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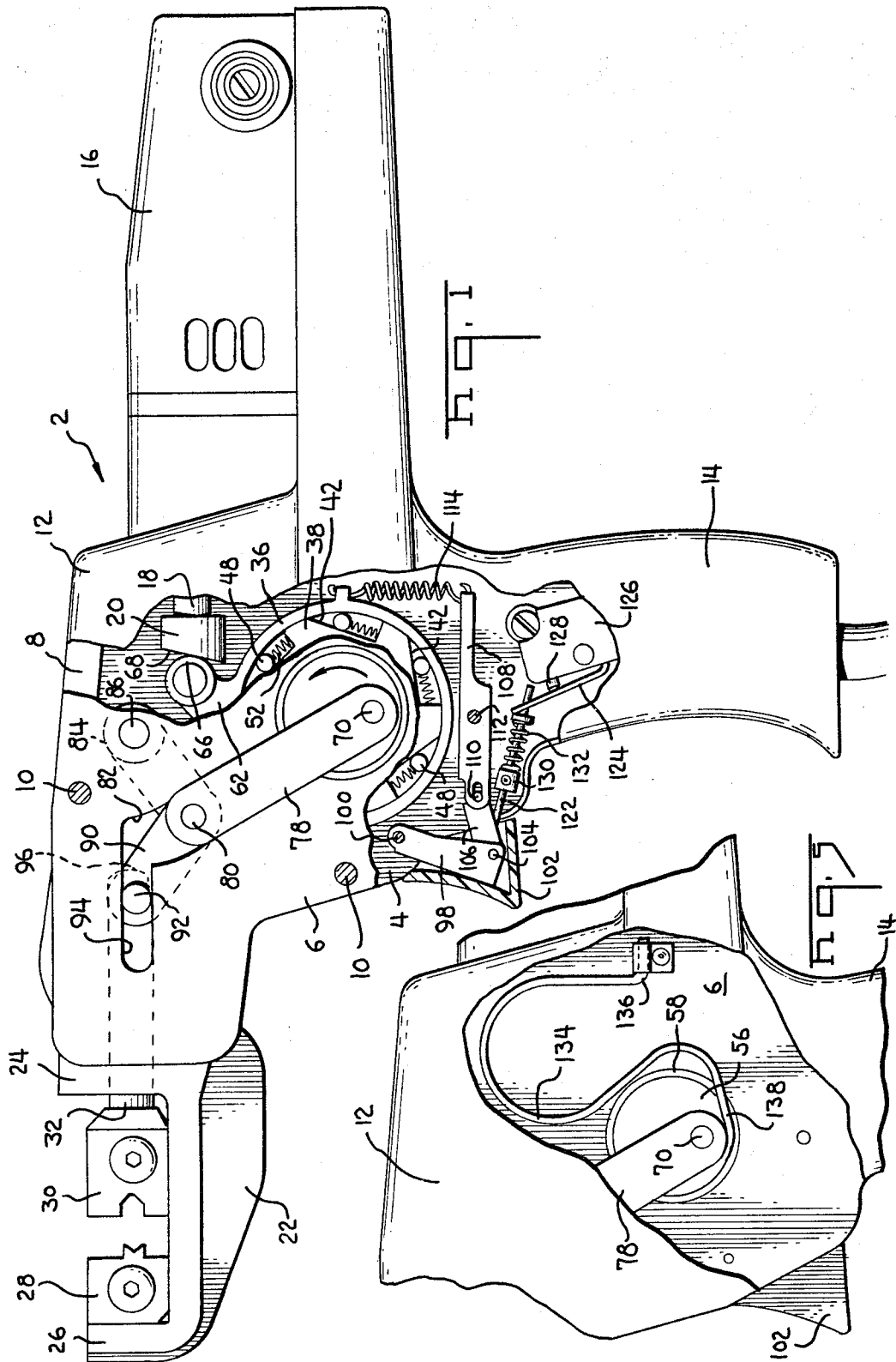
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ELECTRIC HANDTOOL OR PRESS

Filed May 11, 1966

2 Sheets-Sheet 1



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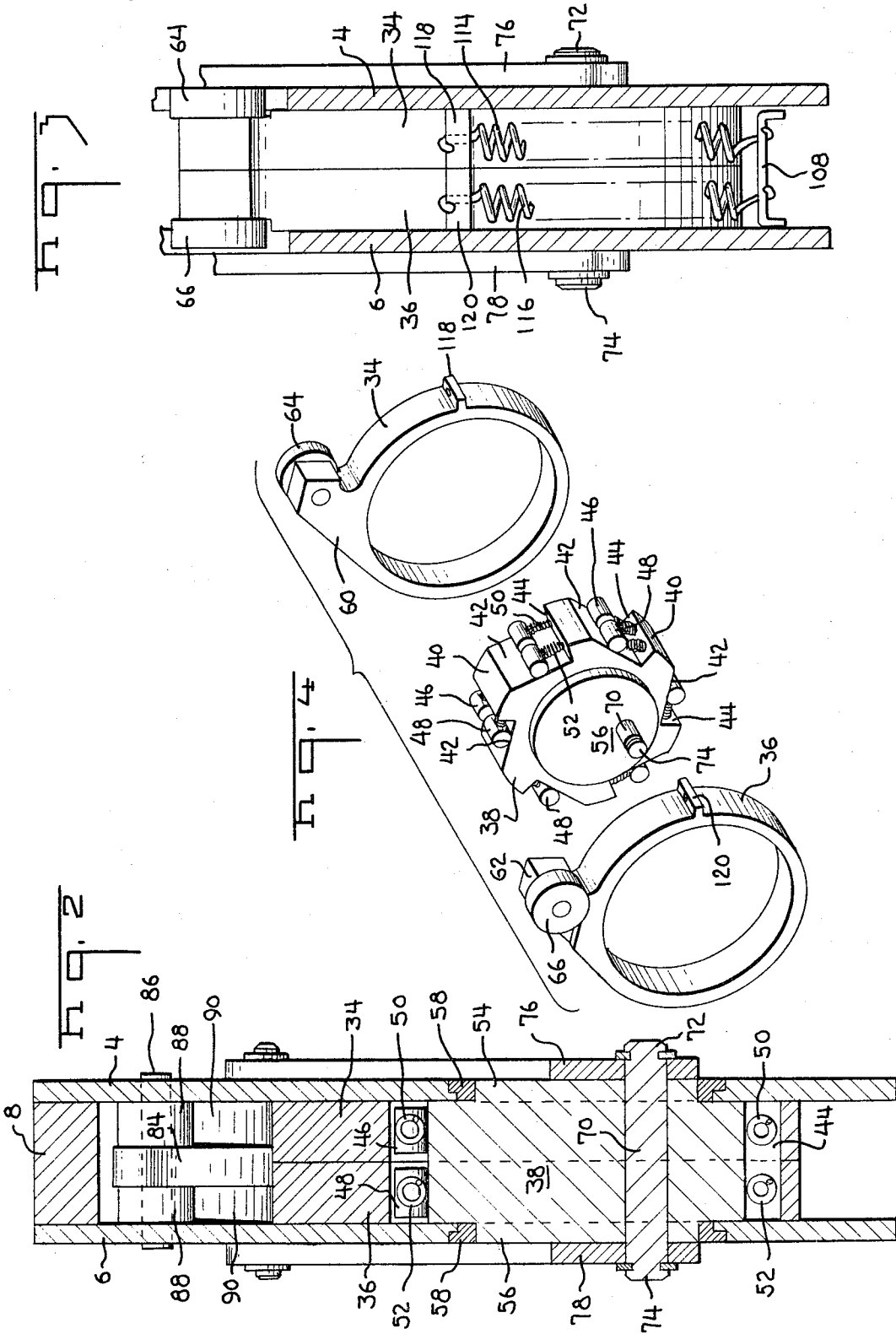
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2 Sheets-Sheet 2



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ELECTRIC HANDTOOL OR PRESS

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Continuation-in-part of application Ser. No. 380,398,
July 6, 1964. This application May 11, 1966, Ser.
No. 549,292

6 Claims. (Cl. 72—416)

This application is a continuation-in-part of application Ser. No. 380,398, filed July 6, 1964, for Compressing Device, and now abandoned.

This invention relates to electric handtools, presses or similar devices having a reciprocable ram.

While it has long been theoretically possible to provide electric tools or presses utilizing a small high-speed motor as a power source to drive a ram to perform an operation such as the crimping of electrical terminals, such tools have not been practical in the past. A possible reason for the fact that such tools or presses have not been generally available is that the friction losses in conventional gear trains or in other known motion transmitting devices render such tools impractical. The present invention is directed to an electric tool or press having an improved motion transmitting system which permits the development of a relatively high force or thrust in a ram by a small electric motor.

It is an object of the invention to provide an improved handtool or the like having a reciprocable ram driven by a continuously rotating shaft turning at a relatively high speed. A further object is to provide an improved motion translating device. A still further object is to provide an improved tool for crimping electrical connecting devices or pipe couplings or performing similar operations.

These and other objects of the invention are achieved in one preferred embodiment comprising a pistol grip-type handtool having a relatively small high speed electric motor and a reciprocable ram for crimping connectors onto wire ends or pipe fittings onto pipes. The motor has a swash plate on the end of a shaft which actuates a pair of circular ratchets or clutches in side-by-side relationship. Cam followers on the outer races of these ratchets bear against the swash plate so that these outer races are oscillated in out-of-phase relationship. A common inner member serves for both of the ratchets or clutches, the arrangement being such that during the out-of-phase oscillation of the outer races of the ratchets, the common inner race or inner member is rotated about the common axis of the two ratchets. The rotary motion of this inner member is transmitted to the reciprocable ram by means of an eccentrically mounted pin on the inner member which acts through a conventional toggle mechanism concatenated with the ram.

In the drawing:

FIGURE 1 is a side view with parts broken away of a preferred form of handtool in accordance with the invention;

FIGURES 2 and 3 are views taken along the lines 2—2 and 3—3 of FIGURE 1;

FIGURE 4 is an exploded perspective view showing the parts of the circular ratchets or clutches by means of which the high-speed rotary motion of the motor is translated into reciprocable motion of the ram; and

FIGURE 5 is a fragmentary side view showing details of a snubber spring used in the motion transmitting mechanism.

A preferred form of tool 2 in accordance with the invention comprises a pair of parallel frame plates 4, 6 (FIGURE 2) maintained in spaced-apart relationship by suitable spacers and fasteners indicated at 8 and 10. The tool shown is provided with a plastic cover 12, which has been broken away in the drawing in the interest of

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clarity, which encloses the motion translating mechanism and the trigger mechanism described below. This cover provides an integral depending handle 14 and a motor 16 is mounted on the upper side of the tool behind the handle. The output shaft 18 of the motor has a swash plate 20 on its end which is effective to oscillate a pair of circular ratchets or clutches described below.

An open gap-type tool head 22 is mounted between the frame plates 4, 6 at the forward end thereof by any suitable means, for example, in the manner shown in my co-pending application Ser. No. 532,393, filed Mar. 7, 1966, in order to permit interchangeability between tool heads having different types of tooling. The base portion 24 of this head, which extends between the frame plates, provides a guide means for a reciprocable ram 32 on the end of which movable crimping die 30 is mounted. A fixed die 28 is mounted against an arm 26 on the end of the tool head for cooperation with the movable die.

The relatively high speed rotary motion of the output shaft 18 of the motor 16 is translated into reciprocating motion in the ram 32 by a motion translating mechanism comprising a pair of cylindrical ratchets or clutches mounted in side-by-side relationship on a common axis. Referring to FIGURE 4, each ratchet comprises a cylindrical outer race or outer member 34 or 36 and a common inner cylindrical member 38, the outer races 34, 36 being rotatably mounted on the spaced-apart lands 40 on the periphery of the inner member 38. The inner member 38 has a plurality of spaced-apart notches on its periphery, each notch having a sloping surface 42 which intersects a radially extending shear surface 44. A pair of roller bearings 46, 48 are mounted in each notch in side-by-side relationship and are adapted to cooperate with the outer races 34, 36. These bearings are biased in a counterclockwise direction, as viewed in FIGURE 1, by springs 50, 52 which bear against the shear sides 44 of the notches and against the sides of the bearings.

Cylindrical bearing bosses 54, 56 are provided on the sides of the inner member 38 and bear against bearing inserts 58 mounted in circular openings in the side plates 4, 6 so that this inner member is permitted to rotate about the common axis of the two clutches or ratchets.

The outer races 34, 36 each have radially extending arms 60, 62 on which are mounted rollers 64, 66. These rollers are adapted to bear against the face 68 of the swash plate 20 on opposite sides of the axis thereof so that during each complete revolution of the shaft 18, the outer races 34, 36 will be oscillated through a minor arc in out-of-phase relationship. During the counterclockwise movement (as viewed in FIGURE 1) of each outer race, the inner cylindrical member 38 will also be moved through a minor arc in the counterclockwise direction. This inner member will not, however, move in a clockwise direction, as viewed in FIGURE 1, for the reason that it will be held against such movement by the roller bearings associated with the other outer race. The outer races 34, 36 thus constitute the driving members of the system and the inner member 38 constitutes a driven member.

It will be apparent that the structure shown in FIGURE 4 comprises, in effect, a pair of conventional roller clutches of the type in which either of the outer races will run free in one direction (the clockwise direction as viewed in FIGURE 1) but which will grip the inner member 38 when they move in the counterclockwise direction so that the inner member will move only in the clockwise direction. In the embodiment shown, the two clutches have a common inner race or cylindrical element 38 for both of the outer races 34, 36. These clutches are referred to herein as circular ratchets since their function is more akin to that of a ratchet mechanism than to

the function of a clutch as will be explained more fully below.

The rotary motion of the inner cylindrical element on race 38 is transmitted to the ram 32 by means of a pin 70 eccentrically mounted in a member 38 and having ends 72, 74 which extend beyond the surface of the side plates 4, 6. Links 76, 78 are pivotally mounted on the ends of this pin and extend upwardly on a pin 80 extending between the side plates and through arcuate slots 82 in the side plates. A link 84 has one end pivoted on the pin 80 and extends upwardly to a fixed pin 86 which also extends between the side plates, spacers 88 being provided on each side of the link 84 to center it with respect to the pin 86. An additional pair of links 90 extend from the pin 80 to a pin 92. This pin is guided along a straight line path between side plates by slots 94 and the end 96 of the ram 32 is suitably connected to this pin by means of a hook so that during movement of the guide pin 70 along its circular path, the ram 32 will be moved towards and away from the fixed die 28.

The links 78, 84, and 90 comprise a simple toggle mechanism for translating the rotary motion of the inner race member 38 into rectilinear motion in the ram 32. Obviously other mechanisms might be used to effect this translation, for example, as shown in application Ser. No. 380,398.

It is desirable to provide a starting mechanism for the motor and an engaging mechanism for the circular ratchets which permits the motor to attain its operating speed before the rollers 64, 66 are engaged with the face of the swash plate. The desirability of such a starting mechanism stems from the fact that the motor 16 will often be a high-speed fractional horse power type motor which may be incapable of starting under load. Accordingly, the disclosed embodiment is provided with a starting mechanism comprising a trigger 98 having a cover 102. This trigger is pivoted between the side plates at 100 and is effective to first energize the motor and to subsequently engage the outer race members 34, 36 with the swash plate. The lower end of the trigger 98 has a pivotal connection 104 with a link 106 which, in turn, has a lost motion pin-slot connection 110 with a channel-shaped lever 108. The lever 108 is pivoted intermediate it sends on a pin 112 extending between the side plates. Springs 114, 116 extend from the right-hand end of this lever to suitable ears 118, 120 on the outer races 34, 36.

A rod 122 has its end secured to the pin 104 and extends generally downwardly and obliquely through a suitable opening in the spring arm 124 of a small switch 126 contained in the handle 14. A collar 130 is mounted on this rod and a spring 132 is interposed between this collar and the spring arm 124 of the switch. The spring arm 124 is adapted to depress a switch button 128 on the spring when the spring arm is moved rightwardly from the position shown in FIGURE 1. It should be mentioned that this starting mechanism is described in more detail and claimed in my co-pending application Ser. No. 549,335, filed May 11, 1966.

In use, the parts will normally be in the position of FIGURE 1 with the rollers 64, 66 bearing only lightly against the surface of the swash plate. When the operator wishes to start the tool, he merely squeezes the trigger 98 causing rightward movement of the rod 122 and flexing of the spring arm 124 to close the start button 128. The motor 16 will be energized and will reach its operating speed although, because of the lost motion pin slot connection 110 between the link 106 and the lever 108, the outer races 34, 36 will not be immediately engaged with the swash plate. When the operator squeezes the trigger further, this lost motion will be taken and the lever 128 will be swung in a clockwise direction about the pivotal axis 112. The right-hand end of this lever and the downward movement stretch the springs 114, 116 and bias the rollers 64, 66 against the swash plate. So long as the trigger is held closed, the

outer races will then be oscillated by the swash plate and the inner cylindrical member 38 will be slowly rotated about the axis of the two circular ratchets in a counterclockwise direction. The springs 114, 116 will, of course, be stretched slightly during each rotation of the swash plate 20. The circular motion of the inner member 38 will be transmitted to the ram by means of a toggle mechanism 78, 84, and 90 as previously described.

In FIGURE 5 there is shown a hairpin spring 134 mounted against the side plate 6 and having one arm 138 which bears against the lower end of the lever 78 and having another arm 136 secured to a suitable clip on the surface of the side plate. This spring acts as a snubber or dash pot during the counterclockwise movement, as viewed in FIGURE 5, of the pin 70 from the twelve o'clock to the six o'clock position (i.e., during return movement of the ram 32). The effect of this pin is to retard the movement of the ram and prevent the parts from commencing a second cycle as a result of their own momentum. A similar spring can be provided on the opposite side of the tool if desired.

It will be understood that while an electric motor and swash plate combination constitute one method of oscillating the outer races of the two ratchets, other camming means and, for that matter, other power sources might be used, for example, a suitable air motor. It will also be understood that under some circumstances, the starting mechanism comprising the trigger and associated structure might be changed or partially eliminated depending upon the characteristics of the motor employed. It is also within the purview of the invention to use types of circular ratchets other than the roller bearing type shown. For example, ratchets of the type in which the driving element and the driven element (corresponding to either of the outer races 34, 36 and the inner member 38 respectively) have interfitting teeth might be used.

The mechanical advantage of the tool can be changed by several different methods. The angle of the swash plate 20 can be made steeper or shallower to increase or decrease the amplitude of the oscillation of the outer races. The toggle mechanism can also be changed as can the relative location of the pin 70 with respect to the axis of the two ratchets.

A significant feature of the type ratchet mechanism shown is that the increments of movement of the inner member 38 are not fixed but will vary depending upon the load imposed on the ram 32. In other words, the tool shown tends to fit its own pace in the event that a relatively high resistance is encountered during the compressing or crimping operation.

The disclosed motion translation mechanism can be used in stationary presses as well as handtools and can be used wherever a reciprocable ram is being driven by a rotating shaft. Tools or presses in accordance with the invention can thus be used for operations other than crimping, for example, for rivet setting, hole punching, etc.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only. The actual scope of the invention is intended to be defined in the following claims when viewed in their proper perspective against the prior art.

I claim:

1. A power operated tool comprising a pair of circular ratchet assemblies in side-by-side relationship on a common axis, said ratchet assemblies comprising a pair of cylindrical driving members and a cylindrical driven member, said driving members being rotatable in either direction with respect to said axis and said driven member being rotatable in only one direction in unison with either of said driving members, a power shaft rotatable at a relatively high speed, camming means effective between

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said power shaft and said driving members to oscillate said driving members in out-of-phase relationship thereby to rotate said driven member about said axis in said one direction, a reciprocable ram, and motion translating means for translating the rotary motion of said driven member into reciprocable motion in said ram.

2. A device as set forth in claim 1 wherein said driving members are in coaxial surrounding relationship to said driven member.

3. A device as set forth in claim 1 wherein said power shaft extends normally of said common axis, said camming means comprising a swash plate on said power shaft and follower means on said driving members.

4. A device as set forth in claim 1 wherein said motion translating means comprises toggle means for reciprocating said ram, said toggle means being actuated by said driven member.

5. An electric handtool comprising a pair of circular ratchet assemblies in side-by-side relationship on a common axis, said ratchet assemblies comprising a pair of cylindrical driving members and a cylindrical driven member, said driving members being rotatable in either direction with respect to said axis and said driven member being rotatable in only one direction in unison with either of said

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driving members, an electric motor having an output shaft extending normally of said common axis, camming means effective between output shaft and said driving members to oscillate said driving members in out-of-phase relationship thereby to rotate said driven member about said axis in said one direction, a reciprocable ram, and motion translating means for translating the rotary motion of said driven member into reciprocable motion in said ram.

6. A device as set forth in claim 5 wherein said camming means comprises a swash plate on said shaft and follower means on said driving members, said follower means being engageable with said swash plate.

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