Oct. 27, 1942. J. SAAD 2,299,931

PRESSURE PUMP OF THE ROTATIVE TYPE

Filed May 28, 1941 3 Sheets-Sheet 1

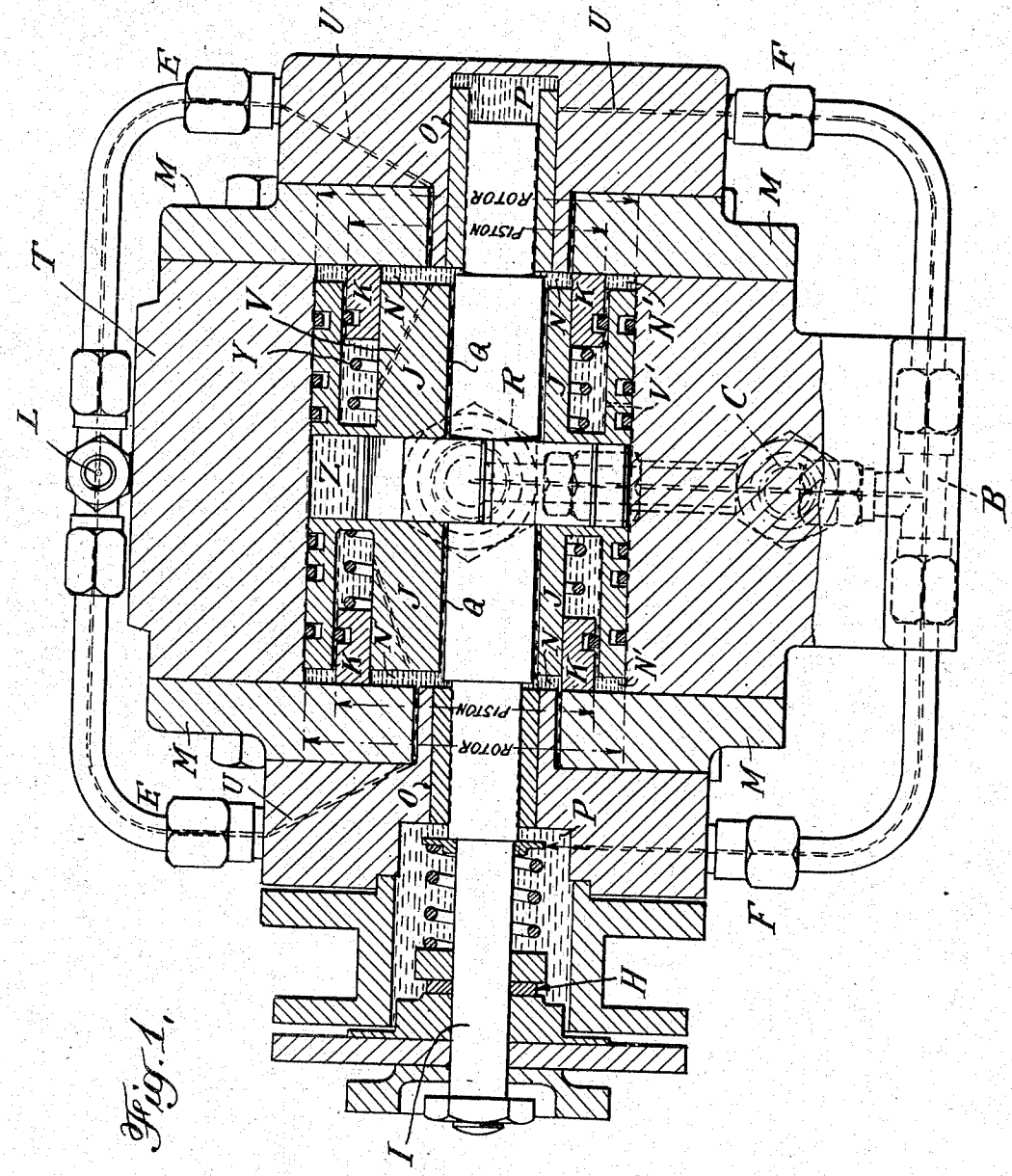


Fig. 1.

INVENTOR
JORGE SAAD

BY
Pennie, Davis, Marvin and Edmonds
ATTORNEYS

Oct. 27, 1942. J. SAAD 2,299,931

PRESSURE PUMP OF THE ROTATIVE TYPE

Filed May 28, 1941 3 Sheets-Sheet 2

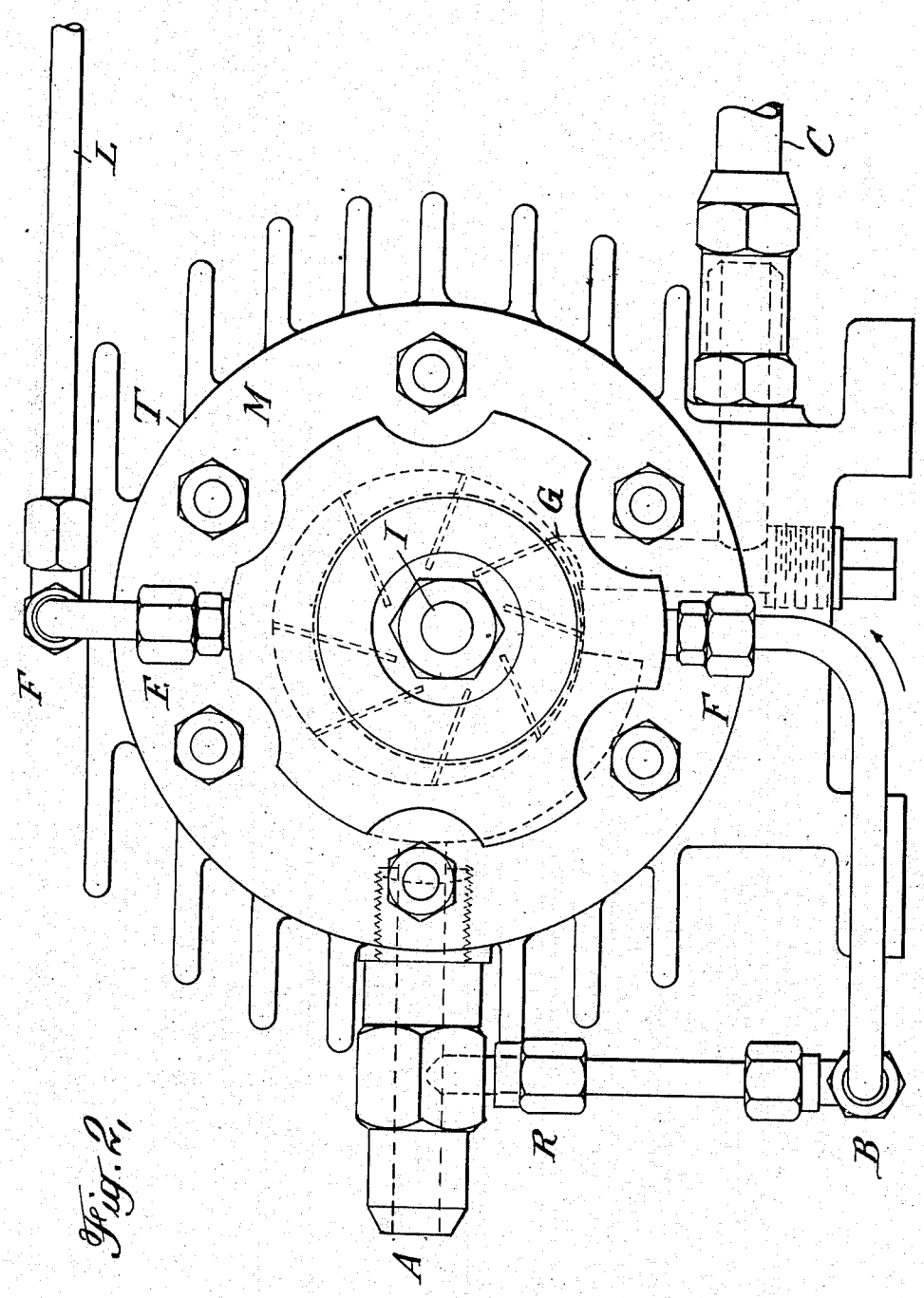


Fig. 2.

INVENTOR
JORGE SAAD
BY
Pennie, Davis, Marvin and Edmonds
ATTORNEYS

Oct. 27, 1942. J. SAAD 2,299,931

PRESSURE PUMP OF THE ROTATIVE TYPE

Filed May 28, 1941 3 Sheets-Sheet 3

Fig. 4.

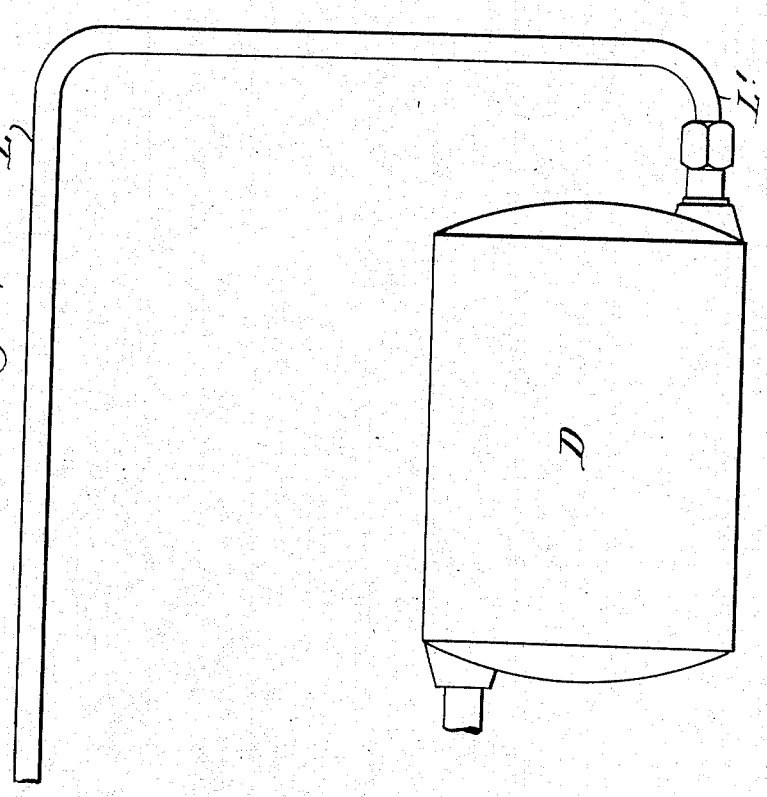
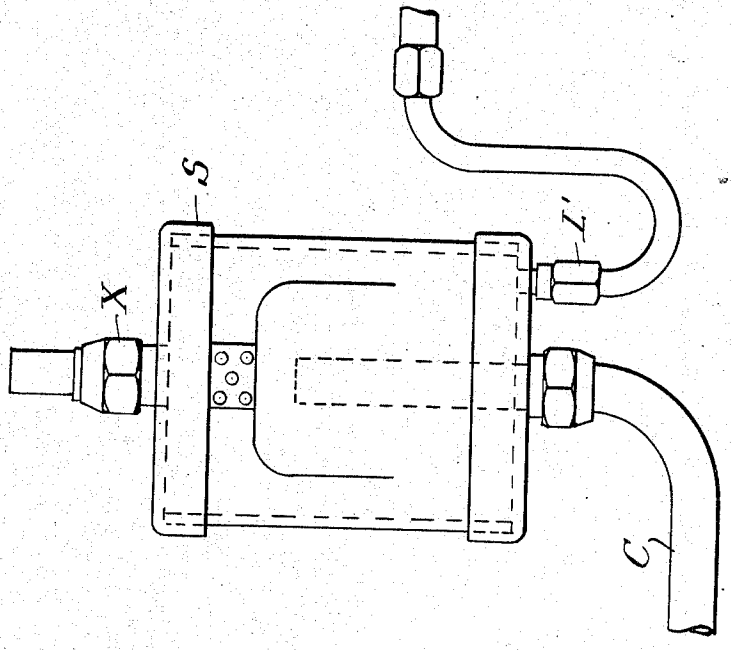


Fig. 3.



INVENTOR
JORGE SAAD

BY
Pennie, Davis, Marvin and Edmonds
ATTORNEYS

Patented Oct. 27, 1942

2,299,931

UNITED STATES PATENT OFFICE

2,299,931

PRESSURE PUMP OF THE ROTATIVE TYPE

Jorge Saad, Rio de Janeiro, Brazil

Application May 28, 1941, Serial No. 395,549
In Brazil July 23, 1940

2 Claims. (Cl. 230—152)

The present invention refers to pressure pumps for the compression of fluids, and more particularly, to rotative pressure pumps of the type referred to in United States Patent No. 2,189,969 of February 13, 1940.

As described in detail in the said United States patent, a pressure pump of that type comprises, broadly speaking, a fixed casing with a central hollow space therein; a rotor mounted in said hollow space in off-center relation therewith and formed with a series of slots regularly arranged along the circumferential periphery thereof, blades slidable in said rotor slots, and floating telescopic pistons mounted over the rotor axle at either side of the rotor and operated by fluid pressure for the endwise sealing of the compression chamber, which latter is thus defined by the circumferential wall of the central hollow space of the fixed casing, the circumferential periphery of the rotor and the end sealing pistons. Due to the off-center relation of the rotor in the said central hollow space and the slidability of the blades in the rotor slots, when the rotor is moved, the blades are constantly moved by centrifugal forces outwardly of their slots and against the wall of the fixed casing, thereby dividing the whole of the compression chamber into a series of smaller cells which vary in volumetric capacity from a maximum at the suction side to a minimum at the point of highest pressure, in this manner providing for the suction and the consequent compression of the fluid to be compressed.

An object of the present invention is to provide an improved cyclic continuous pressure lubricating system for the whole apparatus in which the lubricating oil under compression is also utilized for the purpose of operating the telescopic pistons for the endwise sealing of the compression chamber.

A further object of the invention is to provide an improved mounting system for the rotor axle so devised as to afford freedom of longitudinal expansion and contraction movements of said axle, as, for instance, under temperature variations, and which shall at the same time be adapted to allow the lubricating oil to have ready and positive access to the bearings without loss of compression.

When in the present specification and the appended claims I refer to the lubricating oil or the main fluid, it is to be understood that it is not my purpose to refer to the one or the other as being absolutely pure, but only substantially so, since in practice, as is well known, the oil separators do not succeed in performing a complete and perfect separation, and therefore it may frequently happen that the lubricating oil will carry along a certain percentage of the unseparated main fluid or the latter may frequently carry along a certain percentage of the unseparated lubricating fluid.

The continuous pressure lubrication system according to this invention is effected in cycles in a closed circuit and is broadly characterized as follows: The oil under pressure is discharged from the pipe system at the low pressure or suction side of the apparatus and is carried therefrom, in admixture with the main fluid, into the compression chamber, where it is compressed, together with the main fluid. This compressed mixture of main fluid and lubricating oil then passes from the compression chamber into a section of the pipe system which leads into an oil separator where the lubricating oil is separated from the main fluid, which latter is then led into the respective pipe line, whereas the lubricating oil precipitates and is forced under pressure into a suitable oil reservoir. This oil reservoir is in communication with a section of the pipe system which leads the lubricating oil into the apparatus where, by means of suitably inter-communicating passages in the apparatus, the compressed lubricating oil operates the floating telescopic pistons at either side of the compression chamber so as to force, with predetermined pressure, one of the telescopic elements of each piston against the adjacent end of the rotor and the other telescopic element of the piston against the adjacent cover plate of the apparatus, and at the same time, for lubricating purposes, the oil under pressure passes through the said passages into the bearings and into the space or play left between the end pistons and the axle of the rotor, whereupon the lubricating oil is returned into the compression chamber partly through the said space or play between the rotor axle and the end pistons and partly through passages which lead the oil from the bearings into a section of the pipe system which discharges the oil back again at the suction side of the apparatus, thereby closing the circuit for the lubricating oil under compression and rendering the apparatus ready to re-start a new cycle of oil circulation. The pressure with which the telescopic elements of the end pistons are forced against the respective ends of the rotor and the adjacent cover plates of the apparatus is predetermined in accordance with the pressure of the lubricating oil, which is the same as that of the

main fluid, and the areas of the end pistons in contact, on one side, with the compressed lubricating oil and, on the other side, with the compressed main fluid, in a manner such as to provide for effective endwise sealing of the compression chamber without, however, exercising excessive pressure against the movement of the rotor, all as described in detail in the above-mentioned United States patent.

The mounting system for the rotor axle with free axial expansion and contraction and with pressure lubrication and without loss of lubricant and compressed fluid, comprises mounting the axle on bearings characterized by not offering any fixed obstacles capable of hindering the axial movements of the axle, rendering the bearings and other parts of the axle needing lubrication communicant with the passages provided in the apparatus for the lubricating oil under pressure, and the provision of suitable sealing means arranged in proper cooperation with the bearings.

For the sake of clearness, by way of example only, and without any limitation of the spirit and scope of the invention, the latter will now be described in connection with a preferred embodiment thereof which is illustrated in the accompanying drawings in which:

Fig. 1 is a vertical, central, longitudinal sectional view of an apparatus according to the present invention.

Fig. 2 is an end view of the apparatus of Fig. 1, and

Figs. 3 and 4 illustrate the oil separator and the oil reservoir, respectively, as well as the pipe system which connects the said elements with the apparatus of Fig. 1.

The apparatus, so far as its general construction is concerned, is substantially the same as described in the already mentioned United States Patent No. 2,189,969. It will therefore suffice to give here but a brief description of this part of the apparatus, for the purpose of facilitating a better understanding of the novel part proper which will be described in detail hereafter.

Referring to the drawings, Fig. 1 shows the fixed casing T of the apparatus having a cylindrical bore passing through it. In this bore there is located the slidable blade rotor mounted in off-center relation by means of the axle or shaft I which rotates in the sleeve-type bearings O—O, the said cylindrical bore of the fixed casing being closed at the axial ends thereof by means of end pistons having telescopic sections J—K, and the end cover or head plates M. When the rotor is caused to rotate, the main fluid is drawn in at the suction point A, Fig. 2, the said fluid being then compressed by the rotor in the compression chamber Z, Fig. 1, and once thus compressed, it is discharged into the high pressure pipe system at C, Fig. 2. This is in general outline a brief description of the construction and operation of the apparatus such as disclosed in the above-mentioned United States patent which, of course, in itself, is not claimed in the present invention.

The novel part proper of the invention will now be taken up in somewhat more detail.

According to the invention, in the particular embodiment thereof herein described and illustrated in the drawings, a small chamber N for the lubricating oil under pressure is formed between the telescopic element J of the end poston J—K and the end cover plate M of the fixed casing. Through a passage U, this said chamber N communicates at E with the oil pipe system L which connects the apparatus with the oil reservoir D and through a passage V, the said chamber N communicates with an inner chamber formed in the end piston between the telescopic elements J and K, while a further passage V' renders this said inner chamber of the end piston communicant with the space between the outer periphery of the telescopic element J of the end piston and the fixed casing T of the apparatus, this said space terminating into a second chamber N' around the outer periphery of the other telescopic element K which chamber N' thus surrounds the first-mentioned chamber N. From the chamber N the oil passes also into the space Q between the rotor axle and the end piston, and through this space it reaches the compression chamber Z. From the chamber N the oil reaches also the adjacent bearing O and through the space between the bearing and the journal of the axle it reaches the oil chamber P at the end of the bearing. Through a passage U' the oil from the oil chamber P reaches at F, Fig. 1, the external pipe system, and from F, it is led to a regulation device B, wherefrom the oil flows through the return pipe section R to be discharged at the low pressure or suction point A, Fig. 2, where it is mixed with the main fluid and taken, in admixture therewith, into the compression chamber Z. A section C of the high pressure pipe system communicates the high pressure point G of the apparatus with an oil separator S. A high pressure pipe system X for the main fluid is in communication with the space of the oil separator S which contains the compressed main fluid separated from the lubricating oil, while a section L' of the high pressure pipe system for the lubricating oil communicates the space of the oil separator S which contains the compressed lubricating oil separated from the main fluid, with an oil reservoir D for the lubricating oil under pressure. The main section L of the high pressure pipe system for the lubricating oil communicates the oil reservoir D with the point E admitting the lubricating oil under pressure into the apparatus. A spring Y is arranged within the inner chamber, between the telescopic elements J and K of the end piston, for the purpose of maintaining the said telescopic elements in permanent contact with the adjacent end of the rotor and the adjacent cover plate M of the fixed casing, respectively, so that when the apparatus is started in operation the said telescopic elements shall always be acting against the adjacent rotor end and adjacent cover plate of the fixed casing with a minimum pressure capable of permitting the building up of pressure up to the normal operating pressure of the apparatus. The axle I of the rotor is mounted on bearings O—O of the ordinary type, free from any fixed obstacles which might hinder axial movements of the axle. In the embodiment illustrated in the drawings, the oil chamber P, Fig. 1, adjacent to one end of the axle is closed by means of a fixed covering element, while the oil chamber P adjacent to the other end of the axle is closed by means of a rotary seal H of well-known type which affords effective sealing at the bearings.

The operation of the improved apparatus according to the invention is as follows:

Since the springs Y cause the end telescopic pistons J—K permanently to provide for a sealing action sufficiently effective to create proper suction conditions and to permit the building up of the pressure to normal value independently of any pre-existent fluid or oil pressure in the

apparatus and the pipe system, when the apparatus is set in operation, the main fluid is drawn in at the suction point A, Fig. 2, and will carry in admixture therewith a predetermined volume of oil, discharged at A from the return pipe section R, the amount of which oil is duly controlled by means of the regulation device B. The oil thus carried in admixture with the main fluid reaches the interior of the compression chamber Z where it effects proper lubrication of the rotor and slidable blades. From the high pressure point G in the apparatus, the lubricating oil in admixture with the main fluid flows through the high pressure pipe section C into the oil separator S. In this oil separator, the oil is precipitated and separated from the main fluid and flows, always under pressure, through the pipe section L' into the pressure oil reservoir D, while the main fluid separated from the lubricating oil flows into the high pressure pipe system X for the main fluid. Through the main section L of the oil pipe system, the oil under pressure flows from the oil reservoir D to the point E of admission into the apparatus of the lubricating oil under pressure. From the point E, the oil under pressure flows through the passage U into the chamber N where it forces with predetermined pressure the telescopic element J of the end piston J—K against the adjacent end face of the rotor. From the chamber N, the oil under pressure passes through passage V into the inner chamber formed between the telescopic elements J and K of the end piston, where it forces with predetermined pressure the telescopic element K of the end piston against the adjacent end cover plate M of the apparatus. From this said inner chamber of the end piston, formed between the telescopic elements J and K, the oil passes through the passage V' into the space around the outer periphery of the telescopic element J and filling up this said space finds its way into the second mentioned chamber N' around the outer periphery of the telescopic element K, thereby providing an effective liquid seal against any possible leakage of the main fluid past the piston rings of the end pistons, from the high pressure region of the compression chamber Z back into the low pressure region of the same chamber Z. From the first mentioned chamber N, the oil under pressure flows also through the space Q between the rotor axle I and the end piston, where it lubricates this portion of the axle and finds its way into the compression chamber, where it helps the pressure lubrication of this said chamber. From the said chamber N, the oil under pressure is also given free access into the bearing O, thus providing for pressure lubrication of the said bearing and, filling up the space between the journal and bearing, the oil finds its way into the oil chamber P of the bearing O, adjacent the end of the axle. From the oil chamber P of bearing O, the oil under pressure flows through the passage U' and reaches at F the external pipe system and is led through the latter into the regulation device B, from which point the oil flows into the return pipe section R to be discharged at the suction point A of the apparatus, where the lubricating oil is again mixed with the main fluid and, in admixture with the latter, again drawn into the compression chamber Z, whereupon the circuit of oil under pressure is again closed and the apparatus is again in condition to restart a new cycle of oil circulation.

The axle I of the rotor is freely mounted on the bearings O—O, without any fixed constraint in the axial direction, what constitutes a highly valuable improvement, since the axle I will thus be left entirely free in what concerns its axial movements, and in this manner its movements of axial expansion and contraction can take place with entire freedom under the different temperature conditions during the operation of the apparatus, thereby eliminating a serious difficulty that quite frequently impairs the efficient operation of pressure pumps of this type.

The predetermined pressure with which the telescopic elements J and K of the end piston J—K are forced, respectively, against the adjacent end of the rotor and the adjacent end cover plate of the apparatus, is calculated on a basis of unit pressure of the main fluid, which is the same as that of the lubricating oil, and the surface areas of the telescopic elements in contact, respectively, with the main fluid in the compression chamber Z and the oil under pressure in chamber N and the inner chamber of the end piston between the telescopic elements J and K, this said predetermined pressure being regulated or adjusted so as to give the most effective sealing action obtainable without excessive restraint of the motion of the rotor, in a manner similar to that disclosed in the abovementioned United States Patent No. 2,189,969.

It is to be noted that, since the system of oil circulation according to the present invention takes place in a closed circuit and under pressure, so long as there is no leakage the lubrication will be effective and continuous, depending entirely upon the capacity of the oil separator, which capacity is to be determined according to the purposes for which the apparatus is to be utilized. Therefore, the greater the unit pressure required from the apparatus, the greater will be the unit pressure of the oil in the closed lubrication circuit. Consequently, it is obvious that the apparatus must find itself in a condition of constant equilibrium.

As previously stated, the embodiment of the invention particularly described hereinbefore and illustrated in the accompanying drawings has been given by way of example only, for the sake of clearness, and without any limiting effect as to any changes and alterations as may fall within the spirit and scope of the invention, it thus being understood that the invention is limited only by the appended claims.

I claim:

1. A rotary pressure pump for fluids comprising a casing having a cylindrical bore extending therethrough, head plates at opposite ends of the casing closing the ends of said bore, a rotary shaft passing axially through said bore and eccentrically arranged therein, sleeve-type bearings in which the end portions of said shaft are mounted, a rotor mounted on said shaft, blades carried by the rotor and making contact at their outer ends with the cylindrical wall of said bore, said blades being mounted on the rotor for sliding movement in a generally radial and outward direction, an annular piston disposed between each head plate and the adjacent side wall of the rotors, each piston having telescopic sections adapted to be forced apart axially so that one section bears at its outer end against the corresponding head plate and so that the other section bears at one end directly against the corresponding side wall of the rotor, the cylindrical wall of said bore and the rotor and the opposing walls of the

two pistons forming a compression chamber, said compression chamber having an inlet and an outlet, the section of each piston which bears against a side wall of the rotor forming between its outer end and the adjacent head plate a first oil chamber located adjacent the inner end of one of said bearing sleeves, said telescopic sections of each piston forming between them a second oil chamber, a third oil chamber at the outer end of each bearing sleeve, an oil separator, means for delivering fluid and lubricating oil under pressure from said outlet of the compression chamber to said oil separator, an oil reservoir, the oil separator and oil reservoir being adapted to maintain the oil under pressure, means to deliver oil under pressure from the oil separator to said reservoir, means to deliver oil under pressure from the reservoir to each of said first oil chambers, passages placing said first oil chambers in communication with said second oil chambers, a passage placing each of said second oil chambers in communication with the space between the outer periphery of the corresponding annular piston and the cylindrical wall of said bore, the oil from said first oil chambers having access outwardly through said bearing sleeves to said third oil chambers and also having access inwardly along the shaft to the side walls of the rotor and thence into the compression chamber, and means to conduct oil from said third oil chambers to said inlet of the compression chamber.

2. A pressure pump in accordance with claim 1 in which each of said pistons has a spring located in the oil chamber between the telescopic sections of the piston, said spring acting on said sections to force them apart and to force the inner section with a predetermined pressure into direct contact with the adjacent side wall of the rotor.

JORGE SAAD.