June 14, 1938. E. VOGEL 2,120,914

ELECTROMOTOR

Filed Oct. 4, 1935

Fig. 1

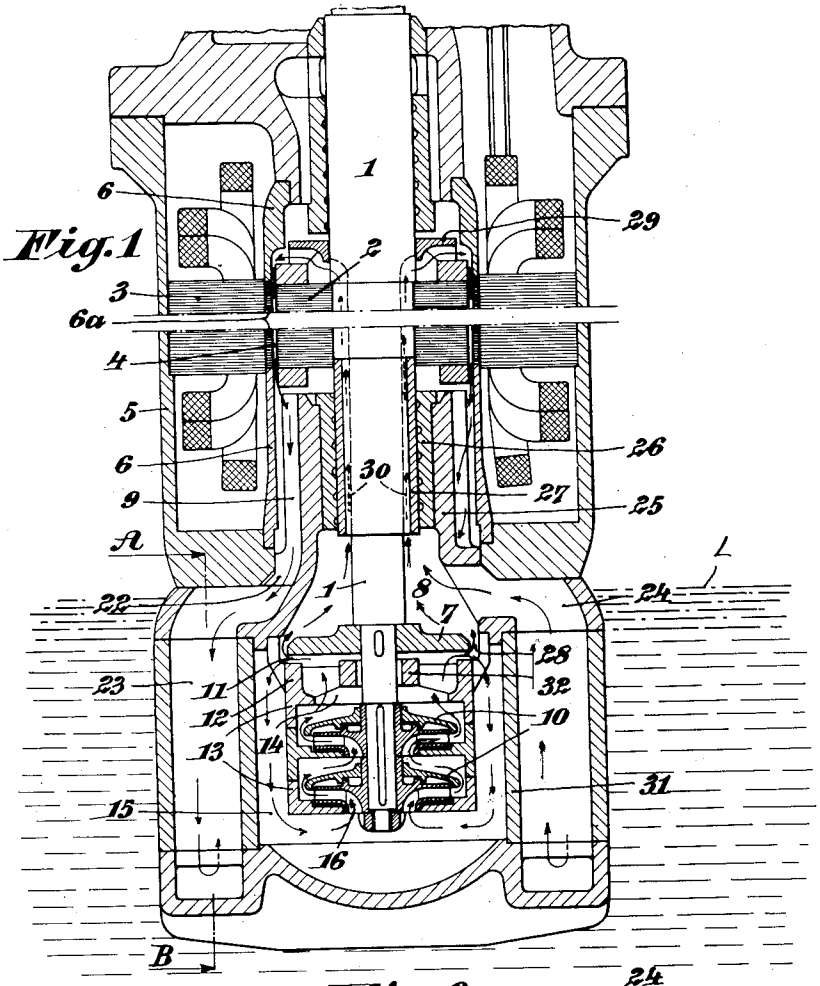
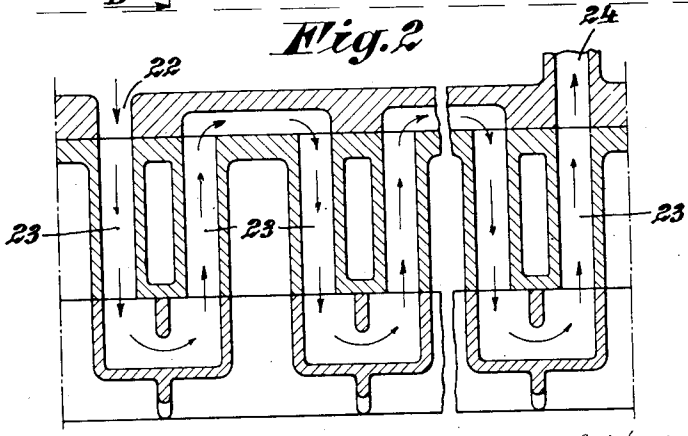


Fig. 2



E. Vogel
INVENTOR

By: Glascock Downing & Seebold
Atty's.

Patented June 14, 1938 2,120,914

UNITED STATES PATENT OFFICE

2,120,914

ELECTROMOTOR

Ernst Vogel, Stockerau, Austria

Application October 4, 1935, Serial No. 43,583
In Austria November 19, 1934

1 Claim. (Cl. 172—36)

In electromotors operating in a liquid in the upright position, the dead weight of the rotor and, in case the motor serves for driving a centrifugal pump, also the dead weight of the rotating parts of this pump and the axial movement have to be compensated for. In the latter event it is known to construct the pump in such a manner, that it produces a hydraulic axial thrust which substantially corresponds in magnitude to the weight but is exerted in the opposite direction. However this axial thrust varies with the different heads of the pump. Further it is known to provide the pump with a relieving plate whereby the weight of the revolving parts is balanced by the upward thrust of liquid pumped against the under side of said plate by the motor. However this relieving device is adapted for use in connection with pure feed-liquid only, because impure or sandy water, when discharged through a small opening underneath the relieving plate, would cause the plate to be worn or otherwise influenced unfavorably.

Compared with the above, the present invention relates to a relieving device for electromotors working in a liquid in an upright position and serving for the operation of any desired device for instance centrifugal pumps. The invention consists in that the relieving plate, known per se, rotates in a liquid which is separated as tightly as possible from the outer liquid and which may be the liquid frequently enclosed in the rotor compartment for instance a lubricant or may be in communication with the same. The relieving plate is arranged below or above the rotor of the electromotor independently of the principal centrifugal pump driven by the motor and the liquid surrounding the plate exerts a pressure underneath the relieving plate by means of a separate pump which is also operated by the electromotor.

The pump driven by the electromotor may be of any convenient type, for instance it may be a rotary piston pump, a centrifugal pump or an automatic suction pump, or if desired a so-called water annulus pump.

The space enclosing the relieving plate and the pump or the chamber, surrounding the said space and closing the cycle of the pressure liquid, is surrounded by the outer liquid and thus is cooled. In particular, a system of pipes for cooling the rotor-liquid is provided and surrounded by the outer liquid.

Also the liquid contained in the rotor compartment and placed in circulation by a feed-device, rotating with the motor-shaft particularly a centrifugal wheel, and passing through the annular gap between stator and rotor is passed through the system of cooling pipes surrounded by the outer liquid.

A constructional example of the invention is illustrated in the drawing, Fig. 1 being an axial section through the motor with relieving and cooling device, while Fig. 2 is the evolution of the section taken on line A—B of Fig. 1.

The rotor 2 of the electric motor is mounted on the shaft 1 and opposite thereto is arranged the stator 3 leaving a gap 4 between itself and the rotor. The stator is enclosed in known manner within the fluid-tight casing 5 and is shielded from the gap by means of the pressure sleeve 6. The top end of the casing is closed by a head, of which only the connection-flange is illustrated and through which the wires pass in a water-tight manner.

According to the invention, the relieving plate 7, secured to the shaft 1 underneath the rotor 2, is arranged in a compartment 8 which is in communication with the rotor compartment 9 containing the rotor 2 in the manner described hereinafter, so that the relieving plate 7 is surrounded by a pure liquid filling this compartment and this pure liquid being separated as completely as the nature of the above mentioned communication permits from the liquid L in which the electric motor is operating.

The rotor-part 10 of a pump, which may if desired be a multi-stage pump and to which the liquid is supplied from below, is mounted on the shaft 1 underneath the relieving plate 7. By means of the pump, the liquid is forced against the bottom face of the relieving plate 7 and then escapes through a very narrow gap 11 between this bottom face and a counter-ring 12. The pressure below the plate 7 adjusts itself automatically by slightly lifting the relieving plate and thus varying the gap in such a manner, that the upward pressure balances the weight of the parts connected with it, such as the shaft 1, so that the relieving plate is kept suspended.

The construction of the arrangement is such, that the relieving plate covers the top of a compartment 14 enclosed by a casing 13 and communicating through the bottom of the compartment at 16 with a space 15 surrounding the compartment. In this arrangement, a portion of the liquid passes from the space 15 through the port 16 to the pump-runner and into the compartment 14, in which it is subjected to pressure, and by way of the narrow gap 11 the liquid is forced into the space 15 again, thus performing

a complete cycle as indicated by the arrows in Fig. 1.

The relieving plate 7 rests on the counter ring 12 when the electromotor and the pump 10 are at a standstill. The relieving plate is not appreciably worn, because the starting of the electromotor only takes a very short time. However in the case of high-power motors when the weight of the parts is great, the relieving plate is preferably prevented from resting on the counter ring 12. It is then advantageous to arrange a ball-bearing or other footstep bearing 32 of non-corroding steel which, if the motor and the pump 10 are at a standstill, keeps open a very small gap 11 (up to approximately 0.1 millimetre) and permits the lift of the relieving plate and shaft and the parts mounted thereon during the operation. This bearing prevents the relieving plate 7 from resting on the counter-ring 12 even if motor and pump 10 operate in the reverse direction, so that in this respect the bearing and the non-return valve represent alternating or supplementary means of serving the same purpose.

The cooling of the circulating inner liquid is of great advantage to the action of the relieving plate 7 and also of the footstep bearing, if provided, as well as of the electromotor.

The considerable amount of heat generated in electromotors of this kind, particularly in electromotors of high-power owing, on the one hand to the electric losses and on the other hand to the frictional contact of the rotating liquid with the walls of the stator and rotor, has to be abstracted for preventing the surpassing of the highest permissible temperature, because the cooling by the liquid L surrounding the electromotor is insufficient.

According to a further feature of the invention the heat of the motor is jointly abstracted with the heat generated by the relieving plate and by any bearings that may be provided.

This cooling action is effected by conducting that portion of the liquid which passes from the rotor-compartment 9 through the channel 22 into a system of cooling pipes 23, which enclose the space 15 preferably in an upright position and through which that portion of the liquid circulates (see also Fig. 2). In these cooling pipes 23 the liquid passes up and down and finally passes through the channel 24 into the compartment 8. The compartments 8 and 9 are separated from each other by a sliding bearing, arranged in the rotor-compartment and comprising a bearing-support 25, brasses 26 and liner 27. The liquid contained in the compartment 8 communicates on the one hand by way of the gap 28 between relieving plate 7 and casing 31 with the space 15 and on the other hand a portion is sucked through sinuous grooves 30 and into the top part of the rotor-compartment in the direction of the arrows, Fig. 1, by means of a feeder rotating with the motor-shaft, preferably by means of a centrifugal pump impeller 29 arranged outside the rotor 2. In this manner the liquid is put in circulation through the annular gap 4, between liner 6a or pressure sleeve 6 and rotor 2, and through the described cooling device by which the heat accumulated by the lubricant is delivered by way of exchange to the liquid L surrounding the electromotor. After leaving the annular gap, the liquid flows into the compartment 9 and from here through the channel 22 to the cooling device 23.

It is practically impossible to perfectly and permanently pack, against the action of the pressure of the liquid surrounding the electromotor, one or more shaft-bearings which are lubricated preferably by a liquid lubricant or consistent grease. In order to remove this drawback, one or more chambers are arranged in front of the space of these shaft-bearings towards the rotor-compartment or towards the outer liquid and the actual connections are established by narrow passages. In this way stuffing boxes are unnecessary and the bearing-lubricant is mixed very slowly only with the liquid in the rotor-compartment or with the outer liquid, so that its lubrication is maintained for a very long time.

If this advantageous arrangement is used in the present invention for the liquid in the rotor-compartment, the result will be that the relieving action caused by the relieving plate 7 remains perfectly effective also if in the case of a longer operation, the inner liquid has mixed with the outer liquid, because the relieving plate (contrary to a thrust-bearing) does not need any liquid lubricant. The footstep bearing is provided solely for the object above mentioned and may be dispensed with.

What I claim is—

In an electric motor, a casing containing a liquid, a stator arranged in said casing, a rotor-shaft also arranged in said casing, a rotor mounted on said rotor-shaft, means operated by said rotor for circulating said liquid through the gap between the rotor and stator, a relieving plate connected with said rotor-shaft, a compartment in said casing below said plate, a pump in said compartment adapted to subject said plate to an upwardly directed liquid pressure, a stop in the casing preventing closure of said compartment by said plate, and means for conducting the portion of said liquid passing through said gap to the vicinity of said pump, said casing being adapted to be arranged in a second liquid and said conducting means being of circuitous form and arranged adjacent the portion of the casing contacting the second liquid.

ERNST VOGEL.