March 31, 1936. R. R. BLOSS 2,035,525

BACK SIDE CRANK

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Fig. 1.

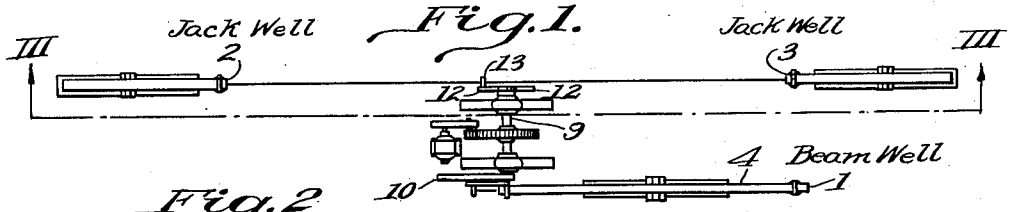



Fig. 2

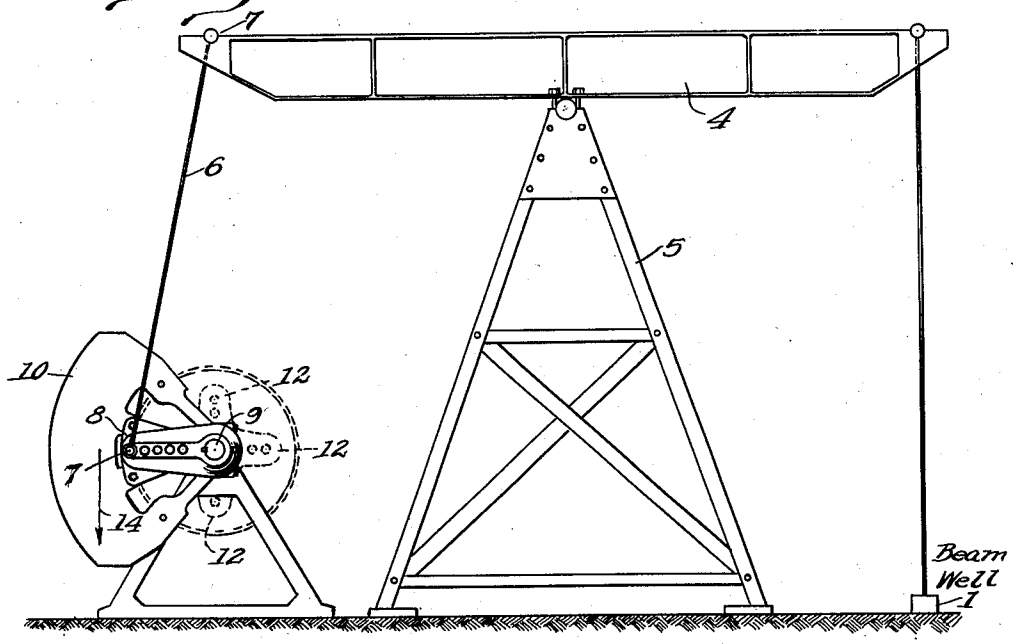
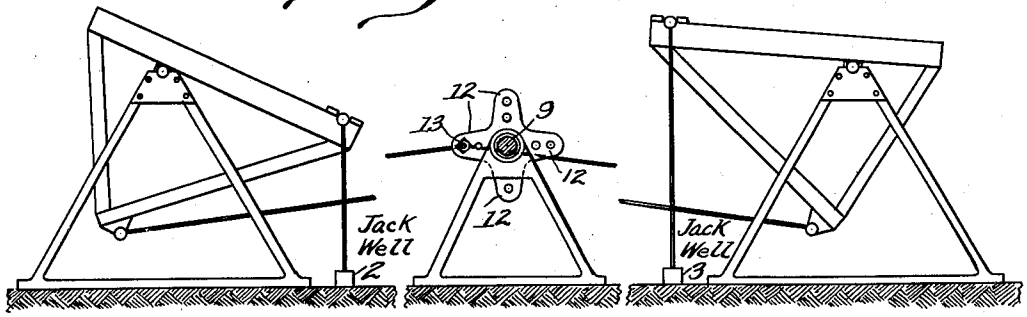



Fig. 3.



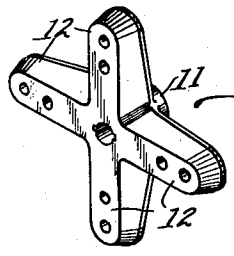




Fig. 8.

Inventor
Richard R. Bloss

By W. S. McHowell

Attorney

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Fig. 4.

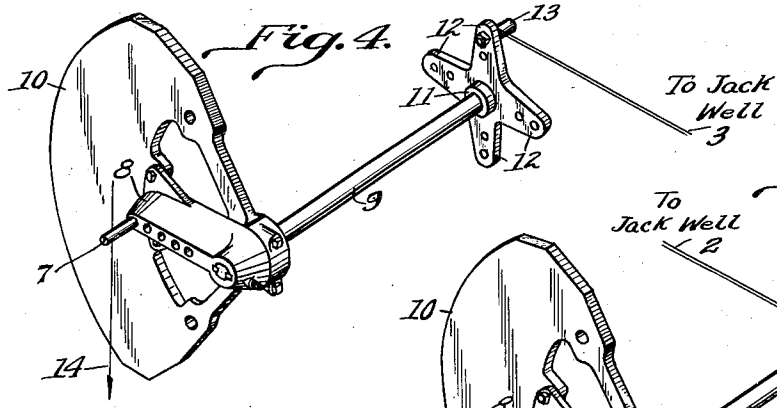



Fig. 5.

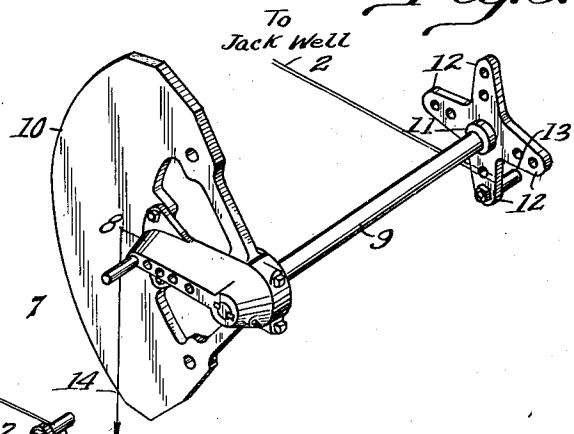



Fig. 6.

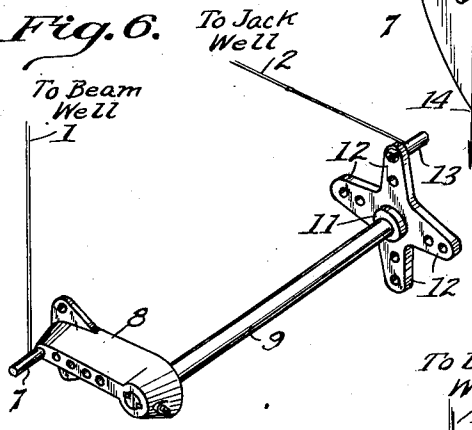



Fig. 7.

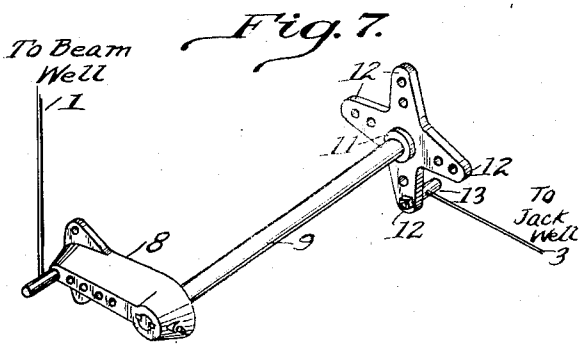



Fig. 9.

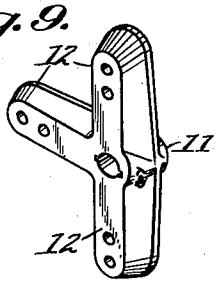
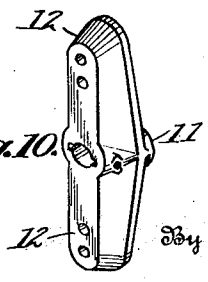



Fig. 10.




Inventor

Richard R. Bloss

By W. S. McDowell

Attorney

Patented Mar. 31, 1936 2,035,525

# UNITED STATES PATENT OFFICE

2,035,525

## BACK SIDE CRANK

Richard R. Bloss, Columbus, Ohio, assignor to International Stacey Corporation, Columbus, Ohio, a corporation of Ohio

Application April 7, 1934, Serial No. 719,529

8 Claims. (Cl. 74—41)

The invention to be hereinafter described relates to counterbalancing mechanism for interconnected reciprocating well pumps.

It is old and well known in the industry to connect two or more reciprocating oil well pumps to a single source of power so that all pumps of the group are operated from and by the one source of power. In certain types of multi-well operation, the source of power is disposed at a centrally located well which serves not only to actuate the walking beam of the standard rig at that well, but also to pump neighboring jack wells by means of pull rods which are connected to an auxiliary crank mounted on the crank shaft. The invention to be described hereinafter relates to this particular rig set-up.

It is also old and well known in the industry to use a counter-weight at the centrally located beam well to counterbalance the weight of the sucker rods and half of the weight of the column of fluid being raised. It is customary to oppose one jack well against another in such a manner that the falling rods in one well counterbalance the rods being raised in the other well. In this way, the entire system of wells is maintained approximately in balance.

When all wells are in operation, the system obviously remains in balance. However, when one or more wells are shut down for any reason, the system of wells may be thrown out of balance. To restore the balance, it is often necessary to shut down one or more opposing wells. The economic loss occasioned by the shutting down of opposing wells which are capable of continued operation is obviously of importance to the industry.

The main objects of the present invention are to provide a simple, efficient, economical, durable and compact device and mechanism whereby any one and/or more wells, to a considerable number, may quickly and adequately be counterbalanced, regardless of the number of wells being operated, or left out of operation, thus making it possible to operate the remaining wells of the system after one or more is out of operation.

Briefly, the invention comprises a special back side crank for attachment to the crank shaft of the rig at the centrally located well, said back side crank being designed and constructed and arranged for particular systematic connection, in varying arrangements, to various pull rods of a plurality of pumping jacks, the position of attachment being variable according to the number and location of wells being pumped, so that any combination of wells may be counterbalanced.

In order to more clearly disclose the construction, operation and use of the invention, reference should be had to the accompanying drawings forming part of the present application. Throughout the several figures of the drawings, like reference characters designate the same parts in the different views, most of which are diagrammatic.

In the drawings:

Fig. 1 is a top plan view of the invention, as applied to a group of three wells;

Fig. 2 is a front elevation of the apparatus for pumping the beam well;

Fig. 3 is a sectional view taken on the line III—III of Fig. 1 and shows the connection of the pumping jacks with the back side crank;

Fig. 4 is a perspective view of the crank shaft counterweight and cranks set to operate one jack well alone;

Fig. 5 is a similar view of the apparatus set to operate the other jack well alone;

Fig. 6 is a perspective view of the crank shaft and cranks set to operate the beam well and one jack well;

Fig. 7 is a similar view of the apparatus set to operate the beam well and the other jack well;

Fig. 8 is a perspective view of the back side crank in its preferred form, and

Figs. 9 and 10 are similar views of modified forms of back side cranks.

The regulation beam well and its operation are well known and need no detailed description here. The same general lay-out or assembly may be used in practically all usual conditions. It comprises, in general terms, the string of sucker rods reciprocable in the well, the Sampson post, walking beam pivoted on the Sampson post, a crank shaft with front side crank, a pitman for connection between one end of the walking beam and the front side crank, a beam hanger for connection between the other end of the walking beam and the sucker rods, and a power unit coupled to the crank shaft to drive it. The string of sucker rods, in itself, is a very heavy load and the column of fluid (oil, etc.) lifted by and with the rods is a great additional load. It is universal practice, now, to apply an adjustable counter weight or balance to the front side crank or to the shaft near the front side crank to offset the weight of the sucker rods and approximately one-half of the column of fluid being raised. This, and the manner in which it is done, is all well known throughout the industry.

Likewise, it is old and well known to provide

a back side crank on the same crank shaft and to connect to this back side crank, pull rods which operate pumping jacks of other wells. In connecting the pull rods to the back side crank, they are so arranged that, as far as possible, the load of one well is opposed to that of another to counterbalance it. This also is all well known throughout the industry, but whenever one of the jack wells of such a group has to be stopped, all have to be stopped as the stoppage of one completely unbalances all others of the group. There has been no means to readjust the balance of the remaining jack wells. The main object of the present invention is to provide means for such adjustment or readjustment so that when one or more of the jack wells is out of operation, the others may be continued in operation with full efficiency and without additional mechanism.

For simplicity, a three-well group has been shown in the drawings and will be described in detail. It comprises a beam well pump, driven from the front side crank and two jack wells operated through pull rods in usual manner from the back side crank. As will later appear, the mechanism and connections are such that either of the jack wells, alone, or the beam well pump alone may be counterbalanced by the front side crank counter weight; or either of the jack well pumps and the beam well pump may counterbalance each other, without the front side counter weight; or all three pumps may be counterbalanced, the beam well pump being counterbalanced by the counter weight of the front side crank, and the two jack well pumps acting as counterbalances for each other.

Briefly, the peak load of the beam well comes on the upstroke just before the crank reaches a horizontal position. The walking beam at this position carries the entire string of sucker rods and the column of fluid being lifted by them. The front side crank counterbalance is therefore so positioned, adjusted and proportioned as to have its maximum efficiency at a substantially horizontal position of the crank.

If the two jack wells are attached to the back side crank at the same radial position as the front side crank, or at a position 180 degrees thereto, the peak loads of the jack wells will occur when the front side crank reaches approximately a vertical position. This distribution of the peak loads of the various wells at different points in the crank cycle is desirable for obvious reasons. It is therefore desirable that the back side crank be equipped with attachment holes located in a radial line coincident with that of the front side crank or at 180 degrees thereto.

If one of the jack wells has to be disconnected, its counterbalancing effect must be compensated for by changing the effective action of the other jack well. The pull rod of the remaining jack well must be connected to an arm of the back side crank which is in a radial line 90 degrees ahead of or beyond the radial line of the front side crank. The back side crank is therefore provided with attachment holes located in radial lines 90 degrees ahead of and 90 degrees beyond the radial line of the front crank. By removing the crank counterbalance from the front side crank and attaching the pull rod of the remaining jack well to the proper back side crank arm, either 90 degrees ahead of or 90 degrees beyond the radial line of the front side crank, the beam well and the remaining jack well will oppose each other, just as the jack wells oppose each other.

When the beam well and one jack well are inoperative, the remaining jack well is counterbalanced by the front side crank counterbalance when the pull rod is connected to the arm of the back side crank which is in a radial line either 90 degrees ahead of or 90 degrees beyond the radial line of the front side crank.

In the present instance, the beam well 1 is operated in the usual manner by the walking beam and cooperating mechanism jack wells 2 and 3, respectively, are each operated by a well known type of pumping jack. The plunger or pump of well 1 is connected in usual and well known manner to the corresponding end of walking beam 4, mounted in the usual and well known manner on the Sampson post 5. The opposite end of walking beam 4 is connected in well known manner by the usual pitman 6 and wrist pin 7 to the standard front side crank 8 of the crank shaft 9, all assembled, mounted and disposed in the usual manner. Either the crank shaft or the front side crank arm is provided with a counterweight 10 of usual and well known type and adjustably secured in the predetermined position by usual and well known devices. As is well known, this counter weight is so adjusted and disposed as to give a gravitational force 14 to properly counterbalance the load being lifted or lowered by the beam 4. It is so calculated as to offset the weight of the sucker rods and one-half of the weight of the column of fluid being lifted by them during the up-stroke. The mechanism so far described, and its operation, are all well known in the industry. It is also old and well known in the industry to have a back side crank carried by the opposite end of the crank shaft 9 and connected to one or more pull rods for operating jacks for pumping jack wells. It is likewise old and well known in the industry to connect jack wells to a back side crank in such a manner as to oppose or counterbalance each other. However, as stated, no means has, so far as I am aware, been disclosed for re-balancing or adjusting the balance when one or more of several of the pumps is inoperative.

To acomplish this result, the back side of the crank shaft is fixedly connected, as by a set screw, key-way and key, or other well known means, to a device whereby any one or more of several jack wells or jack well pull rods may be detachably connected or coupled to the crank shaft in any one of several positions, relative to the axis of rotation of the crank shaft, to change or vary the effective application of the force or pull of the respective well plunger and its load, as applied to the crank shaft and its cranks. This device may take various forms and arrangements. In the forms illustrated, it is a hub or collar 11 keyed, in well known manner, to the crank shaft and formed with two, three or four arms 12 extending radially and arranged either in alignment or at right angles. Each arm is provided with a series of openings to selectively receive a wrist pin 13 by which a pull rod may be secured at different distances from the axis, as may be desired. Obviously, a circular plate or disc, or a square plate, may be used. In that case, radial rows of wrist pin holes are provided corresponding with the rows in the arm 12. Of course, with such plates or discs, other holes may be provided for various other intermediate adjustments, if desired. However, the radial rows as here disclosed will provide ample adjustment for most cases.

Wherever the term arm is used, as applied to

the element 12, it is used generally and to include all equivalents. The parts are so assembled as to present the two cranks in the relative positions of Figs. 1, 2, 3 and 4. It will be noticed that the counterbalance and front side crank on the beam well pump is in a horizontal position. It will also be noticed that the aligned arms 12 of the back side crank, to which the pull rods are connected are horizontal, or parallel with the front side crank. And, as usual, these two jack wells are connected to the crank in opposed relation. Consequently, these three pumps are all in substantially balanced relation and operate smoothly, and with the minimum jolt or jar. This is all well known practice.

But assume that pumping in well 2 has to be stopped. With the construction and arrangement at present in use, well 3 would also have to be disconnected. With this invention, it is only necessary to remove the counterweight 10 and connect the pull rod of well 3 to the arm 12 vertically below the crank shaft 9. This "hook-up" or arrangement is shown in Fig. 7 of the drawings. The loads in wells 1 and 3 are then counterbalanced, one offsetting the other. Now, assume that pumping in well 3 has to be stopped. The same procedure will be followed, except that the pull rod of well 2 will be connected to the arm 12 vertically above crank shaft 9, with the same result. This "hook-up" or arrangement is shown in Fig. 6 of the drawings. Should wells 1 and 2 become inoperative, it is only necessary to shift the pull rod connection of well 3 to the arm 12 vertically above crank shaft 9 and the load of well 3 will be counterbalanced through the counter weight at the front side, as though well 3 were well 1, as shown in Fig. 4. Similarly, should wells 1 and 3 become inoperative, it is only necessary to shift the pull rod connection of well 2 to the arm 12 vertically below crank shaft 9, and the load of well 2 will be counterbalanced as though it were well 1, as shown in Fig. 5 of the drawings.

From the above, it will be clear that in such a group, comprising two jack wells on the back side, any one or more of the wells of the group may be adequately counterbalanced independently of any and all of the others by merely shifting connections between a pull rod and the back side crank, or by removing the front side counter weight, as the case may be. It will be seen also that with a crank having radial arms, three arms are necessary, one at right angles to the other two which are aligned. In assembling such a three-armed crank, the aligned arms might be placed horizontally instead of vertically, with the remaining arm vertically. That would make it necessary to remove and replace the crank under certain circumstances, as will be clear. In other words, two vertically extending arms, one above and one below the shaft 9, are necessary, whereas only one horizontal arm is required to meet all conditions without shifting of the crank. These three arms, properly positioned, will provide for all changes and connections. By having four arms arranged as a cross, if two aligned arms are placed horizontally in first assembling, then there will also necessarily be two vertical arms, one above and one below the crank shaft. So the fourth radial arm is provided for ease of assembling and to avoid possible subsequent adjusting.

A group of three wells has been shown as the simplest group. It will be clearly understood on the other hand that the invention is equally applicable to a multiplicity of other groupings including a considerably greater number of wells. Instead of each of the jack wells, a considerable number may be used. They would simply be interconnected to balance each other in groups, one group balancing another group, according to circumstances, with the resultant load of wells in place of jack well 2 offset by that of the wells in place of jack well 3. Likewise, several wells grouped might be substituted for well 1. Thus any one or more of the three wells here illustrated might be substituted by a number of wells.

It is believed that the construction, operation and use of the invention will be clear from the preceding detailed description.

Many changes may be made in the construction, arrangement and disposition of the various parts of the invention, and of the groupings, connections, and arrangements of the various pump actuating mechanisms, within the scope of the appended claims, without in any degree departing from the field of this invention, and it is meant to include all such within this application, wherein only a single preferred construction and arrangement has been shown, with no thought or intention to in any degree limit the claims by such disclosure.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. Well pumping equipment comprising a crank shaft provided with a front side crank and a back side crank, said back side crank having several arms, each extending at an angle relatively to the front side crank.

2. Well pumping equipment comprising a crank shaft provided with a front side crank and a back side crank having a plurality of arms, at least one of which extends at an angle relatively to said front side crank.

3. Well pumping equipment comprising a crank shaft provided with a front side crank and a back side crank having a plurality of arms, several of which extend at angles relatively to said front side crank.

4. Well pumping equipment comprising a horizontally extending shaft, a crank member secured to one end of said shaft, counter-balance means carried by said shaft and adjustably secured to said crank, and a second crank member formed with a plurality of arms secured to the other end of said shaft.

5. Well pumping equipment comprising a horizontally extending shaft, a crank member secured to one end of said shaft, counter-balance means provided on said shaft and adjustably secured to said crank, and a second crank member secured to the other end of said shaft, said second crank member being formed with a plurality of arms, each of which is arranged at 90° to its adjacent arm.

6. Well pumping equipment comprising a rotatably mounted shaft, a crank member secured to one end of said shaft, counter-balance means adjustably carried by said shaft, and a member provided with a plurality of radially arranged rows of openings for the adjustable reception of a wrist pin secured to the other end of said shaft.

7. Well pumping equipment comprising a rotatably mounted shaft, a crank arm provided with a row of spaced openings secured to one

end of said shaft, and a cross-shaped crank member secured to the other end of said shaft, one of the arms of said cross being arranged parallel to said first named crank arm.

8. Well pumping equipment comprising a rotatably supported shaft, a crank arm provided with a row of openings secured to one end of said shaft and a second crank member provided with a plurality of radially extending arms secured to the other end of said shaft, one of the arms of said second crank member being arranged at a 90° angle to a plane passing longitudinally through said first named crank arm and shaft.

RICHARD R. BLOSS.