Oct. 31, 1961 M. M. ROSS 3,006,201

WELL PUMP MEANS

Filed Nov. 12, 1957 3 Sheets-Sheet 1

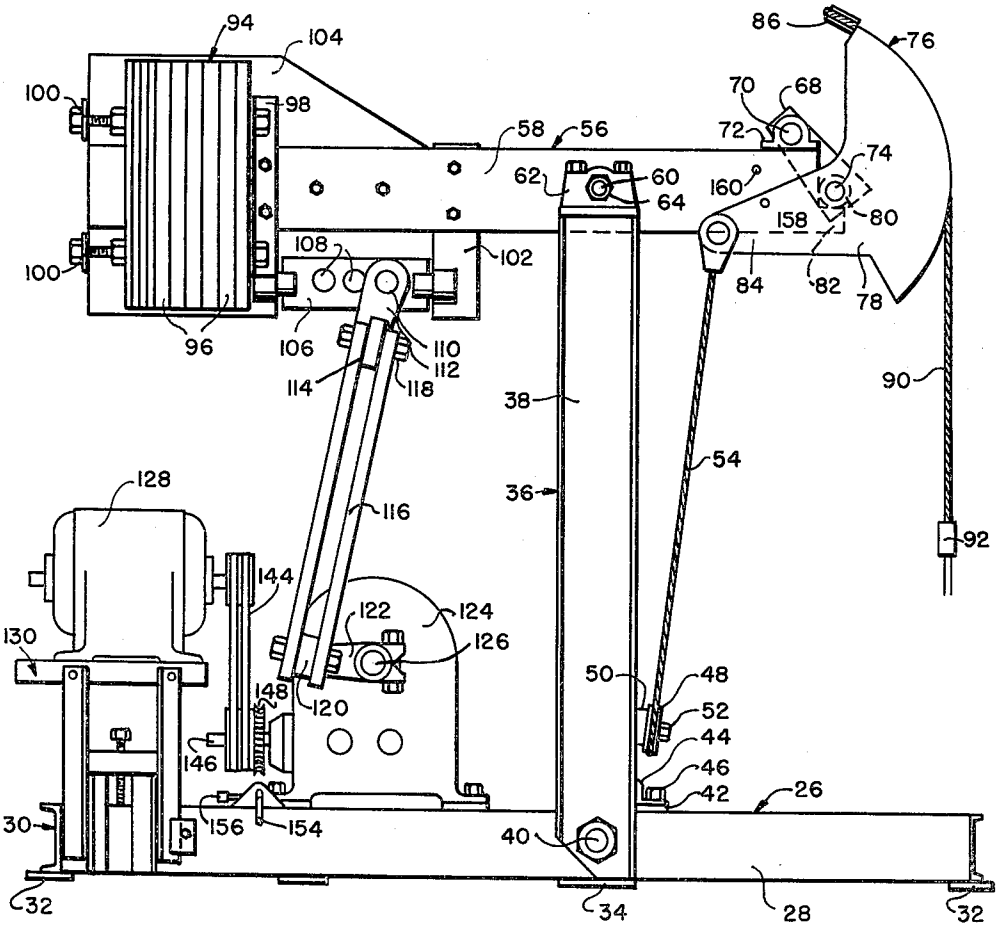


FIG. 1

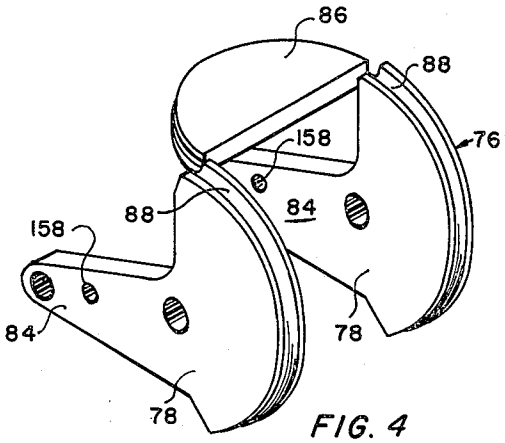


FIG. 4

INVENTOR
MILBURN M. ROSS
ATTORNEY
John H. Widdowson

Oct. 31, 1961 M. M. ROSS 3,006,201

WELL PUMP MEANS

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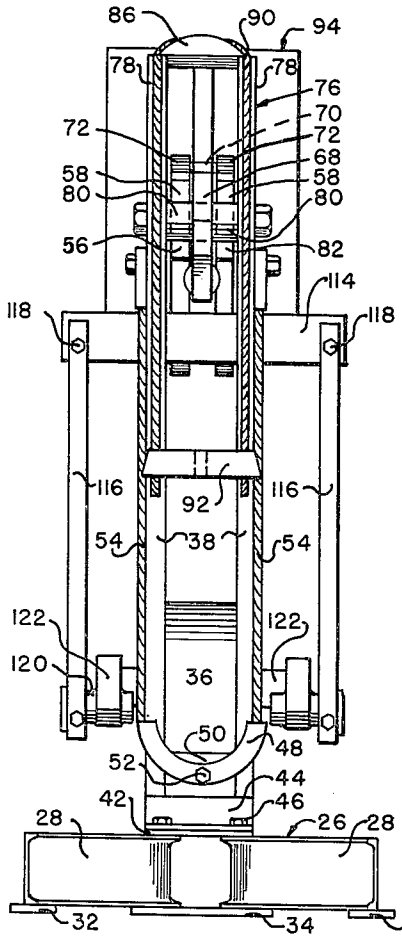


FIG. 2

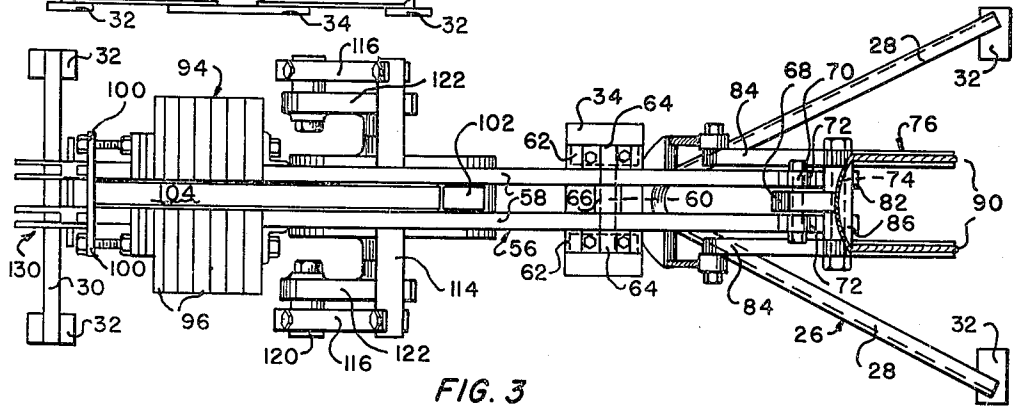


FIG. 3

INVENTOR
MILBURN M. ROSS
ATTORNEY
John H. Widdowson

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WELL PUMP MEANS

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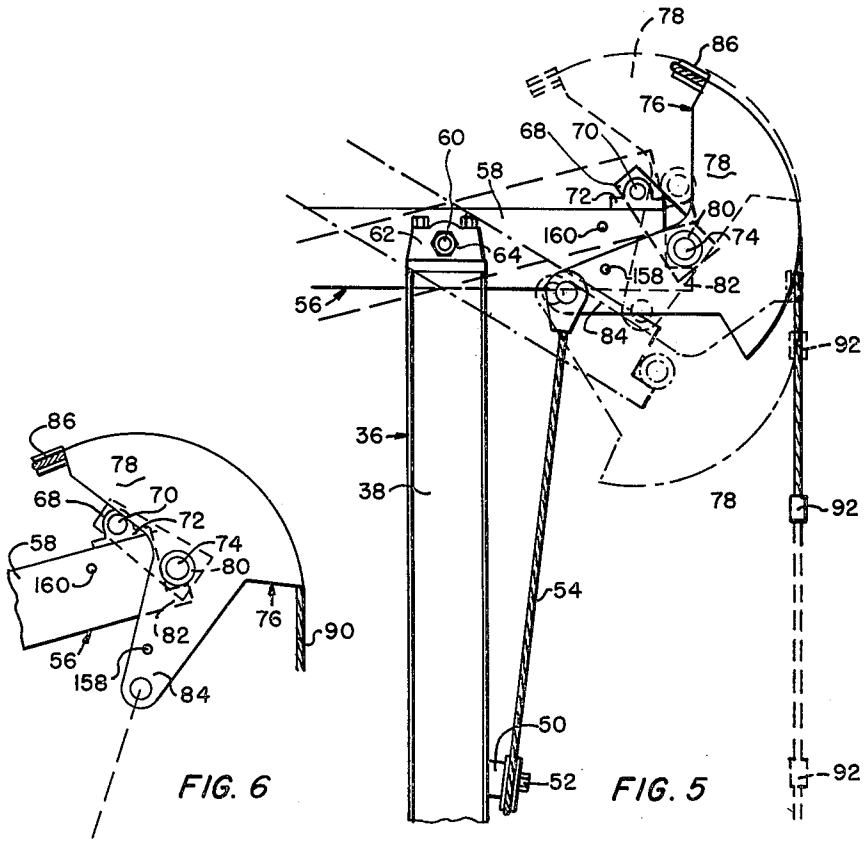


FIG. 5

FIG. 6

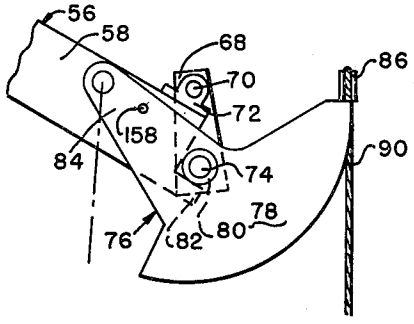


FIG. 7

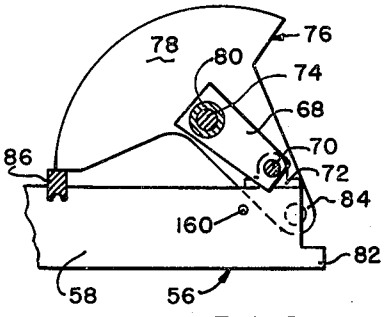


FIG. 8

INVENTOR

MILBURN M. ROSS

ATTORNEY

John H. Widdowson

United States Patent Office

3,006,201
Patented Oct. 31, 1961

3,006,201

WELL PUMP MEANS

Milburn M. Ross, 631 N. Bluff, Wichita, Kans.

Filed Nov. 12, 1957, Ser. No. 695,673
3 Claims. (Cl. 74—41)

This invention relates to pumping. In a more specific aspect this invention relates to means for pumping wells, particularly oil wells. In still a more specific aspect this invention relates to pump jacks for pumping oil wells. In yet a more specific aspect this invention relates to new pump jack means for pumping oil wells, which utilizes a pivoted horsehead assembly to increase the travel of the pump polish rod relative to the distance of travel of the walking beam upon rocking, and which means provides for movement of the pump polish rod up and down in substantially a perpendicular or straight line.

Means for pumping wells has long been known in the art, and it is common in the prior art to use a pump jack having an upright Samson post mounted on a horizontally disposed base structure. A walking beam is commonly mounted on the top of this Samson post, the walking beam rocking up and down in operation. On one end of the common walking beam is mounted a horsehead to which is attached means connecting the horsehead and pump jack to the pump polish rod. The other end of the walking beam of the prior art mounts counterbalance weights, and this portion of the walking beam on one side of the Samson post is connected to power means which rocks the walking beam relative to the Samson post in operation. The usual powering means of the pump jack devices of the prior art consists of a motor or engine which is connected to the walking beam by gearing, normally a gear box assembly connected to the motor engine by pulley belts. In the common pump jacks of the prior art the polish rod of the pump moves up and down the same distance as the end of the walking beam to which the polish rod is attached. Means have been proposed to increase polish rod travel in relation to walking beam travel, but they have been unsuccessful either from a manufacturing standpoint or from an operational standpoint. Further, the usual pump jack means is inefficient and difficult to use and contend with when the well and auxiliary equipment must be worked, for example, the tubing pulled, the pump replaced, the well cleaned out, etc. The pump jack equipment, including the horsehead and walking beam, and even the Samson post, is in the way, making it difficult to use rod and tubing servicing equipment, and the like. Sometimes in working and repairing, it is necessary to completely move the pump jack back from the area of the well. Additional inefficiency and waste of energy and equipment is present in the common pump jack equipment known in the prior art. For example, it is common to use powering means much greater in potential output than is necessary to operate the pump jack during pumping operation, this being done so that the power is available to lift the weighting means when the counterbalance of the pump is not present or available. Such is experienced when repairing equipment, working the well to clean same, and the like. I have invented new well pump means which overcomes all of the disadvantages experienced with the pump means known in the prior art, and common to well pumping operations. In the preferred embodiments of the new well pumping means of my invention, the travel of the pump polish rod is much greater than the travel of the end of the walking beam which mounts the preferred pivoted horsehead assembly of my invention. The new pump means of my invention in the preferred embodiment is easily and conveniently moved back out of the immediate well area, including the Samson post, the walking beam, and the preferred

pivoted horsehead assembly. In the new well pump means of my invention the pump polish rod moves up and down in substantially a perpendicular or straight line during well pumping operations. This provides for long life, cuts down wear very substantially, and saves a great deal of energy which is commonly wasted by the known pump jack means. Further, I have provided new pump jack means which can be handled mechanically by hand crank means. This provides for a pump jack which needs only power means of potential output enough to operate the pump jack during pumping operation. The new well pumping means of my invention is indeed a great step forward in the art.

The new pump means of my invention has a base. This base is normally horizontally disposed at the site of the oil or water well. A Samson post is mounted on the base. It is preferred that this Samson post be tiltably mounted on the base in the preferred specific embodiments of my new pump means. A walking beam is tiltably mounted on the upper end portion of the Samson post. One end portion of the walking beam is provided to receive and secure a pump rope or cable, which is in turn during operation connected to a pump polish rod or similar device. The other end portion of the walking beam mounts counterbalance means. Means are provided to rock the walking beam up and down in operation. The attachment means on the end portion of the walking beam are so constructed and the walking beam is pivotally mounted in a manner that the pump rope or cable or like means in operation remains substantially in a straight line upon rocking the walking beam. In a preferred specific embodiment of the new pump means of my invention, I preferably pivotally mount a horsehead on the well operating end of the walking beam to compound the stroke of same relative to the pump polish rod. In the preferred specific embodiment connecting means operationally connect the pivoted horsehead assembly to the Samson post preferably.

It is an object of this invention to provide new pumping means.

It is another object of this invention to provide new pump jack means for the pumping of wells, particularly oil or water wells.

Another object of this invention is to provide new pump jack means for pumping oil wells which will compound the stroke of the walking beam upon operation relative to the travel of the well pump polish rod.

Still another object of this invention is to provide new pump jack means which is completely adjustable with regard to the travel of the well pump polish rod relative to the travel distance of the end of the walking beam to which it is connected.

A further object of this invention is to provide new pump jack means for pumping wells, the structural members of which can be easily and conveniently moved out of the immediate well area for working the well, particularly moving the Samson post, walking beam, and horsehead back out of the immediate well area.

An additional object of this invention is to provide new pump jack means which can be handled as necessary by hand when not in pumping operation, resulting in less power means requirement.

Another object of this invention is to provide new pump jack means, which are easy and economical to build and install, efficient in operation, and convenient and economical to repair or replace the parts thereof, and which can conveniently be constructed mobile or portable.

Other objects and advantages of the new pump jack means of my invention will become apparent to those skilled in the art upon reading this disclosure.

Drawings accompany and are a part of this disclosure.

These drawings depict a preferred specific embodiment of the new pump jack means of my invention, and it is to be understood that the drawings are not to unduly limit the scope of my invention. In the drawings,

FIG. 1 is a side elevation view of a preferred specific embodiment of pump jack means of my invention.

FIG. 2 is a front elevation view of same.

FIG. 3 is a top plan view of same.

FIG. 4 is a perspective view of the horsehead of the new pump jack means of my invention of FIGS. 1 through 3.

FIG. 5 is a side elevation view of the horsehead and walking beam in up, middle and down operating position, with the horsehead in dotted lines in up and down position.

FIG. 6 is a side elevation view of the horsehead and walking beam in up operating position.

FIG. 7 is a side elevation view of the horsehead and walking beam in down position.

FIG. 8 is a side elevation view partly in cross section of the horsehead and walking beam with the horsehead tilted back and resting in rest position on the top surface of the walking beam.

Following is a discussion and description of the new pump jack means of my invention made with reference to the drawings whereon the same reference numbers are used to indicate the same or similar parts or structure. The discussion and description is of a preferred specific embodiment of the new pump jack means of my invention, and it is to be understood that such is not to unduly limit the scope of my invention.

Referring now to FIGS. 1 through 8 of the drawings, wherein is depicted the most preferred specific embodiment of the new pump jack means of my invention, shown in the drawings of the application, the pump jack is supported on the horizontally disposed base **26**, which is preferably formed of spaced channel beam members **28**, which are bent outwardly in their forward end portions. The rear ends of the spaced channel beam members **28** are suitably secured, preferably by welding, to a transverse base member **30**, which can conveniently be flat stock or a channel beam. Pad members **32**, preferably of metal, are suitably mounted on the ends of channel beams **28**, and transverse member **30**. Base plate **34** is suitably secured to the bottom of base members **28**. It serves to rest channel beams **28** on the usual concrete foundation (not shown) and to provide backing for Samson post **36** when such is in pumping position (FIG. 1).

Samson post **36** is preferably constructed of a pair of spaced and parallel channel beams **38**. These channel beams **38** are pivotally secured in their lower end portions to channel beams **28** on the outside thereof. Nut and bolt means **40** passing through beams **38** and **28** is preferably used to so pivotally mount the Samson post **36**. Samson post **36** is preferably tiltably mounted with the lower ends of beams **38** cut away at the rear to allow them to tilt backwardly. As will be obvious to one skilled in the art, this preferred tiltable mounting can be accomplished by pivotal mounting with the pivot point to the rear of beams **38**. A plate **42** is suitably secured to the upper edges of beams **28** and thereacross. A shoe **44** is suitably mounted on the forward edges of beams **38**. The toe portion of shoe **44** engages plate **42** or beams **28** when Samson post **36** is in upright position, which is the position shown in FIG. 1, and the position of Samson post **36** when the pump is in operating position. Samson post **36** is preferably maintained in upright position by bolt means **46** passing through the toe of shoe **44** and being threadedly engaged in plate **42** or beams **28**. A fixed pivot **48** is suitable mounted on the front edges of channel beams **38** at the lower end portions thereof. This fixed pivot **48** is attached to bracket means **50** which is in turn suitably attached to beams **38** of Samson post **36**. A bolt **52** passing through fixed pivot member **48** and threadedly secured in bracket

means **50** has been found satisfactory. Pivot member **48** has a rope groove around the outside edge thereof to receive operating rope or cable **54**. Of course, member **54** can be a bar or rod connecting link or a chain, if desired.

A walking beam **56** is pivotally mounted in an inner portion between channel beams **38** of Samson post **36**. This walking beam **56** rocks up and down during pumping operation of the pump jack means. The walking beam is preferably constructed of two spaced and parallel steel beams **58**. The beam is mounted on the upper end of Samson post **36** preferably by a shaft **60** bearingly mounted through beams **58**, the ends of shaft **60** being fixed in cap members **62** suitably mounted on the upper ends of beams **38**. Nut means **64** secure the ends of shaft **60**, and shaft **60** is preferably mounted through beams **58** by bearing means **66**.

A hanger member **68** is pivotally mounted in its upper end on the outer end of walking beam **56** members **58** by a shaft **70** journaled in pillar bearings **72** which are mounted on the outer ends of the upper edges of walking beam members **58**. This hanger member **68** mounts a shaft **74** in its lower end portion, and this shaft **74** in turn pivotally mounts horsehead **76**, the ends of shaft **74** preferably being fixed in spaced and parallel horsehead members **78**, and shaft **74** preferably being journaled in hanger member **68**. Of course, if desired, shaft **74** can be journaled directly in the outer end of walking beam **56**. Shaft **74** preferably has spacer sleeve **80** mounted thereon between hanger members **68** and horsehead members **78**. This sleeve **80** maintains the proper spacing, and preferably houses the mounting bearings, and rests against the outer ends of beams **58** when hanger **68** is in forward and down position, which is the position for pump jack operation. The forward ends of beams **58** preferably have lower projecting portions **82** forming a ledge on which sleeve **80** and shaft **74** therein rest.

Horsehead **76** and its spaced parallel members **78** are preferably of the shape shown in the drawings, FIGS. 1 through 8. Members **78** have rearwardly projecting portions **84**, and arcuate outer edges. An upper cable return and connecting member **86** is suitably mounted between members **78**. This member **86** and the forward edges of side members **78** have a contiguous rope or cable groove **88** therein. This contiguous rope groove **88** receives and mounts operating rope or cable **90**. The ends of rope or cable **90** are attached to connecting member **92** which mounts the pump polish rod (not shown) when the pump jack assembly is in operating position, the position of FIG. 1. The ends of rope or cable **54** are pivotally secured in any suitable manner to the outer end portions of arm portions **84** of horsehead members **78**. This connecting means **54** can also conveniently be wire or chain, or other suitable means. When walking beam **56** rocks up and down in pumping operation, horsehead **76** pivots around shaft **74**, since the distance between fixed pivot assembly **48** and the horsehead **76** remains constant as measured by connecting means **54**. In addition, horsehead **76** as a whole moves up and down in an arc with the end of walking beam **56**. The arcuate outer edges of horsehead members **78**, having the rope or cable grooves **88** therein, are so shaped that in operation cable **90** moves up and down in substantially a straight line and perpendicular. Thus, the pump polish rod (not shown) moves up and down in substantially a straight and perpendicular line, eliminating wear and reducing frictional losses. This is best shown in FIG. 5 of the drawings, where the up, center and lower positions of horsehead **76** are shown. The up and lower positions of horsehead **76** are in dotted lines on the drawings. FIGS. 6 and 7 show these up and lower positions of horsehead **76**, respectively, in solid lines. Further, as a result of this unique and new structure of the pump jack means of my invention, the travel of operating cable **90** and thus the pump

polish rod is increased over the up and down travel of the walking beam **56**, resulting in a compounded pump stroke. The new pump jack structure of my invention results in a smaller and more compact unit which is very portable, and with the same length of pump polish rod stroke for the usual much larger non-portable unit.

Counterbalancing weighting means **94** is suitably mounted on the rear end portion of walking beam **56**. In the usual manner, quarter-weights, half-weights and weights are removably mounted so that the counterbalance weight can be adjusted according to the pump load. These weights **96** are secured by weight attaching angle irons **98** which are suitably secured to beam members **58** and by weight clamps and adjusting means **100** suitably mounted on the walking beam **56**. A front bearing support and weighting member **102** is suitably mounted between walking beam **56** members **58**. And a rear bearing supporting member and weight **104** is suitably mounted between walking beam members **58**. A stroke adjuster and aligner is mounted between these bearing support members **102** and **104**. This stroke adjuster and aligner is shown as member **106** on the drawings. It has a plurality of spaced holes **108** therein which receive a shaft and aligning bearings **110** in the desired hole **108**. Connecting members **112** are secured to transverse bar **114**, the other end of connecting member **112** being pivotally mounted on shaft and aligning bearings **110**. Crank arms **116** are suitably connected in their upper end portions to transverse connecting member **114** in its end portions by nut and bolt means **118**. The lower end of crank arms **116** mount crank pins **120**, and these crank pins **120** are rotatably mounted in crank arms **122** which is powered from speed reduction and gearing box assembly **124** by rotating shaft **126**. This speed reduction gearing is of conventional design, and it is suitably mounted on base member channel beams **28**. Speed reduction gearing **124** is powered by motor means **128**, which is preferably mounted on the base member beams **28** by suitable adjustable motor mount means shown generally at **130**. Pulley belts **144** connect the power shaft of motor **128** to the input shaft of speed reduction gearing **124**. The adjustable motor mount means **130** can be used to tighten the pulley belts **144**. The input shaft to speed reduction gearing **124**, namely shaft **146**, preferably mounts a worm spur gear **148** to turn therewith. This worm spur gear **148** is utilized in operating the pump jack means to pivot the walking beam **56** by hand. This is desirable when the pump jack means is positioned for working in the vicinity of the well, particularly when the Samson post **36** is tilted back. An operating worm gear (not shown) is mounted to engage gear **148** and to be turned by hand crank **154**. Pins **156** are retractably mounted in brackets to position operating worm gear in operating engagement with worm spur gear **148** or out of operating engagement therewith. Of course, other engagement means can be used. When the pins **156** are in extended position, the gears are in operating position, and when the pins **156** have been retracted, the gears are out of operating engagement. By these means, the gearing **124** can be operating by hand to rock walking beam **56** and move same into desired position. This type of operating means has great advantage. It cuts down on the requirements of motor **128** from the power standpoint, making it only necessary to have the motor large enough to operate the pump jack during pumping operation. Also, the preferred hand operated means has the great advantage that it is self-locking and will remain in the position to which it has been turned and which is desired. The pump jack assembly can be rather completely tilted back to move out of the immediate well area so that this area can be worked with the usual auxiliary equipment in maintaining an oil well. In FIG. 8 the laid back position of horsehead **76** is shown, to show how the horsehead **76** can be moved back out of the way and from above the immediate well area. Horsehead **76** rear arm portions **84** have apertures **158** therethrough. The outer end portions of walking beam members **56** have apertures **160** therethrough, which are substantially the same size as apertures **158**. A pin (not shown) is passed through these apertures **158** and **160** when in alignment to coincide to permit the tilting back of Samson post **36**.

As will be apparent from a comparison of FIGS. 5, 6 and 7, the construction of horsehead member **78** and the manner of securing the rope or cable **54** or other connecting member to the arm portions **84** thereof is desirably such that a relatively small amount of leverage or mechanical advantage from the horsehead on rope or cable **90** is obtained when the horsehead **78** is in the up position (FIG. 6), and a relatively greater amount of leverage therefrom is obtained as the horsehead **78** moves through its other positions (FIGS. 5 and 7). This is very desirable since this changing leverage as horsehead **78** and walking beam **58** move through the various positions eliminates a substantial amount of rod stretching and breaking usually encountered, since the initial force to move the rods is applied relatively slowly. The greatest force is applied during an intermediate portion of the stroke when static inertia is the lowest. The rod moves slow when the inertia is great at the bottom. This rod stretching and breaking is particularly bothersome with prior art structures. Also, minimum leverage is particularly desirable when the horsehead is in the up position as shown in FIG. 6, since the downward force of the counterbalancing weights is at its greatest when the horsehead is in the up position. As seen in FIG. 6, in the up position of the horsehead and down position of the weights, the points of connection of rope or cable **54** to the Samson post **36** and horsehead **78** are substantially in line with the point of pivot of the horsehead on walking beam **56**, which effectively limits and opposes further upward movement of the walking beam and the horsehead **78** thereon. In common well pumping means, the motor or gearing structure shown generally at **124** in applicant's drawings is the structure which receives the full force of the counterbalancing weights. This downward force represents a considerable amount of force and results in excessive wear and/or repairing of the gear box and further requires greater structural strength to be initially provided in order to oppose this force.

Another advantage of the well pumping means shown in FIGS. 1–8 of the drawings is that when the connecting member **54** is a flexible member the unit itself will indicate the maximum stroke speed. For example, if too fast a stroke is being used, the rods in the well casing will not fall as fast as the walking beam is moving downwardly with the horsehead thereon, thus the horsehead **78** will be impeded in its downward movement and the cable **54** will become slack, thus readily indicating too fast a stroke speed. This simple mechanical feature provides a very easy manner for determining maximum stroke speed for any particular well load.

As will be evident to those skilled in the art, various modifications of this invention can be made, or followed, in the light of this disclosure and discussion without departing from the spirit or scope of the disclosure or from the scope of the claims.

I claim:

1. In a well pumping apparatus having a Samson post, a walking beam pivotally mounted on said Samson post, counterbalancing weight means carried by one end portion of said walking beam, power and connecting means operatively connected to rock said walking beam up and down in operation, the improvement comprising, in combination, a hanger member pivotally mounted in one end portion on the top of said walking beam on the other end portion thereof, a shaft transversely mounted in the other end portion of said hanger member, said shaft and said hanger member being positioned and constructed so that said shaft contacts and rests against the outer end of

said walking beam when said hanger member is in the down position, an elongated horsehead, said horsehead being pivotally mounted on the end portions of said shaft intermediate the front and rear of said horsehead and having a pair of spaced and generally parallel side members with arcuate edges constructed to in operation project substantially forward of said walking beam and integral arm portions projecting substantially rearwardly of the point of pivot, said horsehead and said hanger member being pivotal about said walking beam to tilt back with said horsehead laying against the top of said walking beam, an upper connecting member joining said side members, said connecting member having an arcuate edge, said arcuate edges of said side members and said connecting member constructed and adapted to receive a pump rope or cable to be secured to a polish rod, a connecting means of rope or cable oppositely and pivotally secured in its end portions at fixed points on the outer end portions of said rearwardly projecting arm portions of said horsehead and in a central portion to a lower end portion of said Samson post, said last-named rope or cable and said horsehead being constructed and adapted so that in operation maximum leverage is obtained as said horsehead and said beam pass through an intermediate portion of the upward movement thereof and when said horsehead reaches its upper limit of movement in operation the axis of said connecting means and said point of pivot of said horsehead are substantially in line to thereby limit and resist further upward movement of said walking beam, reduce rod stretching and effectively balance said weights at said one end of said beam as they reach their lowermost position, said arm portions of said horsehead having apertures therethrough alignable with apertures in said walking beam to receive a shaft to lock said horsehead and beams together in moving relation, said well pumping apparatus being constructed and adapted to in operation move said walking beam up and down with said horsehead member compounding the stroke of said walking beam by the leverage action of said arm portions thereof and said last-named rope or cable secured thereto, said horsehead being positioned during operation to maintain the arcuate edges thereof so as to position the cable or rope thereon between said horsehead and a polish rod in a line generally coaxial with the axis of the well casing.

2. In a well pumping apparatus having a Samson post, a walking beam pivotally mounted on said Samson post, counterbalancing means carried by one end portion of said walking beam, and power and connecting means operatively connected to said walking beam to rock said walking beam up and down in operation, the improvement comprising, in combination, a hanger member pivotally mounted in one end portion on the top of said walking beam at the other end portion thereof, a shaft mounted in the other end portion of said hanger member, said shaft and hanger member being positioned and constructed so that said shaft rests against the outer end of said walking beam, an elongated horsehead, said horsehead being pivotally mounted on the end portions of said shaft intermediate the front and rear of said horsehead and having an arcuate edge constructed to in operation project substantially forward of said walking beam and an integral arm portion projecting substantially rearwardly of the point of pivot, said horsehead and said hanger member being pivoted about said walking beam to tilt back with said horsehead laying against the top of said walking beam, said arcuate edge of said horsehead being constructed and adapted to carry a pump rope or cable to be secured to a polish rod, a connecting member pivotally secured in one end portion at a fixed point on the outer end portion of said rearwardly projecting arm portion of said horsehead and in the other end portion to the lower end portion of said Samson post, said connecting member and said horsehead being constructed and adapted so that in operation leverage differential is obtained as said horsehead and said walking beam are moved with minimum leverage being obtained when said horsehead and said walking beam are substantially in their uppermost position with the point of pivot of said horsehead and the axis of said connecting member substantially in line to thereby limit upward movement of said walking beam said well pumping apparatus being constructed and adapted to in operation move said walking beam up and down with said horsehead member compounding the stroke of said walking beam by the leverage action of said arm portion thereof and said connecting member secured thereto, said horsehead being positioned in operation to maintain the arcuate edge thereof so as to position the rope or cable thereon between said horsehead and a polish rod in a line generally coaxial with the axis of a well casing.

3. In a well pumping apparatus having a Samson post, a walking beam carried by said Samson post, and means to rock said walking beam up and down in operation, the improvement comprising, in combination, a horsehead, said horsehead being pivotally mounted on one end portion of said walking beam, said horsehead having an arcuate portion forward of the point of pivot of said horsehead and an arm portion projecting rearwardly of the point of pivot of said horsehead, said forward portion of said horsehead being constructed and adapted to carry a pump rope or cable, a connecting member secured to said Samson post and pivotally secured in an end portion to a fixed point on said rearwardly projecting arm portion of said horsehead and being otherwise out of contact with said horsehead, said well pumping apparatus being constructed and adapted so that the axis of said connecting member and the point of pivot of said horsehead are substantially in line when said horsehead reaches its upper limit of movement.

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