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APPLICATION DATED

13th April, 1933.

Applicant (Assignee of Actual Inventor) .. SIDNEY WILLIAMS & Co. (PTY.) LTD.
Actual Inventor .. .. .. REGINALD WALTER WILLIAMS, of New South Wales.
Application and Provisional Specification.. Accepted, 3rd May, 1933.
Complete Specification .. .. .. Accepted, 13th July, 1934.
Acceptance Advertised (Sec. 50) .. .. 26th July, 1934.

Classes 90.7 ; 60.3.

Drawing attached.

COMPLETE SPECIFICATION.

"Improved windmill reciprocating pump operating mechanism."

I, SIDNEY WILLIAMS & COMPANY (PTY.) LIMITED, of Constitution Road, Dulwich Hill, near Sydney, in the State of New South Wales and Commonwealth of Australia, Mechanical Engineers, hereby declare this invention and the manner in which it is to be performed to be fully described and ascertained in and by the following statement:—

This invention relates to reciprocating pump operating mechanism for converting the rotary motion of a prime mover into the reciprocating motion of the pump and it is particularly applicable to windmill pumps of the single acting plunger type and the invention will be herein described and illustrated as applied to a windmill. In such windmill pumps inefficiency is mainly due to the leakage of the liquid past the valves when the plunger movement is reversed. The period of time expended during reversal of the pump plunger and during the down stroke thereof is a most important factor, and with the majority of existing mechanisms for operating windmill plunger pumps the lengthy duration of the stated period is such as to cause a loss of capacity of as much as 15%.

The object of this invention is to obtain greater pumping efficiency by (a) controlling the velocity of the pump plunger within its cycle (b) providing a system of gearing whereby a practically vertical reciprocation of the pump rod is obtained without the use of the usual sliding or rolling guides within the mechanism and (c) increasing the velocity of the down or non-pumping stroke in the operation of a single acting pump and reducing the velocity of the up-stroke so as to result in an increase in the gear ratio or mechanical advantage.

One of the troubles with an ordinary windmill plunger pump is that the plunger velocity adjacent the ends of the pumping stroke is usually so slow that water slips past the valves of the pump at the change over of the strokes and particularly past the plunger valve at the bottom thereof, and past the bottom valve of the pump at the top of the stroke. In the present invention the deletrious effect of slow deceleration and acceleration adjacent the change over is practically eliminated owing to the rapidity of such deceleration and acceleration and this without such abruptness of change over as to cause jerkiness and consequent damage to the pump rods and other gear.

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In such mechanisms heretofore the crank rod or eccentric rod is not infrequently connected to a rocker arm (in lieu of a crosshead and the gear therefor) resulting in a curved path travel at the point of connection between the pump rod and the eccentric rod.

Now this invention consists of a crank or eccentric operated by the windmill or other prime mover and a bent first order lever having one arm pivotted to said crank and having its other arm coupled to a yoke mounted on the pump rod and a link at one end pivotted to a fixed pin and at the other end pivotted to said lever to constitute the fulcrum thereof, which fulcrum is thus enabled to oscillate in an arc having the link as radius.

By particularly proportioning the lever and link a stroke in excess of what would be obtained with the same lever on a fixed fulcrum, has resulted, and the yoke end of the lever can be made to travel practically vertically on the upward or pumping stroke with very little outward throw or displacement on the down-stroke. There is practically no tendency for the yoke to be thrown sideways at the top and bottom changes of stroke, therefore there is no need to have a guide for the pump rod. It is sufficient to have the rod a fairly neat fit in a hole at the top of the yoke where the latter is free to rotate about the rod when the mill twists round on the turntable. The pump rod must be prevented from turning, otherwise the pump plungers or rod joints may come unscrewed, suitable means for preventing turning may take the well known form of a flat plate; or a square wooden rod, which is prevented from turning by lateral stops.

But in order that this invention may be readily carried into practical effect it will now be described with reference to the drawings wherein:—

Figure 1 is a perspective view of the power transmission mechanism which is housed in the mill head.

Figure 2 is a sectional elevation of the mill head and upper portion of the tower.

Figure 3 is a section on line 5—5 of Figure 2.

The invention as applied to a geared windmill consists of driving pinion 13 meshing a driven gear 14 which is integral with (or keyed to the same shaft as) an eccentric or crank 15 (henceforth referred to as an eccentric 15). The rod for the eccentric is in the form of a bent lever 16 having fulcrum pin 17.

Links 19 connect the fulcrum pin 17 to a shaft 20 which acts as a stationary pivot therefor and the bent lever has one end forked and provided with trunnions 22 whereby it is coupled to the yoke 21 which at its top end neatly but revolvably engages the pump rod 18 which passes down through the seal tube 10.

In a modification (not illustrated) the yoke may be replaced by a link, or links, which would be moveably connected to the pump rod 18, the latter then being extended and guided at its upper end.

The bottom end of the pump rod 18 is guided at the lower end of the mast pipe 23 which latter is integral with the main casting or box 11, sufficient clearance being provided to allow the lateral movement of the top end of the pump rod 18 due to the slightly arcuate path of the trunnion pins 22 on the down-stroke.

In use the gear 14 is rotated by operation of the windmill and consequently the eccentric 15 is also rotated. This rotation tends to oscillate the yoke 21 about its top (where affixed to the pump rod 18) but such oscillation is restricted by the fulcrum 17. If this fulcrum 17 were immovable the lever 16 would also be immovable but by the provision of links 19 the fulcrum 17 is able to move in an arc having its centre at 20. If the lever is regarded as fixed to the links 19 at the fulcrum 17 (the eccentric 15 being regarded as disengaged) the locus of a point at 22 would also be an arc having centre at 20, actually this arc is modified (by displacement of the lever 16 by the eccentric 15) to give a practically rectilinear motion to a point at 22. This will be readily appreciated by reference to Figure 2 where the mechanism is shown as just about to commence an up-stroke. The links 19 and the forked end of lever 16 are neatly in alignment and the centre of displacement of the eccentric is about 45° below the horizontal which passes through the centre of rotation, as the eccentric's displacement centre rises, the point 22 tends to move to the left but this tendency is counteracted by the rising links 19 exercising a thrust to the right until they are horizontal. When this occurs the two centres of the eccentric

are also horizontally in line and after these horizontal positions are passed the throw of the eccentric (being less than the radius of the links **19**) causes its displacement to the left to be greater than the displacement of the fulcrum **17** to the left, with the result that the lever rocks on its fulcrum and when the eccentric is at the 45° position opposite to that shown in Figure 2 the forked end of the lever **16** is horizontal and is about one sixth of the stroke from top position. In arriving at this position (one sixth below top centre) the fork in rising to the horizontal tends to move the point **22** to the right but this is counteracted by the increasing angularity of the links **19** and so the rectilinear path is maintained. From this point until the top of the stroke is arrived at the links **19** are almost stationary and the descending eccentric causes the forked end of the lever and the links **19** to be once more in alignment when the top of the stroke is reached, at this point the eccentric displacement centre is on the horizontal line passing through its centre of rotation.

It will be noticed from the foregoing that the upstroke requires about 225° or utilises about five eighths of each revolution of the eccentric so that the down stroke must be completed within the remaining three eighths of each revolution, which explains the greater velocity of down-stroke achieved by this invention. The down stroke is only a slightly "straightened" arc having its centre at the point **20** but this down stroke is relatively unimportant and provided the locus of the point **22** approximates to a straight line the mechanism is fully efficient.

It will be apparent that there are no appreciable slowing down periods in the reciprocatory cycle as those which occur in the vicinity of the dead centre positions of an ordinary crank, for it is only at the instant of reversal that the links **19** cease (momentarily) to contribute to the motion of the point **22** this causes the velocity of the point **22** to be practically uniform for almost its entire stroke in either direction which in turn causes the "change-over" to be effected with a velocity which renders capacity losses in the pump at these points to be almost entirely dispensed with.

Having now fully described and ascertained my said invention and the manner in which it is to be performed, I declare, that what I claim is:—

1. Improved windmill reciprocating pump plunger rod operating mechanism (whereby the return stroke of said plunger is effected in a shorter time than the working stroke thereof) which consists of (a) an eccentric rotated by the windmill (b) a bent first order lever having a strap at one end to take over said eccentric and having its other end bifurcated said bifurcated end having a yoke coupling to a pump rod and (c) links pivotted to said lever and to a fixed pin to forcibly oscillate the lever fulcrum in an arcuate path on rotation of said eccentric said links having the said fixed pin so positioned that the link axes and the axis of the yoke lever coupling are substantially coplanar during the pump return stroke substantially as herein described.

2. Improved reciprocating pump operating mechanism constituted of a prime mover shaft an eccentric such as **15** lever such as **16** pins such as **17** and **20** links such as **19** yoke such as **21** and rod such as **18** substantially as herein described and illustrated in the drawings.

3. The combination and arrangement of the mechanical parts or integers constituting improved reciprocating pump operating mechanism substantially as herein described and as illustrated in the drawings.

Dated this 11th day of July, A.D. 1934.

SIDNEY WILLIAMS & COMPANY (PTY.) LTD.,
By his Patent Attorney,
FRED WALSH,
per Arthur S. Cave.

Witness—H. Haldane.

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Fig. 1.

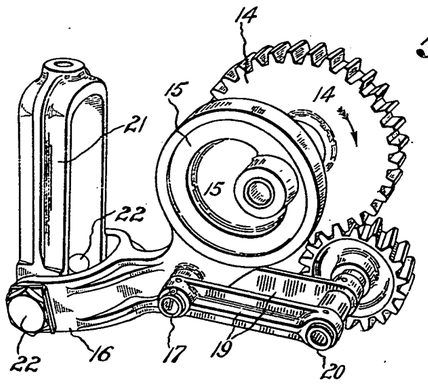

Fig. 2.

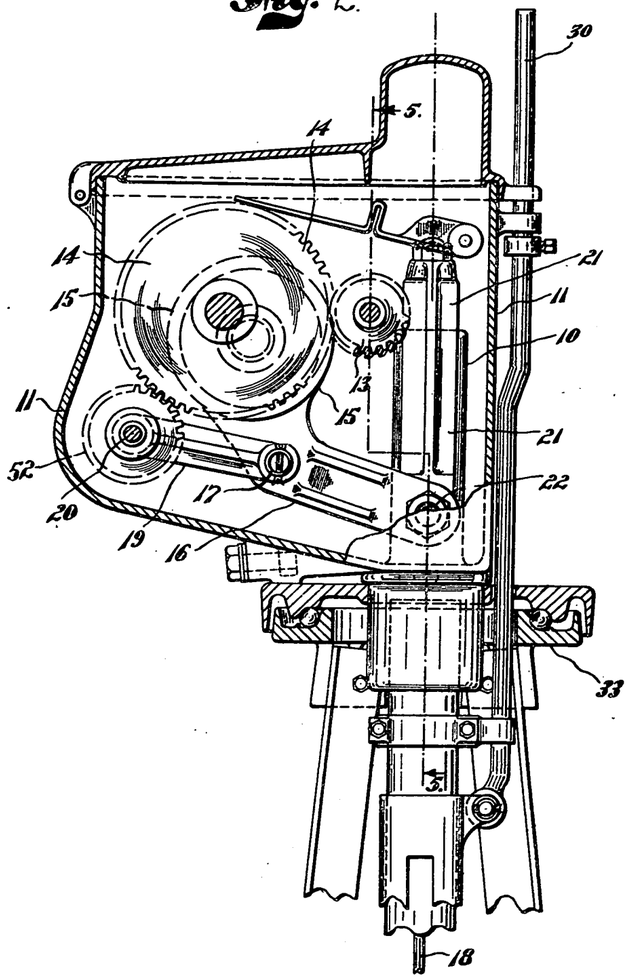

Fig. 3.