

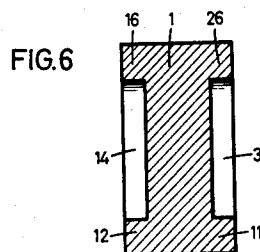
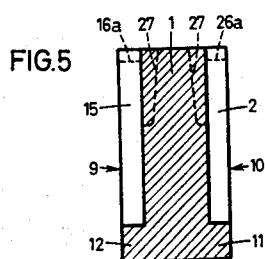
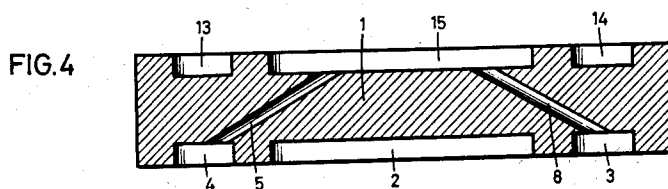
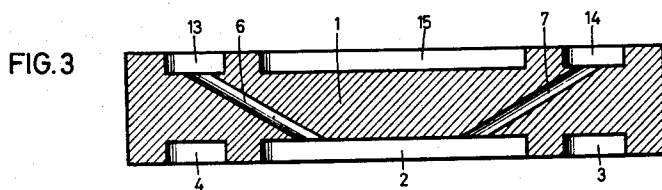
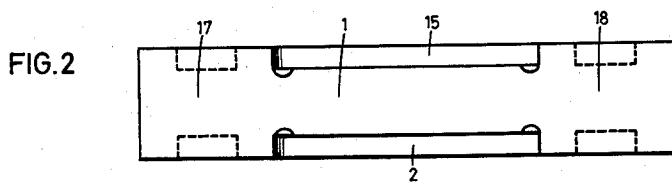
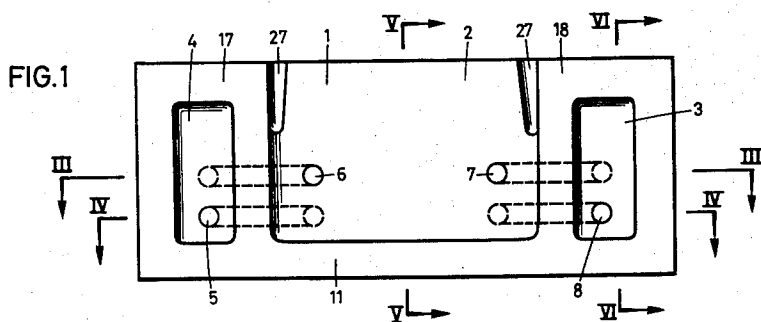
June 1, 1965

K. EICKMANN
ROTARY VANE MACHINE

3,186,347

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7 Sheets-Sheet 1



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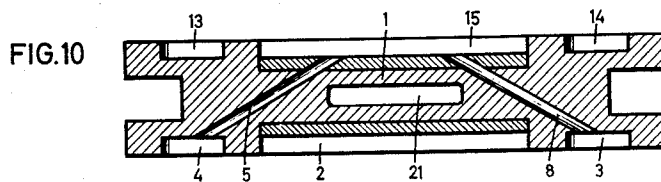
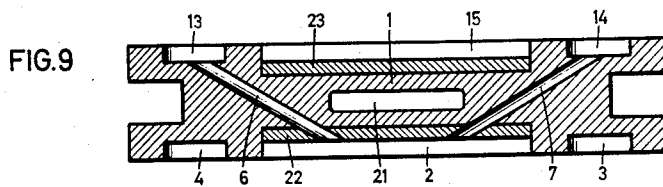
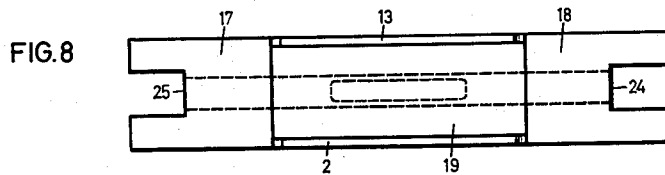
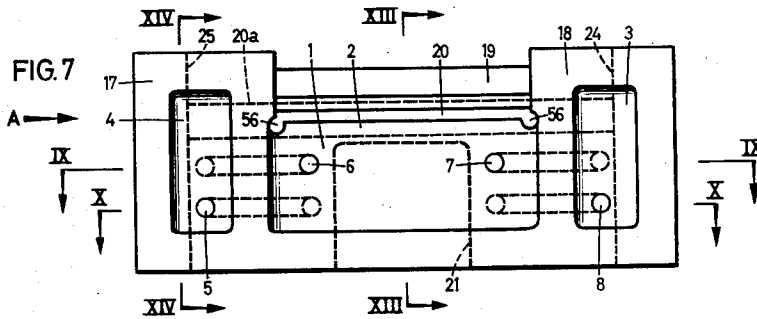
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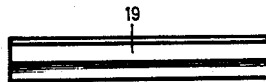
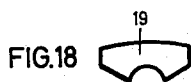
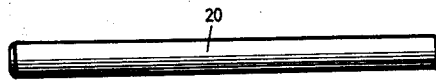
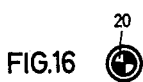
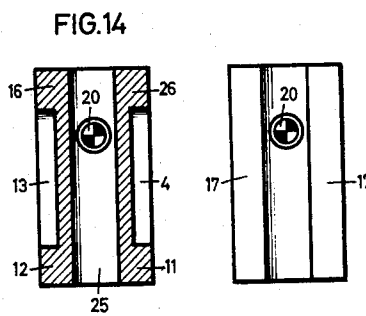
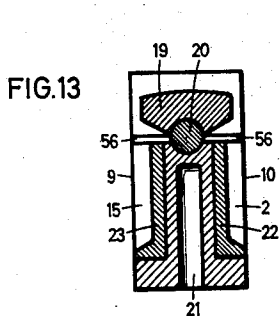
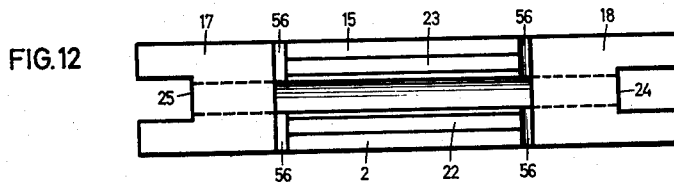
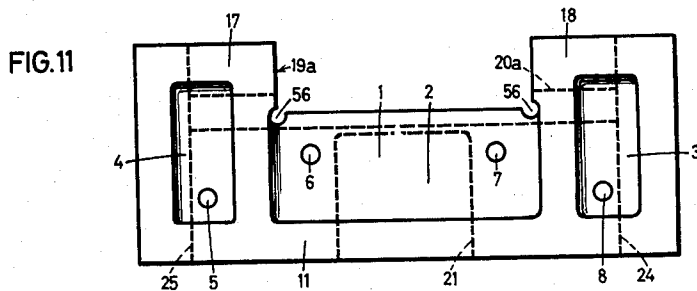
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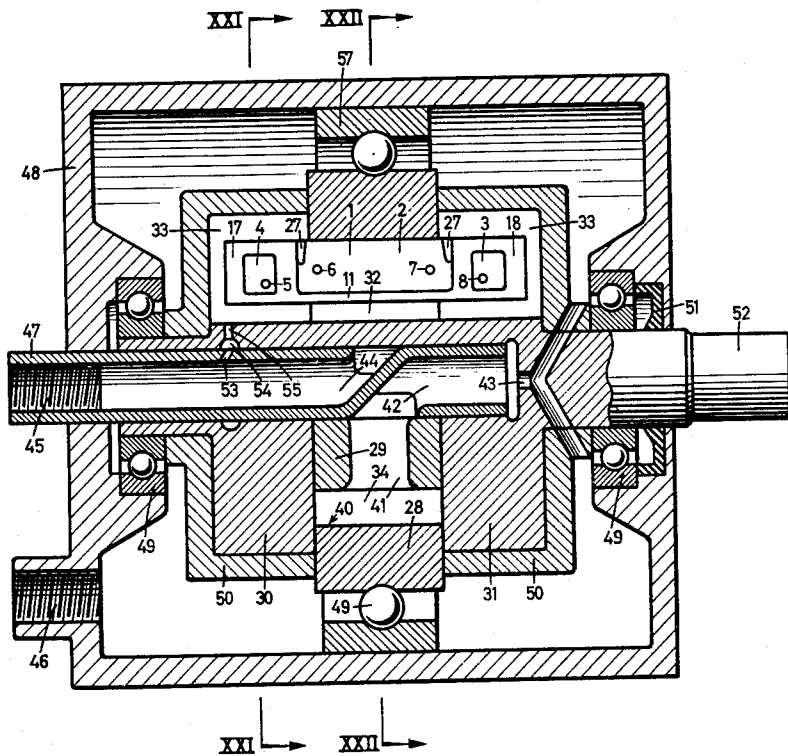
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ROTARY VANE MACHINE

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FIG. 20



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FIG. 21

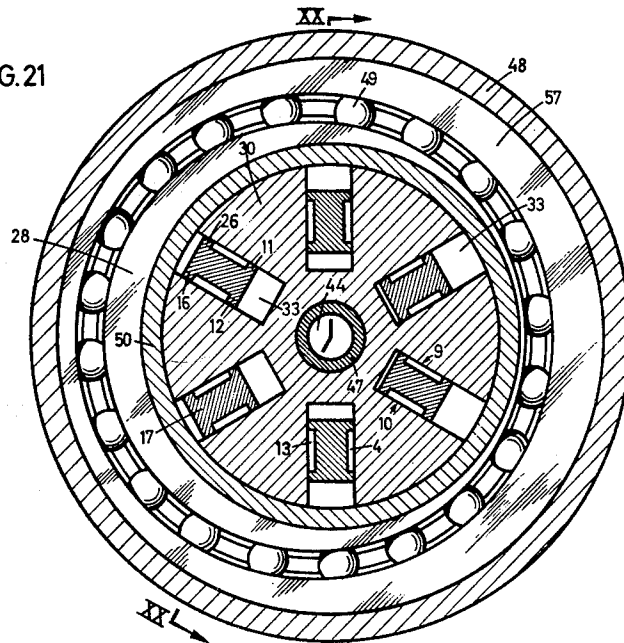
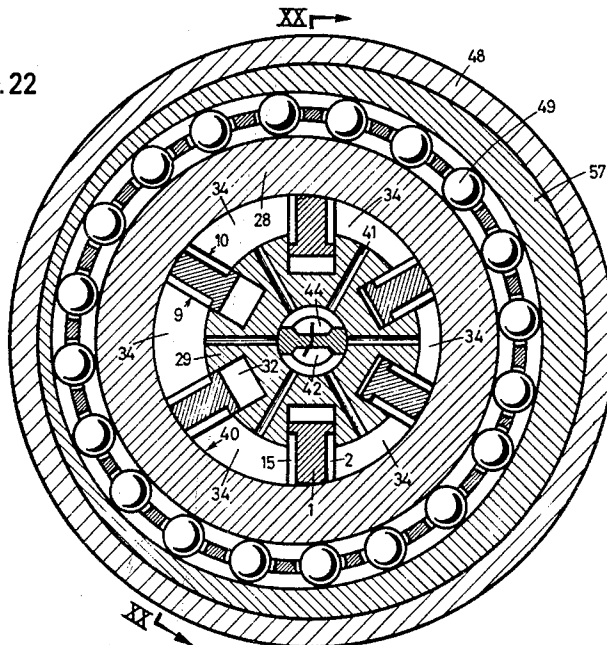


FIG. 22



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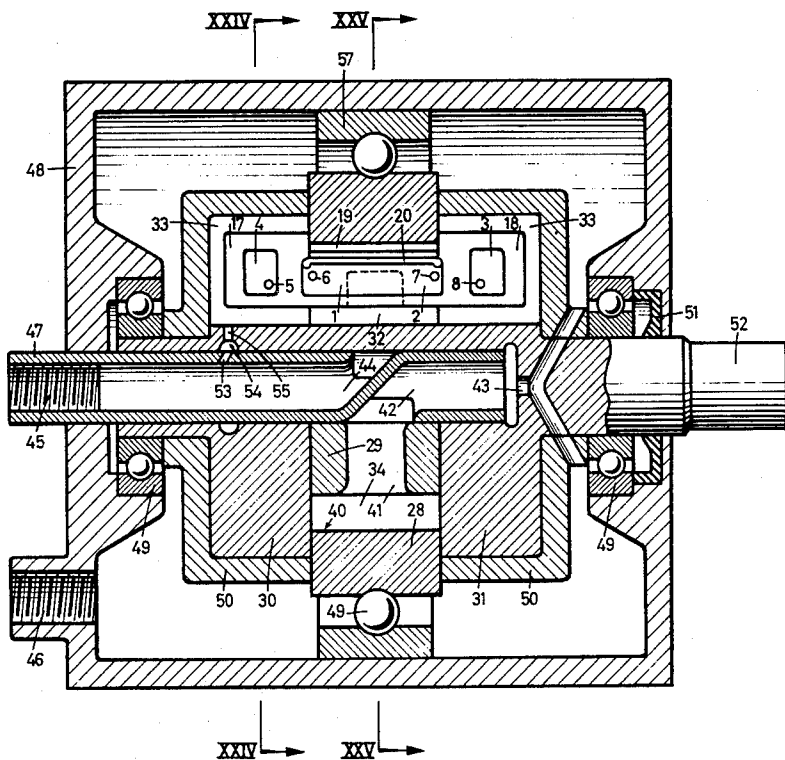
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FIG. 23



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ROTARY VANE MACHINE

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FIG. 24

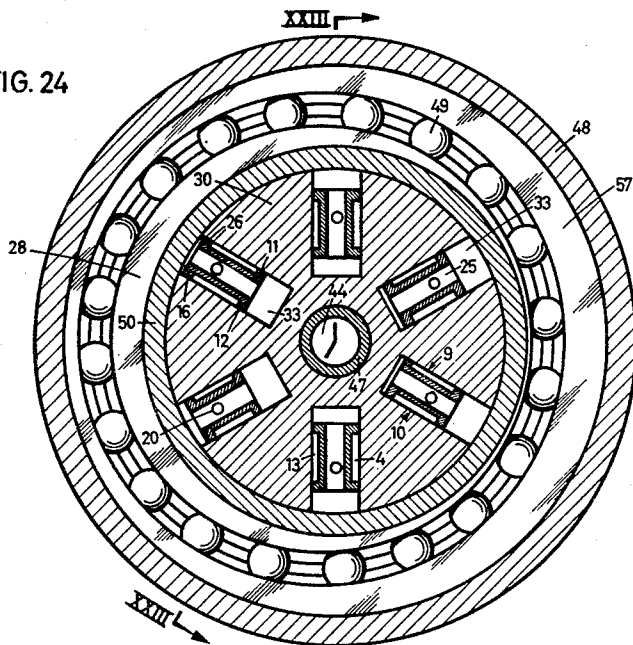
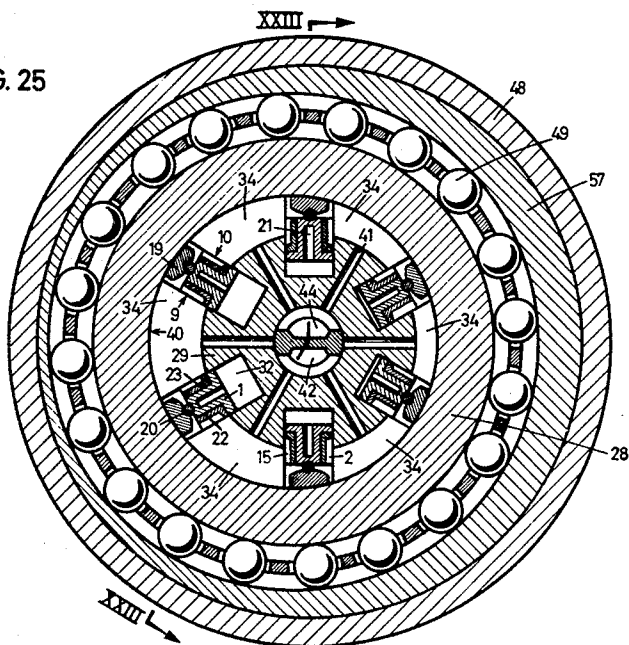


FIG. 25



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3,186,347

ROTARY VANE MACHINE

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Filed Oct. 10, 1962, Ser. No. 229,566

Claims priority, application Germany, Oct. 17, 1961,
E 21,815

20 Claims. (Cl. 103—121)

The present invention relates to rotary vane machines which may be operated either by liquids or gases, such as fluid pumps, hydraulic motors, hydraulic gears, compressors, air motors, gas engines, steam engines, rotary combustion engines, and the like, and especially it relates to rotary vane machines of the type in which the vanes separating the work chambers from each other are slidably mounted in a radial or nearly radial direction in slots in the rotor or also by means of their axial ends or extensions in slots in rotor side walls which are revolving with the rotor, and in which the axial extensions of the vanes in the slots of the rotor side walls are provided with balancing areas for balancing the forces of pressure media, particularly of liquids or gases.

Such machines, as described, for example, in the U.S. Patent No. 2,975,716, have been very successfully employed as gas compressors, pumps, compressors or expanders (also called "releasers") of internal combustion engines, or as liquid pumps or engines. They excel by their low friction, long period of service, high efficiency, effective sealing of the individual work chambers or cells even at very high pressures, and therefore also by their high attainable output.

More particularly, the invention relates to machines of the above-mentioned kind in which the axial extensions of the vanes are provided with recesses forming balancing areas which are acted upon by the pressure medium contained in the work chambers.

It is a primary object of the present invention to improve the balance of pressure on the vanes by very simple means and to attain at a cost of construction much lower than previously a more effective total balance of the gas or liquid forces acting upon the vanes in a tangential direction, that is, a total balance which results in a reduction of leakage and is therefore suitable for higher pressures and whereby the vanes float in the slots in the rotor and rotor side walls.

Further objects, features, and advantages of the present invention will become more clearly apparent from the following detailed description thereof which is to be read with reference to the accompanying drawings, in which all those details which are not essential for understanding the invention but might render the showing unclear are omitted, and in which all parts which perform equal functions are indicated by the same reference numerals.

In the drawings,

FIGURE 1 shows a vane according to the invention for the use in a rotary vane machine;

FIGURE 2 shows a plan view of the vane according to FIGURE 1;

FIGURES 3, 4, 5, and 6 show cross sections taken in FIGURE 1 along the lines III—III, IV—IV, V—V, and VI—VI, respectively;

FIGURE 7 shows a modification of the vane according to the invention for the use in a rotary vane machine and provided with a pivot pin and a vane skid;

FIGURE 8 shows a plan view of the vane according to FIGURE 7;

FIGURES 9, 10, 13, and 14 show cross sections taken in FIGURE 7 along the lines IX—IX, X—X, XIII—XIII, and XIV—XIV, respectively;

FIGURE 11 shows the vane according to FIGURE 7 from which the pivot pin and the vane skid are removed;

FIGURE 12 shows a plan view of FIGURE 11;

FIGURE 15 shows an end view of the vane according to FIGURE 7 as seen in the direction of the arrow A;

FIGURE 16 shows an end view of the pivot pin according to FIGURE 7;

FIGURE 17 shows a longitudinal view of the pivot pin according to FIGURE 7;

FIGURE 18 shows an end view of the vane skid according to FIGURE 7;

FIGURE 19 shows a longitudinal view of the vane skid according to FIGURE 7;

FIGURE 20 shows a longitudinal section of a rotary vane machine which may be operated by liquids or gases and which is equipped with vanes according to FIGURES 1 to 6;

FIGURES 21 and 22 show cross sections taken in FIGURE 20 along the lines XXI—XXI and XXII—XXII, respectively;

FIGURE 23 shows a longitudinal section of a rotary vane machine which is preferably gas-driven, for example, for use as an expander or "releaser" on internal combustion engine, or may also be driven by a liquid, and which is equipped with vanes with pivot pins and vane skids according to FIGURES 7 to 19; while

FIGURES 24 and 25 show cross sections taken in FIGURE 23 along the lines XXIV—XXIV and XXV—XXV, respectively.

In the drawings, FIGURES 1 to 6 and 7 to 19, respectively, illustrate different embodiments of the rotary vanes according to the invention, while FIGURES 20 to 25 merely show examples of rotary vane machines which are equipped with vanes according to FIGURES 1 to 19. These vanes may, however, also be installed in vane machines of any other type of construction, if the respective machine is provided with side walls which are rotatable with the rotor or the central part thereof and if these side walls are provided with radial or nearly radial slots in which the axial extensions of the vanes are mounted so as to be slidable in a radial or nearly radial direction when the work chambers increase or decrease in size. The vanes according to the invention may further be installed in rotary vane machines in which the rotor is disposed at the center of the machine and the work chambers are located radially around the rotor and are closed radially toward the outside by rings or housing parts and in which, when the work chambers increase in size, the vanes slide substantially radially out of the rotor in the outward direction. The vanes according to the invention may, however, also be installed in rotary vane machines which are provided with an outer revolving rotor and side walls thereon and in which the work chambers are formed radially within the rotor and are closed by rings or housing elements which are disposed radially within the work chambers and in which, when the size of the work chambers increases, the vanes slide substantially radially toward the inside. All of these known kinds of rotary vane machines may be equipped with the vanes according to the invention without material alterations of the rotor parts. If only one of the longitudinal surfaces of the vanes according to the invention is provided with balancing areas, these vanes may also be installed in machines of the type as disclosed, for example, in the U.S. Patents Nos. 2,680,384 and 2,975,716, FIGURE 7, in which the vanes are mounted with considerable play in the slots in the rotor and side walls and in which each vane therefore always engages with only one slot wall.

Vaness 1, as are illustrated in detail in FIGURES 1 to 6, separate and seal the work chambers 34 (FIGURES 20 to 22) relatively to each other which are formed in the conventional manner between the casing ring or housing

28, the central rotor part 29 (hereafter simply referred to as the "rotor"), the rotor side walls 30 and 31, and the vanes 1. These vanes which are disposed within the slots 32 of the rotor and the outer edges of which are movable along and guided by the inner surface 40 of the casing ring or housing 28 are provided in the conventional manner with axial extensions 17 and 18 by means of which vanes 1 are mounted axially at both sides of the central rotor 29 in radial or substantially radial slots 33 which are at least partly in alignment with the slots 32 and provided in the rotor side walls 20 and 31 which are rotatable with the rotor so that, when the machine is in operation and the work chambers increase or decrease in size, the vane extensions 17 and 18 will slide in these slots 33 in the radial direction toward the inner or outer ends thereof. The parts of the vane extensions 17 and 18 which are disposed within the slots 33 in the rotor side walls are also provided in the usual manner with balancing areas 3, 4, 13, and 14 into which a pressure medium is conducted from the work chambers 34 through channels 5, 6, 7, and 8. Vanes 1 are further provided in the known manner with plane bearing surfaces 9 and 10 which are slidable on the plane surfaces of the walls of the rotor slots 32 and the side walls slots 33.

The balancing areas 3, 4, 13, and 14 may be provided in only one of the bearing surfaces 9 or 10 or in both surfaces.

An important feature of the present invention consists in providing the central part of each vane at the point where the vane is to be mounted in the central rotor part of the machine, that is, in the longitudinal direction of the work chambers, with at least one recessed area 2 or 15 for the action of a pressure medium. This central pressure area is associated with at least two balancing areas one of which is provided in each vane extension 17 and 18 in the opposite surface of the vane. According to the invention, this central pressure area is extended so far in the radial direction within the vane that at any position of the latter, this area will communicate with a work chamber, for example, by extending in a radial direction up to the edge of the vane, as shown in FIGURE 5, whereas it is closed in the other radial direction. The invention further provides the channels 5, 6, 7, and 8 to be arranged so as not to terminate into the bearing surfaces 9 or 10 of vane 1, as they were designed in the past, but into the central pressure area 2 or 15 so as to form a connection between each balancing area with one central pressure area. Thus, for example, channel 5 connects the balancing area 4 with the pressure area 15, channel 8 connects the pressure area 15 with the balancing area 3, channel 6 connects the pressure area 15 with the balancing area 13, and channel 7 connects the pressure area 2 with the balancing area 14.

Since each central pressure area 2 and 15 in the vane always communicates with a work chamber 34, the pressure area adjacent to any work chamber will always contain the same or nearly the same liquid or gas pressure as the work chamber. In the other radial direction, each central pressure area 2 or 15 is closed by the web 11 or 12, respectively. The size of the surface of the central pressure area therefore remains constant regardless of the extent of the movement of the vane into or out of its associated rotor slot 32. Since the pressure of liquids or gases extends uniformly over the entire area in which they are active, the pressure of the medium acting from the central pressure area 2, 15 tangentially upon the vane will also be constant if the pressure in the work chamber is constant, or it will be proportional to the pressure in the adjacent work chamber when the pressure of the pressure medium varies. This applies regardless of the distance between the vane and the center of the rotor, that is, regardless of the extent of the movement of the vane radially into or out of the slot 32, 33.

Due to this proportionality to the pressure of the medium independently of the position of the vanes within

the slots, the balancing areas 3, 4, 13, and 14 may also be made of a constant size and, because of the connection through the channels 5, 6, 7, and 8, the pressure which is active in the work chamber 34 opposite to the longitudinal side of the vane will act in the respective balancing areas in the opposite direction to the associated pressure area upon the vane 1 so that, if the balancing areas are made of ideal dimensions, the positive and negative forces of the pressure medium which are active in a tangential direction will balance each other.

The balancing areas may, however, also be made of such dimensions that the tangential forces will only partly balance each other.

The balancing area 3, 4, 13, and 14 are limited in the radial direction by the walls 11, 12, 16, and 26, respectively. In determining the proper size of the balancing areas 3, 4, 13, and 14 and the walls 11, 12, 16, and 26, it is necessary to keep in mind that between the bearing surfaces 9, 10 and the walls of slots 32, 33, a thin layer of liquid or gas will form in which a pressure gradient prevails between zones of a higher and lower pressure. This liquid or gas layer will also exert a pressure in a tangential direction upon vanes 1. In actual practice it is therefore usually necessary to make the total of the surface size of the balancing areas slightly smaller than the surface size of the associated central pressure area which is communicating therewith.

In order to attain a radial equilibrium of forces, the central pressure areas 2 and 15 may also be provided in the radial direction opposite to the webs 11 and 12 with narrow webs 16a and 26a. If the axially outer ends of the pressure areas 2 and 15 are also undercut, as shown at 27, the radial edges of vane 1 facing the casing ring or housing 28 and sliding peripherally along the latter may be very easily ground to accurate dimensions. The vanes according to the invention which are made of such a simplified construction may be mass-produced, for example, on presses, and since the balancing and pressure areas may be impressed therein, it is possible to produce these vanes very inexpensively. The surfaces, and especially the bearing surfaces of each vane, may be face-ground which reduces the cost of production considerably. Furthermore there will be absolutely no leakage which in prior constructions could not even be avoided by the installation of sealing slide bars into the balancing areas.

Vane 1 as illustrated in FIGURES 7 to 19 is provided in the radial direction with a bore 20a which extends through the entire length of the vane, and at the center of the vane with a milled-out recess 19a of a width equal to that of the rotor. Vanes of such a design are already known and it is also known to install a pivot pin 20 in the bore 20a for mounting a vane skid 19 tightly between the axial extensions 17 and 18 of the vane so as to be pivotable about the axis of pivot pin 20. FIGURES 11, 12 and 16 to 19 illustrate the individual parts of such a vane unit, FIGURE 7 shows the entire unit after being assembled, while FIGURES 13 and 14 show cross sections which are taken at different points of the assembled unit.

FIGURES 7 to 10, 13, and 14 illustrate the manner in which the central pressure areas 2 and 15, the balancing areas 3, 4, 13, and 14 and the channels 5, 6, 7, and 8 may be provided in this particular embodiment of the vane according to the invention. They carry out the same functions as the corresponding areas and channels in the embodiment of the vane according to FIGURES 1 to 6.

A particular feature of this vane consists in the provision of radial slots 24 and 25 in the axial vane extensions 17 and 19 so as to permit the areas radially inside and radially outside of the vanes to communicate with each other. These radial slots 24 and 25 have the further advantage that the longitudinal bore in the vane for receiving the pivot pin 20 will then be shorter than the vane itself and may therefore be more easily and inexpensively produced.

A further important advantage of the present invention, which is especially effective in machines operating with hot gases in the work chambers 34, that is, for example, in steam engines, hot-air engines, gas engines, or internal combustion engines, may be attained by extending the central pressure area or areas 2, 13 over the entire width of the rotor (i.e. the central part of the rotor) or even so far that the pressure area or areas 2, 15 extend slightly into the rotor side walls 30, 31. In machines of this type in which the work chambers contain hot gases, the rotor side walls are usually cooled. The actual effective sealing parts of the bearing surfaces 9 and 10 of the vanes are then located completely within the rotor slot or in the rotor side walls and are therefore closely adjacent to the cooling slot walls. The hottest parts, however, are the rotor slot walls and vane walls in the vicinity of the work chamber containing the hot gases. The slot walls in the central rotor, especially in the vicinity of the work chamber, are therefore subjected to heat deformation when the particular work chamber contains hot gases. Similar heat deformations occur in such cases on the walls of vane 1 in the vicinity of the work chamber which is filled with hot gases. Because of this heat deformation and the close fit between the relatively movable parts, vanes of the type as were previously employed would then have the tendency to clamp within the rotor slot. However, since the central pressure area or areas 2 and 15 are worked into each vane 1 according to the invention, the hot zones of the vanes are thinner than the slots 32 in the central rotor and there is a sufficient space between vane 1 and slots 32 which is larger than that which is taken up by the heat deformation.

The central pressure areas 2 and 15 may in addition be coated with heat-insulating layers, for example, of a ceramic material, in order to reduce the heat transmission to the vane. Such layers would be unsuitable for vanes with a close fit in the rotor slot. The recesses in the vanes formed by the central pressure areas permit, however, the application of relatively brittle but efficient heat insulating layers, for example, of earthen-ware, ceramics, or the like, as indicated at 22 and 23. It is also possible to provide the vane in a known manner with cooling slots or cavities 21 in which a coolant coming from the rotor slots may cool the vane from the inside. By the provision of such cooling areas, especially when combined with the insulating layers 22 and 23 in the pressure areas as mentioned above, it is possible to attain that the vane 1 will be exposed to much lower temperatures in the vicinity of the webs 11, 12, 16, and 26 of the bearing surfaces 9 and 10 than in the vicinity of the work chambers 34. This vane design is therefore also very suitable for very high temperatures as occur, for example, in expanders or "releasers" of internal combustion engines.

FIGURES 7 and 11 further show recesses 56 which may be produced by relief milling, drilling, filling, or the like. They may extend axially or radially into the vane or into the axial extensions thereof and they permit the respective tool, for example, a grinding disk, to run out freely, whereby especially the inner sealing surfaces of the axial vane extensions may be finished very accurately at the radial extensions of these vane extensions, for example, by grinding, so that the vane skid 19 may be fitted precisely between these inner sealing surfaces.

The rotor 29, as illustrated in FIGURES 20 to 22, is either flanged together or made integral with the rotor side walls 30 and 31 so that the latter are rotatable together with rotor 29.

The central pressure areas 2 and 15 which during each revolution of the rotor project for continuously varying distances into the associated work chambers 34 may extend merely over the axial length of rotor 29, 32 but, if desired, they may also extend slightly into the slots 35 in the rotor side walls. The working gas or working

liquid is supplied through one and discharged through the other of the two control shaft channels 44 and 42.

The rotary vane machine may operate as an engine if it is supplied with a medium under pressure or it may operate as a pump or compressor if it produces a pressure medium.

The rotor channels 41 connect either the channel 42 or the channel 44 with the work chambers 34, depending upon the particular position of the rotor during its rotation. A system of connecting channels 43 may also connect one of the two control shaft channels, preferably the channel containing a low pressure, with the inside of the machine housing 43. The connections for the pressure media or for a suction line or discharge line are indicated at 45 and 46. Channels 44 and 42 are provided at the inside of a normally stationary control shaft 47, while the revolving rotor shaft 52 together with the rotor 29 and the parts revolving with the rotor are mounted in bearing 49 in the machine housing 48. A gasket ring 51 seals the inside of the machine housing around the rotor shaft toward the outside.

Slots 33 in the rotor side walls 30 and 31 are closed in the axial and radial directions toward the outside by lateral rotor caps 50. The rotor slots 32 and side wall slots 33 are connected with channel 44 in the control shaft 47 by connecting channels 53, 54, and 55 through which the pressure of the medium flowing through channel 44 is transmitted to the inside of the slots. A control ring 57 which may be adjustable or nonadjustable determines the distance of the central axes of the rotor and casing ring from each other.

In all other respects, the machine operates in the conventional manner and the functions which are then carried out by the parts 49 to 55 are also known as such in machines of this type.

In FIGURES 23 to 25, all parts corresponding to those shown in FIGURES 20 to 22 are also indicated by the same reference numerals. The vanes employed in this embodiment are of the same kind as previously described with reference to FIGURES 7 to 19.

Contrary to the embodiment according to FIGURES 20 to 22, vanes 1 according to FIGURES 23 to 25 do not slide directly along the inner surface 40 of the casing ring 28 but by means of vane skids 19 (FIGURE 25) which are mounted on pivot pins 20 between the axial vane extensions 17 and 18 and therefore effect a good sealing action between the individual work chambers 34. Each vane 1 is shielded from the heat in the work chamber by insulating layers 22 and 23. Although the gases or liquids enter each pressure-medium area 2 or 15 from the adjacent work chamber 34 and there is almost no limitation on the action of the pressure of these gases or liquids within the pressure-medium area 2 or 15, the heat from the respective work chamber can be transmitted to the vanes only through the relatively narrow surface which corresponds to the cross-sectional size of the end walls of the recess forming the particular central pressure area. On the other hand, this heat will be dissipated by the relatively large surfaces of the rotor slot walls. Therefore, a temperature gradient which decreases with the distance from the work chamber is built up in the central pressure area 2 or 15 so that the sealing webs 11, 12, 16, and 26 lie in zones of a lower temperature, as compared with the maximum temperature in the work chambers, and are therefore subjected to less heat deformation. This, in turn, improves the reliability of operation of the machine and the sealing effect between vanes 1 and the walls of the rotor slots 32 and slide wall slots 33.

Although my invention has been illustrated and described with reference to the preferred embodiment thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. A rotary, vane machine comprising a rotor having a central part, a plurality of substantially radial slots in said central part, vanes mounted in said slots, guide means for guiding said vanes in said slots so that during the rotation of said rotor said vanes carry out a substantially radial movement in said slots, rotor side walls rotatable with and disposed axially at both sides of said central rotor part, said central rotor part, said guide means, said vanes, and said rotor side walls together defining work chambers which are separated from each other by said vanes and are limited in the axial direction by said rotor side walls and periodically increase and decrease in size at each revolution of said rotor, substantially radial slots in said rotor side walls at least partly in alignment with said slots in said central rotor part, said vanes having extensions projecting into said radial slots in said rotor side walls and movable therein in a substantially radial direction, each of said vanes further having a central pressure area at one longitudinal side thereof adjacent to said central rotor part and adapted to receive a pressure medium, said vane extensions having balancing areas at the opposite longitudinal side of each vane adjacent to said rotor side walls and adapted to receive a pressure medium, said balancing areas being closed by said vane extensions relative to said slots in said rotor side walls, communicating means for connecting said central pressure area at one longitudinal side with said balancing areas at the opposite side of said vane, said central pressure area having a radial opening toward and communicating with the work chamber limited by and located at the same longitudinal side of said vane, said opening remaining open even during the movement of said vanes in said slots so that the pressure of said pressure medium acting upon said last longitudinal side of said vane in said work chamber and in said central pressure area remains substantially constant regardless of the increase or decrease of the size of said work chamber.

2. A rotary, vane machine as defined in claim 1, in which said central pressure areas and balancing areas of said vanes are formed by recesses in the longitudinal sides of said vanes.

3. A rotary, vane machine as defined in claim 1, having at each of the two longitudinal sides of said vane and opposite to each other one of said central pressure areas adjacent to said central rotor part and one of said balancing areas in each of said two vane extensions, each of said two central pressure areas being connected by said communicating means with each of said two balancing areas at the opposite longitudinal side of said vane.

4. A rotary, vane machine as defined in claim 1, in which said central pressure areas and said balancing areas are made of such dimensions that the force of the pressure medium acting in said work chamber and in the associated central pressure area in one longitudinal side of said vane is substantially equal to the force of the pressure medium acting in said balancing areas in the opposite longitudinal side of said vane.

5. A rotary, vane machine as defined in claim 1, in which said central pressure areas in said vanes are formed by recesses each having a constant axial width along the radial extent thereof.

6. A rotary, vane machine as defined in claim 2, in which said communicating means are formed by bores each extending through said vane from a recess forming one of said central pressure areas in one longitudinal side of said vane to another recess forming one of said balancing areas in the opposite longitudinal side of said vane, said bores extending obliquely to said longitudinal sides.

7. A rotary, vane machine as defined in claim 1, in which at least a substantial part of the surface defining said central pressure area is coated with a layer of a heat insulating material.

8. A vane machine as set forth in claim 1 wherein each

of said vanes includes a main portion consisting of a base material and a layer of a heat insulating material applied on said base material at one longitudinal side of said vane for shielding said base material from a work chamber facing the longitudinal side of said vane.

9. A vane machine as defined in claim 8, in which said longitudinal side of said vane is provided with a recess forming said central pressure area and communicating with said work chamber facing said side, said layer covering the bottom of said recess.

10. A machine as set forth in claim 8 wherein each said vane includes a cavity open at the inner edge of said vane and being located in said main portion of the same and adapted to receive a coolant.

11. A vane for a rotary, vane machine extending longitudinally, vertically, and transversely for separating the work chambers of said machine from each other comprising a central vane part and vane extensions extending axially thereto forming two end parts of said vane, said central vane part having at least one recess in one longitudinal side of said vane adapted to form a central pressure area communicating with a work chamber, said recess extending in the vertical direction of said vane up to a longitudinal edge thereof and substantially constantly in its longitudinal direction so as to terminate in an opening along said longitudinal edge, the longitudinal side of said vane opposite to said first side having at least one recess in each of said end parts adapted to serve as balancing areas when acted upon by a pressure medium, and connecting channels in said vane connecting each of said two recesses in said end parts with said recess in said central vane part.

12. A vane as defined in claim 11, in which the central part of said vane is provided with one of said first recesses in each of said two longitudinal sides thereof and each of said end parts at each of said two longitudinal sides is provided with one of said second recesses, each of said first two recesses in said central part being connected with said second recesses in said end parts of the opposite longitudinal side of said vane.

13. A vane as defined in claim 11, in which said recess in said central vane part is covered with a heat-insulating material.

14. A vane as defined in claim 11, in which the lateral edges of said recess in said central vane part limiting said recess in the axial direction toward said end parts are provided with additional recesses which are relatively small as compared with said first recess.

15. A vane as defined in claim 14, in which said additional recess only extends over a part of the vertical length of said first recess adapted to form said central pressure area and starts at the upper longitudinal edge of said vane.

16. A vane as defined in claim 14, in which said additional recess is provided at each end of said first recess and the longitudinal edge of said vane at the open side of said first recess is ground straight.

17. A vane as defined in claim 11, in which said end parts of said vane extend in the vertical direction of said vane beyond said central vane part, the radial extensions of said vane being thereby limited by edge surfaces extending substantially vertically to the longitudinal edge surface limiting said central vane part, said edge surfaces of said vane extensions and said longitudinal edge surface of said central vane part having undercut recesses in the corners between said edge surfaces.

18. A vane as defined in claim 11 in combination with an aperture in said central vane part provided for cooling said vane.

19. A vane machine comprising a rotor having a central part formed with substantially radial first slots, vanes mounted in said first slots for radial movement, rotor side walls rotatable with and disposed axially at both sides of said central part, said rotor side walls being formed with substantially radial second slots at least partly in alignment with said first slots, said vanes

having extensions projecting into said second slots in said side walls, each of said vanes having a recess at least in one longitudinal side thereof extending into said extensions so that the axial ends of said recess are located in said second slots, each recess being bounded by radially extending surface portions of said vane extensions so that said surface portions are in sliding engagement with surface portions of said second slots so as to guide the respective vane in said second slot for movement in radial direction.

20. A vane machine comprising a rotor having a central part formed with substantially radial first slots, vanes mounted in said first slots for radial movement, rotor side walls rotatable with and disposed axially at both sides of said central part, said rotor side walls being formed with substantially radial second slots at least partly in alignment with said first slots, said vanes having extensions projecting into said second slots in said side walls, each of said vanes having a recess in both longitudinal sides thereof extending into said extensions so that the axial ends of said recesses are located in said second slots, each recess being bounded by radially

extending surface portions of said vane extensions so that said surface portions are in sliding engagement with surface portions of said second slots so as to guide the respective vane in said second slot for movement in radial direction.

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