Oct. 12, 1926. 1,603,228

E. WOERNER

OIL PRESSURE PUMP

Filed Dec. 20, 1923 2 Sheets-Sheet 1

Fig. 1

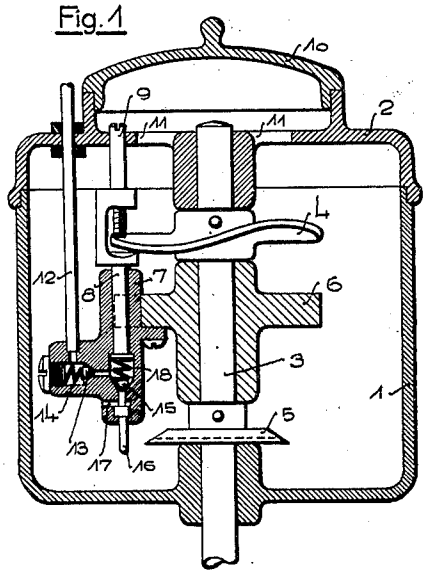


Fig. 2

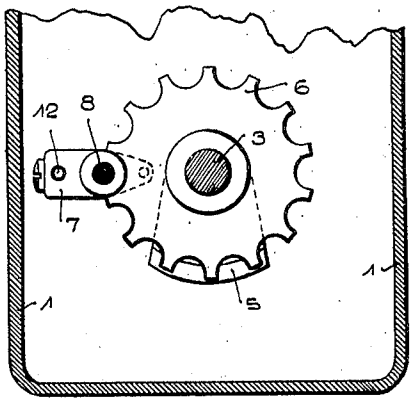


Fig. 3

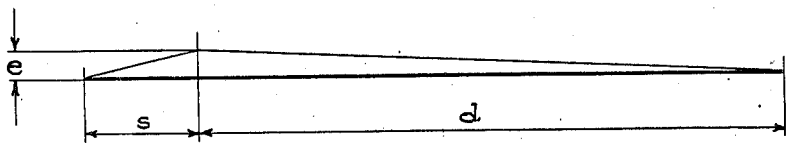
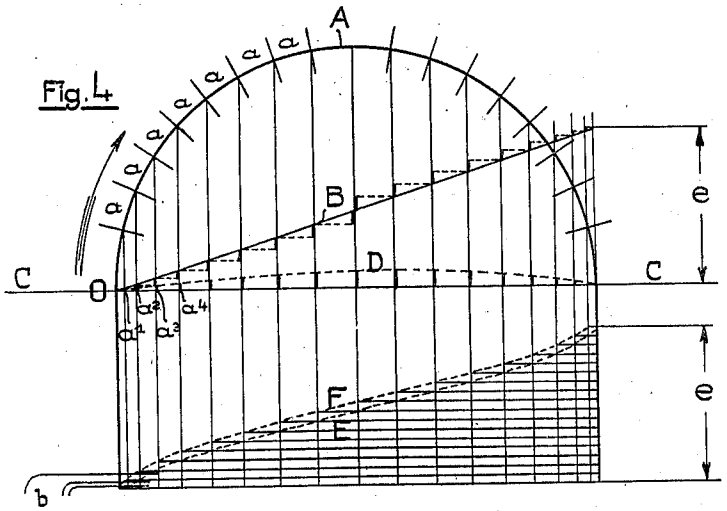


Fig. 4



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Filed Dec. 20, 1923 2 Sheets-Sheet 2

Fig. 5

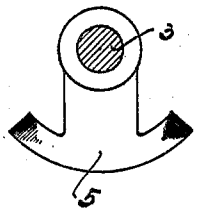


Fig. 6

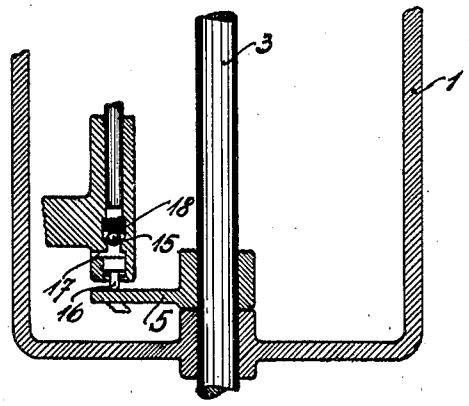
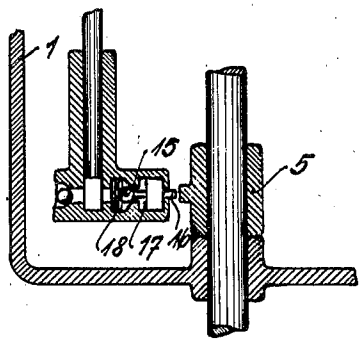


Fig. 7



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UNITED STATES PATENT OFFICE.

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OIL-PRESSURE PUMP.

Application filed December 20, 1923. Serial No. 681,799.

It has become known to drive in oil pumps by an inclined disk, all the pistons being arranged in a circle. No uniform oil delivery is obtained by a pressure stroke over equal circumferential parts of the inclined disk which revolves with uniform speed. A uniform delivery is however very important as only in this case the lubricating can be most economical and at the same time very effective. An inclined disk presents further the inconvenience that suction stroke and pressure stroke are necessarily equal. One half of each revolution of the driving disk is therefore lost for the delivery or for the uniformity of the same.

According to this invention in order to avoid the first mentioned inconvenience of the inclined disk the driving disk is of such a shape that the part of its circumference which produces the pressure stroke forms a helical line. With a view to avoid the second mentioned inconvenience the part of the driving disk which corresponds with the suction stroke and which is ascending and preferably forms also a helical line is shorter and steeper than the descending part which corresponds with the pressure stroke.

The helical line shaped construction of the driving element for pump pistons, on said part of the circumference of the driving element which corresponds to the pressure stroke as well as on the part corresponding to the suction stroke, is known, but only for pumps of another type. The use of the helical line shaped construction of the driving element in pumps of the type in question means, however, for these pumps, a considerable progress as mentioned above and as will be further explained at the end of the specification.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming a part of this specification, with the understanding that while on the drawings one embodiment of the invention is disclosed, the invention is not confined to any strict conformity with the showing of the drawings, but may be embodied in any manner which does not make a material departure from the salient features of the invention.

In the drawings:—

Fig. 1 is a longitudinal section, and

Fig. 2 is a cross section showing the improved driving disk.

Fig. 3 is a development of the driving disk.

Fig. 4 illustrates the evolution and peculiarity of the improved driving disk compared with the inclined disk.

Fig. 5 shows in plan view the cam for operating the valve.

Fig. 6 shows the cam and a valve in vertical section.

Fig. 7 shows in vertical section a modified construction of the valve operating means.

The driving shaft 3 is journaled in the bottom of the casing 1 and in the top plate 2 of the same. On this shaft 3 the driving disk 4 and the cam 5 for the inlet valves of the pump are keyed. The pump bodies 7 arranged in a circle around the driving shaft are mounted on a supporting ring 6 which is loosely mounted on the driving shaft. The pump pistons 8 engage in the well known manner, by means of a projection similar to a crank shaft, over the driving disk 4 and rest upon the latter through the intermediary of adjusting screws 9 which are guided in the lid 2 of the casing and which are designed to determine the piston stroke. The oil is admitted into the casing 1 through the hood 10 and the aperture 11 of the lid 2 and it flows through the passages 17 under the suction valves 15 and pressure springs 18 to flow out of the pump bodies through the pressure valves 13 with pressure springs 14 and the pressure pipes 12. These pressure pipes which are secured at the upper ends in the lid of the casing serves, together with the adjusting screws 9 which engage with the lid, to secure the whole pump body including the supporting ring 6 against rotation on the driving shaft. The suction valves 15 are controlled in a reliable manner by the cam 5 during the suction stroke, but this control may be omitted.

As can be seen from Figs. 1 and 3 the suction stroke takes place, when the shaft is rotating, only over a short part s of the total circumference of the driving disk 4, the remaining part d of the circumference of said disk being at disposal for the pressure stroke. The cam 5 is mounted on the driving shaft with regard to the driving wheel 4 in such a position and it is of such

a width that it opens or maintains open the inlet valves only during the suction stroke. It acts through the intermediary of tappets 16 on several inlet valves or pump cylinders at the same time.

In Fig. 4 the semi-circle A represents the circumference of a driving disk (inclined disk or driving disk according to the invention) which is divided into equal sections *a*. If the line B is the front elevation of the working rim of the inclined disk and if a point of the circumference of this disk moves, at the rotation of the disk, successively over the sections *a* of the circumference of said disk in the direction of the arrow, the total stroke of said point, counted from the starting point O of the movement, will correspond to the ordinates erected at the end points of the perpendiculars at the ends of the sections *a* on the axis of abscissæ C and reaching up to line B. The differences a', a^2, a^3 of these ordinates indicate that the piston stroke is not uniform over the several uniform sections *a* of the circumference of the inclined disk but extends along a sine-line D.

Example: At a stroke extending over 300° of the circumference of the wheel similar quantities of oil have to be delivered for every 30° or for equal center angles. In the oil pump described this is obtained by making the heights of the stroke for the first 30° and for all the following 30°, e. g. for all angles, accurately equal, e. g. a^1, a^2, a^3 and so forth are of the same height whereby the delivery of an equal quantity of oil is ensured.

The quantities of lubricant delivered during the several sections of the entire pressure stroke *e* are therefore unequal. If however, in order to attain a uniform pressure stroke over every section *a* of the circumference always the same stroke difference *b* is traced on the next following ordinate a curve E is obtained which represents a helical line according to which the new driving element is shaped. In this case the pressure stroke is equally great over all its time sections and the quantity delivered is absolutely uniform during the pressure stroke. A curve F laid through the end points of the corresponding ordinate-differences shows the steady, uniform acceleration of the pistons in contradistinction to the irregular line of acceleration D of the inclined disk. The helical elevation line E corresponds to the straight lined progress of the working surface in the development in Fig. 3, but in opposition to the latter it is supposed in Fig. 4 that the suction stroke of the driving disk and the pressure stroke extend each over one half of the circumference of the disk. If the suction stroke is selected shorter and steeper a much more uniform distribution of the oil delivery results with regard to the entire circumference.

The inlet valves may be arranged so that they open in horizontal position. Instead of the cam 5 shown in the drawing a radially acting element of convenient construction is used in this case as shown in Fig. 7.

I claim:—

1. An oil pump comprising in combination pump cylinders arranged in a circle, pistons in said cylinders, and a common driving disk the part of the circumference of said driving disk which corresponds with the pressure stroke presenting the form of a helical line.

2. An oil pump comprising in combination pump cylinders arranged in a circle, pistons in said cylinders, and a common driving disk the part of the circumference of said driving disk which corresponds with the pressure stroke presenting the form of a helical line and that part which corresponds with the suction stroke and which is ascending extending preferably also in a helical line but being shorter and steeper than the descending part which corresponds with the pressure stroke.

3. An oil pump of the type described comprising in combination a pump cylinder, pistons arranged in a circle, a common disk for operating said pistons the descending part of the circumference of said disk which corresponds with the pressure stroke being in the shape of the helical line and the descending part of the circumference of said disk which corresponds with the suction stroke being also in the shape of a helical line but shorter and steeper than the descending part, and positively controlled spring loaded valves for controlling the admission of lubricant into the pump cylinder, and valves for controlling the outflow of lubricant from the pump cylinder.

4. An oil pump of the type described comprising in combination a pump cylinder, pistons arranged in a circle, a common disk for operating said pistons the descending part of the circumference of said disk which corresponds with the pressure stroke being in the shape of the helical line and the descending part of the circumference of said disk which corresponds with the suction stroke being also in the shape of a helical line but shorter and steeper than the descending part, positively controlled spring loaded valves for controlling the admission of lubricant into the pump cylinder, and valves for controlling the outflow of lubricant from the pump cylinder, a driving shaft, a cam disk rotating with said driving shaft, and a segment of said cam disk designed to control the inlet valves and situated in the area of the suction stroke of the pistons.

In testimony whereof I affix my signature.

EUGEN WOERNER.