Sept. 8, 1931. J. B. SPERRY 1,822,546

PUMPING APPARATUS

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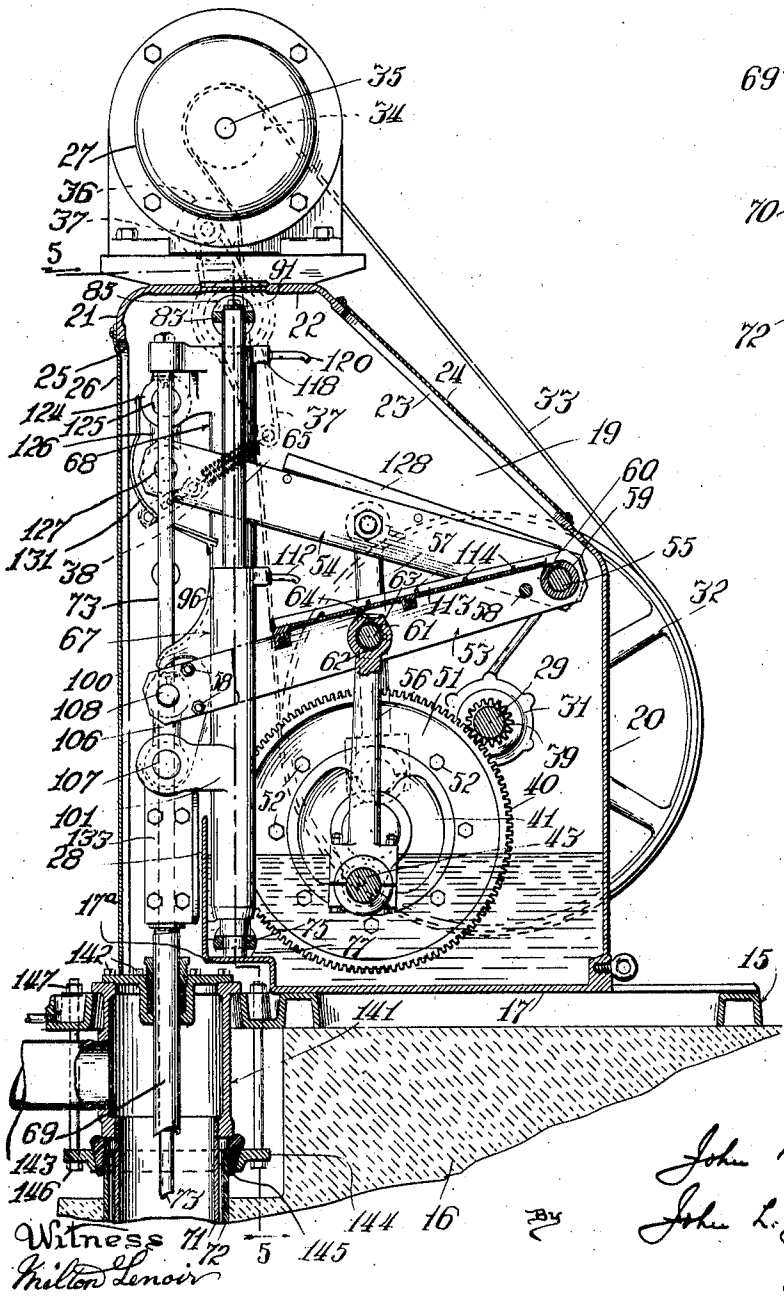
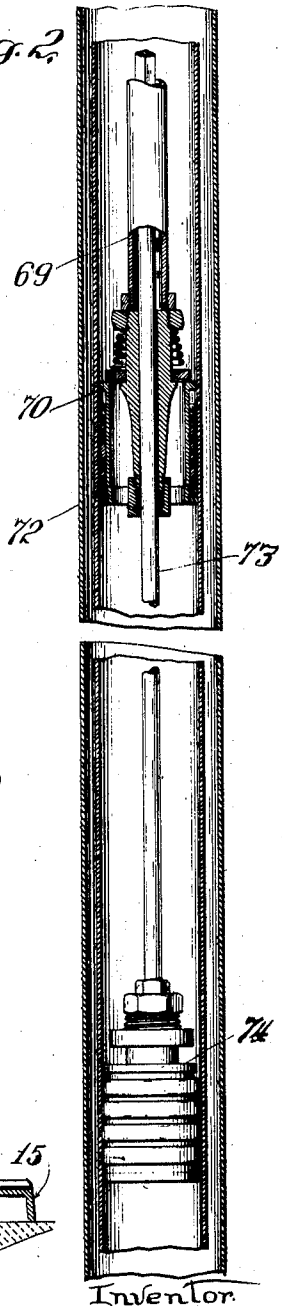
Fig. 1.



Witness
Milton Lenoir

Fig. 2.



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Sept. 8, 1931. J. B. SPERRY 1,822,546

PUMPING APPARATUS

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Fig. 3.

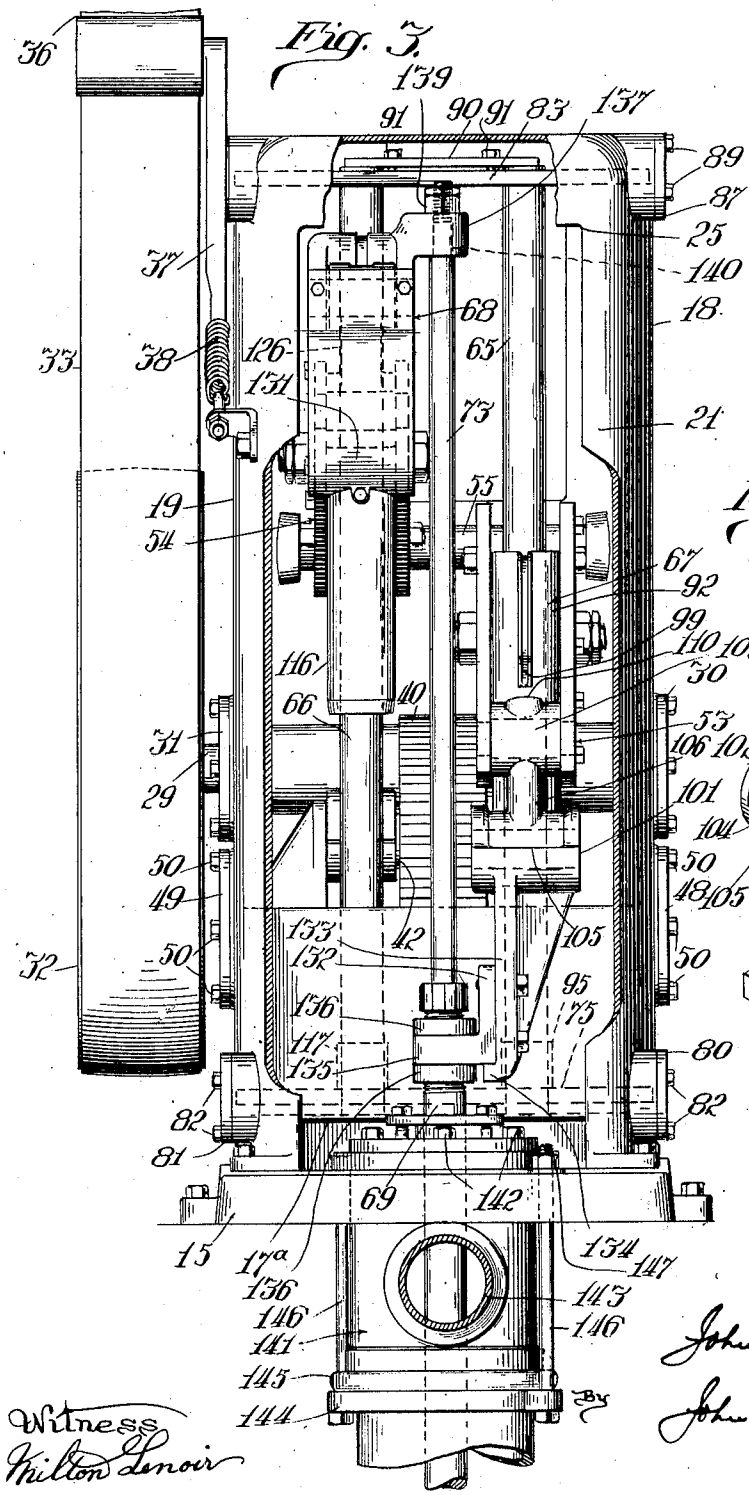
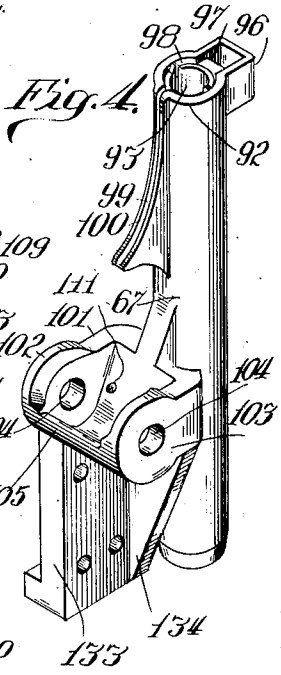


Fig. 4.



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PUMPING APPARATUS

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Fig. 5.

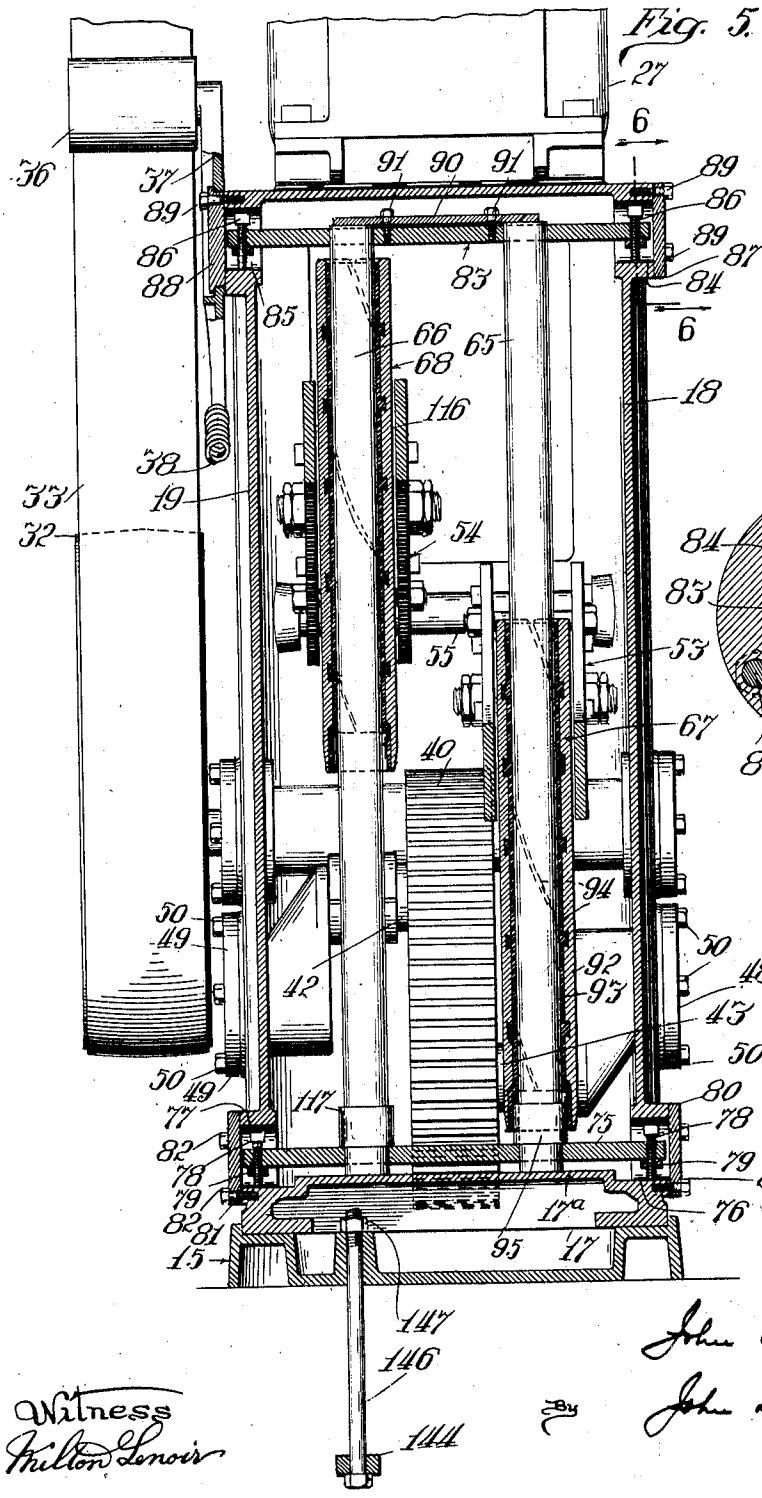
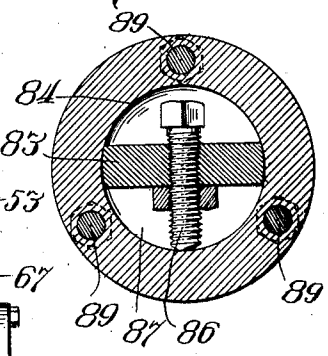


Fig. 6.



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PUMPING APPARATUS

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Fig. 7.

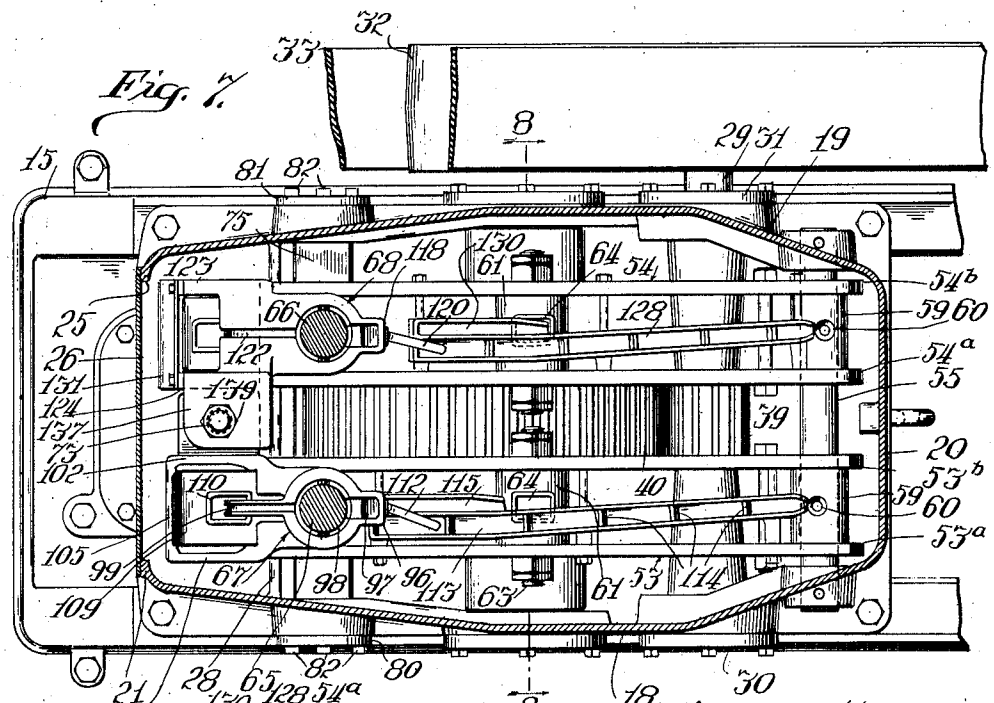

Fig. 8.

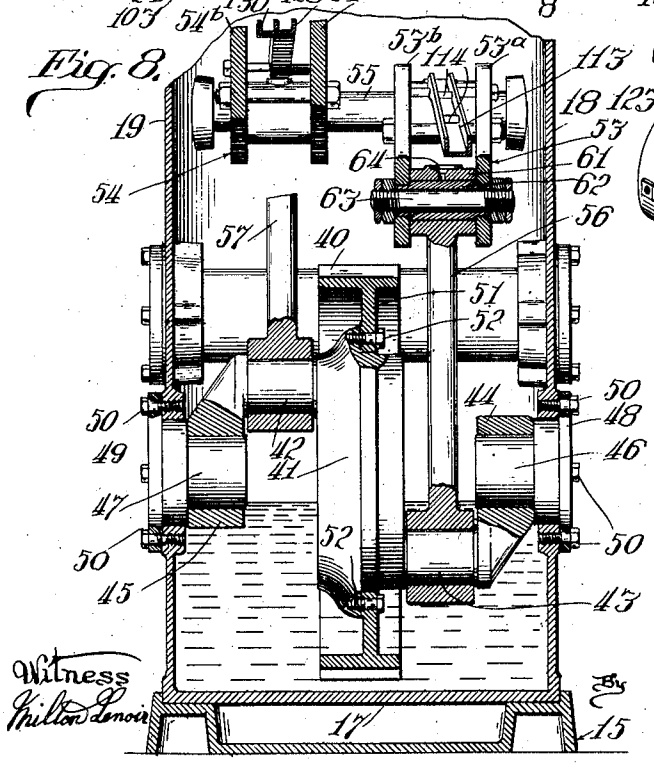

Fig. 9.

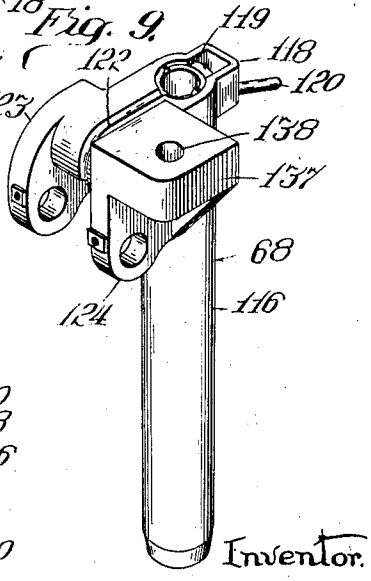

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Fig. 10.

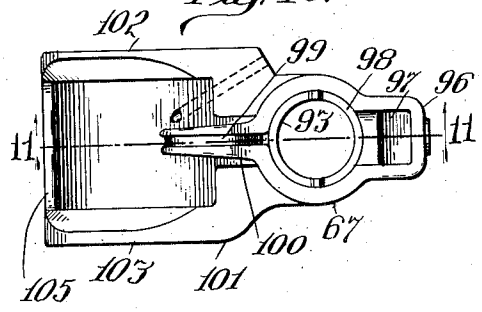

Fig. 13.

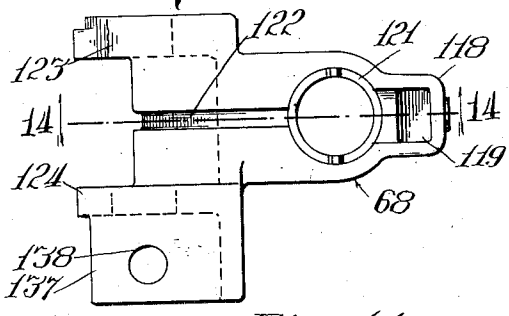

Fig. 14.

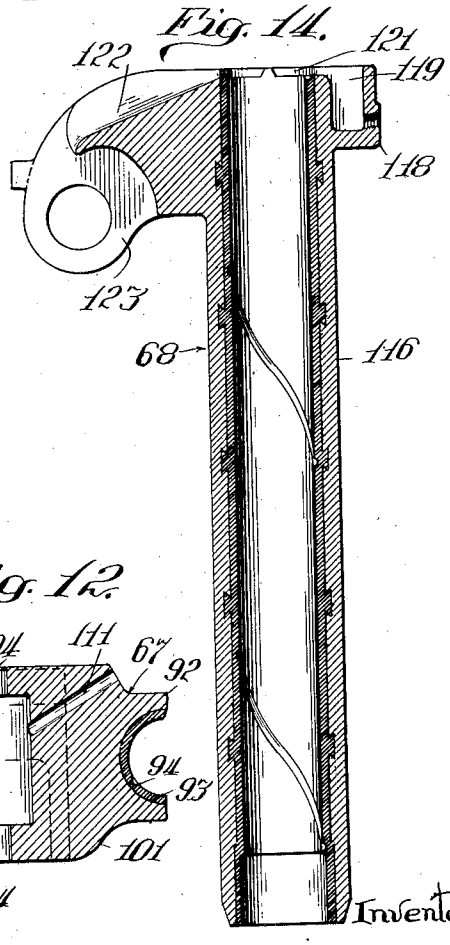

Fig. 11.

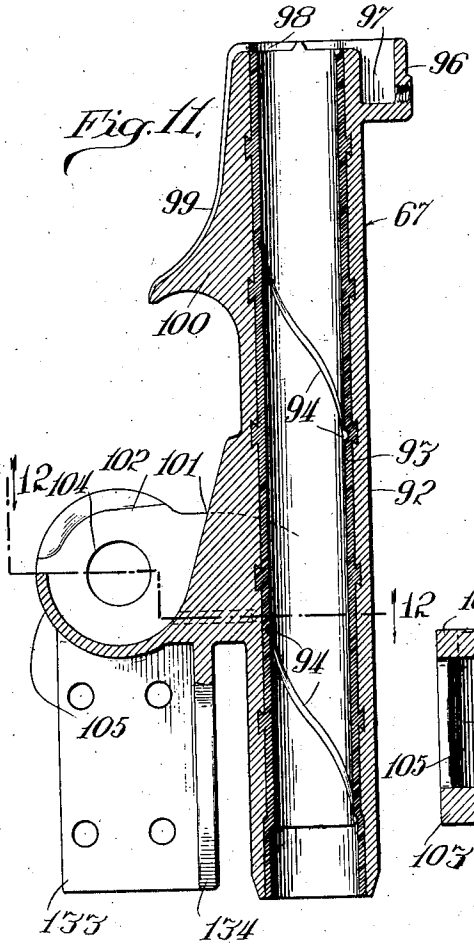

Fig. 12.

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Patented Sept. 8, 1931

1,822,546

UNITED STATES PATENT OFFICE

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PUMPING APPARATUS

Application filed August 29, 1925. Serial No. 53,274.

My invention relates to pumping apparatus of the type in which one or more pistons are reciprocated vertically by the operation of rotary driving mechanism contained within a suitable housing or casing which is also adapted to contain a quantity of oil or other suitable lubricant by which the driving mechanism is lubricated, and while my improvements are especially adapted for application to double acting pump jacks in which two pistons are simultaneously reciprocated by the driving mechanism, certain features thereof may be applied to single acting pumps. The improvements to which my present application is particularly directed have to do with the lubrication of the actuating devices for the pistons; with the construction of the devices for actuating the pistons and their adjustment to insure parallelism of the plunger rods by which the pistons are connected with the actuating mechanism; and with the construction of the driving mechanism. The object of my invention is to improve the construction and operation of deep well pump jacks with respect to the parts above mentioned, which object I accomplish as illustrated in the drawings and hereinafter described. What I regard as new is set forth in the claims.

In the accompanying drawings,—

Fig. 1 is a longitudinal vertical sectional view illustrating more particularly the driving mechanism by which the plunger rods are actuated; also the lubricating devices, and the connections between the pump jack housing and the upper end of the well tube;

Fig. 2 is a partial vertical section of the well tube showing the pistons therein, some parts being broken away;

Fig. 3 is an end view of the parts shown in Fig. 1, part of the housing being broken away and the cover plate being removed;

Fig. 4 is a perspective view of the cross-head by which the outer or tubular plunger is actuated;

Fig. 5 is a vertical sectional view on line 5—5 of Fig. 1;

Fig. 6 is an enlarged vertical sectional view on line 6—6 of Fig. 5;

Fig. 7 is a plan view, the housing and the guide rods of the cross-heads being shown in section;

Fig. 8 is a partial transverse vertical section on line 8—8 of Fig. 7;

Fig. 9 is a perspective view of the cross-head by which the inner plunger rod is actuated;

Fig. 10 is a plan view of the cross-head shown in Fig. 4;

Fig. 11 is a vertical section on line 11—11 of Fig. 10;

Fig. 12 is a horizontal section on line 12—12 of Fig. 11;

Fig. 13 is a plan view of the cross-head shown in Fig. 9; and

Fig. 14 is a vertical section on line 14—14 of Fig. 13.

Referring to the drawings,—15 indicates a base which rests on the ground surface, indicated in Fig. 1 by the reference numeral 16. From the base 15 rises a housing, the bottom of which is indicated by reference numeral 17 (see Fig. 1), the side walls by 18, 19, and the end walls by 20, 21. The top is indicated by 22. As best shown in Fig. 1, the upper portion of the end wall 20 is inclined toward the opposite wall and is provided with an opening 23 to receive a detachable cover plate 24 by the removal of which access may be had to the interior of the housing. Also the end wall 21 is provided with an opening 25 closed by a detachable cover plate 26 as shown in said figure. Mounted upon the top 22 is an electric motor 27 which furnishes power to drive the pumping mechanism hereinafter described.

The lower portion of the housing is adapted to contain a quantity of oil or other lubricant, as indicated in Fig. 1, and to this end the bottom 17 is provided with an upwardly extending plate or partition 28 the ends of which connect with the side walls 18, 19, thereby forming a well of sufficient depth to hold the desired quantity of lubricant.

Extending across the oil containing chamber formed by the housing, at a point considerably above the normal level of the oil therein, is a shaft 29 which is journaled in suitable bearings 30, 31 in the side walls 18, 19, as best shown in Figs. 1 and 7. One

end of said shaft extends out beyond the side wall 19 and it carries a pulley 32 adapted to be driven by a belt 33 from a pulley 34 mounted on the armature shaft 35 of the motor 27, as best shown in Fig. 1. A belt tightener pulley 36 carried by a rocking arm 37 and yieldingly pressed against the belt 33 by a spring 38 serves to maintain the proper tension on said belt, as illustrated in dotted lines in Fig. 1 and in full lines in Fig. 5.

The shaft 29 carries a pinion 39 that meshes with a gear 40 mounted in the oil chamber so that its lower portion rotates in the body of oil therein, as illustrated in Figs. 1 and 8. Said gear is mounted on a double crank shaft comprising a central or hub portion 41 having two diametrically disposed crank portions 42, 43 at opposite sides thereof, at the outer ends of which crank portions are axially alined bearing members 44, 45, as best shown in Fig. 8. These bearing members are journaled upon trunnions 46, 47, respectively, carried by heads 48, 49 fitted in suitable openings in the side walls 18, 19 of the housing and secured thereto by screws 50. The gear 40 is secured to the hub portion 41 of the crank shaft by providing said gear with an inwardly extending radial web 51 which is secured to the hub 41 by screws 52. By this arrangement the gear 40 rotates with the crank shaft about the trunnions 46, 47, and as the parts rotate, said gear and also the crank portions 42, 43 dip into the oil in the housing so that they are properly lubricated.

Mounted in the housing at points above the crank portions 42, 43, respectively, are two levers or walking beams 53, 54, both of which are mounted at one end upon a pivot 55 supported by the side walls 18, 19 adjacent to the end wall 20, as shown in Fig. 1. The arrangement of the walking beams is such that one of them overlies the crank portion 42 and the other overlies the crank portion 43, and they are operatively connected with said crank portions by pitmen 56, 57, respectively. Consequently rotation of the gear 40 swings said walking beams 53, 54 vertically so that they move simultaneously in opposite directions. As shown in Figs. 7 and 8, each of said walking beams comprises two bars, indicated respectively by 53^a, 53^b and 54^a, 54^b, the bars of each walking beam being suitably connected in parallel relation to each other by cross bolts 58 or by any other appropriate means. Also at the end of each of the walking beams on which it is fulcrumed it is provided with a bearing sleeve 59 having an oil hole 60 in its upper side to admit lubricant to the outer surface of the pivot 55. As best shown in Fig. 8, each of the pitmen is connected at its upper end with the appropriate walking beam by providing it with a head 61 which fits on a sleeve 62 having its ends fitted in suitable openings in the members of the walking beam and secured in place by a cross bolt 63. Each head 61 is provided with a flared oil hole 64 at its upper side for admitting lubricant to the bearing.

The function of the walking beams 53, 54 is to reciprocate the cross-heads connected respectively with plunger rods by which the pistons in the well are actuated, and the arrangement of these parts will now be described.

As best shown in Figs. 1 and 5, two vertically disposed guide rods 65, 66 are provided, which are located in the housing at opposite sides of the gear 40 and adjacent to the partition 28, their lower ends being submerged in the oil in the housing as shown in Fig. 1. These guide rods serve to guide cross-heads, indicated generally by 67, 68, which are caused to slide vertically on their respective guide rods by the vertical swinging of the walking beams 53, 54. The cross-head 67 is connected to a tubular plunger rod 69 that carries a piston 70 operating in a cylinder 71 in a well tube 72, as shown in Fig. 2, and the cross-head 68 is connected to an inner plunger rod, preferably solid, indicated by 73, that extends through the plunger rod 69 and is connected with a piston 74 that operates in the lower portion of said cylinder. The connections by which the walking beams are connected with their respective cross-heads and the cross-heads are connected with their respective plunger rods will be explained more in detail later, but attention is here called to the fact that inasmuch as the plunger rod 73 operates in the plunger rod 69 it is of vital importance that the cross-heads by which said plunger rods are respectively reciprocated always move in parallelism with each other and with the plunger rods. To this end it is therefore necessary that the guide rods 65, 66 on which said cross-heads respectively travel be maintained vertical and in parallelism with each other, and the means by which this may be accomplished is one of the features of my present invention.

As best shown in Figs. 1 and 5, the lower ends of the rods 65, 66 are supported on an offset portion 17^a of the bottom 17 and extend through openings in a horizontal bar 75 arranged slightly above said bottom. The end portions of said bar extend into circular openings 76, 77 in the side walls 18, 19, and for the purpose of holding said bar against vertical movement the width of the end portions of said bar is made equal to the diameter of said openings and the side margins of such end portions are curved to match the contour of said openings, as best shown in Fig. 6 which illustrates a corresponding upper bar hereinafter described. Such end portions, however, do not fit in said openings tightly enough to prevent the endwise movement of said bar for adjustment purposes hereinafter described, and, therefore, to clamp said bar in place and hold it firmly

against movement it is provided at its ends with adjusting screws 78 which extend through it and are adapted to bear at their lower ends against the bottom faces of the openings 76, 77. Lock nuts 79 are screwed on said screws below the bar 75 to hold them against turning. It will be understood from the foregoing that by turning the screws 78 in the proper direction the end portions of the bar 75 may be forced upward into tight contact with the walls of the openings 76, 77, thereby clamping the bar tightly in place, but by turning said screws in the opposite direction the bar may be released so that it may be adjusted endwise. The openings 76, 77 are normally closed by removable cover plates 80, 81 secured by bolts 82. Obviously endwise movement of the bar 75 will move the lower ends of the rods 65, 66 in unison laterally or toward or from the side walls 18, 19 of the housing. A bar 83, similar to the bar 75, is provided at the upper ends of the rods 65, 66, and is similarly secured in openings 84, 85 by screws 86. The openings 84, 85 are closed by removable plates 87, 88 held by screws 89. The bar 83 is further provided with a plate 90 secured to its upper side by screws 91, which plate extends over the upper ends of the rods 65, 66 and holds them against upward movement. The openings in the bar 75 which receive the lower ends of the rods 65, 66 are the same distance apart as the openings in the bar 83 in which the upper ends of said rods are fitted. Consequently the guide rods are held in parallelism with each other by said bars. If the guide rods should deviate from a vertical position, or from a position of alinement with the plunger rods, they may be properly adjusted by adjusting either or both of the bars 75, 83 longitudinally, as will be apparent. By this means, therefore, the lines of movement of the two cross-heads may always be correctly maintained.

The cross-head 67 by which the outer or tubular plunger 69 is actuated slides on the guide rod 65, and its construction is best shown in Figs. 4, 10 and 11. Referring particularly to Fig. 4, it will be seen that said cross-head comprises a sleeve 92 of suitable internal diameter and preferably provided with an anti-friction lining 93 having inclined oil grooves 94 therein, as indicated by dotted lines in Fig. 5. The lower end of the sleeve 92 is enlarged internally to some extent, as shown in Fig. 11, so that it is adapted to fit over a collar 95 secured on the lower end of the guide rod 65 and resting on the bar 75. (See Fig. 5.) The arrangement is such that when the cross-head moves down to near the lower end of its stroke it telescopes over the collar 95 and co-acts therewith to pump oil from the oil chamber up along the guide rod 65, the collar 95 serving as the piston element of a pump, while the lower end of the sleeve 92 serves as the cylinder thereof. The result is that toward the end of each downward stroke of the cross-head oil is pumped up to lubricate the bearing of the cross-head. It also rises to the top of the sleeve 92, at which point said sleeve is provided at one side with a lateral extension 96 which forms an oil pocket 97. The upper end of said sleeve is also somewhat enlarged internally, as shown at 98 in Fig. 11, to form an annular channel which leads to the pocket 97 and also to a groove or duct 99 at the opposite side of said sleeve formed in a web 100 at that side, as shown in Figs. 4 and 11.

The web 100 extends over a bracket 101 which projects laterally from the lower portion of the sleeve 97 and is provided with ears 102, 103 spaced apart and provided with alined openings 104, said ears being connected at the bottom by a transverse concave web 105. Said ears are adapted to receive between them a link 106 which is pivotally connected to them at its lower end by a pivot 107 as shown in Fig. 1. Said link serves the purpose of connecting the cross-head with the walking beam 53, its upper end being pivotally connected with the members 53^a, 53^b of said walking beam by a pivot 108. As shown in Fig. 1, said walking beam members lie at opposite sides of the sleeve 92 and at opposite sides of the link 106. The web 100 is so designed and located that its lower end overlies the pivot 108, and the upper end of the link 106 is preferably provided with a transverse sleeve 109 having an oil cup 110 adapted to receive drippings from the duct 99, as shown in Fig. 3. From the foregoing description it should be understood that oil pumped up through the cross-head sleeve 92 will pass into the channel 98, and part of it will flow down through the duct 99 and will drip into the cup 110, thereby lubricating the bearing of the pivot 108. Also, some of the oil will pass down along the link 106 to the bearing of the pivot 107, any surplus oil accumulating on the upper side of the web 105. To prevent excessive accumulation of oil on said web a duct 111 is provided in the bracket 101, as shown in Fig. 12, which is arranged to conduct oil back to the oil chamber in the housing. By this construction the pivotal connections between the walking beam 53 and the cross-head 67 are always properly lubricated by oil supplied from the oil chamber through the reciprocation of the cross-head. At the same time, in order to lubricate the bearing of the pivot 55 of said walking beam the extension 96 is provided with a spout or tube 112, best shown in Fig. 1, which is arranged to discharge the oil forced into the pocket 97 by the downward stroke of the cross-head into a duct or channel 113 which extends longitudinally of the walking beam 53 at the upper side thereof from a point adjacent to the cross-head 67 to the oil hole 60.

Said duct is preferably provided with a series of transverse baffles 114, spaced at suitable intervals, to retard reverse flow of oil along said duct, as shown in Figs. 1 and 7. As the duct 113 is mounted on the walking beam 53 it rocks with said walking beam, and as it receives its supply of oil principally at the end of the lower stroke of the cross-head, when the outer end of the walking beam again moves upward the duct 113 is tipped in a direction to cause the oil to flow toward the inner end of said walking beam and to be delivered to the oil hole 60. This operation is repeated with each oscillation of the walking beam so that its lubrication is well maintained. In like manner oil is supplied to the oil hole 64 at the upper end of the pitman 56 by a short duct 115 arranged beside and preferably formed integral with duct 113 as shown in Fig. 7, the duct 115 being arranged to discharge into the oil hole 64. Said duct receives oil from the duct 113 in any suitable way, such as by providing a hole through the side wall of the duct 113 lying between the two ducts.

The cross-head 68 by which the inner plunger 73 is actuated is in general similar to the cross-head 67, although it differs therefrom with respect to some details. The cross-head 68 also comprises a sleeve 116 similar to the sleeve 92 and arranged to slide on the guide rod 66. The lower end of the sleeve 116 is similar to the lower end of the sleeve 92 and cooperates with a collar 117 to force oil up through said sleeve to the upper end thereof. At its upper end the sleeve 116 is provided with a lateral extension 118 which provides an oil pocket 119 having a spout 120 similar to the spout 112. Also at the upper end of the sleeve 116 is an annular channel 121 which communicates with the pocket 119 and also with a duct 122 that extends in the opposite side of the sleeve 116 between two parallel ears 123, 124 which receive a pivot pin 125, as best shown in Figs. 1 and 13. A link 126 is pivoted at its upper end on the pivot 125, and at its lower end is connected with the walking beam 54 by pivot 127. By this arrangement the swinging of the walking beam 54 serves to reciprocate the cross-head 68, and the bearings of the pivots 125, 127 are lubricated in substantially the same way as the bearings of the link 106. The walking beam 54 is also provided with a duct 128 similar to the duct 113 which leads to the oil hole 60 arranged to lubricate the bearing at the inner or fulcrum end of the walking beam 54, as shown in Fig. 7. A short duct 130 is provided beside the duct 128 for lubricating the upper bearing of the pitman 57. By the means described the proper lubrication of all the bearings with oil taken from the oil chamber is provided for. Preferably a shield or deflector 131 is provided adjacent to the outer end of one or both walking beams to direct any oil thrown therefrom back to the oil chamber. In Fig. 1 I have shown one of such deflectors associated with the upper walking beam 54 only, but a similar deflector, if desired, may be provided for the other walking beam.

The cross-head 67 is connected with the outer plunger rod 69 by means of an angle bracket 132 that is secured to a vertical plate 133 that depends from the bracket 101 and is braced by a flange 134, as best shown in Fig. 4. The bracket 132 has an arm 135 that extends laterally from the plate 133 and has an opening to receive the upper end of the plunger rod 69, which is connected with it by nuts 136, as shown in Fig. 3. The inner plunger rod 66 is connected with the upper end portion of the cross-head 68 by means of a head 137 which extends laterally from the sleeve 116 so as to overlie the horizontal portion 135 of the bracket 132. The head 137 is provided with a hole 138 in vertical alinement with the hole in the arm 135. The upper end of the plunger rod 66 passes through the hole 138 and is secured thereto by a nut 139, and as illustrated by dotted lines in Fig. 3, the upper end of said plunger rod is reduced in diameter to form a shoulder at 140 which bears against the under side of the head 137 so that endwise movement of said plunger rod relatively to the head 137 is prevented. From the foregoing it will be seen that the plunger rods are held in alinement with each other, and as the cross-head guides may be adjusted laterally at either end, as has been already described, the plunger rods may be maintained in correct alinement with the axis of the pump cylinder.

As best shown in Fig. 1, the upper end of the pump cylinder 71 is connected with the base 115 by a coupling 141 secured thereto by screws 142, as shown in Fig. 3, with which coupling connects the discharge pipe 143 for the liquid pumped from the well. The well tube 72 rises outside of the pump cylinder 71, and to prevent sewage and other impurities from getting into the well tube I provide a collar 144 which is somewhat larger than the upper end of the well tube and is provided with a tapered inner face. Between this collar and the upper end of the well tube I insert a packing ring 145, of rubber or other suitable material, which is wedge-shaped in cross-section, the thicker portion of said packing ring being uppermost, as shown in Fig. 1. The arrangement is such that the thick upper portion of said packing ring is adapted to engage the lower margin of the coupling 141 by upward movement of the collar 144, thereby forming a tight closure between the well tube 72 and the lower end of the coupling 141. For drawing the collar 144 upward to effect the compression of said packing ring I provide bolts 146, the heads of which engage the under surface of

the ring 144, while the screw threaded ends of said bolts extend up through the base 15 and are provided with nuts 147 by means of which upward pressure may be applied to the collar 144. By this means the upper end of the well tube may be tightly sealed, but it may readily be released when necessary.

While I have described with considerable particularity the embodiment of my invention illustrated in the drawings I wish it to be understood that in doing so I have not intended to limit myself to such specific construction, as my invention includes such modifications or variations as would occur to those skilled in the art. The claims hereinafter made are, therefore, to be construed accordingly.

What I claim as my invention and desire to secure by Letters Patent, is—

1. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and driving mechanism in said chamber, of a vertically reciprocating cross-head, a guide therefor, a walking beam mounted to swing vertically in said chamber and operatively connected to actuate said cross-head, means for actuating said walking beam by said driving mechanism, and means including a grooved sleeve in said cross-head for supplying oil from said chamber to the bearing about which said walking beam swings.

2. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and driving mechanism in said chamber, of a vertically reciprocating cross-head, a guide therefor, a walking beam mounted to swing vertically in said chamber and operatively connected to actuate said cross-head, means for actuating said walking beam by said driving mechanism, and means for supplying oil from said chamber to the bearing about which said walking beam swings comprising a sleeve in said cross-head and a collar on said guide rod for forcing oil upward between the sleeve and guide rod and means arranged to receive oil from said cross-head and conduct it to said bearing.

3. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and driving mechanism in said chamber, of a vertically reciprocating cross-head, a guide therefor, a walking beam mounted to swing vertically in said chamber and operatively connected to actuate said cross-head, means for actuating said walking beam by said driving mechanism, means for supplying oil from said chamber to the bearing about which said walking beam swings comprising a sleeve in said cross-head containing a spiral groove and a counter bore and a collar on said guide rod which registers with said counter bore to force oil through said groove to the top of said cross-head, a duct carried by the walking beam and leading to said bearing from a point adjacent to said cross-head, and means for delivering oil from said cross-head to said duct.

4. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and driving mechanism in said chamber, of a vertically reciprocating cross-head, a guide therefor, a walking beam mounted to swing vertically in said chamber and operatively connected to actuate said cross-head, means for actuating said walking beam by said driving mechanism, means for supplying oil from said chamber to the bearing about which said walking beam swings comprising a sleeve in said cross-head containing a counter bore and a collar on said guide rod which registers with said counter bore to force oil to the top of said cross-head, a spout carried by the cross-head, and a duct arranged to receive oil from said spout.

5. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and driving mechanism in said chamber, of a vertically reciprocating cross-head, a guide therefor, a walking beam mounted to swing vertically in said chamber and operatively connected to actuate said cross-head, means for actuating said walking beam by said driving mechanism, means for supplying oil from said chamber to the bearing about which said walking beam swings comprising a sleeve in said cross-head containing a counter bore, and a collar on said guide rod which registers with said counter bore to force oil upward along said guide rod to the top of said cross-head, a duct carried by the walking beam and leading to said bearing from a point adjacent to said cross-head, said duct having transversely disposed baffles at intervals, and means for delivering oil from said cross-head to said duct.

6. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, a crank shaft mounted in said chamber, and means for rotating said crank shaft, of a vertically reciprocating cross-head, a guide therefor, a walking beam mounted to swing vertically in said chamber and operatively connected to actuate said cross-head, and means for forcing oil from said chamber through said cross-head to the bearing on which said walking beam swings.

7. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, a crank shaft mounted in said chamber, and means for rotating said crank shaft, of a vertically reciprocating cross-head, a guide therefor, a walking beam mounted to swing vertically in said chamber and operatively connected to actuate said cross-head, a pitman connected at its lower end with said crank shaft and at its upper end with said walking beam, and means for forcing oil from said chamber through said cross-head to the upper bearing of said pitman.

8. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, a crank shaft mounted in said chamber, and means for rotating said crank shaft, of a vertically reciprocating cross-head, a guide therefor, a walking beam mounted to swing vertically in said chamber and operatively connected to actuate said cross-head, a pitman connected at its lower end with said crank shaft and at its upper end with said walking beam, means for forcing oil from said chamber through said cross-head to the upper bearing of said pitman and means arranged to receive oil from said cross-head and conduct it to said bearing.

9. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, a crank shaft mounted in said chamber, and means for rotating said crank shaft, of a vertically reciprocating cross-head, a guide therefor, a walking beam mounted to swing vertically in said chamber and operatively connected to actuate said cross-head, a pitman connected at its lower end with said crank shaft and at its upper end with said walking beam, and means for forcing oil from said chamber between the cross-head and its guide to the upper bearing of said pitman comprising a duct carried by the walking beam and leading to said bearing from a point adjacent to said cross-head, and means for delivering oil from said cross-head to said duct.

10. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and driving mechanism in said chamber, of a vertically reciprocating cross-head, a guide therefor, a pitman for actuating said cross-head from said driving mechanism, said pitman having a bearing in its upper end, and means actuated by the reciprocation of said cross-head on its guide for forcing oil between said cross-head and guide for conducting it to said upper bearing.

11. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and driving mechanism in said chamber, of a vertically reciprocating cross-head, a guide rod on which said cross-head is mounted to slide vertically, said cross-head being movable into the oil in said chamber and operating to pump oil therefrom upward between the cross-head and guide rod to lubricate said guide rod, and an oil delivering duct at the upper end portion of said cross-head arranged to receive oil pumped thereby.

12. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and driving mechanism in said chamber, of a vertically reciprocating cross-head, a guide rod on which said cross-head is mounted to slide vertically, said cross-head being movable into the oil in said chamber and operating to pump oil therefrom upward between the cross-head and guide rod to lubricate said guide rod, an oil delivering duct at the upper end portion of said cross-head arranged to receive oil pumped thereby, and means arranged to receive oil from said duct and to conduct it to the parts to be lubricated thereby.

13. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and driving mechanism in said chamber, of a vertically disposed guide rod, a cross-head mounted to slide on said guide rod comprising a sleeve internally enlarged at its lower end, a collar at the lower end of said guide rod adapted to fit within the lower end of said sleeve and cooperating therewith to force oil from said chamber upward along said guide rod, and means operatively connecting said driving mechanism with said cross-head for actuating the same.

14. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil and a driving mechanism in said chamber, of a vertically reciprocating cross-head, a guide therefor, a walking beam pivotally mounted at one end in said chamber to swing vertically, a pivot connecting the other end of said walking beam with said cross-head, means for forcing oil from said chamber through said cross-head to the top of the cross-head, a spout on the cross-head, a trough on said walking beam for receiving the oil from said spout and delivering it to said pivot, and transverse baffles in said trough for regulating the flow of oil therethrough.

15. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and a driving mechanism in said chamber, of a vertically reciprocating cross-head, a guide therefor, a walking beam pivotally mounted at one end in said chamber to swing vertically, a pivot connecting the other end of said walking beam with said cross-head, means for forcing oil from said chamber through said cross-head to the top of the cross-head, a spout on said cross-head for delivering said oil to one of said pivotal connections, a second spout, a trough on said walking beam for receiving oil from said second spout and delivering it to the other of said pivotal connections, and means for regulating the flow of oil.

16. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and a driving mechanism in said chamber, of a vertically reciprocating cross-head, a guide therefor, a walking beam pivotally mounted at one end in said chamber to swing vertically, a pivot connecting the other end of said walking beam with said cross-head, means for forcing oil from said chamber between said cross-head and its guide to lubricate the surface therebetween and a duct at the upper end portion of said

cross-head arranged to deliver oil to said pivot.

17. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and a driving mechanism in said chamber, of a vertically reciprocating cross-head, a guide therefor, a walking beam pivotally mounted at one end in said chamber to swing vertically, a pivot connecting the other end of said walking beam with said cross-head, means for forcing oil from said chamber between said cross-head and its guide to lubricate the surface therebetween and ducts at the upper end portion of said cross-head arranged to deliver oil to the connections at both end portions of said walking beam.

18. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and driving mechanism in said chamber, of a vertically disposed guide rod in said chamber, a cross-head adapted to slide along said guide rod and comprising a sleeve arranged to pump oil from said chamber along said guide rod, said cross-head having an annular channel at its upper end, a walking beam pivotally mounted at one end in said chamber to swing vertically, means pivotally connecting the other end portion of said walking beam with said cross-head, means for actuating said walking beam by said driving mechanism, and ducts communicating with said channel for delivering oil therefrom to the pivotal connections of said walking beam.

19. In a pumping apparatus, the combination with a chamber adapted to contain a body of oil, and driving mechanism in said chamber, of a vertically disposed guide rod, a cross-head, a sleeve in said cross-head slidably fitting it on said guide rod, a spiral groove in the face of said sleeve engaging said rod, a counter bore in the lower end of said sleeve, a collar rigidly attached to said guide rod below the surface of said body of oil, said collar registering with said counter bore to force oil through said groove to the top of said cross-head, a plurality of oil grooves at the top of said cross-head for conducting said oil therefrom, and means operatively connecting said driving mechanism with said cross-head for actuating the same.

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