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STROKE ADJUSTER

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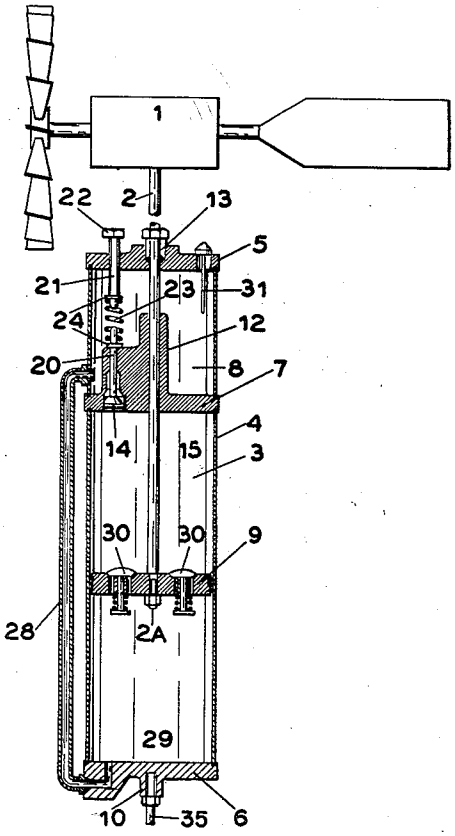


FIG. 1

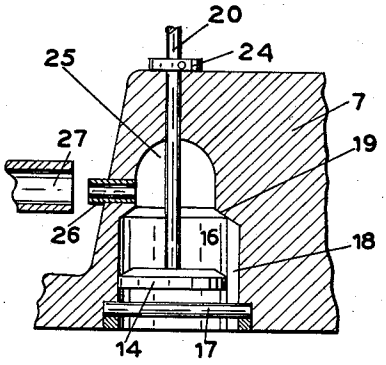
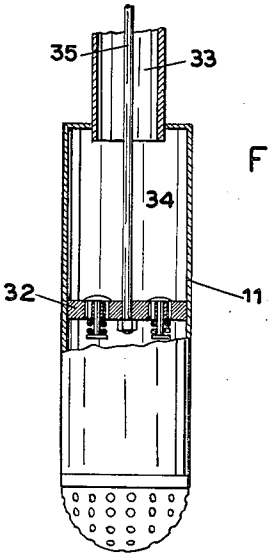


FIG. 2



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STROKE ADJUSTER

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2 Claims. (Cl. 74—586)

This invention relates to windmills and in particular to means for varying the stroke of a deep well pump worked by the mill.

Windmills when operating to pump water from deep wells frequently have difficulty in effecting a pumping stroke and more particularly in reaching the top of the pumping stroke when the wind is light. Many efforts have been made to overcome this disadvantage by balancing the up stroke by a counter balance weight but this is not always satisfactory. A shortening of the stroke would often solve the problem but any mechanism so far proposed for doing this automatically has been expensive and somewhat delicate.

It is the object of this invention to provide for the regulation of the effective length of the pumping stroke to be automatically adjusted in relation to the power applied by the windmill through a simple hydraulic mechanism.

In accordance with this invention there is provided a stroke adjuster adapted to be inserted between two portions of a windmill pump rod said adjuster comprising a hydraulic cylinder and a piston therein, a supply of liquid in the cylinder, means for attaching the piston to the one portion of the pump rod and for attaching the cylinder to the other portion of the pump rod, a reservoir for the liquid, a constricted passageway allowing a flow of liquid from the space in the cylinder above the piston to said reservoir and means for allowing a relatively unrestricted return flow of the liquid from the reservoir to said space.

The invention further provides for the stroke adjuster to have a connection between the reservoir and the cylinder space below the piston; also a constricted passage for the liquid through the cylinder head into the liquid reservoir and a loaded valve to close said passage; also for the piston to have a non return valve for the liquid below the piston to pass to the space in the cylinder above the piston.

A preferred form of the invention is illustrated diagrammatically in the accompanying drawing in which:

Fig. 1 shows the stroke adjuster in position in the length of a divided windmill pump rod,

Fig. 2 is a detail to an enlarged scale of a portion of Figure 1.

In the drawing 1 represents the power head for a windmill from which depends the vertical reciprocating pump rod 2.

The stroke adjuster 3 comprises a long cylinder 4 closed at its ends with covers 5, 6, and having a partition 7 dividing its length to provide an upper chamber 8 to act as a liquid reservoir. The liquid used is usually oil and will so be referred to in this specification.

A piston 9 is fitted in the lower chamber and is attached by nut 2^a to the pump rod 2 passing through the partition 7 and also the top cover 5. The cylinder 4 connects the pump rod 2 with the bucket rod 35 fastened to the pump bucket 32.

The bottom cover 6 of the cylinder 4 is provided with

means such as the threaded socket 10 into which the upper end of the bucket rod 35 is screwed to continue down the well to the pump barrel 11.

The partition 7 in the top portion of the cylinder 4 may have a long bearing sleeve 12 projecting into the upper chamber 8 through which the pump rod 2 reciprocates. The top cover 5 of the cylinder 4 is provided with a gland 13 through which the pump rod 2 passes. The partition 7 in the cylinder 4 is provided with a valve 14, adapted to move upwardly to prevent the passage of oil from the space 15 above the piston 9 to the chamber 8. The valve 14 may be retained in its cylindrical recess 16 by a transverse pin 17. As shown in Fig. 2 the valve 14 slides as a piston in recess 16. The wall of the recess 16 is grooved at 18 said groove acting as a leakage passage for the oil passing the valve 14 until the latter rises sufficiently to rest on its seat 19 at the top of its travel.

The valve stem 20 of the valve 14 passes through the partition 7 and projects upwardly towards the end of a screwed rod 21 depending from cover 5. The head 22 provides a means for rotating the screwed rod 21 to adjust its position relative to the end of valve stem 20. A spring 23 between the collars 24 provides means by which the lift of the stem 20 of valve 14 may be loaded. The loading on valve 14 is therefore regulated by the rotation of the head 22 on screwed rod 21.

Above valve 14 is a small chamber 25 with a side outlet 26 from which the liquid passing valve 14 may escape into the chamber 8. As shown in Figure 2 outlet 26 is conveniently in the form of a tube projecting towards the mouth 27 of a pipe 28 through which the oil passes into the space 29 in the cylinder 4 below the piston 9.

The reservoir formed by chamber 8 is constantly connected to the space 29 below the piston 9.

The piston 9 has one or more non-return valves 30 adapted to open upwardly to pass fluid from the space 29 below the piston to space 15 above the piston 9.

A plug 31 in the cover 5 closes the inlet for the oil. It is provided with an air vent and a stick marked to show the preferred level of oil in chamber 8. This chamber 8 acts as a reservoir or steady head for the liquid used in the adjuster.

The action of the windmill pump stroke adjuster is as follows:

Assume that the pump bucket 32 is at the bottom of its barrel 11, the space 15 in the cylinder 4 of the stroke adjuster 3 above the piston 9 is full of oil with the piston 9 at the bottom of its cylinder 4, and the windmill actuated under a fair breeze. The windmill head 1 will allow the pump rod 2 to be in its lowest position and on the upstroke, the stroke of the pump will be of full length, that is normal, less a small measure due to the momentary leakage of oil through the groove 18, until the pressure of the oil in space 15 pushes up valve 14 against the loading of spring 23 to close the small and momentary leakage through groove 18. Due to such leakage the stroke of the windmill will have a cushioned start.

The rising main 33 opening into the space 34 above the pump bucket will be full of water, ready for the windmill to lift the column and discharge an amount approximately equal to the quantity displaced from the space 34 by the upward sweep of bucket 32.

Since the windmill during this stroke was working normally the space 15 will have kept practically full of oil and the piston 9 at the bottom of the cylinder 4 will have kept substantially stationary relatively to the latter. The valve 14 will remain closed and no leakage of oil after the initial small amount will have passed through groove 18. The pump rod 2 will act substantially as if it was continuous right down to the pump bucket 32 which will

lift through practically a full stroke to discharge water into the rising main 33.

During the normal working strokes of the windmill the adjuster as described acts as a shock absorber. On the down stroke any oil below the piston 9 will have to be forced either into the space above piston 9 or into the reservoir 8. This will prevent any "thump" of the pump bucket 32 at the bottom of its travel.

If the breeze becomes very light and the windmill is without a stroke adjuster the pump bucket 32 might be lifted up halfway in the pump barrel 11, mainly under the momentum accumulated in the moving parts during the down stroke, but principally by the momentum of the pump rod 2, the bucket rod 35 and of the water in the rising main 33. Having got half way up its stroke the windmill will stop, the water in the pump barrel 11 below the bucket 32 tending to support it in this mid-position but the wind pressure will not be sufficient for the mill to finish the up stroke. Thus with a very light breeze without a stroke adjuster no further water will be pumped.

Now assume that this condition of very light wind again applies but with the adjuster 3 in position. Due to the breeze being very light the upward pressure of the piston 9 on the oil in the adjuster will be too weak to close the loaded valve 14 so that some leakage through groove 18 takes place. The upward movement of piston 9 will be slower than the upward movement of the lower part of the pump rod 2 so that the pump bucket 32 will complete only a fraction of its stroke. The full up stroke of pump rod 2 is taken up partly by the upward movement of piston 9 while forcing some oil through groove 18 during the stroke of the pump rod 2 and partly by the raising of pump bucket 32. The relief thus given may be slight but will be sufficient to allow the windmill to turn and complete the up stroke of the windmill crank.

With the same conditions prevailing on the downstroke of the windmill pump as the piston 9 descends the valves 14 and 30 will open, the latter particularly allowing a flow of oil from space 29 into chamber 15 which is relatively unrestricted compared to the restricted flow from chamber 15 during the ascending movement of piston 9 so that the adjuster imposes a negligible additional load on the windmill during this downstroke.

The net result will be that the windmill will continue to work on strokes automatically adjusted to the strength of the breeze.

It will be understood that when the windmill is operating at any speed less than the speed for which the loaded valve 14 is set to take the full load, part of the movement of the upper portion of the pump rod 2 is taken up by the movement of piston 9 in the cylinder 4, the amount of the movement so taken up increasing with decrease of windmill speed until at very low speeds no movement is transmitted from the pump head 1 to the bucket 32.

It will be appreciated from the foregoing description

that the oil reservoir is constituted partly by chamber 8 and partly by space 29 below piston 9, and that by furnishing a restricted passageway in piston 9 preferably associated with a valve assembly such as valve 14 and seat 19 the chamber 8 could be eliminated. Alternatively the valves 30 could be mounted in partition 7 to open in a reversed direction in which case the chamber 8 could be used as the only reservoir in which case pipe 28 could be eliminated. Such structures are not considered, however, to be as satisfactory as that illustrated and described above.

It will be found that in the aggregate with this invention more water will be pumped by a windmill even if the pump is working through a fraction of its normal stroke than by a windmill not fitted with an adjuster.

The reason for this is that without the adjuster when the breeze is very light no water at all is pumped, the stroke of the pump being too long for the mill to lift and it stops altogether. With this invention when the mill tends to stall the slow leakage of oil allows for some movement which is often sufficient to keep the mill working and pumping slowly.

What I claim as new and desire to secure by Letters Patent is:

1. A stroke adjuster for insertion between two portions of a rod comprising a hydraulic cylinder having a piston slidably mounted therein, a supply of liquid in said cylinder, means for attaching the piston to one portion of said rod and for the attachment of said cylinder to the other portion of said rod, a partition in said cylinder defining a fluid reservoir in said cylinder, a passageway through said partition, a valve loaded to close said passageway at a predetermined pressure in the fluid above said piston and a passageway communicating with said reservoir and with said cylinder at a point below said piston for allowing a relatively unrestricted return flow of the liquid from the reservoir to a point below said piston.

2. A stroke adjuster as defined in claim 1 further including means external of said cylinder for adjusting the load on said valve to close said passageway at a predetermined liquid pressure in the liquid above said piston.

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