in the aggregate B₁ is so set that the excessive combustion gases from the aggregate A₁ are delivered through the lower ports 36d behind the pistons 51a and thereby rotate the carrier member 50a in the direction of the curved arrow. The gases are then discharged through ports 54 by so adjusting piston 55 that a port or all of the ports 54 are open. The piston 56 in this case is so set that all ports 57 are closed.

If the aggregate B₁ is intended to rotate in an opposite direction, the rotary slide 35d is so adjusted that it sets free all the upper ports 36d, while the piston 56 is so adjusted that it sets free the ports 57 and the piston 55 is so adjusted that it closes the ports 54. The torque of the aggregate B₁ can be controlled by controlling the number of inlet ports 36d, which are set free by the slide 35d.

In Fig. 5 an alternative construction similar to the mechanism shown in the upper part of Fig. 3 is applied to the Fig. 1 mechanism. The parts corresponding to similar parts in Fig. 3 bear reference numerals similar thereto, and the parts corresponding to similar parts in Fig. 1 are similarly numbered.

I claim:

1. In a rotary piston engine, a housing with

a partly cylindrical inner surface, a drum with an outer diameter corresponding to the inner diameter of the cylindrical portion of said surface and rotatable in said housing, at least one recess in said drum, an elongated piston extending parallel with the axis of the drum and movable radially in said recess, means for moving the piston radially in said recess whereby the piston together with said recess and said cylindrical inner surface forms a working chamber, one side of said engine constituting a compression part in which said piston moves generally radially outward, another side of said engine constituting an expansion part in which said piston moves generally radially inward, an air inlet in connection with one end of said compression part, means forming a chamber having an opening adjacent another end of the compression part through which air compressed in said compression part can pass into said last-mentioned chamber, a continuously operating burner in said last-mentioned chamber, said engine having a second opening in one end of said expansion part communicating with said last-mentioned chamber providing a passage for the combustion gases into the working chamber, and exhaust opening means in the other end of said expansion part.

2. In a rotary piston engine, a housing with a partly cylindrical inner surface, a drum with an outer diameter corresponding to the inner diameter of the cylindrical portion of said housing and rotatable in said housing, at least two recesses in said drum angularly spaced from one another and dividing said drum into sectors,

a crank fixed in said housing, at least two pistons rotatably connected with said crank and radially movable in said recesses, respectively, whereby the pistons together with the recesses and said partly cylindrical inner surface form working chambers, one side of said engine constituting a compression part in which said pistons move generally radially outward to decrease the size of one working chamber, and an expansion part angularly spaced from said compression part constituted by another side of said engine and in which said pistons move generally radially inward to increase the other working chamber upon rotation of said drum and pistons, an air inlet in connection with one end of the compression part of the housing, means forming a chamber having an opening adjacent the other end of the compression part of said engine through which air compressed in said compression part can pass into the last-mentioned chamber, a continuously operating burner in said last-mentioned chamber, said engine having a second opening in the one end of said expansion part communicating with said last-mentioned chamber providing a passage for the combustion gases into the working chamber when said openings are unmasked by the sectors of said drum, the angular distance of at least one sector between said pistons, with respect to the angular distance between said openings being such that said openings, during part of the rotation of said drum, simultaneously providing communication between said last-mentioned chamber and both of said working chambers.

REINHOLD MIKSITS.