Feb. 8, 1938. A. N. PORTER 2,107,498

WELL PUMPING APPARATUS

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Fig. 1.

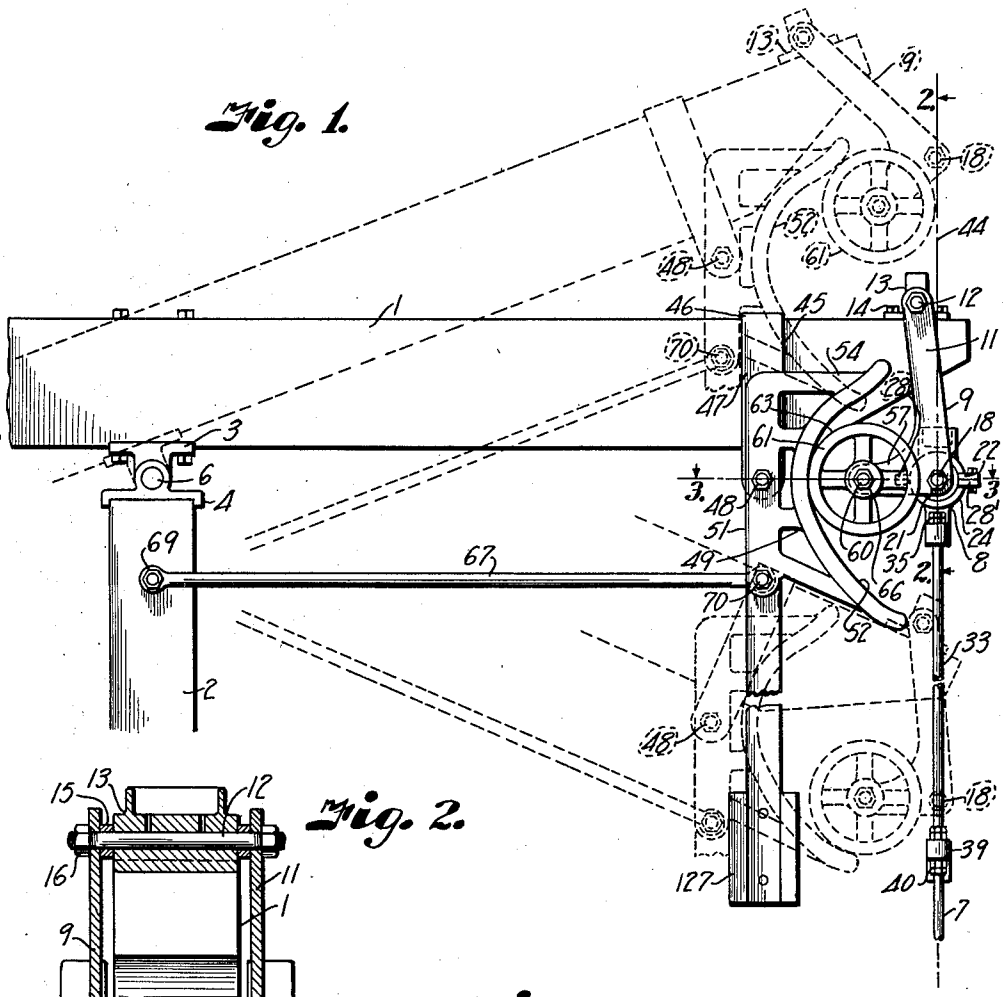


Fig. 2.

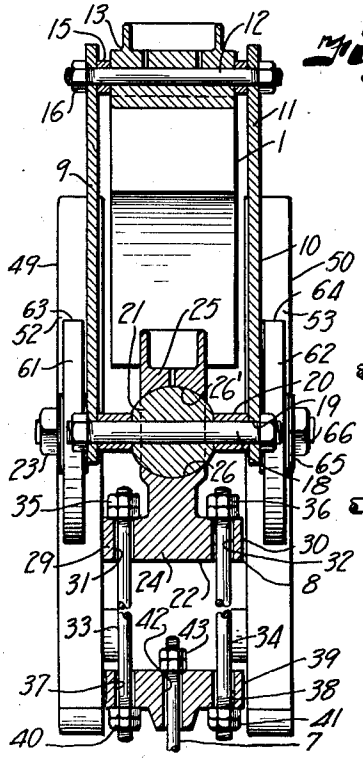
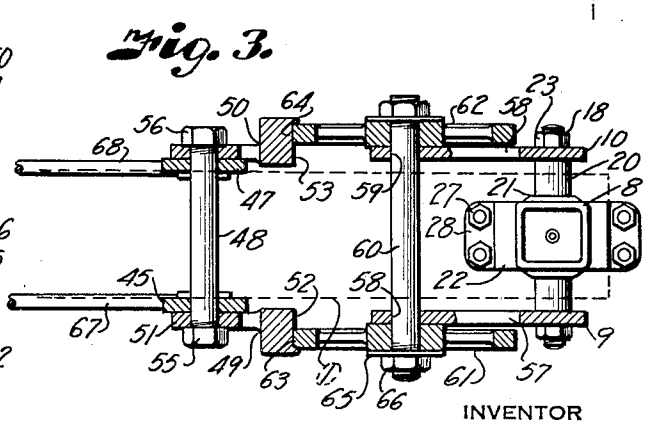


Fig. 3.



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Fig. 4.

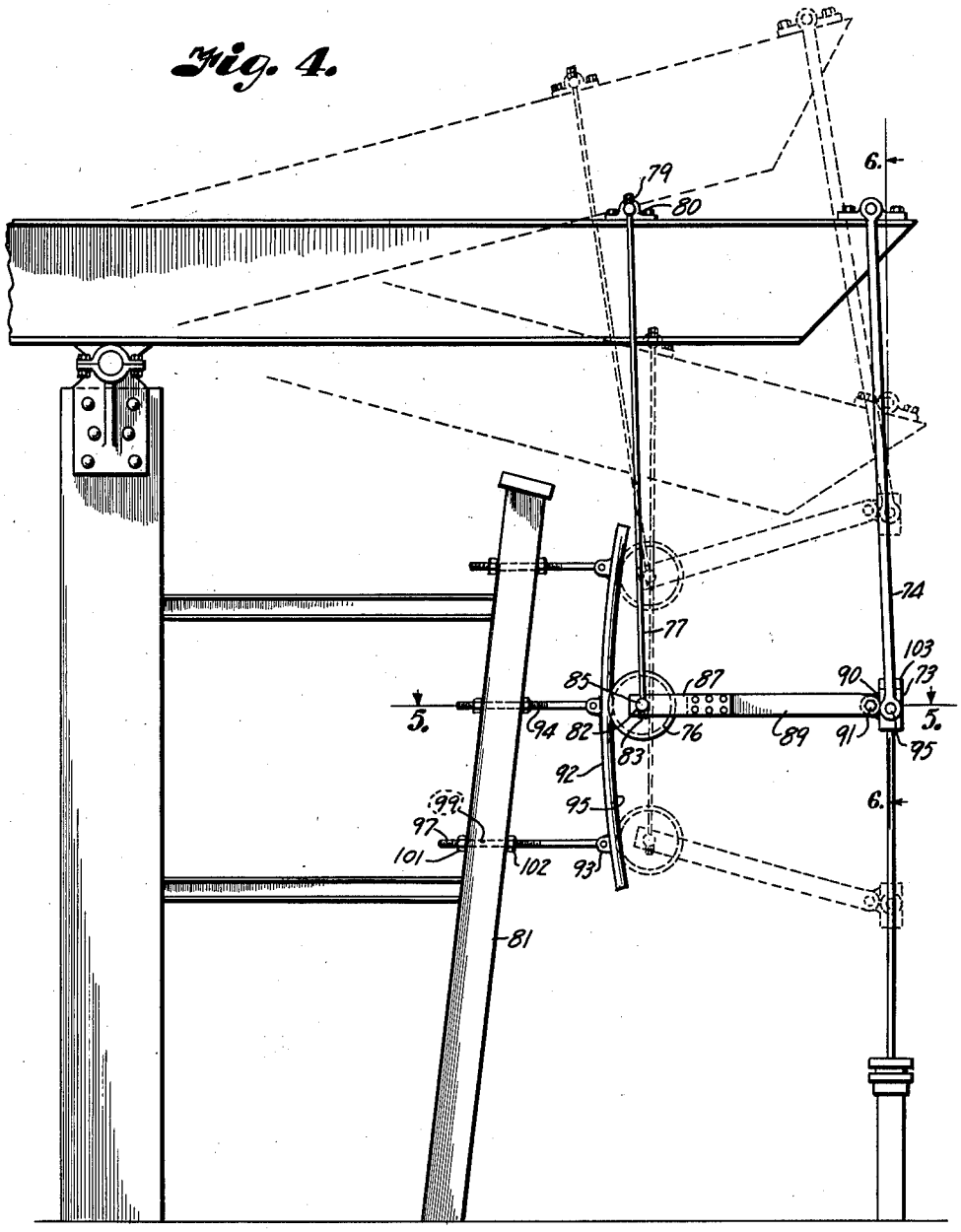
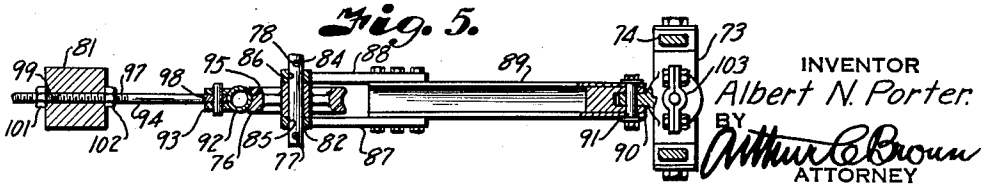


Fig. 5.



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Fig. 6.

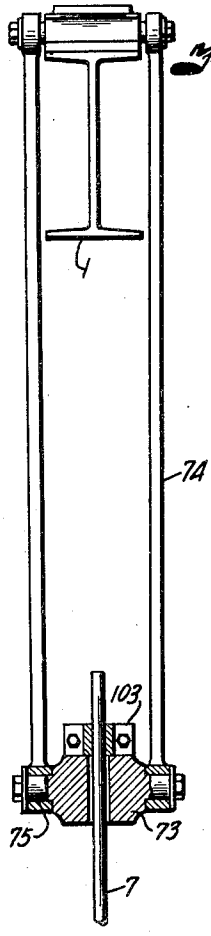


Fig. 7.

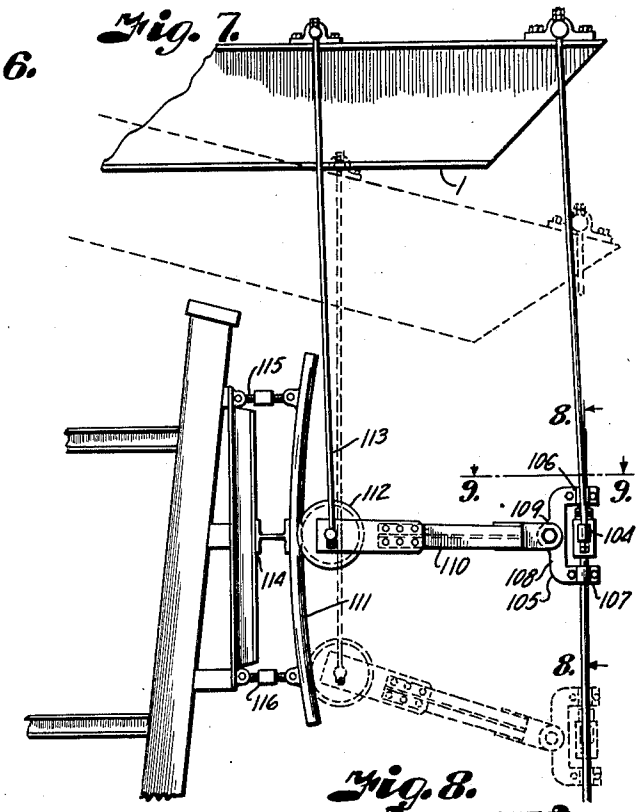


Fig. 8.

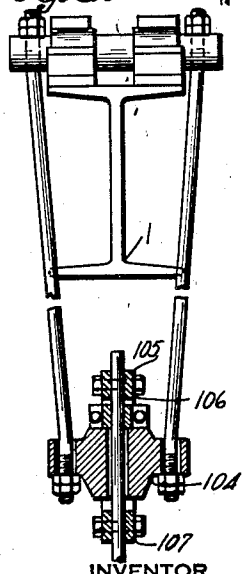


Fig. 9.

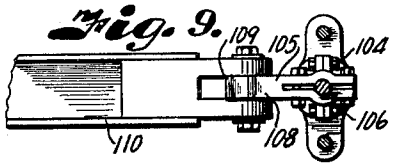
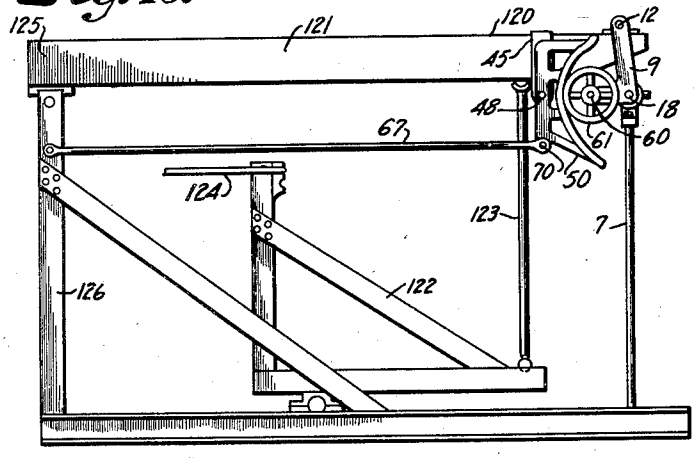


Fig. 10.



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WELL PUMPING APPARATUS

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Application October 10, 1936, Serial No. 105,011

12 Claims. (Cl. 74—103)

This invention relates to well pumping apparatus, particularly to a long stroke straight lift attachment for walking beams, pumping jacks and other similar devices for producing reciprocatory motion of a string of pumping rods, and has for its principal object to transpose arcuate movement of a beam or the like into a vertical straight lift in direct axial alignment with the rods, thereby alleviating wear and bending action of the rods and reducing the power required to actuate the beam.

It is also an important object of the present invention to provide an attachment which may be readily adjusted to any standard type and length of beam.

In accomplishing these and other objects of the invention, I 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 the operating end of a walking beam equipped with a long stroke straight lift attachment embodying the features of the present invention.

Fig. 2 is a vertical section on the line 2—2, Fig. 1, particularly illustrating the universal self-aligning feature of the polish rod hanger.

Fig. 3 is a horizontal section on the line 3—3, Fig. 1, particularly illustrating the pivotal mounting of the cam tracks and rollers for controlling a vertical movement of the polish rod hanger.

Fig. 4 is a side elevational view of a modified form of the invention, wherein the cam has fixed support on the headache post or rest for the walking beam.

Fig. 5 is a vertical section on the line 5—5, Fig. 4.

Fig. 6 is a vertical section through the polish rod hanger illustrated in Fig. 4, the arms being shown in elevation.

Fig. 7 is a view similar to Fig. 4 showing a further modified form of the invention as applied to a rod hung on a conventional type of rod hanger.

Fig. 8 is a vertical section on the line 8—8, Fig. 7.

Fig. 9 is a horizontal section on the line 9—9, Fig. 7.

Fig. 10 is a side elevational view of a form of the invention as applied to a conventional pumping jack.

Referring more in detail to the drawings:

1 designates a walking beam pivoted on the upper end of a Samson post 2 by means of the usual saddle and side irons 3 and 4 respectively whereby the outer end 5 of the beam is caused to oscillate in the arc of a circle with the trunnions 6 of the saddle as the center upon operation of a crank and pitman connected to the opposite end of a walking beam (not shown) to reciprocate a string of pumping rods as represented by the polish rod 7.

In ordinary practice, the pumping rod 7 is directly connected with the outer end of the beam by a hanger frame, which causes the polish rod to bend back and forth as the beam swings on the opposite sides of its horizontal center, which bending movement not only produces wear of the polish rod and stuffing box, but causes crystallization that soon results in breakage and expansive repairs.

In the present invention the hanger 8 is not directly connected with the walking beam but is suspended therefrom by a pair of bell crank levers 9 and 10, the vertical arms 11 of which hang from the ends of a cross bolt 12 pivotally mounted in a saddle 13 that is rigidly attached to the upper face of the walking beam by suitable fastening devices 14.

The arms 11 of the bell cranks are spaced from the side faces of the walking beam by washers 15 sleeved on the ends of the cross bolt between the sides of the saddle and the arms as best shown in Fig. 2 and the arms are retained in engagement with the washers by nuts 16 threaded on the ends of the bolt and engaging the outer faces of the arms 11.

Connecting the opposite ends of the arms is a similar cross bolt 18 having its ends extending through suitable bearing openings 19 therein, spacing sleeves 20, and a central spherically shaped bearing 21 for mounting the cross head 22 of the angle frame, the spacing sleeves 20 being of suitable length to retain the bell cranks in spaced parallel relation. Nuts 23 are threaded on the outer ends of the cross bolt 18 to retain bell cranks thereon.

The cross head 22 includes base and cap sections 24 and 25 having substantially semi-spherically shaped sockets 26 and 26' conforming to the bearing 21. The cap and base sections of the cross head are clamped about the bearing by suitable bolts 27 extending through mating flanges 28 and 28' on the respective sides of the cross-head sections as best illustrated in Fig. 3.

Extending laterally of the base section of the cross-head are ears 29 and 30 having openings 31 and 32 for passing the hanger rods 33 and 34 which are suspended therefrom by nuts 35 and 36 threaded on the projecting ends of the arms and seated against the upper faces of the ears as in

conventional practice. The lower ends of the rods extend through similar openings 37 and 38 in a swivel head 39 that is retained on the arms by nuts 40 and 41 threaded on the lower ends of the rods and engaging the under face of the swivel head.

The polish rod 7 extends through a central vertical opening 42 in the swivel head and is suspended therein by nuts 43 screwed onto the projecting end of the rod or by a suitable polish rod clamp engaging the upper face of the swivel head.

With the operation of the structure thus far described, the axis of the cross bolt 12 will move in an arc about the axis of the saddle trunnions 6. However, I provide means for retaining the axis of the cross bolt 18 in plane with the extended axis of the polish rod as indicated by the dot and dash line 44, Fig. 1, as now to be described.

Mounted on the walking beam at a point spaced from the saddle 13 is a U-shaped bracket having the cross bar portion 46 thereof seating on the upper edge of the walking beam and the legs 47 depending from the sides of the beam to form a support for a cross bolt 48 extending below the beam 1 in exact horizontal alignment with the cross bolt 18 and the trunnion 6 when the beam is in the horizontal position illustrated in Fig. 1 to pivotally mount cam members 49 and 50.

The cam members 49 and 50 each include vertical lever arm portions 51 carrying cam shaped tracks 52 and 53 at the upper ends thereof, the tracks 52 and 53 being secured to the lever portions 51 by connecting webs 54 to support the cam tracks in fixed relation therewith.

The lever arm portions 51 are pivotally mounted on the ends of the cross bolt 48 in such a manner as to support the central part of the cam in horizontal alignment with the cross bolt 18 when the beam is in horizontal position as shown in Fig. 1. The lever arm portions are retained thereon by nuts 55 and 56 threaded on the projecting ends of the bolt 48 as best illustrated in Fig. 3.

The lateral arms 57 and 58 of the bell cranks extend in the direction of the cam tracks and are provided with aligning openings 58 and 59 to pass a shaft 60 for rotatably mounting wheels 61 and 62 on the ends thereof which project outwardly from the bell crank arms and in position so that the peripheries 63 and 64 thereof engage the face of the cam tracks, the wheels being retained on the shaft by washers 65 and nuts 66 respectively sleeved and threaded on the outer ends of the shaft as best illustrated in Fig. 3.

In order to support the cam tracks in parallel vertical relation relatively to the extended axis of the polish rod, during reciprocation of the beam, I provide tie rods 67 and 68 having their ends pivotally connected to the Samson post 2 and to the lever arms 51 of the cam track members respectively by bolts 69 and 70 located in a plane parallel with the plane extending through the axes of the trunnions 6 and cross bolts 48.

The tie rods are of sufficient length so that the pivotal points of connection are spaced apart a distance equal to the distance between the axis of the trunnion 6 and the cross bolt 48. It is thus obvious that when the beam is oscillated, the links 67 and 68 remain parallel with the plane extending through the axis of the trunnion 6 and cross bolt 48 previously described, thereby retaining the lever arms 51 in perpendicular position to prevent tilting of the cam tracks under pressure influence of the wheels 61 and 62. The cam tracks are so shaped as to impart lateral throw to the wheels so that the axis of the cross head is kept in a perpendicular plane during the entire stroke of the beam.

Figs. 4, 5 and 6 illustrate a modified form of the invention wherein a rod hanger 73 is suspended from the end of the beam by links 74 pivotally mounted on trunnions 75 on the hanger similarly to the manner in which the arms of the bell crank levers suspended the cross head previously described in the preferred form of the invention and the wheel 76 is swingingly suspended by links 77 and 78 from a cross shaft 79 pivotally mounted in a bracket 80 carried on the upper face of the beam adjacent the headache post 81, the wheel 76 being mounted on a shaft 82 having its ends supported by nuts 83 carried on the ends of the links 77 and 78 which links project through openings 84 in the shaft. The shaft is also mounted in bearing openings 84 and 86 in ears 87 and 88 of a tie rod 89 that is pivotally connected to an ear 90 on the rod hanger by means of a pin 91.

In this modification of the invention, the cam track is mounted in stationary position on the headache post 81 and is shown as including a curved pipe 92 having ears 93 thereon for engaging bolts 94 projecting forwardly from the post to form a cam track 95 on which the wheel 76 operates during oscillation of the beam.

In this form of the invention, the cam track 95 may be adjustably mounted on the post by the bolts in such a manner that the shape of the track can be varied so as to impart lateral movement of the rod hanger 73 during reciprocation of the beam.

The connecting or adjusting bolts are shown as comprising I-bolts 97 having the heads 98 thereof pivotally connected with the ears 93 and their shanks extending through openings 99 in the post to support the bolts in vertical position therein. Threaded on the ends of the bolts and engaging the respective sides of the post are nuts 101 and 102 to adjust the relative spacing of selected points of the cam tracks from the post.

The polish rod is shown in this form of the invention as being secured to the rod hanger 73 by a conventional polish rod clamp 103.

It is thus apparent that by adjusting the I-bolts relatively to the post, the various shapes may be imparted to the cam tracks so that they may be caused to take the shape required to give the wheel 76 the desired throw to retain the rod hanger in vertical alignment during oscillation of the beam.

When the beam is reciprocated, the cam track will cause the wheel 76 to move along the track and the curvature thereof produces lateral swinging movement of the arms 77 and 78 to cause the tie rod 89 to impart similar movement to the suspending links 74 for retaining the polish rod hanger in vertical alignment throughout the length of beam stroke.

In Fig. 7 is illustrated a further modified form of the invention wherein the rod hanger 104 is of conventional design and showing an adapter 105 having spaced collars 106 and 107 for clamping on the polish rod above and below the hanger respectively. The collars are connected by a bar portion 108 having an ear 109 on which is pivotally mounted the tie rod 110 for connecting the wheel and the rod hanger to impart lateral movement to the hanger during reciprocation of the beam so that the hanger is retained

in vertical alignment with the rods throughout the entire stroke of the beam.

In this form of the invention, the cam track **111** is also mounted on the headache post and the wheel **112** is suspendingly supported by links **113** complementary to links **77** and **78** of the form shown in Fig. 4. The cam is rigidly mounted on a beam **114** at its central portion and the ends are adjustably supported by the turnbuckles **115** and **116**.

Fig. 10 shows the adaptation of my invention to a conventional pumping jack **120** wherein the beam **121** is reciprocated by a bell crank lever **122** through a connecting link **123**, the bell crank lever **124** being operated by a pull rod **124** as in conventional pumping jack practice.

The walking beam **121** is pivoted at its rear end **125** on the vertical post **126** of the pumping jack and its forward end moves in an arc in the same manner as the walking beam illustrated in the other forms of the invention.

The vertical lift attachment shown in this form of the invention is identical to that illustrated in the form of the invention shown in Figs. 1, 2 and 3, so that the same numerals will relate to the corresponding parts of the apparatus shown in Fig. 10.

In order to remove some of the strain from the rods **67** and **68**, the lever arm portions **51** of the cam track members may extend below the pivotal connection of the tie rods **67** and **68** and carry weights **127** which tend to retain the arms in perpendicular position during pivotal movement of the walking beam.

The operation of the form of invention shown in Fig. 1 is as follows:

Assuming that the walking beam is moving upwardly from its horizontal center, the cam track members are carried therewith, but due to the tie rods **67** and **68**, they maintain their relative relation with the required path of travel of the polish rod. Even though the arcuate movement of the walking beam causes lateral shifting of the cam tracks in the direction of the post **2**, the shape of the cam tracks cause the wheels to move in the direction of the extended axis of the polish rod to maintain the cross head connection in the desired vertical plane. During this shifting movement of the wheels relatively to the cam track, the bell cranks carrying the wheels are pivoted on the cross bolt **12**.

As the beam oscillates in the opposite direction, the wheels following the tracks maintain the relative position of the cross head and as the walking beam passes horizontal position, the wheels are again moved outwardly by the lower portions of the cam tracks to maintain the required relative position of the cross head.

The form of the invention shown in Fig. 4 operates in substantially the same manner as that of the preferred form; however, in this form of the invention, the cam is fixed and the lateral swinging movements of the arms are effected by the rollers **76** through the rod **89**.

The construction shown in Fig. 7 operates in a similar manner to that shown in Fig. 4, except that the tie rod **110** is connected to the adapter **105** on the polish rod to cause lateral movement of the conventional rod hanger during swinging movement of the beam to retain perpendicular alignment of the polish rod.

From the foregoing, it is apparent that I have provided a simple long stroke vertical lift attachment for use in connection with pivotally mounted beams of pumping apparatus and that the polish rod is always retained thereby in a vertical plane regardless of swinging arcuate movement of the beams.

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

1. In combination with a pumping apparatus including a pivoted beam, a straight lift attachment including a rod hanger movably carried by the beam, a cam member having vertical support relatively to the rod hanger and curved reversely to the arcuate travel of the end of the beam, and a wheel carried by the beam and operable on the cam member to retain the rod hanger in a vertical plane during actuation of the walking beam.

2. In combination with a pumping apparatus including a pivoted beam, a straight lift attachment including a polish rod hanger pivotally suspended from the beam, a polish rod carried by the polish rod hanger, a cam member pivoted on the beam, and a wheel carried by the beam and operable on the cam member to retain the polish rod hanger in the vertical plane of the polish rod during actuation of the walking beam.

3. In combination with a pumping apparatus iucluding a pivoted beam, a straight lift attachment including a rod hanger movably carried on the beam, a cam member pivoted on the beam, a wheel having connection with the rod hanger and operable on the cam member to retain the polish rod hanger in the vertical plane of the polish rod during actuation of the walking beam, and means supporting the cam member in parallel relation with the polish rod hanger during movement of the beam.

4. In an apparatus of the character described including a supporting member, a beam member, means pivotally mounting the beam member on the supporting member, a polish rod hanger, means pivotally suspending the polish rod hanger from the end of the beam member, a cam carried by one of said members and having its ends curved reversely to the arcuate path of travel of the end of the beam, a wheel operable on the cam, and means for pivotally suspending the wheel from the beam member including means for effecting pivotal movement of the suspending means during pivoting of the beam member to impart a straight lift of the polish rod hanger.

5. In an apparatus of the character described including a supporting member, a beam member, means pivotally mounting the beam member on the supporting member, a polish rod, means movably supporting the polish rod from the beam member, a cam carried by one of said members and having its ends curved reversely to the arcuate path of travel of the end of the beam, a wheel operable on the cam, and means for pivotally suspending the wheel from the beam member including means for effecting pivotal movement of the polish rod supporting means during pivoting of the beam member to impart a straight lift of the polish rod.

6. In an apparatus of the character described including a supporting member, a beam member, means pivotally mounting the beam member on the supporting member, a polish rod hanger, means pivotally suspending the polish rod hanger from the beam member, a cam carried by one of said members, a wheel operable on the cam, means for pivotally suspending the wheel from the beam member including means for effecting pivotal movement of the suspending means during pivoting of the beam member to impart a

straight lift of the polish rod hanger, and means adjustably connecting the cam member with its supporting member for selectively varying position of the cam relatively to the beam member.

7. In combination with a pumping apparatus including a support and a pivoted beam on the support, a straight lift attachment including a bell crank lever pivotally connected with the beam, a polish rod hanger pivotally suspended from the bell crank, a wheel rotatably mounted on the bell crank lever, a cam track, means pivotally mounting the cam track on the beam, and a link connecting the cam track with the support for controlling movement of the cam track upon operation of the beam.

8. In combination with a pumping apparatus including a pivoted beam, a straight lift attachment including a polish rod hanger movably carried by the beam, means including a cam member for moving the polish rod hanger on the beam, and means for selectively changing position of the cam member relatively to the beam.

9. In an apparatus of the character described including a supporting member, a beam member, means pivotally mounting the beam member on the supporting member, a polish rod hanger, means pivotally suspending the polish rod hanger from the beam hanger, a cam carried by one of said members, a wheel operable on the cam, means for pivotally suspending the wheel from the beam member including means for effecting pivotal movement of the suspending means during pivoting of the beam member to impart a straight lift of the polish rod hanger, and means for selectively changing position of the cam relatively to the beam member.

10. In an apparatus of the character described including a supporting member, a beam member, means pivotally mounting the beam member on the supporting member, a polish rod hanger, means movably supporting the polish rod hanger from the beam member, a curved cam carried by the support, a wheel operable on the cam, links for swingingly suspending the wheel directly from the beam member to follow the curvature of said cam, and tie rods connected with the links and said polish rod support for effecting pivotal movement of the polish rod support during pivoting of the beam member to impart a straight lift of the polish rod hanger.

11. In an apparatus of the character described including a supporting member, a beam member, means pivotally mounting the beam member on the supporting member, a polish rod hanger, means movably supporting the polish rod hanger from the beam member, a curved cam carried by one of said members, a wheel operable on the cam, and means for swingingly suspending the wheel from the beam member to follow the curvature of said cam including means for effecting pivotal movement of said hanger supporting means during pivoting of the beam member to impart a straight lift of the polish rod hanger.

12. In combination with a pumping apparatus including a pivoted beam, a straight lift attachment including a rod hanger movably carried by the beam, a cam member having a vertical support relatively to the rod hanger and curved reversely to the arcuate travel of the beam, and a cam engaging member carried by the beam and operable on the cam member to retain the rod hanger in a vertical plane during actuation of the walking beam.

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