Aug. 18, 1925. 1,550,286

O. SORGE

ROTARY PUMP

Filed Nov. 6, 1924

*Fig. 1.*

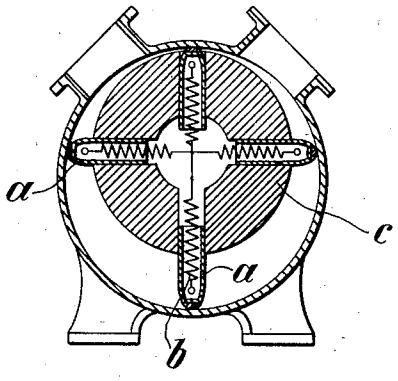
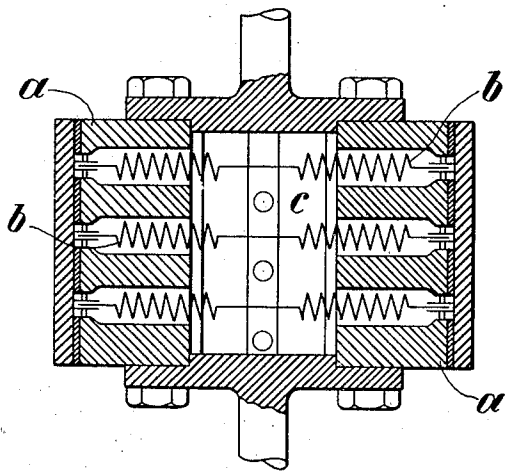



*Fig. 2.*




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Patented Aug. 18, 1925. 1,550,286

# UNITED STATES PATENT OFFICE.

OTTO SORGE, OF BERLIN-SCHMARGENDORF, GERMANY.

## ROTARY PUMP.

Application filed November 6, 1924. Serial No. 748,126.

*To all whom it may concern:*

Be it known that I, OTTO SORGE, civil engineer, a citizen of the German Republic, and resident of Berlin-Schmargendorf, Germany, have invented a new and useful Improved Rotary Pump, of which the following is a specification.

My invention relates to rotary pumps having a rotary eccentrically arranged blade-carrier carrying radially movable blades, the outer end-faces of which slide along the circumferential inner wall of the casing enclosing said blade-carrier with its blades. There arises, of course, friction between said end-faces and said inner wall, and the friction is very great in consequence of the large number of revolutions of the rotatory blade-carrier and of the centrifugal force arising. Owing to that great friction it is difficult to maintain proper tightness at the said end-faces. In this respect two requirements must be considered. One thereof is that the surface-pressure at each blade end-face be only moderate; the other, that each blade end-face be continuously in proper contact with the circumferential interior surface of the casing. It is extremely difficult to answer both requirements even with rotary pumps with only a moderate number of revolutions, but as regards rotary pumps with a large number of revolutions, especially pumps which are to be coupled directly with electromotors or other high-speed motors or engines, it has not been possible hitherto to answer said two requirements continuously, that is to say, in plants where the rotary pump must run interruptedly for days, if not weeks.

The difficulties experienced in practical service of this kind are based on the fact that a large number of revolutions entails a high sliding-speed of the blade end-faces at the inner casing-wall, and that at the same time the surface-pressure rises considerably in consequence of the strong centrifugal force arising in the blades. I am aware of the fact that endeavors have been made to overcome the difficulties with the aid of springs connected at one end with the blades and at the other end either with the blade-carrier or with the shaft thereof, but the respective constructions have proved unsuited for continuous service in that the springs arranged in the manner stated cannot possibly stand the very great incessant changes of the stress to which they are subjected while the pump is in operation. Matters will be perfectly clear if it is borne in mind that the number of these changes of stress amounts annually in average to say about 150 millions, and that, besides, owing to the narrowness of the chamber or chambers enclosing the said springs, the specific stress of the material of which the springs consists must be appropriately great.

Now, all difficulties experienced and all drawbacks met with are overcome completely by my invention, the gist of which resides in the feature that the springs are arranged to extend diametrically from one blade to the diametrically opposite blade. In other words: two diametrically located blades are connected with one another either by a spring common to them both, or by two springs which are connected with one another by an intermediate member, for instance a wire (which may be integral with the two springs), the arrangement being always such that the two blades concerned are connected with one another either by the one spring or by the two springs and their connecting member, this latter constructional form being practically only immaterially different from the other one. The spring is, or the springs are, under a certain tension, generally and preferably tensile stress (although constructional forms are possible in which the springs are subjected to compressive stress) and it is a particular and characteristic, as well as a decisive feature from which depends the lasting efficiency of my improved rotary pump, that the tension of the spring or springs connecting two oppositely located blades with one another remains practically the same irrespective of the position of the two blades in their carrier while this is rotating.

The rotatory carrier need not have only two oppositely located blades, or only one pair of blades respectively; there may be, for instance, two pairs which are located at right angles with respect to one another. I have shown this constructional form by way of example in the accompanying drawing in which Figure 1 is a vertical cross-section through this pump, and Figure 2 a horizontal section through the blade-carrier and two of the oppositely located blades, this figure being drawn to an enlarged scale.

On the drawing *a* denotes the blades which are radially movable in the rotatory blade-carrier *c* which is arranged eccentrically in

known manner in the casing *d*. Two blades located diametrically opposite to one another form a pair. There are two such pairs in the example shown. The blades forming a pair are connected with one another by a spring *b* which consists of two helical parts located within the hollow blades and of a straight connecting member which is integral with the two helical parts, or springs proper respectively. There are provided, in the example shown, three springs *b* for each pair of blades, but there may be less or more than three springs, as desired or required, and depending chiefly upon the axial length of the pump. The springs of the other pair of blades extend, of course, at right angles to those of the first-mentioned pair of blades, but their arrangement relatively to these latter springs is such (Fig. 2) that the straight middle or connecting parts of one set lie midway between the straight or connecting parts of the other set so that the two sets do not in the least interfere with one another.

In view of the fact that the eccentricity of the rotatory blade-carrier relatively to the casing is comparatively slight, the length of any one of the springs *b*, or of two connected springs *b* respectively (pertaining to a pair of blades, as described), does not change considerably, only slightly. In Fig. 1 the eccentricity is somewhat exaggerated intentionally in order to show that even in this case the length of the spring (or springs) located horizontally at the time being, relatively to the length of the springs located vertically at the time being, is very slight, in fact, so slight that it can be practically neglected. It is obvious from this that the tension of the springs changes only very slightly, in fact, extraordinarily slightly. The tension of the springs is so determined that the end-faces of the blades *a* press only slightly upon the inner circumferential wall of the casing, while the blade-carrier is rotating with proper speed, just sufficient to maintain the necessary tightness, the friction being balanced nearly completely by the springs, which are expanded as soon as the rotatory blade-carrier has attained a certain speed.

When the pump is at rest, the blades project either only a little or not at all over the circumference of the blade-carrier, in that they are then retained within this latter by the springs. Also this is a very favorable feature in that a pump of this kind can start very easily as it can start without load which is useful especially in the case of the pump being coupled directly with an electromotor, for instance a motor with short-circuited rotor. The delivery commences only after a certain number of revolutions has been attained and the blade end-faces have come in contact with the inner circumferential surface of the casing. It is obvious that the work of friction is greatly diminished by the arrangement described and by the mode of operation resulting therefrom; the wear and tear of these pumps is extraordinarily small, and the efficiency is exceptionally good. The pumps can run with the same number of revolutions as have normal electro-motors; it is no more necessary to employ slow-speed motors which are considerably more expensive than normal ones.

I claim:

1. A rotary pump, comprising, in combination: a casing; an eccentrically arranged rotatory blade-carrier therein; radially movable blades arranged diametrically opposite to one another in said carrier; and a spring connecting said blades with each other and being adapted to counteract the centrifugal force arising in the said blades while the said carrier rotates.

2. A rotary pump, comprising, in combination: a casing; an eccentrically arranged rotatory blade-carrier therein; radially movable blades arranged diametrically opposite to one another in said carrier; and a helical spring connecting said blades with each other and being adapted to counteract the centrifugal force arising in the said blades while the said carrier rotates.

3. A rotary pump, comprising, in combination: a casing; an eccentrically arranged rotatory blade-carrier therein; radially movable blades arranged diametrically opposite to one another in said carrier; and a spring connecting said blades directly with each other and being adapted to counteract the centrifugal force arising in the said blades while the said carrier rotates.

4. A rotary pump, comprising, in combination: a casing; an eccentrically arranged rotatory blade-carrier therein; radially movable blades arranged diametrically opposite to one another in said carrier; and a tension-spring connecting said blades with each other and being adapted to counteract the centrifugal force arising in the said blades while the said carrier rotates.

5. A rotary pump, comprising, in combination: a casing; an eccentrically arranged rotatory blade-carrier therein; hollow, radially movable blades arranged diametrically opposite to one another in said carrier and being closed at their outer ends and open at their inner ends; springs located in said blades and being each connected at one end with a closed blade-end; and a member connecting the opposite springs with one another at their other ends, the connected springs being adapted to counteract the centrifugal force arising in the said blades while the said carrier rotates.

6. A rotary pump, comprising, in combination: a casing; an eccentrically arranged rotatory blade-carrier therein; pairs of radially movable blades in said carrier, the

blades forming a pair being arranged oppositely to one another; springs connecting the oppositely located blades with one another and being adapted to counteract the centrifugal force arising in the said blades while the said carrier rotates.

7. A rotary pump, comprising, in combination: a casing; an eccentrically arranged rotatory blade-carrier therein; pairs of radially movable blades in said carrier, the blades forming a pair being arranged oppositely to one another; springs connecting the oppositely located blades with one another and being adapted to counteract the centrifugal force arising while the said carrier rotates, the middle portions of the springs pertaining to one pair of blades being located between the middle portions of the springs pertaining to another pair of blades.

8. A rotary pump, comprising, in combination: a casing; an eccentrically arranged rotatory blade-carrier therein; pairs of hollow, radially movable blades in said carrier, the blades being closed at their outer ends and open at their inner ends, and the blades forming a pair being arranged oppositely to one another; springs located in said blades and being each connected at one end with a closed blade-end; and members connecting the opposite springs with one another at their other ends, the connected springs being adapted to counteract the centrifugal force arising while the said carrier rotates, the connecting members of the springs pertaining to one pair of blades being located between the connecting members pertaining to another pair of blades.

In testimony whereof I affix my signature.

OTTO SORGE.