W. VON PITTLER.

ROTARY COMPRESSOR OR THE LIKE.

APPLICATION FILED JAN. 4, 1910.

974,913.

Patented Nov. 8, 1910.

4 SHEETS—SHEET 1.

Fig. 1.

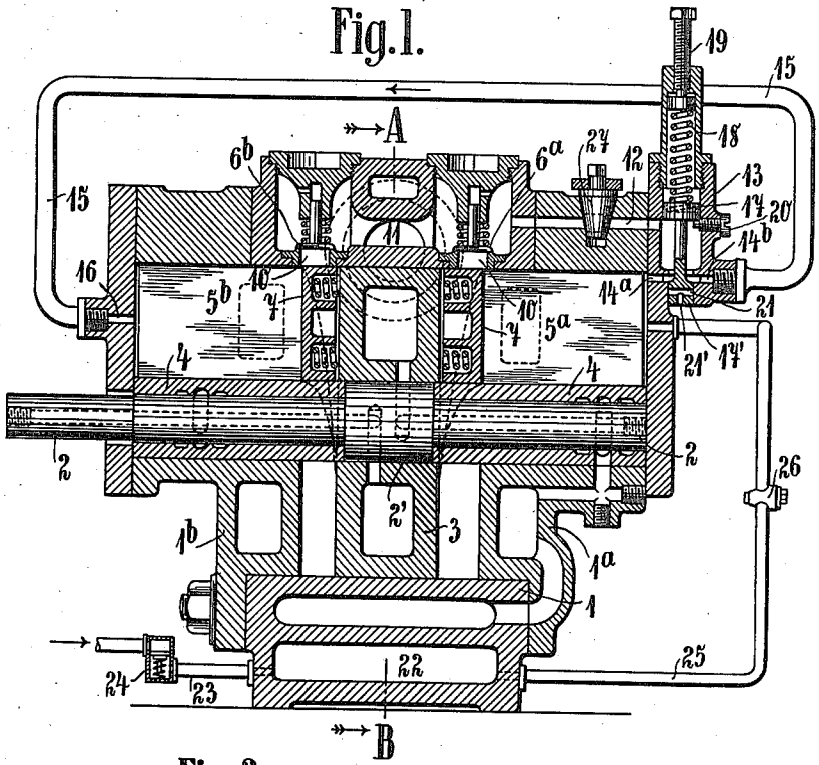
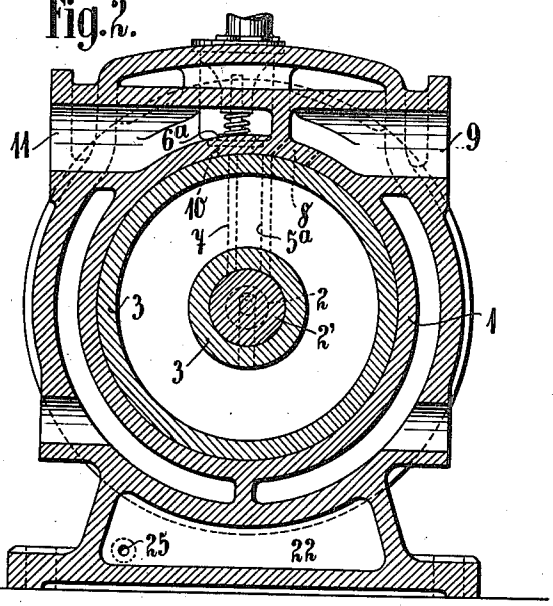


Fig. 2.



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4 SHEETS—SHEET 2.

Fig. 3.

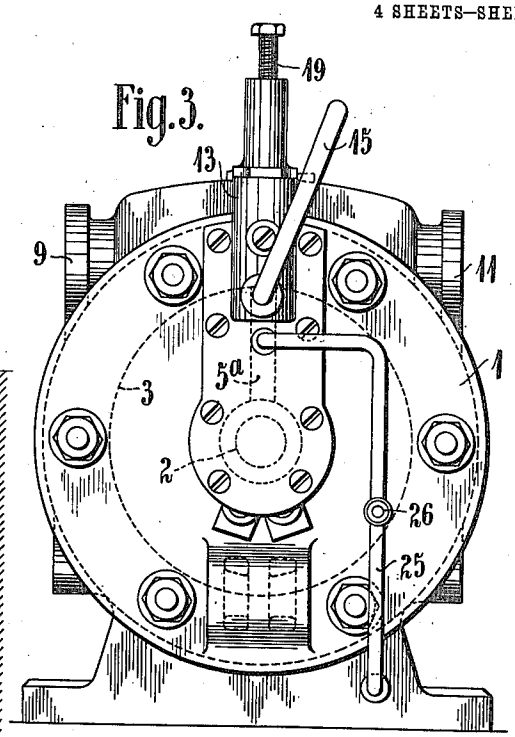


Fig. 4.

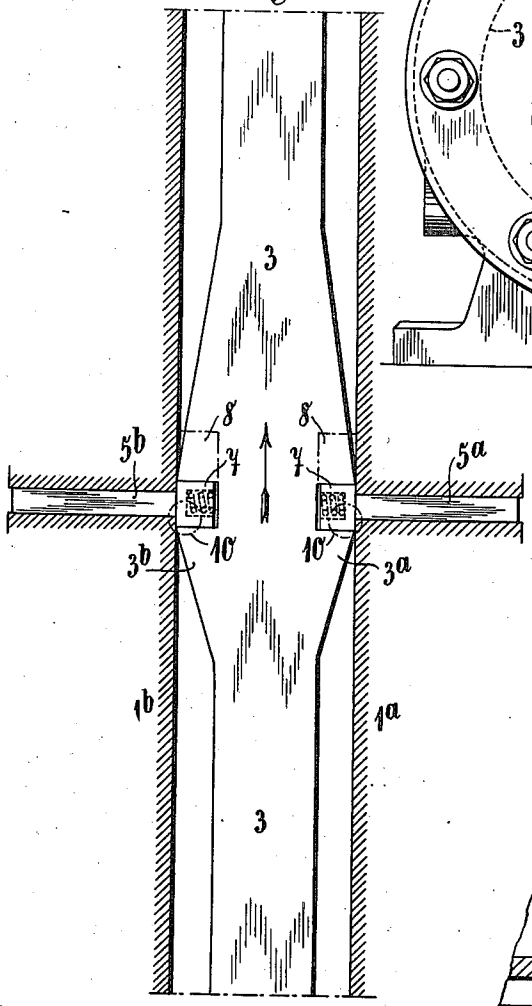
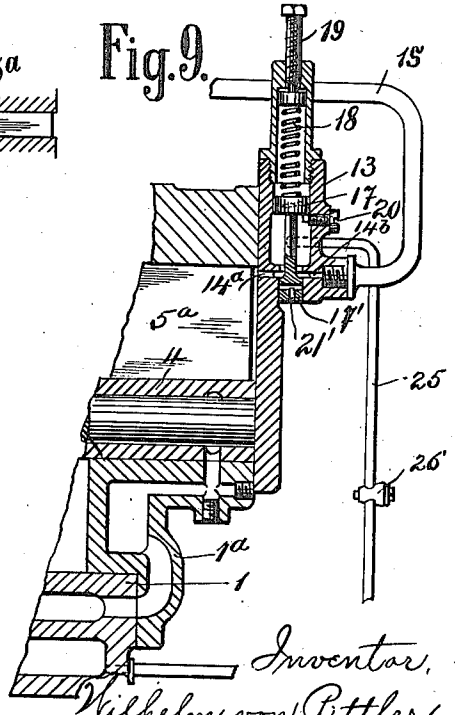


Fig. 9.



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4 SHEETS—SHEET 3.

Fig.5.

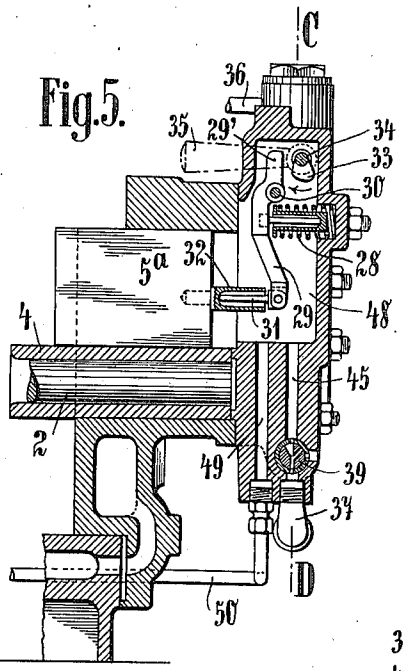


Fig.7.

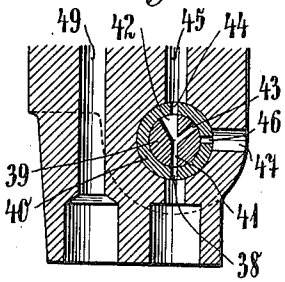


Fig.6.

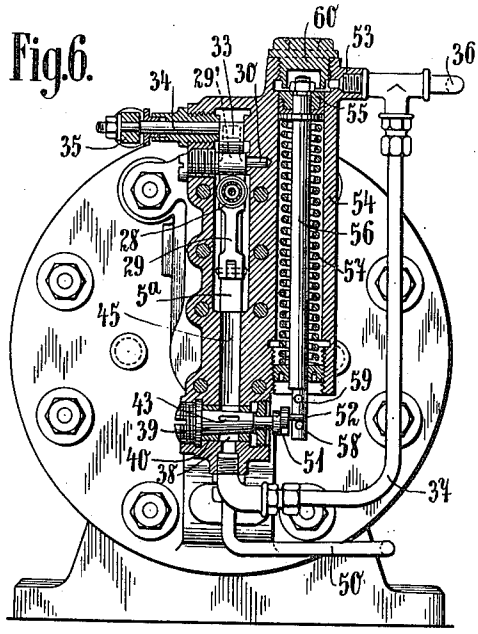
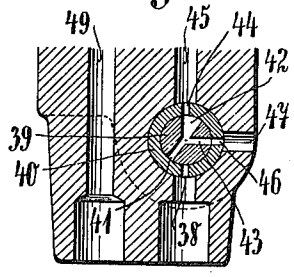


Fig.8.



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4 SHEETS—SHEET 4.

Fig. 10

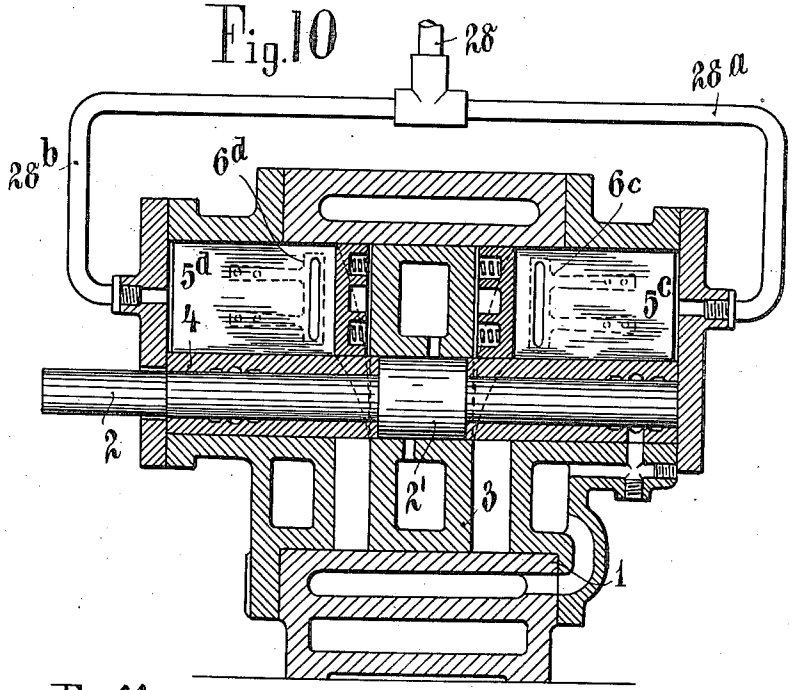


Fig. 11.

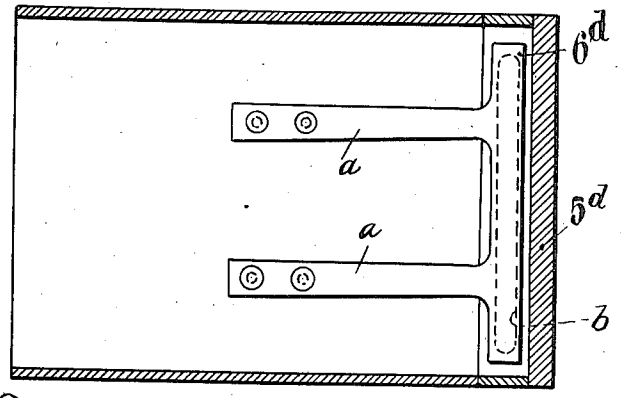
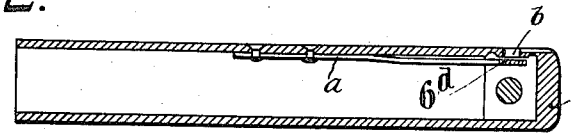


Fig. 12.



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UNITED STATES PATENT OFFICE.

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ROTARY COMPRESSOR OR THE LIKE.

974,913. Specification of Letters Patent. Patented Nov. 8, 1910.

Application filed January 4, 1910. Serial No. 536,393.

To all whom it may concern:

Be it known that I, WILHELM VON PITTLER, a subject of the King of Prussia, residing at Wilmersdorf, near Berlin, Germany, have invented certain new and useful Improvements in Rotary Compressors or the Like, of which the following is a specification.

The present invention relates to a rotary engine, in which the piston or pistons is or are fixed in a disk or drum revolving in a casing, while the abutment or abutments is or are movable, so as to allow the pistons to pass.

According to the present invention the disk has on its side substantially level or plane faces, over which the pistons project with suitable curves of transition, which control the abutment slides movable axially in guides arranged in the casing and kept in contact with the disk by suitable means. The parts are so arranged, that during the revolution of the disk sliding friction in the direction of rotation can occur only at the ends or contact faces of the slides, which touch the sides or faces of the piston disk, while the inner and outer sides are subject only to friction in an axial direction, and consequently there is nowhere frictional motion in two directions at right angles to each other. For this purpose independent abutment slides are provided for each side of the piston disk which are independently movable by suitable means, and said abutment slides slide outside on guiding surfaces of the stationary casing, while on the inside they move along stationary bushes, which surround the axle of the piston disk and extend to the sides of the disk or preferably somewhat into the disk.

An important part of the invention consists further in means for regulating the working pressure of the machine, if used as a compressor or vacuum pump by setting out of action the controlling device for the abutment slides, if the desired pressure or vacuum is exceeded, so that the engine runs without load.

The engine may be used as a compressor, vacuum-pump, compressed air engine, hydraulic pump or motor and generally as a fluid pressure engine.

The drawing shows an example of an engine serving as a compressor.

Figure 1 is a longitudinal section, Fig. 2 a transverse section along line A—B of Fig. 1 looking toward the right, Fig. 3 a right hand end view of Fig. 1 and Fig. 4 shows the circumference of the piston disk and piston extended into a plane, Fig. 5 shows in longitudinal section, corresponding to Fig. 1, the modified right end part of the engine, Fig. 6 is a transverse section along line C—D of Fig. 5, and Figs. 7 and 8 show the cock valve according to Figs. 5 and 6 in different positions. Fig. 9 is a vertical section of a modification showing the pressure reservoir directly connected to valve casing 13. Fig. 10 is a vertical, longitudinal section through a modified form, showing the outlet valves mounted in the abutment slides. Fig. 11 is a vertical section, and Fig. 12 a horizontal section of one of the slides shown in Fig. 10.

In a cylindrical casing 1 is mounted a cylindrical disk-shaped body 3 on a thickened part 2′ of the axle 2, which is mounted in the covers 1^a, 1^b of the casing by means of bushes 4. The length of the thickened part 2′ is slightly less than the thickness of the disk 3, so that the bushes 4, which reach to the boss 2′, extend a short distance into the disk. The disk 3 has on each side a piston provided with transition surfaces or cams in the shape of a flat swelling 3^a or 3^b (Fig. 4). The slides 5^a, 5^b sliding in slots of the covers 1^a, 1^b are guided with their edges facing the axle by the bushes 4 and are held in contact with the disks 3 by suitable means. The pistons 3^a and 3^b are preferably arranged on the disks 3 symmetrically, for insuring a complete balancing of pressures in an axial direction. They, together with their transition surfaces or cams, may be integral with the disk 3, or they may be screwed on, and thereby rendered exchangeable. On the apex of every piston I prefer to mount an elastic packing piece 7, in order to always insure a tight contact with the plane inner faces of the covers 1^a and 1^b. The packing pieces 7 have preferably a level face of greater width than the face of the abutment slides 5^a, 5^b, to insure, that they will never for a moment lose their guidance on the covers of the casing, even in moving past the abutment slides.

The suction ports 8 and delivery ports

10 communicating respectively with the suction pipe 9 and delivery pipe 11 are situated on both sides of the slides 5^a, 5^b in the casing 1 (Figs. 1 and 4). No valves are provided in the suction conduits, but valves 6^a, 6^b are necessary on the pressure side, as otherwise, when the pistons 3^a, 3^b pass in front of the pressure openings 10, pressure air would flow back into the working chambers, which at that moment are still under atmospheric pressure, and when the engine stops, a back pressure would arise.

The disk 3 may have two or more pistons on each side, or several slides may be arranged in combination with one piston. For pressing the abutment slides 5^a, 5^b against the disk 3, the pressure of the compressed air may, for instance, be employed, as assumed in the drawing. From the chamber of the valve 6^a a passage 12 leads to a control valve 13, from which a passage 14^a leads to the back of the slide 5^a, and a passage 15 adjoining a duct 14^b leads through a duct 16 to the back of the slide 5^b. The valve 13 serves to eliminate the effect of the compressor, as soon as the allowable pressure of the same is exceeded, which may occur for instance, if not enough compressed air is abstracted from the pressure reservoir. The valve 13 has a differential piston composed of pistons 17 and 17′; there is an excess of fluid pressure in the upward direction, and as a rule, this is overcome by the action of the spring 18, which keeps the piston in contact with the set screw 20, as shown by the drawing. In this position the ducts 14^a and 14^b are open, so that the slides 5^a and 5^b are pressed against the disk 3. The pressure of the spring 18 is adjusted by means of the screw 19, in such a manner that at the desired pressure caused by the compression there exists equilibrium. If the pressure rises further, the excess of upward pressure on the piston 17 overcomes the pressure of the spring 18, the differential piston rises, and the lower piston 17′ closes the ducts 14^a, 14^b, against the supply of pressure air, while establishing communication between the said ducts and the ducts 21, 21′ leading to the atmosphere. Consequently the slides 5^a, 5^b remain thrust back, so that the pistons simply carry with them by their rotary motion the volume of air contained in the working chamber and the compressor therefore runs without load.

To prevent the slides from being thrown back violently, when relieved of their load, the ascending surfaces 3^a and 3^b of the pistons have the shape of slow inclines. This insures the further advantage, that the non-return valves 6^a and 6^b arranged in the pressure openings, which valves open after the required pressure at the back of the same has been attained, will slowly descend upon their seats, while the apex of the pistons approaches the abutment slides. The shape of the descending curves is to be chosen only with regard to the motion of the slides and they may be fairly steep.

In order that the slides may be loaded also in starting the compressor, independently of the pressure reservoir which may be perhaps quite empty, an auxiliary reservoir 22 is arranged in the base of the machine. Compressed air is supplied to this reservoir from the main reservoir through the pipe 23. The return of compressed air from the reservoir 22 into the main receptacle, when the pressure in the latter decreases, is prevented by the check valve 24 arranged in the conduit 23, so that on the stoppage of the machine the pressure in the reservoir 22 is preserved.

In starting the machine, the stopcock 26 arranged in the conduit 25 is opened and the stopcock 27 arranged in the conduit 12 (and which is open during normal working) is closed. After that compressed air flows from the receptacle 22 through pipe 25 to the back of the slide 5^a and through 14^a, 14^b, 15, 16 also to the back of the slide 5^b. After some time the cock 27 is re-opened and the cock 26 closed. As an alternative, the pipe 25 may be joined to the valve 13, in which case the duct 12 together with cock 27 may be omitted and the loading of the slide permanently effected through the intermediary of the receptacle 22 as shown in Fig. 9.

For pressing on the slides, at the time of starting the machine, a loading spring may be employed, as shown in Figs. 5 and 6. This spring may be allowed to act permanently in addition to the air pressure, or it may be arranged so that it can be set out of action by hand, as represented, or automatically by utilizing in a suitable manner the pressure of the loading medium.

According to Figs. 5 and 6 the loading spiral spring 28 acts upon the slide 5^a by means of a lever 29 journaled at 30, a pin 31 articulated to the end of the lever 29 bearing against the bottom of a sleeve 32 fixed to the rear end of the slide. For the purpose of relieving the slide of the spring load, a cam 33 is fixed on an axle 34 which may be turned to a certain extent by means of a handle 35 in the direction of the arrow, Fig. 5. In this movement the cam depresses the rear end 29′ of the lever 29 which consequently moves outward against the action of the spring 30 and brings the pin 31 out of contact with the bottom of the sleeve 32.

The device for relieving the slide of the loading fluid pressure, if the maximum pressure to be produced by the compressor is exceeded, has according to Figs. 5 to 8 a cock or valve 39 which is turned by the action of a spring-pressed piston 55 acted

upon by the fluid compressed by the machine. The valve 39 has three radial slots 41, 42 and 43 corresponding to slots 38, 44, and 46 respectively in the bush 40 receiving the valve. The slot 42 is of a greater width than the other slots, so that it may communicate with the slot 44 of the bush in both positions of the valve shown in Figs. 7 and 8.

Compressed fluid is led by the pipe 36 and the connection 53 into the cylinder 54 above the piston 55 located within said cylinder. At normal pressure a spring 57 surrounding the piston rod 56 overcomes the fluid pressure and holds the piston in its uppermost position according to Fig. 6, where it abuts against the screw plug 60. In this position of the piston a pin 58 at the free outward end of the piston rod 56 acts upon the crank pin 52 of a crank 51 which is fixed on the axle of the valve 39, in such a manner as to give to the valve 39 the position shown in Fig. 7. In this position the compressed fluid flowing through pipe 36 and branch pipe 37 has free passage through slots 38, 41, 42, 44, and channel 45 to the chamber 48 in the back of the slide 5^a and from here through channel 49 and pipe 50 to the corresponding chamber in the back of slide 5^b. When however the fluid pressure exceeds a certain degree, the pressure upon the piston 55 overcomes the tension of the spring and consequently effects a downward movement, the rate of which corresponds to the degree of the surplus pressure. When this degree reaches a certain amount, a second pin 59 on the piston rod 56 strikes the crank pin 52 so that the valve 39 is moved into the position shown in Fig. 8. In this position the admission of compressed fluid from the pipe 37 to the chamber 48 is cut off, while the latter is put into communication with the atmosphere by intermediance of channel 45, slots 44, 42, 43, 46 and passage 47, so that the slide 5^a remains in its pushed back position. The corresponding chamber in the back of slide 5^b, being in communication with the chamber 48, is at the same time put in communication with the atmosphere and consequently this slide is also relieved of the loading pressure.

In the modification represented in Figs. 5 to 8 the auxiliary reservoir 22 shown in Figs. 1 to 3 is dispensed with and the pipe 36 is substituted for the passage 12 shown in Fig. 1. The special arrangement of the fluid pressure relieving device according to Figs. 5 to 8 offers the advantage of avoiding a continuous change from load to relieve and vice versa by the influence of slightly increasing and decreasing height of pressure, the idle space between the pins 58 and 59 admitting a certain increase and decrease before the valve 39 is reversed.

Different alterations in construction could be made without departing from the spirit of the invention. For example the pressure valves 6 could be arranged in the ends of the abutment slides. This arrangement would secure the further advantage of reducing to a minimum the waste space. Such an arrangement is shown in Figs. 10–12, wherein the abutments 5^c and 5^d are made hollow and open at the back. Each slide has a lateral port *b* closed by a valve 6^c and 6^d mounted within the abutments. This valve is preferably made in one piece with its spring arms *a* which are secured by rivets or otherwise to one of the vertical walls of the abutment. At the back of each abutment its open end communicates with the pipes 28^a and 28^b that receive the compressed air and deliver it through the pipe 28 connected to both of them.

If the engine is used as a compressor, the casing, its covers, as well as the piston disk are provided in the known manner with canals and hollow spaces for cooling, as represented.

Having thus described the invention, what I claim as new is:

1. In combination, a cylindrical revolving disk having substantially flat side faces, a piston mounted on one side face of said disk and provided with transition surfaces, a casing including said disk, an axle for the disk, a bush on the axle, and an abutment slide axially movable in a guideway of the casing in contact with said disk and piston, said slide being guided with its outer edge face on a stationary guiding surface of the casing and with its inner face on the bush surrounding the axle of the disk and extending at least to the plane of the flat side of the disk.

2. In combination, a cylindrical revolving disk having substantially flat side faces, pistons mounted on both side faces of said disk and provided with transition surfaces, a casing including said disk, and abutment slides axially movable in guideways of the casing in contact with said disk and pistons, said slides being guided with their outer edge faces on stationary guiding surfaces of the casing and with their inner edge faces on bushes surrounding the axle of the disk and extending at least to the planes of the flat faces of said disk.

3. In combination, a casing, a revolving piston, an abutment slide movable in the casing with relation to the piston, means for controlling the slide and exerting pressure from the delivery side of the piston behind said slide, and means for placing said controlling means out of action and simultaneously relieving the pressure behind the abutment.

4. In combination, a casing, a revolving

piston flanked by transition surfaces, a movable abutment in the casing coöperating with said piston and surfaces, means to load the abutment by fluid pressure and means acting to control the abutment loading fluid and simultaneously relieve the abutment of the load thereof.

5. In combination, a casing, a revolving piston mounted therein, cams flanking the piston, an abutment slidable in the casing and in operative relation to the piston and cams, means to supply motive fluid behind the abutment and a cut-off device in said supply automatically operated by the fluid delivered by said piston.

6. In combination, a casing, a revolving piston, an abutment in working relation to said piston, cams for controlling said abutment, means to supply working fluid back of the abutment, a cut-off valve inserted in said means, a cylinder having a passage for leading compressed fluid thereto, a spring-pressed piston within said cylinder, and means for transmitting the movement of said piston to said valve.

7. In combination, a casing, a revolving piston, an abutment in working relation to said piston, cams for controlling said abutment, a passage to supply compressed fluid to said abutment, a cut-off valve and casing inserted into the passage for the supply of compressed fluid to the back of the abutment, said casing having three passages two of which communicate with the supply passage, while the third communicates with the atmosphere, a cylinder, a passage for leading compressed fluid to said cylinder, a piston within said cylinder, means for transmitting the movement of said piston to said valve, the valve being so arranged that in its normal position the compressed fluid has free access to the back of the abutment through the supply passages, while when the fluid pressure overcomes the spring pressure, the fluid supply to the abutment is cut off and a communication is established between the back of the abutment and the atmosphere.

8. In combination, a casing, a revolving piston, an abutment in working relation to said piston, cams for controlling said abutment and means to load the abutment with compressed fluid, a cut-off valve to control the supply of compressed fluid to the back of the abutment, a crank on the valve, a cylinder, a fluid supply passage in connection with said cylinder, a spring-pressed piston within said cylinder, a piston rod connected to said piston and in working relation to the crank.

9. In combination, a casing, a revolving piston, an abutment in working relation to said piston, cams for controlling said abutment, means to load the abutment with compressed fluid, a cut-off valve to control the supply of compressed fluid to the back of the abutment, a cylinder, a fluid supply passage in connection with said cylinder, a spring-pressed piston within said cylinder, a piston rod connected to said piston, two abutments on said piston rod, a crank on the axle of said valve, the pin of said axle being situated between the abutments of the piston rod which are arranged at such distance as to allow idle motion of the piston before one of the pins strikes the crank pin.

10. In combination, a casing, a revolving piston flanked by cams, an abutment in working relation to said piston, a spring-pressed lever acting on said abutment and means for moving said lever against the action of its loading spring.

11. In combination, a casing, a revolving piston flanked by transition surfaces, an abutment in working relation to said piston and surfaces, a spring to exert pressure on the abutment and means operating on the spring to relieve the abutment of the stress thereof.

12. In combination, a casing, a revolving piston having transition surfaces, an abutment in working relation to said piston, a spring-pressed lever acting on said abutment, a cam rotatably adjacent said lever whereby the turning of said cam actuates the lever against the action of its loading spring.

13. In combination, a casing, a revolving piston having transition surfaces, an abutment in working relation to said piston, a spring to exert pressure on said piston, means acting on the spring for relieving the abutment of spring pressure, means for supplying compressed fluid on the back of said abutment and means for relieving said fluid pressure.

14. In combination, a casing, a rotary disk mounted therein and having a piston thereon, an abutment slide mounted in the casing and coöperating with the piston, and means to operate said slide by fluid pressure from the delivery side of the piston and maintain said pressure substantially uniform.

15. In combination, a casing, stationary bushings in the casing, a shaft directly mounted in the bushings, a disk on the shaft between the bushings, said bushings extending to the face of the disk, pistons on the disk, abutment slides mounted in the casing and sliding throughout their entire length on said bushings and means to urge the slides toward said disk.

16. In combination, a casing, a rotary piston mounted therein, a sliding abutment in operative relation to the piston, means to load the abutment with fluid compressed by said piston, and means operated by the compression pressure of said fluid to control the pressure of the loading fluid.

17. In combination, a casing, a rotary pis-

ton mounted therein, a sliding abutment in operative relation to said piston, an auxiliary reservoir into which fluid compressed by said piston may discharge, and means to supply compressed fluid at the back of said abutment from said reservoir.

18. In combination, a casing, a rotary piston mounted therein, a sliding abutment in operative relation to said piston, means to supply fluid compressed by said piston to said sliding abutment, mechanism to control said supply, an auxiliary reservoir, and means to supply pressure fluid from said reservoir to the abutment.

19. In combination, a casing, a rotary piston mounted therein, a plurality of sliding abutments in operative relation to said piston, means to supply pressure fluid behind said abutments, mechanism to control said supply, an auxiliary reservoir, means to supply pressure fluid from said reservoir to one of the abutments and thence through the controlling mechanism to the remaining abutments.

20. In combination, a casing, a rotary piston therein, a plurality of sliding abutments in operative relation to said piston, means to connect the delivery side of said piston with the backs of said abutments, a controlling mechanism interposed between the delivery side of the piston and the abutments to control the supply of pressure fluid to the latter, a valve between said mechanism and the delivery side of the piston, an auxiliary reservoir, means to supply pressure fluid from the reservoir to said abutments upon starting, said valve for the time being, being closed.

21. In combination, a casing, a rotary piston therein, sliding abutments in operative relation to the piston, means to supply pressure fluid to said abutments to urge them toward the piston, and a mechanism to simultaneously control the supply of pressure fluid to said abutments and vent their urging pressure fluid to the atmosphere.

22. In combination, a casing, a rotating piston therein, slidable abutments in operative relation to said piston, means to spring-load each abutment, and fluid pressure means to additionally load the abutments, and a mechanism to simultaneously control the supply of loading fluid to said abutments and the venting thereof to the atmosphere.

23. In combination, a casing, a rotary piston therein, slidable abutments in operative relation to said piston, means to spring-load each abutment, means to set said spring-loading means out of operation, means to supply pressure fluid to said abutments, and mechanism to simultaneously and automatically control the supply of pressure fluid to said abutments and vent their urging pressure fluid to the atmosphere.

24. In combination, a casing, a rotary piston mounted therein, sliding abutments in operative relation to said piston, means to supply pressure fluid to said abutments and mechanism to automatically control and maintain the pressure of the pressure fluid on said abutments uniform.

25. In combination, a casing, stationary bushes mounted in the casing, a shaft mounted in the bushes and having an enlarged central portion between the bushes, a piston mounted on said enlarged portion and projecting over the ends of said bushes, and abutment slides mounted in the casing and having full bearing at one side on the bushes under all conditions of operation.

26. In combination, a casing, a rotary piston therein, sliding abutments in operative relation to the piston, means to supply pressure fluid from the delivery side of said piston to the backs of the abutments to load them and pressure fluid operated means to vent the loading fluid to the atmosphere.

27. In combination, a casing, a rotary piston therein, a sliding abutment in operative relation to the piston, means to supply pressure fluid from the delivery side of said piston to the back of said abutment to load it, automatic means actuated by pressure fluid to vent the loading fluid to the atmosphere.

28. In combination, a casing, a rotary piston therein, a sliding abutment in operative relation to the piston, means to supply pressure fluid behind the abutment, a valve controlled by the pressure of said fluid to vent the loading fluid back of the abutment to the atmosphere, a reservoir for pressure fluid and means to supply pressure fluid from the reservoir to the back of the abutment.

29. In combination, a casing, a rotary piston therein a sliding abutment in operative relation to the piston, a pressure fluid reservoir, a pressure fluid actuated valve and means to supply the contents of the reservoir through said valve to the back of the abutment, said valve including means whereby pressure fluid may be automatically vented to the atmosphere.

30. In combination, a casing, a revolving piston therein, a movable abutment, slidable in the casing in working relation to said piston, and means to supply pressure fluid from the delivery side of the piston to and maintain a uniform fluid pressure behind the abutment under all conditions of operation.

31. In combination, a casing, a revolving piston and transition surfaces therefor, an abutment slide in working relation to the piston, a spring to exert pressure on the slide during starting, and means to supply pressure fluid to the abutment from the delivery side of the piston when sufficient pressure has been attained on said delivery side.

32. The combination of a casing, a revolv-

ing piston therein and an abutment slide in operative relation to the piston; of mechanism to supply fluid from the delivery side of the piston to the back of the abutment slide, said mechanism automatically controlled by the compression pressure of said fluid.

In testimony whereof I affix my signature in presence of two witnesses.

WILHELM VON PITTLER.

Witnesses:
AUGUST TRAUTMANN,
HENRY HASPER.