Nov. 23, 1943. G. W. MILLER ET AL 2,334,943

WELL PUMPING DEVICE

Filed March 1, 1941 2 Sheets-Sheet 1

Fig. 1.

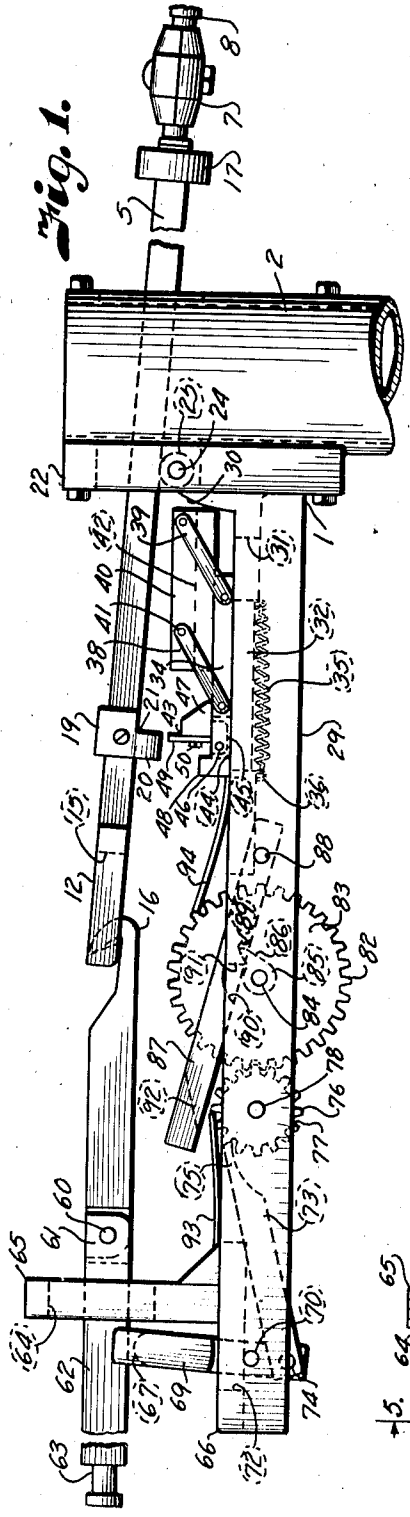


Fig. 2.

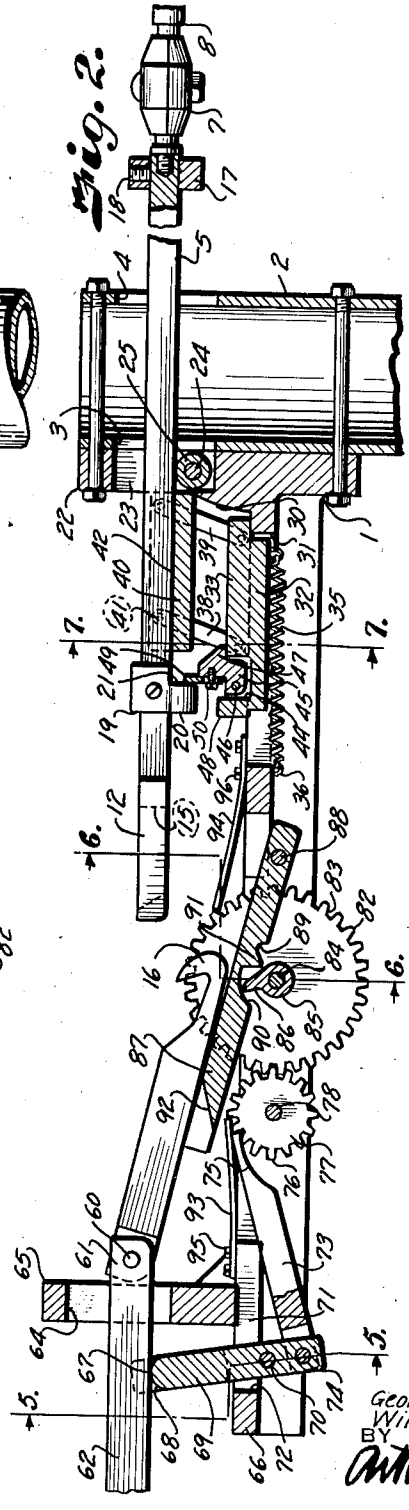
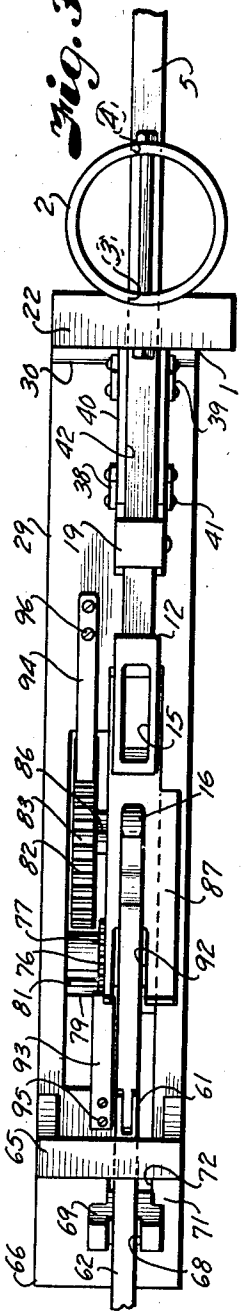


Fig. 3.



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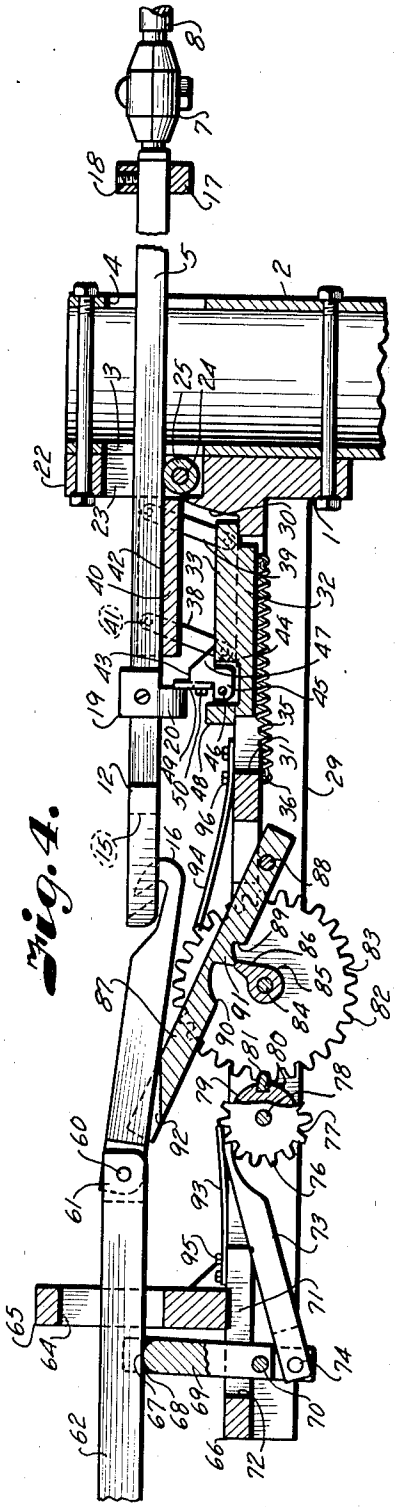


Fig. 4.

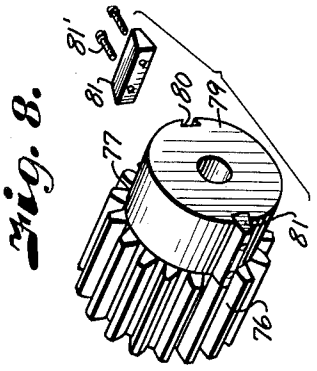


Fig. 8.

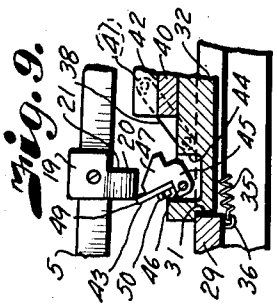


Fig. 9.

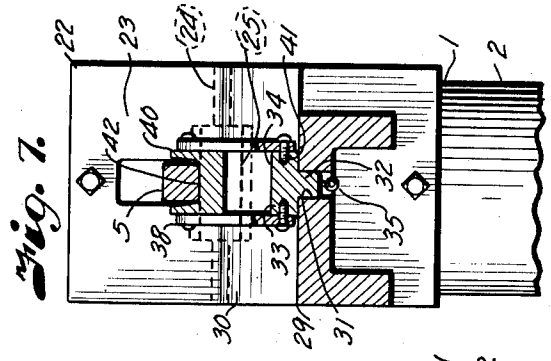


Fig. 7.

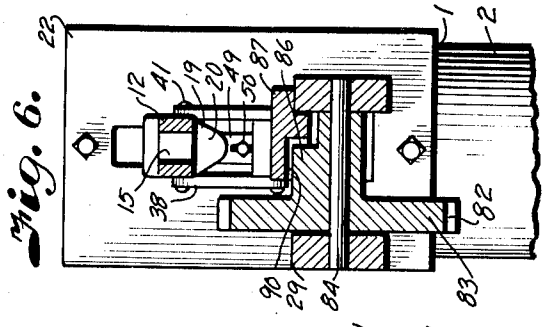


Fig. 6.

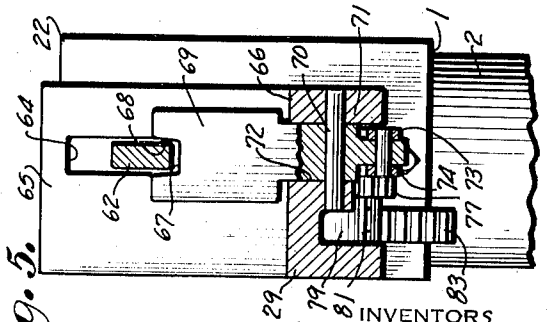


Fig. 5.

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WELL PUMPING DEVICE

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Application March 1, 1941, Serial No. 381,340

8 Claims. (Cl. 74—593)

This invention relates to well pumping devices and more particularly to a device of that character for connecting and disconnecting a well pumping rod line with a power transmission mechanism in such a manner as to hook the rod line and well on and off relative to the power predeterminedly; the principal object of the present invention being to provide a convenient, relatively economical and highly efficient device for the noted purposes.

Other objects of the present invention are to provide for adjusting the device to "hook-off" the well at a predetermined fluid level in the well and to "hook-on" the well at predetermined time intervals; to provide for efficiently operating a number of wells by a single power at the same time; to prevent damage to wells and pumping equipment therefor; to provide for varying the time interval for "hooking-on" the well; and to provide improved elements and arrangements of them in a well pumping device of this character.

In accomplishing these and other objects of the present invention, we have provided improved details of structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a side elevational view of a well pumping device embodying the present invention.

Fig. 2 is a longitudinal vertical cross section through a well pumping device embodying this invention.

Fig. 3 is a plan view of the well pumping device shown in Figs. 1 and 2.

Fig. 4 is a longitudinal vertical sectional view similar to Fig. 2, showing the "hook-on" device being raised to operative position.

Fig. 5 is a detail vertical transverse section through the well pumping device substantially on the line 5—5, Fig. 2.

Fig. 6 is a view similar to Fig. 5, substantially on the line 6—6, Fig. 2.

Fig. 7 is a view similar to Figs. 5 and 6, substantially on the line 7—7, Fig. 2.

Fig. 8 is a detail perspective view of a modified form of mechanism for causing the hook-on device to be lifted to operative position at variable time intervals.

Fig. 9 is a detail elevational view partly in vertical cross section showing the latch mechanism.

Referring more in detail to the drawings:

1 generally designates a well pumping device that preferably includes a post 2 which may, for convenience, take the form of a pipe section embedded and suitably anchored in the ground near a power transmission mechanism, not shown. The post is preferably vertically arranged and is provided with aligned slots 3 and 4, the post preferably being braced in a suitable manner.

5 designates a bar that is connected at one end, by a coupling 7 with and forms a section of a rod line 8 leading to pumping devices in a well, not shown, the other end of the bar being provided with a clevis 12. The clevis is provided with a slot 15 to receive a hook 16, or the like, that is connected with a suitable power transmission mechanism, not shown.

Mounted on the bar 5 between the post 2 and rod line 8 is a weight 17, or the like, the weight being adjustable longitudinally on the bar, as by the set screw 18, relative to a stop collar 19 fixed to the bar 5 between the post 2 and clevis 12, the stop collar having a depending foot member 20 the inner face of which, relative to the post, forms a shoulder 21.

22 designates a standard that is mounted on the post 2 by suitable fastening devices, preferably on the power side thereof in alignment with the slots 3 and 4 therein. The standard is provided with a closed yoke at its upper end, the spaced arms 23 of which have aligned apertures in which the ends of a bearing shaft 24 are arranged to rotatably support a roller 25. The roller 25 provides a roller bearing support for the bar 5, when it is moved in one direction by the hook 16, upon actuation of the power, and in the other direction by the weight of rods to pump the well.

On the power or lift stroke of the bar 5, i. e. to the left relative to Figs. 1 and 2, the rods are under tension and are maintained in the same, substantially horizontal plane, as shown in Fig. 4.

On the drop stroke of the bar, i. e. to the right relative to Figs. 1 and 2, the rods are under tension until such time as the usual well pump plunger "hits" liquid in the well, at which time slack or a reduction in the tension on the rods is produced in the rod line, due to the buoyant effect of the liquid and, aided by the weight 17, the bar 5 pivots about the roller 25 to lower the weighted portion thereof and raise the rear portion thereof, the boss 19 and foot member 20 consequently being lifted relative to the weight 17.

When oil or other liquid in the well being pumped is reduced to a relatively low level, tension is applied to the rod line substantially throughout the length of its stroke, the result

of which is that the rod line is maintained in the same substantially horizontal plane at all times, i. e., on both power and drop strokes.

Upon exhaustion of fluid from the well, severe wear is applied to pumping apparatus and the oil, for example, in the well is damaged.

It is, therefore, desirable to "hook-off" an exhausted well before damage occurs.

Ordinarily, a single power is employed to pump a number of wells over a relatively large area. The well pumper's attention may, and often is, required at locations on a multiple well "lease," for example, some distance away from a particular exhausted well and it is, therefore, further, desirable that the exhausted well be "hooked-off" as and when it becomes exhausted.

In effecting this desideratum, the standard 22 is provided with a guide 29 extending laterally of the post 2 in parallel relation to the bar 5. In the angle between the standard proper and guide, an arcuately shaped block-guide 30 is arranged and a guide slot 31 is longitudinally arranged in the guide 29.

A slide-block 32, of less length than the slot 31, is slidably mounted in the slot 31, the slide-block having laterally arranged arms 33 and 34, Fig. 7, on its upper end slidably mounted on the upper face of the guide 29. The slide-block is normally maintained in retracted condition, as shown in Fig. 1, by a spring 35, one end of which is secured to the slide-block and the other end of which is mounted on the guide, as at 36.

38 and 39 designate pairs of links pivotally mounted at their lower ends on the slide-block 32 and at their upper ends on a "knock-off" of "hook-off" block 40, as by pivot pins 41, the upper face of which block 40 is grooved, as at 42, Fig. 7, to form a bearing seat for the bar 5.

A latching device 43 is mounted in a recess 44, Figs. 2 and 4, of the slide-block 32 as by pivoting an arm 45 thereof on a pivot pin 46 arranged transversely of the recess in the slide-block. The latching device normally tends to rock forwardly, or to the right, Figs. 1, 2 and 4, and downwardly, and is controlled in its downward movement by a nose 47 thereon which bears on the slide-block. The latch is controlled in its rearward movement by engagement with a lug 48 on the slide-block, as shown in Fig. 9. A shoe 49 is mounted on the latching device, as by a fastening device 50, and projects upwardly therefrom substantially into the path of the shoulder 21 of the foot member 20 on the stop collar 19 and bar 5.

With the construction thus far described, it is apparent that a well may be "hooked-off" when the fluid in the well has been reduced to a point at which the sucker rods have too little to act upon and would otherwise be doing useless work.

It is also desirable to "hook-on" the well at predetermined intervals and the present invention provides for such an arrangement in the following manner:

The hook 16 is preferably pivotally mounted, at its outer end, on the pivot pin 60, which is supported at the inner end 61 of a supplemental bar 62 forming a section of the rod line and adapted for connection, as at 63 with the driving mechanism or power above mentioned. The supplemental bar 62 is reciprocably mounted in a slot 64, Fig. 2, formed in a vertically arranged bracket 65 that is mounted adjacent the outer end 66 of the guide 29. The supplemental bar 62 when not under tension also has frictional bearing support on the convex surface 67 defining the bottom of a groove 68 in a lever 69, the lower end of which is pivoted, as at 70, between the side walls 71, Fig. 5, of the guide 29 in such a manner that the lever may pivot longitudinally in the aperture 72 of the guide in an outward position on the guide relative to the bracket 65. A pawl 73 is pivoted at one end, as at 74, on the lower end of the lever 69, the pawl having a reduced finger portion 75 opposite its pivoted end that is engageable with the teeth 76 of a pinion 77. The pinion is rotatably mounted on a shaft 78 arranged transversely of the guide 29 and supported in suitable bearings therein. As shown in Fig. 8, the pinion 77 may be provided with an extension 79 having grooves 80 therein for receiving teeth 81 to key the teeth to the extension. The teeth may, if desired, be secured to the extension by fastening devices 81'. In this manner, the pawl 73 may move the pinion in response to reciprocation of the bar 62 yet the pinion 77 may be reactive on the sprocket 83 only in response to engagement of the teeth 81 of the pinion extension with the teeth 82 on the sprocket. The pinion teeth 81 mesh with the teeth 82 of a sprocket 83, that is rotatably mounted on a shaft 84 arranged transversely of the guide 29 in suitable bearings therein.

The sprocket shaft 83 is provided with a cam 85 having a lobe 86 that moves in response to rotation of the sprocket and engages portions of a push bar 87 that acts on the hook 16. The push bar 87 is pivoted, as at 88, at one end on a pivot pin arranged transversely of the guide 29, the push bar having depressions 89 and 90 in its lower face between which a lobe 91 is arranged. The outer end of the push bar is also provided with a tapered groove 92 to provide a guide by which the push bar is readily engageable with the hook 16 to guide it into hooking contact with the clevis 12 of the bar 5.

Resilient stop members 93 and 94 are mounted on the guide, as by fastening devices 95 and 96, in the path of the pinion and sprocket respectively, and in engagement with the teeth thereof for preventing reverse movements of the pinion and sprocket and thus providing against slippage as well as providing for accurate incremental movement of the push bar.

The operation of a well pumping device constructed as described is as follows:

Assuming the well to have accumulated liquid therein and the bar 5 to be hooked onto the power by the hook 16, the power is energized and imparts a power stroke (to the left, Figs. 1 and 2) to the rod line 8 to maintain the same in taut, tense and plane condition. The foot-member 20 on the bar 6 strikes the shoe 49 on the slide-block latching device, but passes over the same due to pivotal movement of the latch, as shown in Fig. 9.

On the down stroke (to the right, Figs. 1 and 2) the well pump plunger "strikes" liquid in the well, normally before the drop stroke is completed, and due to buoyant effect of the liquid produces slack or reduction in the tension of the rod line which, aided by the weight 17 on the bar, effects a sag or deflection in the rod line and lifts or "kicks" the foot-member 20 over latch shoe 49 on the drop stroke.

As the well is exhausted of liquid, the drop stroke approaches completion before the "kick" is applied to the foot-member and, depending somewhat upon the position of the weight 17, the foot-member contacts the latch shoe and

moves the slide-block forwardly against tension of the spring **35**. The tension on the rods during the power stroke remains substantially the same during the pump operation, and the variation in the tension on the down stroke is the controlling factor in operating the hook-off device.

As the slide-block moves forwardly, the "knock-off" block **40** rides up the arcuate face of the guide **30** into supporting relation to the bar **5** and in line with the collar **19** on the bar, thus halting movement of the rod line in the direction of the well. The power continues, however, and continued movement of the hook **16** in the direction of the well causes the hook to drop, by gravity, through the slot in the clevis, to "hook-off" the well, yet allowing continue pumping of other wells. The hook-off can only be effected when the motion of the bar **5** has stopped as the weight or tension on the rods is always sufficient to move said rods faster on the down stroke than the pumping power operates.

When it is desired to again "hook-on" the well, the power is again actuated and when the hook **16** is positioned below the clevis slot it may be moved upwardly into engagement with the clevis to again "hook-on" the well.

When the hook **16** has been "hooked-off" relative to the clevis **12**, the tension is removed from the bar **62** allowing it to drop into engagement with the lever **69** and the bar, still being connected with the power, reciprocates in the slot **64** of the bracket **65** and pivotally moves the lever **69** through frictional contact of the bar **62** with the convex surface **68** of the lever. Pivotal movement of the lever **69** reciprocates the pawl **73** to rotate the pinion **77** and consequently, intermittently advances the sprocket **82**. The cam **85** on the sprocket also rotates to cause the lobe **86** of the cam to lift the push bar **87** from the lowered position, as shown in Fig. 2, upwardly, first by contact with the push bar in the recess **89**, to its top position, as shown in Fig. 4, by contact of the lobe of the cam with the lobe **91** of the push bar. When the hook **16** has been raised to the position shown on Fig. 4, continued reciprocation of the bar **62** causes engagement of the hook with the clevis and the well is again "hooked-on." The effect of the tension on the rod line then lifts the bar **62** from engagement with the lever **69** and the hook lifting device, cam and pinions remain idle until the hook-off mechanism is again actuated.

With this structure, it is possible to delay "hooking-on" of the well for any desired time period.

The operation of the apparatus with the modification just above noted is substantially similar to that first described.

It is apparent, therefore, that a convenient, relatively economical and highly efficient well pumping apparatus is provided by the present invention by which wells may be hooked on and off relative to a power.

What we claim and desire to secure by Letters Patent is:

1. In a device of the character described, a support, a rod line reciprocably mounted on the support, said rod line consisting of two sections comprising a pumping section adapted for connection to a well pumping mechanism and a power section adapted for connection to a power transmission mechanism, a hook pivotally connected to one of the sections and adapted for connecting engagement with the other section, a boss on the pumping section of the rod line, a guide on the support, a block slidably mounted on the guide engageable with the support and boss to stop movement of the pumping section of the rod line in one direction and to effect disengagement of the hook, a lever pivotally mounted on the guide and adapted for frictional engagement with the power section of the rod line, said frictonal engagement oscillating the lever when the hook is in disengaged condition, a push bar pivotally mounted on the guide and engageable with said hook, and means interposed between the push bar and the lever operable responsive to oscillation of said lever for moving said push bar to effect interconnection of the rod line sections by said hook.

2. In a device of the character described, a support, a rod line reciprocably mounted on the support and having separable portions adapted for engagement with a well pumping mechanism and power transmission mechanism respectively, a hook mounted on one portion of the rod line and separable from the other portion thereof, a boss on the rod line having a foot member, a guide on the support, a block slidably mounted on the guide and engageable with the support, a latch on the block engageable with the foot member to move the block into engagement with the support for stopping movement in one direction of the portion of the rod line having engagement with the well pumping mechanism and effecting disengagement of the hook, means on the guide for guiding the block upwardly into the path of the boss, a lever pivotally mounted on the guide frictionally engageable with and operable by the portion of said rod line having engagement with the power transmission mechanism when the hook is in disengaged condition, a pinion gear, means engageable with the pinion gear and operable by said lever in response to oscillation thereof, a sprocket engaged with and movable by said pinion gear, a cam on said sprocket, and a push bar pivotally mounted on said guide and engageable by said cam for pivoting the same, said push bar being engageable with said hook to effect engagement thereof with the other portion of the rod line.

3. In a device of the character described, a support, a separable rod line reciprocably mounted on the support and having portions adapted for engagement with a well pumping mechanism and power transmission mechanism respectively, a hook mounted on one portion of the rod line and separable from the other portion thereof, a boss on the rod line having a foot member, a guide on the support, a block slidably mounted on the guide and engageable with the support, a latch on the block engageable with the foot member to move the block into engagement with the support for stopping movement in one direction of the portion of the rod line having engagement with the well pumping mechanism and effecting disengagement of the hook, means on the guide for guiding the block upwardly into the path of the boss, a lever pivotally mounted on the guide and frictionally engageable and operable by the portion of said rod line having engagement with the power transmission mechanism when the hook is in disengaged condition, a pinion gear, means engageable with the pinion gear for imparting rotary motion thereto and operable by said lever in response to oscillation thereof, a sprocket engaged with and movable by said pinion gear, a cam on said sprocket, a push bar pivotally mounted on said guide and engageable by

said cam for pivoting the same, said push bar being engageable with said hook to effect engagement thereof with the other portion of the rod line, and means for retaining said pinion gear and sprocket in stationary condition when not being rotated by the rotation imparting means.

4. In a device of the character described, a support, a separable rod line reciprocably mounted on the support and having portions adapted for engagement with a well pumping mechanism and power transmission mechanism respectively, a hook mounted on one portion of the rod line and separable from the other portion thereof, a boss on the rod line having a foot member, a guide on the support, a block slidably mounted on the guide and engageable with the support, a latch on the block engageable with the foot member to move the block into engagement with the support for stopping movement in one direction of the portion of the rod line having engagement with the well pumping mechanism and effecting disengagement of the hook, means on the guide for guiding the block upwardly into the path of the boss, a lever pivotally mounted on the guide frictionally engageable and operable by the portion of said rod line having engagement with the power transmission mechanism when the hook is in disengaged condition, a pinion gear, a pawl engageable with said pinion gear for imparting rotary motion thereto and operable by said lever in response to oscillation thereof, a sprocket, means on said pinion gear for intermittently moving said sprocket, a cam on said sprocket, and means operable by said cam and engageable with said hook to effect engagement thereof with the other portion of the rod line.

5. In a device of the character described, a separable rod line, means engageable with the ends of the rod line for connecting said ends with a power mechanism and a driven apparatus respectively for reciprocating said rod line and applying pulling force thereto, said driven apparatus imparting a pulling force which changes at a variable point of the stroke, hook means for coupling the separate portions of the rod line, means actuated by the reciprocable rod line when a change in pull on the rod line imparted by the driven apparatus does not occur at a predetermined point for effecting uncoupling of the hook means from one portion of the rod line, and means actuated by the rod line portion having connection with the power mechanism for effecting recoupling of the hook means and the rod line portion after a predetermined time interval whereby the duration of the operation of the driven apparatus is controlled by the variation in the point of change in the pull provided by said driven apparatus.

6. In a device of the character described, a driven rod line, means engageable with one end of the rod line for connecting said end with a well pumping mechanism, means supporting the rod line whereby weight of the rod line causes deflection thereof, said deflection of the rod varying with the pulling force acting on the rod line, said well pumping mechanism imparting a pulling force to the rod which changes at a variable point of the stroke, a supplemental bar adapted for engagement with a power means and continuous reciprocation thereby, a hook pivotally mounted on the end of the supplemental bar and adapted to be coupled with the driven rod line for imparting reciprocation thereto, means actuated by the driven rod line when the change in pull on said rod line imparted by the well pumping mechanism does not occur at a predetermined point in the stroke for effecting uncoupling of the hook from said driven rod line, a cam, oscillatable means on the support having frictional engagement with the supplemental bar while the hook and driven rod line are uncoupled, means operated by the oscillation of the oscillatable means for rotating the cam, and means actuated by the cam for raising the hook and recoupling same with the driven rod line.

7. In a device of the character described, a support, means reciprocably mounted on the support for transmitting reciprocal motion from a driving mechanism to a driven mechanism, said driven mechanism providing a pull on the reciprocable means, said pull changing at a variable point in the reciprocation of the reciprocable means, means connecting the reciprocable means to one of the mechanisms, means on the reciprocable means engageable with the other of said mechanisms, means actuated by the reciprocable means when the change in pull on the reciprocable means does not occur at a predetermined point for effecting disengagement of said connecting means from the mechanism with which it is adapted to be connected, and means for effecting reengagement of said connecting means connected with the other of said mechanisms after a predetermined time interval.

8. In an apparatus of the character described, a support, a rod line reciprocably mounted on the support adapted for engagement with a driven mechanism, said driven mechanism providing a pull on the rod line, said pull changing at a variable point in the reciprocation of the rod line, a supplemental bar adapted for engagement with a driving mechanism, means including a hook pivotally mounted on the supplemental bar for coupling the supplemental bar and the rod line, means actuated by the rod line when the change in pull on the rod line does not occur at a predetermined point for effecting uncoupling of said bar and rod line, means for raising the hook, means frictionally engageable with the supplemental bar and responsive to reciprocation thereof for actuating said hook raising means to effect recoupling of said hook with the rod line at predetermined intervals, and means for varying the time interval between uncoupling and recoupling of said hooks with said rod line.

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