A. SADGER.

ROTARY MACHINE.

APPLICATION FILED AUG. 18, 1911.

1,028,285.

Patented June 4, 1912.

2 SHEETS—SHEET 1.

Fig. 1

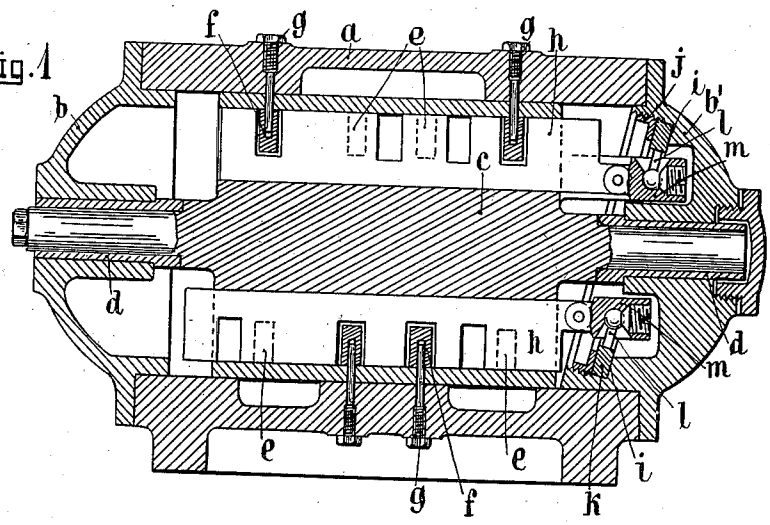


Fig. 4

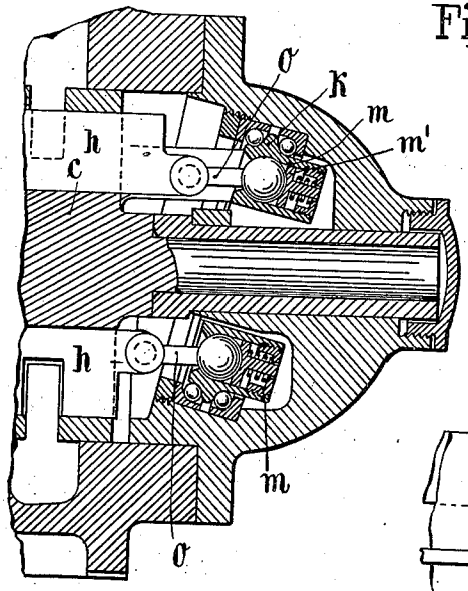


Fig. 2

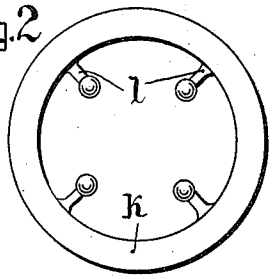
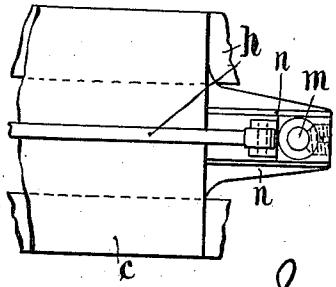


Fig. 3



Witnesses.
B. Dommers
E. Teichert.

Inventor.
Adolf Sadger,
By Munn & Co
Atty.

A. SADGER.

ROTARY MACHINE.

APPLICATION FILED AUG. 18, 1911.

1,028,285.

Patented June 4, 1912.

2 SHEETS—SHEET 2.

Fig. 5

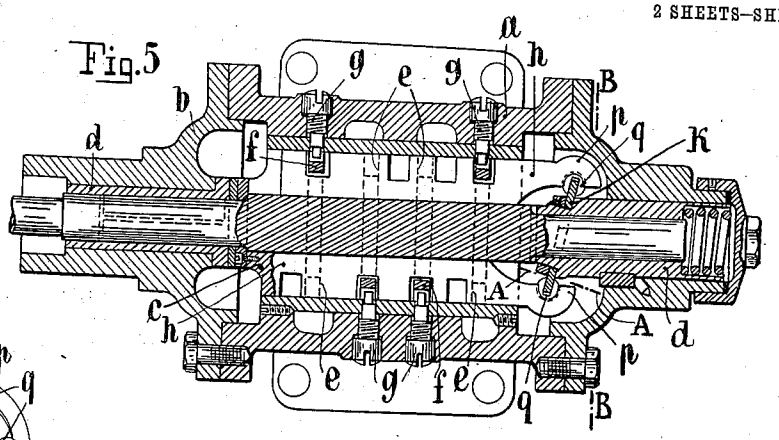


Fig. 6

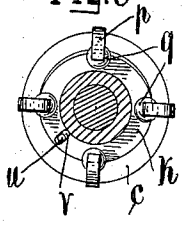


Fig. 7

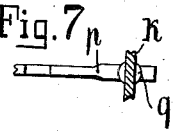


Fig. 10

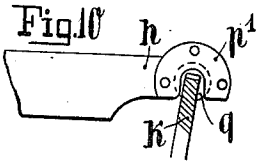


Fig. 8

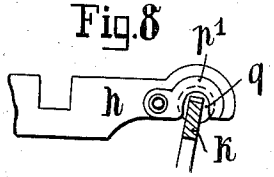


Fig. 11

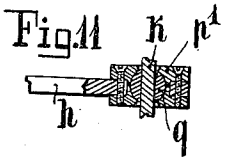


Fig. 9

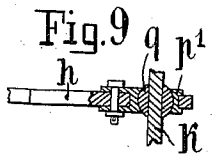


Fig. 12

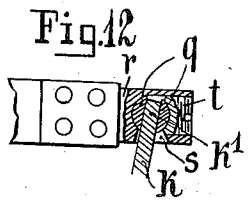


Fig. 14

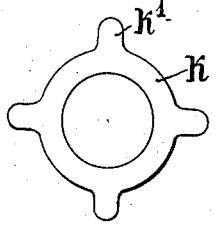
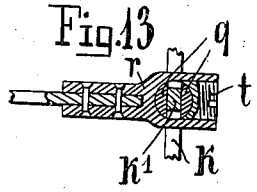


Fig. 13



Witnesses:
B. Dommers
E. Leckert.

Inventor.
Adolf Sadger.
By Munn & Co
Atty.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ADOLF SADGER, OF BERLIN, GERMANY, ASSIGNOR TO THE AMERICAN ROTARY MACHINE COMPANY, OF NEW YORK, N. Y.

ROTARY MACHINE.

1,028,285. Specification of Letters Patent. Patented June 4, 1912.

Application filed August 18, 1911. Serial No. 644,873.

To all whom it may concern:

Be it known that I, ADOLF SADGER, engineer, a subject of the Emperor of Austria-Hungary, residing at Berlin, Germany, have invented certain new and useful Improvements in Rotary Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The present invention relates to a rotary machine of the kind described in U. S. patent to J. W. von Pittler No. 894391 dated July 28, 1908, having working chambers provided in radial annular grooves in a rotary drum in which grooves engage abutments acting as pistons and fitted to the casing; instead of the cylinder heads of the ordinary reciprocating machines slides being provided, which are axially displaceable in radial longitudinal slots in the drum and can be so adjusted by means of a suitable steering gear, that they will open the working chambers for the passage of the pistons. It is known that cam surfaces in machines of this kind have been employed for the purpose of producing the axial movement of the slides, which cam surfaces may for instance act on the ends of the slides. This operating gear has proved quite satisfactory as it will be possible in machines of the kind in question to close the working grooves by means of the slides with an overlap, so that there will be no necessity of a permanently accurate adjustment and thus a certain independence of the unavoidable wear of both cams and slides will be obtained. In consequence of the pressures between the cam surfaces and the slides with the increasing dimensions of the machines and the resulting frictional resistances and wear, it was, however, necessary to limit these machines to moderate dimensions, although in theory, the design in question admits of constructing these machines of any size and for the largest duties by correspondingly increasing the number of the grooves, whereby only the length of the machine would be increased. With greater lengths of the machines and correspondingly long and heavy slides the pressures between the contact surfaces of the cams and slides proved to be too great, as these parts can, in consequence of the varying curvature of the cam only touch in a single line at a time. The natural consequence is an excessive wear.

According to the present invention and for the purpose of obtaining a planary instead of a linear contact and so render it possible to construct machines of this kind of larger dimensions and furthermore to increase the life of smaller machines, the travel of the slides is no longer produced by means of a cam but by a device (a ring or a disk) participating in the rotation and journaled obliquely to the axis of the drum. The displacement pressure is in this case received by a larger bearing surface; the sliding friction may, however, also be converted into a rolling friction by providing a ball bearing. The slides must of course be coupled to the guide ring or the like by means of universal joints, for which preferably ball joints may be used. Also in these there will always be a surface contact, so that the production of excessive surface pressures will be avoided.

In the accompanying drawings various constructional forms of the present invention are exemplified.

Figure 1 is a constructional form shown in longitudinal section. Figs. 2 and 3 are details of the same. In Fig. 4 a fragmentary view of an engine is shown, in which the oblique steering disk is supported on balls. Fig. 5 is a machine with a most simple ball joint for coupling the slide with the steering member. Fig. 6 is a section of a detail along the line B—B in Fig. 5. Fig. 7 is a section along the line A—A in Fig. 5. Figs. 8 to 14 illustrate further constructional forms of the ball joint, on the same principle as that according to Figs. 5 to 7.

The machine shown in Figs. 1–3 has a rotary drum c running in known manner in bearings d, d in a casing with heads b, b^1; in the circumferential surface of this drum c are cut annular grooves e forming the working chambers, and closed at one point by means of abutments f acting as pistons and secured to the casing by means of bolts g. In longitudinal grooves in the drum c slides h are arranged axially adjustable, and having notches admitting of their pass-

ing the abutments or pistons f, but which will during their working stroke close with their solid parts the annular grooves e and thus serve as cylinder heads. The slides h must therefore perform an axial movement during the rotation of the drum, so as to alternately close and open the grooves. This movement is obtained by the following arrangement. The head b^1 has on its inner side a bearing surface i inclined toward the longitudinal axis. Between this bearing surface i and a ring j screwed into the said head is fitted an annular disk k so that it can rotate freely. From this disk extend inwardly lugs l which engage with spherical heads in corresponding spherical sockets in separate bearing blocks m. Each slide is hinged to one such block m. For dogging the annular disk k on the drum c being rotated, a pair of guide ways n are provided on the latter, between which one of the blocks m is guided. When the drum revolves the ring k will revolve with it, but in another plane. The various points of the drum and the ring will therefore periodically vary their relative axial position, so that also the slides coupled to the ring will perform an axially reciprocating movement with relation to the drum.

In the constructional form according to Fig. 4 the ring k is arranged between two ball races. The ring here carries the ball sockets m, while the balls are arranged at the ends of stems o extending from the slides. For the purpose of an automatic readjustment in case of wear the bottoms of the ball sockets m are made in form of separate parts m^1 supported by springs. The elastic support offers the further advantage that it affords the possibility of the gear yielding in case of any strong resistances occurring which may lead to a damaging of the machine.

In the machine according to Figs. 5–7 a slotted ball q is arranged in a ball socket at the end of each slide h, in the slot of which ball the obliquely supported steering disk engages, so that the single balls fit as if riding on the edge of the disk. As the disk is positively dogged by the drum by aid of an abutment, for instance a dog pin u (Fig. 6) on the drum engaging in a radial slot v in the disk, and the axis of the drum passes through the center of the disk, the relative rotation of the drum and the disk will be such that every pair of radii of the two parts lying in one radial plane at any one position, will maintain this relation also at any other position. The balls on the edge of the steering disk will therefore not be displaced in the direction of the periphery. In consequence, however, of the inclined position of the steering disk and the circumstance, that the balls must always remain at the same distance from the axis of the drum, a radially reciprocating movement of the balls with relation to the disk will be produced, the extent of which corresponds to the incline of the disk.

In the constructional form according to Figs. 8 and 9 the ball socket is not provided in the slide itself but in a shoe p^1 secured to the same. This arangement affords the advantage that the ball socket may consist of other material than the slide and that on its being worn, the original condition may be easily reëstablished by exchanging the shoe, which may be done at a comparatively small expense.

The constructional form according to Figs. 10 and 11 shows the same arrangement with the difference that the shoe p^1 is here made in two pieces. This will facilitate the fitting of the ball and besides admit of a subsequent readjustment.

In the arrangement according to Figs 12, 13 and 14 the ball is not only slotted, but completely severed. The whole ball bearing is arranged in a sleeve r, which is arranged at the end of the slide and into which the disk k engages through an opening s with a lug k^1 provided on its periphery. The two ball segments ride on this lug k^1. The one segment lies in a spherical recess in the bottom of the sleeve r, while the other segment engages in a corresponding recess in a screw t, by means of which the device may, when worn, be readjusted. The complete division of the ball offers the advantage of admitting of compensating by means of screw t also a wear between the disk and the sectional surfaces of the ball sliding on the latter. This is not possible when the balls are merely slotted on one side according to Figs. 5 to 11.

It is known to produce the axial working stroke of the pistons in machines with reciprocating pistons working in revolving cylinders by means of obliquely arranged disks. Between such machines and the machine according to the present invention there, however, exists the essential difference, that in the former the oblique disk is an element for transmitting the driving power to the pistons, and thus represents a driving crank, while in the present invention the oblique disk gear has only to perform a kind of steering duty. The said known machines have not proved satisfactory in consequence of the extremely heavy strain on the oblique disk gear. It has been found, that the bearings of the oblique disk and the ball bearings cannot meet the strains put to them by the load of the working pressure, as no material could stand so high a surface pressure. In the present case, where the oblique disk gear has only to fulfil a steering duty by opening and closing the cylinder head, it will fully meet its purpose.

I claim:

1. In a rotary machine the combination of a casing, a rotary drum therein having a circumferential groove and a radial longitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in a said longitudinal slot and having a notch corresponding to said circumferential groove, a steering element journaled obliquely to the axis of and participating in the rotation of said drum, and means to connect said slide to said steering element.

2. In a rotary machine the combination of a casing a rotary drum therein having a circumferential groove and a radial longitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in said longitudinal slot and having a notch corresponding to said circumferential groove, a steering element journaled obliquely to the axis of and participating in the rotation of said drum, and a universal joint connecting said slide to said steering element.

3. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a radial longitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in said longitudinal slot and having a notch corresponding to said circumferential groove, a steering element journaled obliquely to the axis of and participating in the rotation of said drum, and a ball joint connecting said slide to said steering element.

4. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a radial longitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in said longitudinal slot and having a notch corresponding to said circumferential groove, a steering disk journaled obliquely to the axis of and participating in the rotation of said drum, a ball socket on said slide, a slotted ball in said socket, said steering disk engaging into the slot of said ball.

5. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a radial longitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in said longitudinal slot and having a notch corresponding to said circumferential groove, a steering disk journaled obliquely to the axis of and participating in the rotation of said drum, a removable ball socket piece fitted to the end of said slide, a slotted ball in said socket piece, said steering disk engaging into the slot of said ball.

6. In a rotary machine the combination of a casing, a rotary drum therein having a circumferential groove and a radial longitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in said longitudinal slot and having a notch corresponding to said circumferential groove, a steering disk journaled obliquely to the axis of and participating in the rotation of said drum, a removable ball socket piece, consisting of two sections, fitted to the end of said slide, a slotted ball in said socket piece, said steering disk engaging into the slot of said ball.

7. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a radial lon gitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in said longitudinal slot and having a notch corresponding to said circumferential groove, a steering disk journaled obliquely to the axis of and participating in the rotation of said drum, a ball socket on said slide, a ball in said socket completely slotted through, said steering disk engaging into said slotted ball.

8. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a radial longitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in said longitudinal slot and having a notch corresponding to said circumferential groove, a steering disk journaled obliquely to the axis of and participating in the rotation of said drum, a removable ball socket piece, consisting of two sections, fitted to the end of said slide, a ball in said socket completely slotted through, said steering disk engaging into said slotted ball.

9. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a radial longitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in said longitudinal slot and having a notch corresponding to said circumferential groove, a steering disk journaled obliquely to the axis of and participating in the rotation of said drum, a ball socket on said slide, a slotted ball in said socket, said steering disk having a lug engaging into the slot of said ball.

10. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a radial longitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in said longitudinal slot and having a notch corresponding to said circumferential groove,

a steering disk journaled obliquely to the axis of and participating in the rotation of said drum, a removable ball socket piece being fitted to the end of said slide, a slotted ball in said socket piece, said steering disk having a lug engaging into the slot of said ball.

11. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a radial longitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in said longitudinal slot and having a notch corresponding to said circumferential groove, a steering disk journaled obliquely to the axis of and participating in the rotation of said drum, a removable ball socket piece, consisting of two sections, fitted to the end of said slide, a ball completely slotted through in said socket, said steering disk having a lug engaging into the slot of said ball.

12. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a radial longitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in said longitudinal slot and having a notch corresponding to said circumferential groove, a steering element participating in the rotation of the drum and supported on a ball race obliquely to the axis of the drum, and a universal joint connecting said slide to said steering element.

13. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a radial longitudinal slot, an abutment fitted to said casing and engaging into said circumferential groove, a slide axially movable in said longitudinal slot and having a notch corresponding to said circumferential groove, a steering element journaled obliquely to the axis of and participating in the rotation of said drum, a universal joint connecting said slide to said steering element, and an adjusting device combined with said universal joint connection.

14. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a plurality of radial longitudinal slots, an abutment fitted to said casing and engaging into said circumferential groove, slides axially movable in said longitudinal slots, each of which slides has a notch corresponding to said circumferential groove, a steering element participating in the rotation of the drum and journaled obliquely to the axis of said drum, and means to connect said slides to said steering element.

15. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a plurality of radial longitudinal slots, an abutment fitted to said casing and engaging into said circumferential groove, slides axially movable in said longitudinal slots, each of which slides has a notch corresponding to said circumferential groove, a steering element participating in the rotation of the drum and journaled obliquely to the axis of the drum, and universal joints connecting said slides to said steering element.

16. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a plurality of radial longitudinal slots, an abutment fitted to said casing and engaging into said circumferential groove, slides axially movable in said longitudinal slots, each of which slides has a notch corresponding to said circumferential groove, a steering element participating in the rotation of the drum and journaled obliquely to the axis of the drum, and ball joints connecting said slides to said steering element.

17. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a plurality of radial longitudinal slots, an abutment fitted to said casing and engaging into said circumferential groove, slides axially movable in said longitudinal slots, each of which slides has a notch corresponding to said circumferential groove, a steering disk journaled obliquely to the axis of and participating in the rotation of said drum, and ball joints connecting said slides to said steering disk.

18. In a rotary machine, the combination of a casing, a rotary drum therein having a circumferential groove and a plurality of radial longitudinal slots, an abutment fitted to said casing and engaging into said circumferential groove, slides axially movable in said longitudinal slots, each of which slides has a notch corresponding to said circumferential groove, a steering disk participating in the rotation of the drum and journaled obliquely to the axis of the drum, a ball socket on each slide, a slotted ball in said socket, said steering disk engaging into the slot of said ball.

19. In a rotary machine, the combination of a casing, a rotary drum therein having a plurality of circumferential grooves and a plurality of radial longitudinal slots, a plurality of abutments fitted to said casing and engaging into said circumferential grooves, slides axially movable in said longitudinal slots and having notches corresponding to said circumferential grooves, a steering element journaled obliquely to the axis of and participating in the rotation of the drum, and means to connect said slides to said steering element.

20. In a rotary machine, the combination

of a casing, a rotary drum therein having a plurality of circumferential grooves and a plurality of radial longitudinal slots, a plurality of abutments fitted to said casing and engaging into said circumferential grooves, slides axially movable in said longitudinal slots and having notches corresponding to said circumferential grooves, a steering element participating in the rotation of the drum and journaled obliquely to the axis of the drum, and universal joints connecting said slides to said steering element.

21. In a rotary machine, the combination of a casing, a rotary drum therein having a plurality of circumferential grooves and a plurality of radial longitudinal slots, a plurality of abutments fitted to said casing and engaging into said circumferential grooves, slides axially movable in said longitudinal slots and having notches corresponding to said circumferential grooves, a steering element participating in the rotation of the drum and journaled obliquely to the axis of the drum, and ball joints connecting said slides to said steering element.

22. In a rotary machine, the combination of a casing, a rotary drum therein having a plurality of circumferential grooves and a plurality of radial longitudinal slots, a plurality of abutments fitted to said casing and engaging into said circumferential grooves, slides axially movable in said longitudinal slots and having notches corresponding to said circumferential grooves, a steering disk journaled obliquely to the axis of and participating in the rotation of said drum, and ball joints connecting said slides to said steering disk.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

ADOLF SADGER.

Witnesses:
AUGUST TRAUTMANN,
HENRY HASPER.