May 4, 1937. H. H. STINNES 2,079,050

MACHINE WITH SWASH RING DRIVE

Filed Jan. 2, 1936 3 Sheets-Sheet 1

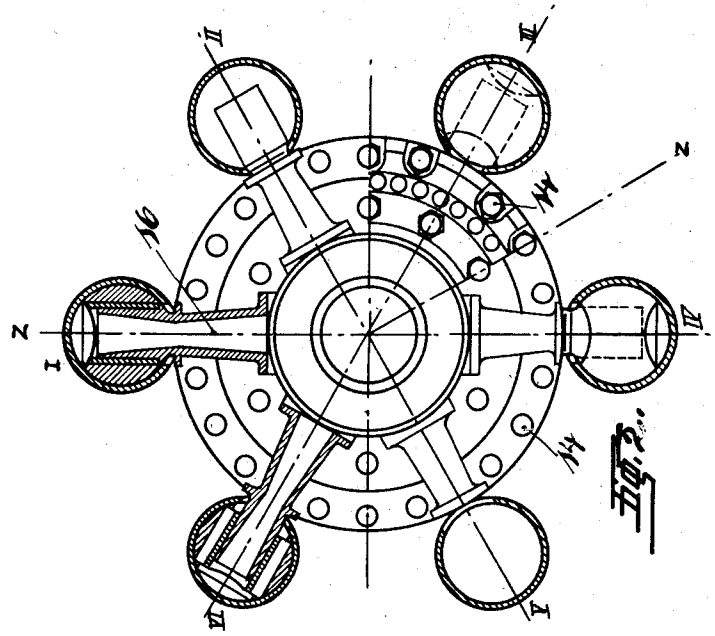


Fig. 2.

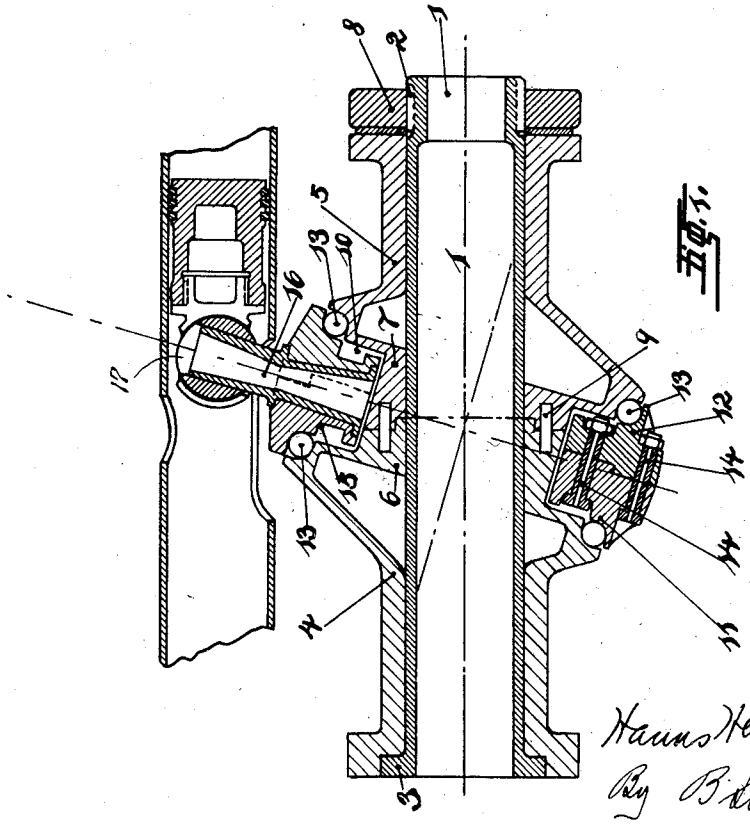


Fig. 1.

Inventor
Hans Heinz Stinnes
By Blinger, atty.

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MACHINE WITH SWASH RING DRIVE

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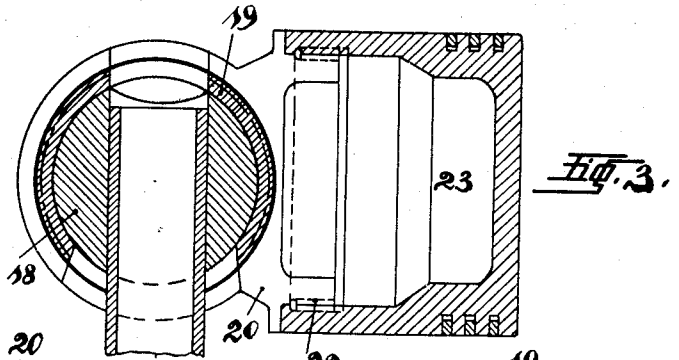


Fig. 3.

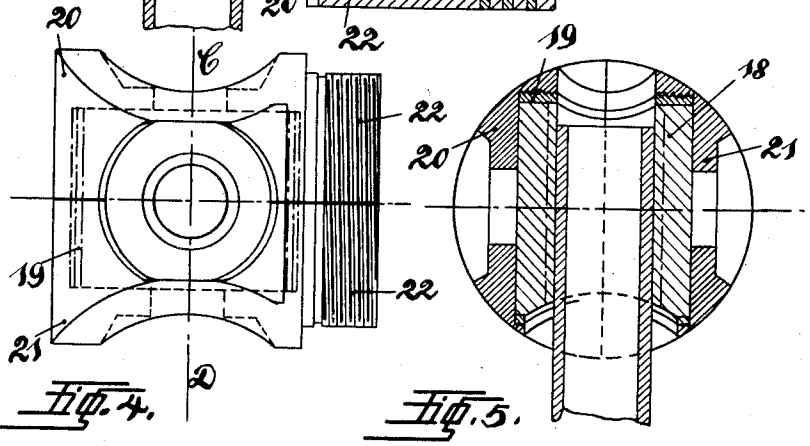


Fig. 4. Fig. 5.

Fig. 7.

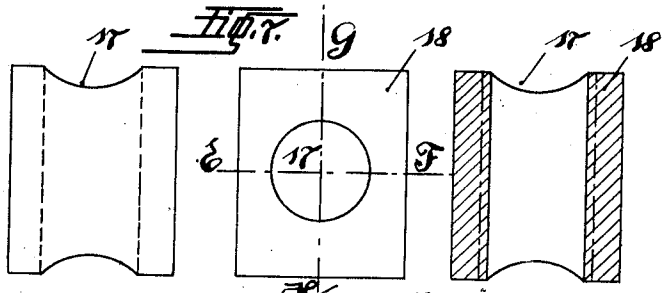


Fig. 6. Fig. 8.

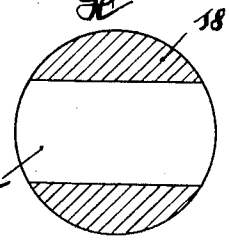


Fig. 9.

Inventor
Hanns Heinz Stinnes
By B. Singer, atty.

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MACHINE WITH SWASH RING DRIVE

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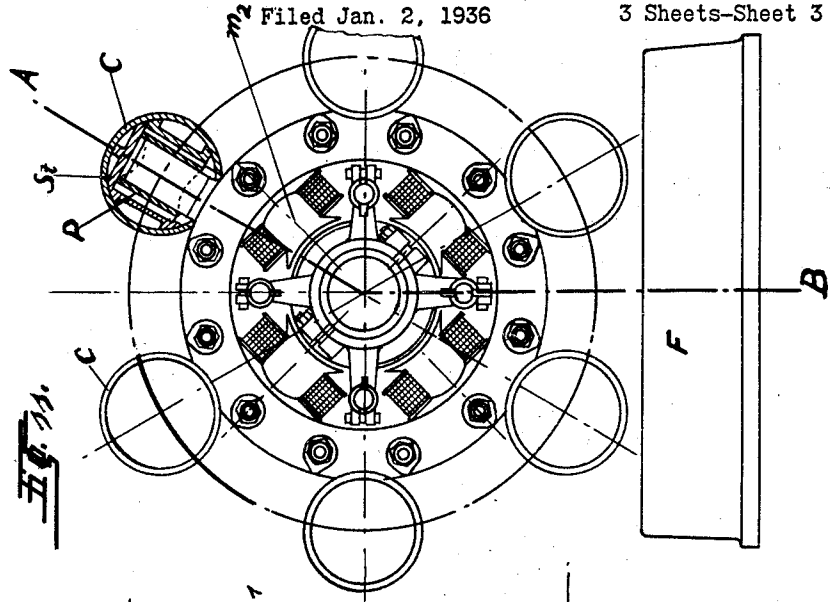


Fig. 11.

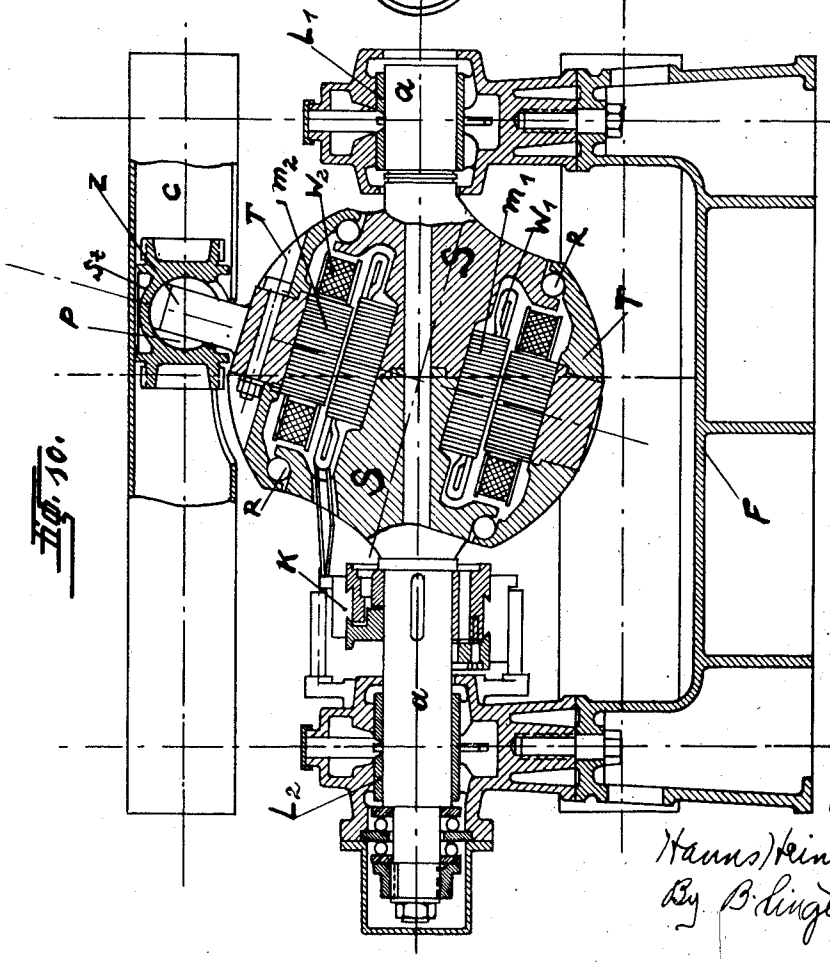


Fig. 10.

Inventor
Hanns Heinz Stinnes
By B. Singer, atty.

Patented May 4, 1937 2,079,050

UNITED STATES PATENT OFFICE

2,079,050

MACHINE WITH SWASH RING DRIVE

Hanns Heinz Stinnes, Berlin, Germany

Application January 2, 1936, Serial No. 57,288
In Germany January 4, 1935

12 Claims. (Cl. 171—252)

The employment of a swash ring drive for translation of a rotation into an oscillatory movement and vice versa is advantageous because of the small space required. This invention presents an improvement in a swash ring drive by simplification in structure of the individual parts, whereby the further advantage is also obtained that the incorporation of such mechanism for other purposes of services, for example for electric generators or electric motors, is improved and simplified.

The field of employment of swash ring drives is thereby enlarged and improved. For this purpose, in the individual parts of the drive, the swash disc which is secured to the shaft, and the ring which is mounted on the disc, are divided obliquely to the shaft axis, and the piston is divided in the longitudinal direction.

By division of the swash disc, each of the pieces of the swash disc can be directly united with the adjacent shaft stumps, whereby the simplicity and strength can be increased and the weight reduced.

By division of the ring the production thereof is improved and as forgings and pressings the pieces make it possible to employ good material and to provide holes for reducing the weight thereof. By means of the holes in the swash disc and ring the furnishing thereof with windings, bobbins, magnets and so forth is simplified and therefore the possibility of construction as an electro-magnetic machine is presented.

The division of the piston gives a closed piston form which permits the maximum lateral movement for the stud guide and improved qualities of strength for the piston.

In the drawings:

Figure 1 is a view in longitudinal section of a machine with swash ring drive with six cylinders of which only one is shown, taken on a line corresponding with line Z—Z of Figure 2.

Figure 2 is a view in cross-section taken through the stud centre line of the machine with six cylinders, the ring and swash disc being however shown in projective elevation, and the guide in the cylinder for the piston being shown in different elevations and sections.

Figure 3 is a plan view, looking down on the inner surface in the plane of division, of the half piston with the piston ring carrier arranged in front.

Figure 4 is an elevation of a portion of the piston turned 90 degrees relative to Figure 3.

Figure 5 is a view in section taken on line C—D of Figure 4.

Figure 6 is a front elevation of the swivel block.

Figure 7 is a plan view of the same.

Figure 8 is a view in section of the swivel block taken on line E—F of Figure 7.

Figure 9 is a view in section taken on line G—H of Figure 7.

Figure 10 is a view in longitudinal section of an electromagnetic machine with swash ring drive and with six cylinders of which only one is shown, taken on a line corresponding with the line A—B of Figure 11.

Figure 11 is a side view of the machine according to Figure 10 regarded from the collector brushes, showing a projective elevation of the magnet bobbins and the swash ring and showing an elevation of the six cylinders and a section taken at one cylinder through one stud guide with lateral movement.

Referring to the drawings, in the construction according to Figures 1 and 2, the hollow shaft 1 has at one end a male screw-thread 2 and at the other end a flange 3. The hollow shaft stumps 4 and 5 are mounted on the hollow shaft 1 together with swash plate halves 6 and 7 which belong to and are integral with them and, together with their shaft stumps are clamped tightly together by means of a nut 8. The said halves 6 and 7 are so connected together by shear tubes 9 that a rotary displacement of the two swash ring halves relative to each other, which would bring the bearing surfaces for the ring out of parallel position is prevented. A solid shaft can project into the hollow shaft 1 and be journalled in bearings, or the hollow shaft stumps 4 and 5 can be journalled in bearings, and the external connection of the hollow shaft can also be made in any desired manner, either directly or through a shaft lying therein and so forth.

In a recess 10 of the swash disc halves 6 and 7 there is the swash ring composed of two parts 11 and 12 and mounted on balls 13, the two parts being held together by screw bolts 14. The division extends through the surface of the ring so that there are two complete half rings with recesses 15. The studs 16 are accommodated by radial recesses and are held by flanges at the outer and inner surfaces of the ring.

The studs 16 engage the hole 17 of the swivel blocks 18 form of which can be ascertained from Figures 6 to 9. The swivel blocks 18 have the broad section if no lateral movement of the studs 16 is necessary, according to the Figures 5, 7 and 8. If a lateral movement of the studs 16 is wanted the hole 17 is made of a larger bore so as to leave a clearance between stud 16 and the wall of the swivel block 18 sufficient to obtain the desired movement; swivel blocks sit in swivel block bushes 19 by means of which the halves 20 and 21 of the connecting rod extension provided with female screw-threads, are screwed together at right angles to the plane of division. The piston halves, besides with the aid of the bushes can be held together by casting in of

metal, pressing in, shrinking on, or by bayonet connection or in any other way. Each piston half is provided with a screw-thread 22 on to which is screwed the front piece 23. When assembling, the swivel block 18 is first pushed into the bush 19, after the piston halves 20 and 21 have been screwed together, the front piece 23 is screwed on and the swivel block 18 then sits in a completely closed piston structure.

The studs or bolts 16 are guided linearly at two optionally chosen but diametrically opposed places of the ring periphery. Figure 2 shows these two places at the uppermost cylinder (I) and undermost cylinder IV. All intermediately lying studs must be guided with lateral clearance in order to be able to carry out the lemniscatic cross-movements of the stud and swivel blocks, which can be seen in the sectional view of the cylinder VI. The cylinder II shown in section discloses only the stud without piston and swivel block. In the part sectional view of the cylinder III the cylinder and swash ring are seen after removal of the segment of the swash shaft. Cylinder IV shows a rear view of the piston and the cut cylinder, and at cylinder V the stud, swivel block and piston have been omitted.

In the construction according to Figures 10 and 11, the two swash disc halves S are held together by a central draw armature. Both shaft stumps *a* are formed as swash disc halves S which have cavities for the accommodation of the electromagnets M', and the winding W'. This is connected in known manner to the commutator K. Only one place of connection is shown in the drawings. The shaft stump *a* lies at one side in a bearing L1 and at the other side in a bearing L2 and the bearings are seated in the bed F.

The swash ring T lies over the swash disc shaft S and performs the function of the stator of an electric machine. Magnets M2 with windings W2 are mounted in the inner periphery of the ring in recesses provided in the inner side of the same. They act as field magnets to produce the electro-magnetic field of force in which the hereinbefore described swash disc armature S rotates when current is supplied to it and the field magnets M2 of the swash ring.

The swash ring T is mounted on the swash disc S by means of balls. The swash ring T carries at its outer periphery the studs Z on which the swivel blocks P are seated. These are swiveled in the pistons S*t*. The pistons move to and fro in the cylinders C when the swash disc S is rotated and it thereby sets the swash ring T in a to-and-fro swinging motion.

One or two opposed studs Z are rigidly guided by the swivel blocks P in the sockets of the pistons S*t* and thereby in the cylinders C. The swivel blocks P connected to the other studs have lateral clearance to permit the lemniscatic curviform movement to take place.

Front pieces can be provided on the pistons S*t* to suit each particular case, according to what work the pistons shall do, whether pumping, pressing, stamping, sucking or bricketing or any other work, and be formed according to the particular requirement. As shown in Figure 10 the pistons can be provided with projections at both sides in order to operate as a double-acting power machine, pump, or other double-acting machine.

If for example the cylinders C are those of a power machine, the pressure acts through the pistons S*t*, swivel blocks P and studs Z on the swash ring T. This is set by the pressure in a to-and-fro swinging swash motion and thereby rotation of the swash disc armature S mounted in it.

By known and suitable connection in series or shunt and with self or external excitation, electric energy can thereby be generated in the winding W of the swash disc armature S on their passage through the electro-magnetic field of force of the magnets M2 of the swash ring, and thus energy can be drawn upon at the commutator K.

It is thus possible in one and the same machine to convert reciprocatory motions through rotary motions into electric energy, or electric energy through rotary motions into reciprocatory motions.

Having now declared and ascertained the nature of my said invention I declare that what I claim is:

1. A machine including a rotary shaft carrying a rigidly mounted inclined body, a non-rotatable ring supported around the periphery of said body, to lie in a plane inclined to the shaft, reciprocally mounted members, studs carried by said ring to engage said members, whereby rotation of said shaft will impart reciprocation to said members and vice versa, said inclined body being split in a plane at right angles to said shaft and said ring and its studs being split symmetrically in a plane which includes the axes of all said studs, and means to secure the parts of said body together, and means to secure the parts of said ring together.

2. A machine including a rotary shaft carrying a rigidly mounted inclined body, a non-rotatable ring supported around the periphery of said body, to lie in a plane inclined to the shaft, reciprocally mounted members, studs carried by said ring to engage said members, whereby rotation of said shaft will impart reciprocation to said members and vice versa, said inclined body being split in a plane at right angles to said shaft and said ring and its studs being split symmetrically in a plane which includes the axes of all said studs, means to secure the parts of said body together, means to secure the parts of said ring together, said body and said ring having oppositely disposed recesses, and cooperative means in said recesses for influencing the relation of the ring to the body.

3. A machine including a rotary shaft carrying a rigidly mounted inclined body, a non-rotatable ring supported around the periphery of said body, to lie in a plane inclined to the shaft, reciprocally mounted members, studs carried by said ring to engage said members, whereby rotation of said shaft will impart reciprocation to said members and vice versa, said inclined body being split in a plane at right angles to said shaft and said ring and its studs being split symmetrically in a plane which includes the axes of all said studs, means to secure the parts of said body together, means to secure the parts of said ring together, said body and said ring having oppositely disposed recesses, and cooperative means in said recesses for influencing the relation of the ring to the body, said influencing means comprising electro-magnets.

4. A machine comprising a rotating body formed in halves, stub shafts formed with the halves of said body, means to secure said halves of the body together, said body having a peripheral surface which is inclined to the axis of the body and its stub shafts, a non-rotatable swash ring mounted on said peripheral surface,

said body being rotatably located in said ring, at least one stud-like member radiating from the periphery of said ring, and a reciprocally mounted piston into which said stud-like member projects.

5. A machine comprising a rotating body formed in halves, stub shafts formed with the halves of said body, means to secure said halves of the body together, said body having a peripheral surface which is inclined to the axis of the body and its stub shafts, a non-rotatable swash ring mounted on said peripheral surface, said body being rotatably located in said ring, at least one stud-like member radiating from the periphery of said ring, a reciprocally mounted piston into which said stud-like member projects, said ring being split in a plane which includes the axes of all stud-like members, and means to secure the parts of said ring together.

6. A machine comprising a rotating body formed in halves, stub shafts formed with the halves of said body, means to secure said halves of the body together, said body having a peripheral surface which is inclined to the axis of the body and its stud shafts, a non-rotatable swash ring mounted on said peripheral surface, said body being rotatably located in said ring, at least one stud-like member radiating from the periphery of said ring, a reciprocally mounted piston into which said stud-like member projects, said ring being split in a plane which includes the axes of the stud-like member, means to secure the parts of said ring together, said ring having recesses between the halves thereof in which the stud-like member is held, the stud-like member having a flange to restrain movement thereof along its longitudinal axes.

7. A machine comprising a rotating body formed in halves, stub shafts formed with the halves of said body, means to secure said halves of the body together, said body having a peripheral surface which is inclined to the axis of the body and its stub shafts, a non-rotatable swash ring mounted on said peripheral surface, said body being rotatably located in said ring, at least one stud-like member radiating from the periphery of said ring, a reciprocally mounted piston into which said stud-like member projects, said piston being longitudinally divided, a swivel block held between the divided parts of said piston in which block said stud-like member has bearing, and means to hold the parts of said piston together.

8. A machine comprising a rotating body formed in halves, stub shafts formed with the halves of said body, means to secure said halves of the body together, said body having a peripheral surface which is inclined to the axis of the body and its stub shafts, a non-rotatable swash ring mounted on said peripheral surface, said body being rotatably located in said ring, at least one stud-like member radiating from the periphery of said ring, a reciprocally mounted piston into which said stud-like member projects, said piston being longitudinally divided, a swivel block held between the divided parts of said piston in which block said stud-like member has bearing, means to hold the parts of said piston together, said last named means including a front piece having provisions to receive similar portions of the piston halves.

9. A machine comprising a rotating body formed in halves, stub shafts formed with the halves of said body, means to secure said halves of the body together, said body having a peripheral surface which is inclined to the axis of the body and its stub shafts, a non-rotatable swash ring mounted on said peripheral surface, said body being rotatably located in said ring, at least one stud-like member radiating from the periphery of said ring, a reciprocally mounted piston into which said stud-like member projects, said piston being longitudinally divided, a swivel block held between the divided parts of said piston in which block said stud-like member has bearing, means to hold the parts of said piston together, and said last named means including a threaded swivel block bush onto the ends of which the halves of said piston are screwed.

10. A machine comprising a rotating body formed in halves, stub shafts formed with the halves of said body, means to secure said halves of the body together, said body having a peripheral surface which is inclined to the axis of the body and its stub shafts, a non-rotatable swash ring mounted on said peripheral surface, said body being rotatably located in said ring, at least one stud-like member radiating from the periphery of said ring, a reciprocally mounted piston into which said stud-like member projects, said piston being longitudinally divided, a swivel block held between the divided parts of said piston in which block said stud-like member has bearing, means to hold the parts of said piston together, said last named means including a threaded swivel block bush onto the ends of which the halves of said piston are screwed, the piston halves having projections, and a front piece constructed to fit over said projections and secure the piston halves together.

11. A machine comprising a rotating body formed in halves, stub shafts formed with the halves of said body, means to secure said halves of the body together, said body having a peripheral surface which is inclined to the axis of the body and its stub shafts, a non-rotatable swash ring mounted on said peripheral surface, said body being rotatably located in said ring, at least one stud-like member radiating from the periphery of said ring, a reciprocally mounted piston into which said stud-like member projects, said piston being longitudinally divided, a swivel block held between the divided parts of said piston in which block said stud-like member has bearing, means to hold the parts of said piston together and including a swivel block bush, and said swivel block bush lying crosswise to the plane of division of the piston.

12. A machine comprising a rotating body formed in halves, stub shafts formed with the halves of said body, means to secure said halves of the body together, said body having a peripheral surface which is inclined to the axis of the body and its stub shafts, a non-rotatable swash ring mounted on said peripheral surface, said body being rotatably located in said ring, at least one stud-like member radiating from the periphery of said ring, and a reciprocally mounted piston into which said stud-like member projects, said means to secure the halves of the body together comprising a hollow tensioning member within the stub shafts having means for drawing the halves of the body together.

HANNS HEINZ STINNES.