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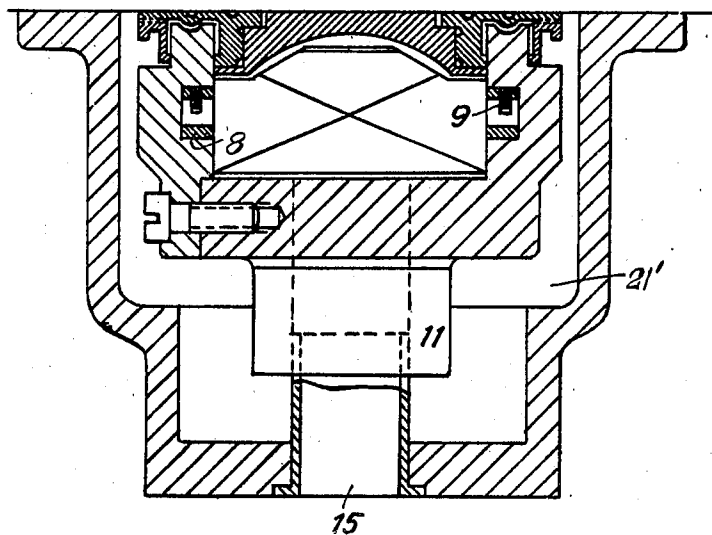
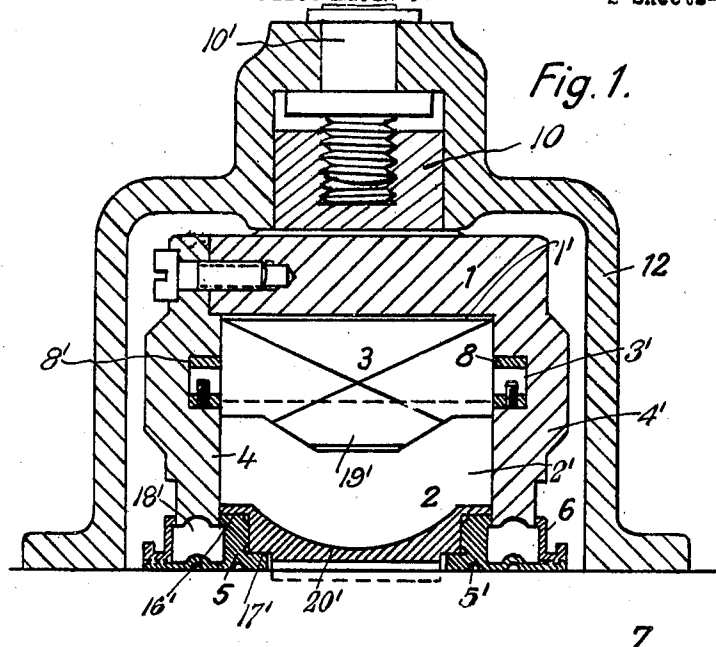
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W. KÜHN

VARIABLE CAPACITY LIQUID MOTOR

Filed March 1, 1924

2 Sheets-Sheet 1



Inventor:
Wilhelm Krich
By. Amos L. Norris
Attorney.

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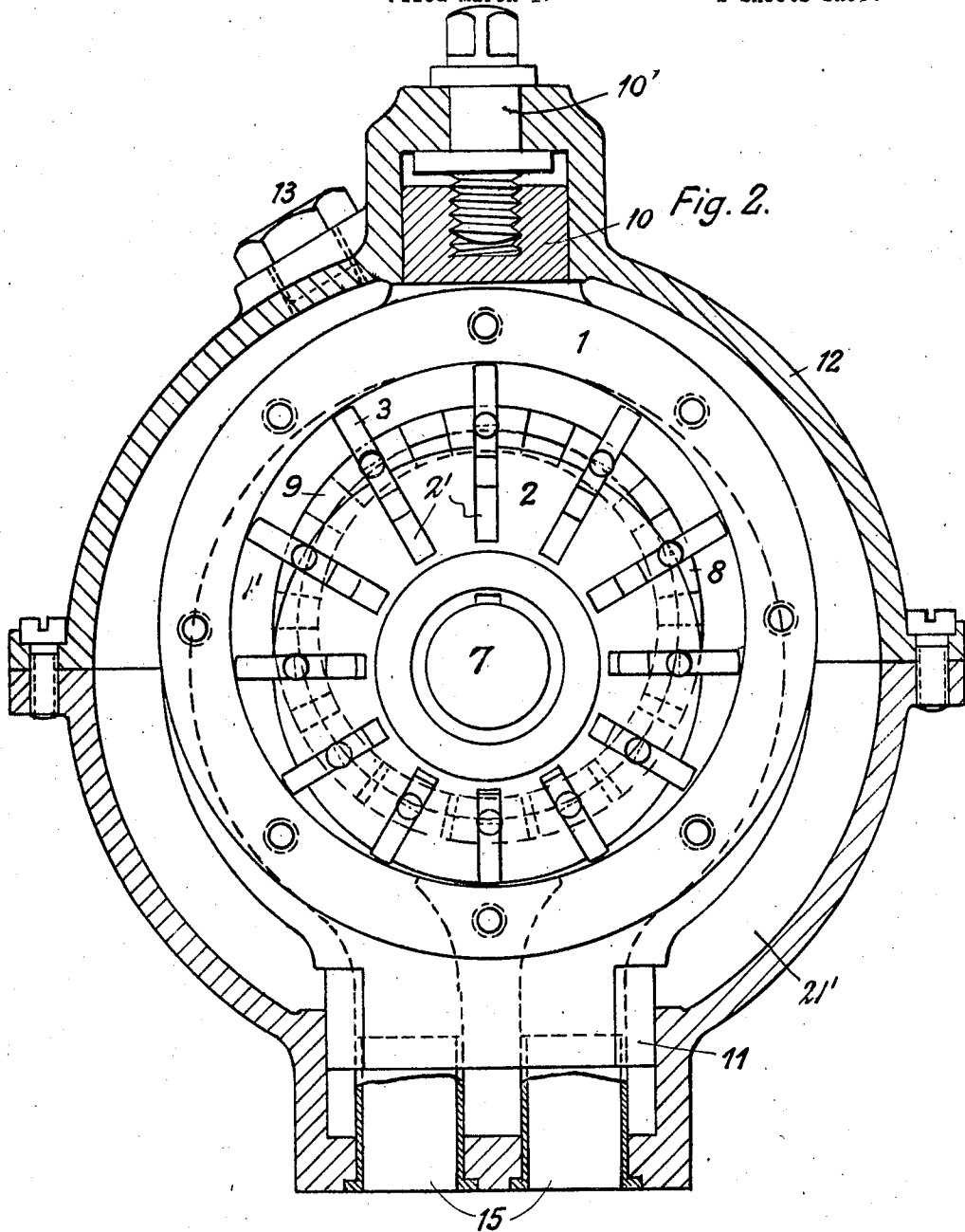
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VARIABLE CAPACITY LIQUID MOTOR

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2 Sheets-Sheet 2



Inventor:
Wilhelm Kühn
(By *Amos L. Norris*)
Attorney

UNITED STATES PATENT OFFICE.

WILHELM KÜHN, OF ESCHERSHEIM, NEAR FRANKFORT-ON-THE-MAIN, GERMAN
VARIABLE-CAPACITY LIQUID MOTOR.

Application filed March 1, 1924, Serial No. 696,322, and in Germany June 26, 1922.

This invention relates to fluid operated motors or pumps and particularly to a rotary motor of the sliding abutment impact type. Such motors, in general, are characterized by the provision of a cylindrical rotor operating in a cylindrical casing, on an axis eccentric to the axis of said casing, the rotor carrying radial abutments which are projected outwardly by suitable means into sliding contact with the circumscribing wall of the casing. The eccentric mounting of the rotor causes the abutments to reciprocate radially, through co-action with said circumscribing wall, defining between themselves and said wall chambers of progressively increasing capacity as they approach the point of greatest eccentricity, and which progressively diminish in capacity as they recede beyond this point. The inlet of the motor communicates with the chambers of increasing capacity, while the outlet communicates with those chambers which are progressively diminishing.

It is frequently desirable to alter the capacity of a motor of this type, whether functioning as a motor or pump, this having been attempted heretofore by varying the eccentricity of the rotor. Great difficulty has been experienced, however, in preserving a seal between the sides of the rotor and those of the casing in making this adjustment, so that variable capacity motors of this type have been pronounced impractical.

One of the objects of the present invention is to provide a novel construction by means of which the relative eccentricity between the rotor and casing or cylinder with which it cooperates may be varied without any disturbance of the packing.

Another object of the invention is to provide novel means for simultaneously actuating the sliding abutments to cause them automatically to accommodate themselves to changes in the relative eccentricity of the parts with which they coact. Still another object of the invention is the provision of a fluid actuated motor so constructed that leakage of the motive fluid, and entry of air, under certain conditions, is prevented.

Other objects of the invention will appear as the following description of a preferred embodiment of my invention proceeds.

In the drawings, in which similar reference characters are used in the several figures to denote the same part,

Fig. 1 is a longitudinal section of a fluid-actuated motor embodying my invention.

Fig. 2 a side view with the side wall removed.

Referring now in detail to the several figures, the numeral 7 represents a shaft upon which the rotor 2 is keyed. Said shaft is carried in bearings at the opposite sides of a frame, which in the present instance takes the form of a casing 12, for a purpose which will presently appear. A stationary cylinder 1 is mounted within the casing 12, the same enclosing a cylindrical chamber 1' within which the rotor 2 operates. Said cylinder is provided with side walls 4 and 4' one of which may be integral with the cylinder while the other, for example the side wall 4, is detachably secured to the cylinder so that it may be removed for the insertion and assemblage of the rotor parts.

The rotor 2 is formed with radial guide-ways 2' in which the abutments 3 are mounted so as to be freely slidable in a radial direction. Said abutments are normally maintained with their outer ends close to but slightly out of contact with the circumscribing wall of the cylindrical chamber 1' thereby avoiding the loss of efficiency of the motor due to friction between the abutments and said circumscribing wall. The abutments 3 are retained in this position by means of trunnions 3' projecting from opposite sides of the abutments extending into annular grooves 8' formed in the inner face of the side walls 4 and 4' concentrically with the cylinder axis. In the normal operation of the device the cylinder 1 is eccentric with respect to the rotor 2, so that the abutments are caused to reciprocate during the revolution of the rotor, being guided by the grooves 8'.

The cylinder is provided, preferably in the direction of its axis of eccentricity with upper and lower slides 10 and 11, the latter being supported by the casing 12, said slides, and with them the cylinder 1, being slidable relative to said casing and to the shaft 7 in the direction of said axis of eccentricity when the slides are actuated by suitable means such as the screw 10'. By this means, the degree of eccentricity of the cylinder relative to the rotor may be altered, varying the capacity of the motor. The inlet and outlet passages to and from the rotor, may, for convenience pass through the lower slide 11, the walls of said passages assuming

telescopic relation with respect to inlet and outlet pipes 15 carried by the slide 11 at the base of the motor.

In order that the cylinder 1 may be translatorily moved with respect to the rotor without disturbing the packing between the cylinder and rotor I have provided flanged packing collars 5 and 5' journaled upon the shaft 7 and making sealing contact with the opposite sides of the rotor 2. The side walls 4 and 4' are provided with apertures 18' surrounding the shaft 7 of such size as to give ample clearance for the cylinder 1 to be moved in a direction transversely of the shaft throughout the range of eccentric movement for which it is designed. The packing collars 5 and 5' are preferably formed in a stepped manner comprising a pair of annular shoulders 16' and an intermediate cylindrical sealing surface 17'. The outer ends of the packing collars are provided with flanged nuts 6 which may be screwed inwardly to adjust the degree of compression of the shoulders 16' of the flanged packing collars 5 and 5' against the inner sides of the side walls 4 and 4'. When it is desired to adjust the eccentricity of the cylinder the screw 10' is turned to impart the proper degree of translatory movement to the cylinder. This may be done without any disturbance whatsoever of the sealing surfaces between the packing collars and rotor.

It will be noted from Figure 1 that the provision of the stepped elongated sealing surfaces between the packing collars and rotor has necessitated a considerable cutting away of the material at the ends of the hub of the rotor, so that the ends of the guideways 2' in which the abutments 3 slide are abnormally short. This is compensated for by reducing the thickness of the middle portion of the hub of the rotor in the planes of said guideways, making the bases of the guideways concave as is indicated at 20' and providing the abutments with basal extensions 19' fitting into the concave portions of the guideways.

It will be readily understood from an inspection of Figure 2 that, since the position of the abutments is determined by the guiding grooves 8' (which are concentric to the cylinder) and not by springs as employed in other constructions to force the abutments outwardly, there is nothing inherent in the construction of the abutments or the circumscribing wall of the cylinder to cause the abutments to alter their position to correspond with new positions of said circumscribing wall when the cylinder is translatorily moved in the act of changing the degree of eccentricity thereof. Special means are therefore provided for causing the abutments to act together in changing their relative position to correspond with that of

the circumscribing cylinder wall, said means consisting of a chain of abutting guiding blocks 8 moving in the grooves 8' and between certain of which the trunnions 3' of the abutments are intercalated. The blocks 8' are held by rings 9 at the fitting up of the drive-mechanism.

As will be seen on referring to these figures the rings 9 abut with their outer circumference against the bottom of the grooves provided for the purpose on the sliding blocks. The sliding blocks are thus held by the rings in such a manner, that they always take up a definite position in relation to the ring and therefore to the cylinder. The outer diameters of the rings 9 are so large that they project into slots formed in the guide trunnions of the abutments 3, whereby a lateral stripping off of the sliding blocks from the pistons is rendered impossible, as long as the rotor with the pistons is entirely or partly in the cylinder.

In the preferred construction of my motor the frame constitutes a casing 12 which surrounds the cylinder 1 in spaced relation thereto, forming a chamber 21'. This chamber is adapted to be filled with fluid, particularly liquid of the same kind which is utilized as the motive agent. A filler plug 13 is provided, closing an aperture in which liquid may be poured until the chamber 21' has been filled. The filler plug may then be replaced, the liquid within said chamber acting as a sealing means to prevent leakage of motive fluid past the bearings of the packing collars and also to prevent entry of air into the motor when it is idle.

It will be readily understood that I do not limit myself to the exact details of construction described and illustrated and that modifications within the ambit of my claims will suggest themselves to persons skilled in the art without departing from the spirit of my invention or sacrificing any of its advantages.

What I claim is:

1. In a variable capacity rotary motor, a shaft, a rotor on said shaft, a cylinder enclosing said rotor having side walls through which said shaft passes and a circumscribing wall defining motive fluid space between said rotor and cylinder, means for moving said cylinder diametrically of said rotor to alter the degree of eccentricity of said circumscribing wall, said side walls being formed with openings surrounding said shaft and sufficiently larger than the shaft to provide for the required range of translatory movement of said cylinder, packing collars on said shaft making a sliding sealed joint with said rotor, said collars engaging the portions of said side walls adjacent said openings and being sufficiently large to close said openings in all positions of said cylinder.

der, and means for clamping said collars to the side walls of said cylinder.

2. In a variable capacity rotary motor, a shaft, a rotor on said shaft, a cylinder enclosing said rotor having side walls through which said shaft passes and a circumscribing wall defining motive fluid space between said rotor and cylinder, said rotor being formed with radial guideways, sliding abutments in said guideways intersecting said motive fluid space, means for moving said cylinder diametrically of said rotor to alter the degree of eccentricity of said circumscribing wall, said side walls being formed with openings surrounding said shaft and sufficiently larger than the shaft to provide for the required range of translatory movement of said cylinder, packing collars on said shaft having inner faces projecting into and co-acting with correspondingly shaped recesses in the sides of said rotor making a sealed joint therewith, said collars engaging portions of said side walls adjacent said openings and being sufficiently large to close said openings in all positions of said cylinder, means for clamping said collars to the sides of said cylinder, said guideways being relatively shallow adjacent said recesses and relatively deep adjacent the intermediate portions of the rotor, and said abutments being correspondingly proportioned.

3. In a variable capacity rotary motor, a shaft, a rotor on said shaft, a cylinder enclosing said rotor having side walls through which said shaft passes and a circumscribing wall defining motive fluid space between said rotor and cylinder, means for moving said cylinder diametrically of said rotor to alter the degree of eccentricity of said circumscribing wall, said side walls being formed with openings surrounding said shaft and sufficiently larger than the shaft to provide for the required range of translatory movement of said cylinder, packing collars on said shaft making a sliding sealed joint within said rotor, said collars engaging the portions of said side walls adjacent said openings and being sufficiently large to close said openings in all positions of said cylinder, means for clamping said collars to the side walls of said cylinder, and a casing surrounding said cylinder adapted to be filled with liquid.

4. In a variable capacity rotary motor, a shaft, a rotor on said shaft, a cylinder enclosing said rotor having side walls through which said shaft passes and a circumscribing wall defining motive fluid space between said rotor and cylinder, means for moving said cylinder diametrically of said rotor to alter the degree of eccentricity of said circumscribing wall, said side walls being formed with openings surrounding said shaft and sufficiently larger than the shaft to provide for the required range of translatory move-

ment of said cylinder, packing collars on said shaft making a sliding sealed joint with said rotor, said collars engaging the portions of said side wall adjacent said openings and being sufficiently large to close said openings in all positions of said cylinder, and means for clamping said collars to the side walls of said cylinder, said rotor being formed with radial guideways, and sliding abutments carried in said guideways having trunnions projecting from their sides, the side walls of said cylinder being formed with grooves receiving said trunnions, said grooves being concentric to said circumscribing wall.

5. In a variable capacity rotary motor, a shaft, a rotor on said shaft, a cylinder enclosing said rotor having side walls through which said shaft passes and a circumscribing wall defining motive fluid space between said rotor and cylinder, means for moving said cylinder diametrically of said rotor to alter the degree of eccentricity of said circumscribing wall, said side walls being formed with openings surrounding said shaft and sufficiently larger than the shaft to provide for the required range of translatory movement of said cylinder, packing collars on said shaft making a sliding sealed joint with said rotor, said collars engaging the portions of said side wall adjacent said openings and being sufficiently large to close said openings in all positions of said cylinder, means for clamping said collars to the side walls of said cylinder, said rotor being formed with radial guideways, sliding abutments carried in said guideways having trunnions projecting from their sides, the side walls of said cylinder being formed with grooves receiving said trunnions, said grooves being concentric to said circumscribing wall, and means for causing said abutments to alter their positions to correspond to changes in the degree of eccentricity of said circumscribing wall, said means comprising a chain of abutting blocks travelling in said grooves between certain of which said trunnions are intercalated.

6. In a variable capacity rotary motor, a shaft, a rotor on said shaft, a cylinder enclosing said rotor having side walls through which said shaft passes and a circumscribing wall defining motive fluid space between said rotor and cylinder, means for moving said cylinder diametrically of said rotor to alter the degree of eccentricity of said circumscribing wall, said side walls being formed with openings surrounding said shaft and sufficiently larger than the shaft to provide for the required range of translatory movement of said cylinder, packing collars on said shaft making a sliding sealed joint with said rotor, said collars engaging the portions of said side wall adjacent said openings and being sufficiently large to close said openings in all positions of said cylinder,

means for clamping said collars to the side walls of said cylinder, said rotor being formed with radial guideways, sliding abutments carried in said guideways having 5 trunnions projecting from their sides, the side walls of said cylinder being formed with grooves receiving said trunnions, said grooves receiving said trunnions and being concentric to said circumscribing wall, means 10 for causing said abutments to alter their positions to correspond to changes in the degree of eccentricity of said circumscribing wall, said means comprising a chain of abutting blocks travelling in said grooves between certain of which said trunnions are 15 intercalated, and rings engaging grooves in said trunnions and blocks for holding them together.

In testimony whereof I have affixed my signature.

WILHELM KÜHN.