(No Model.)

J. BARRETT.

OIL WELL DRILLING APPARATUS.

No. 495,689. Patented Apr. 18, 1893.

Fig. 6.

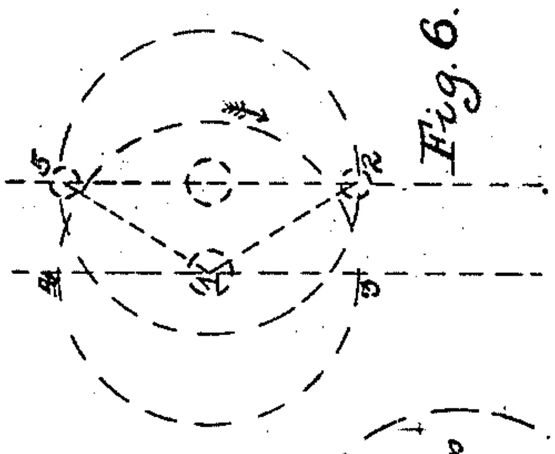

Fig. 5.

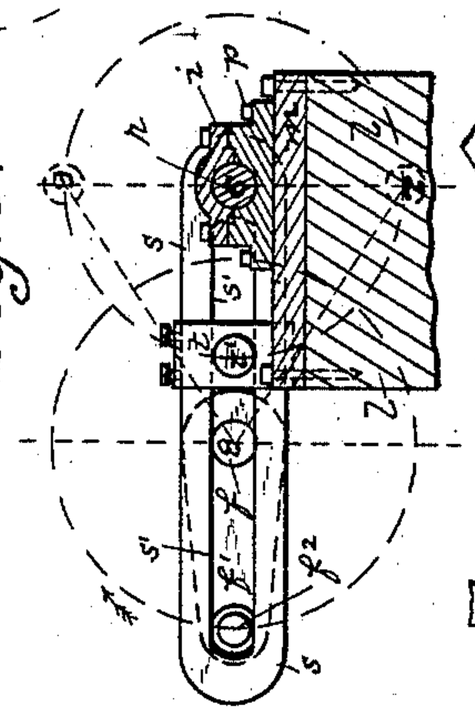

Fig. 3.

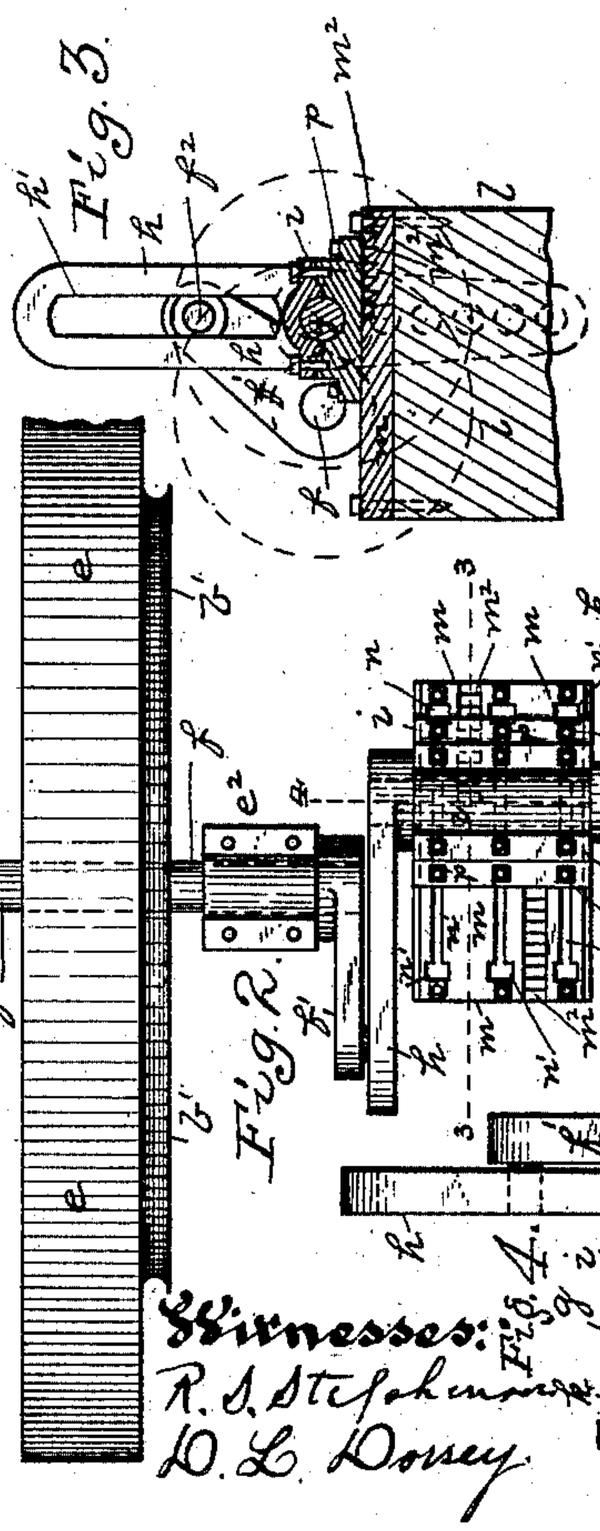

Fig. 2.

Fig. 4.

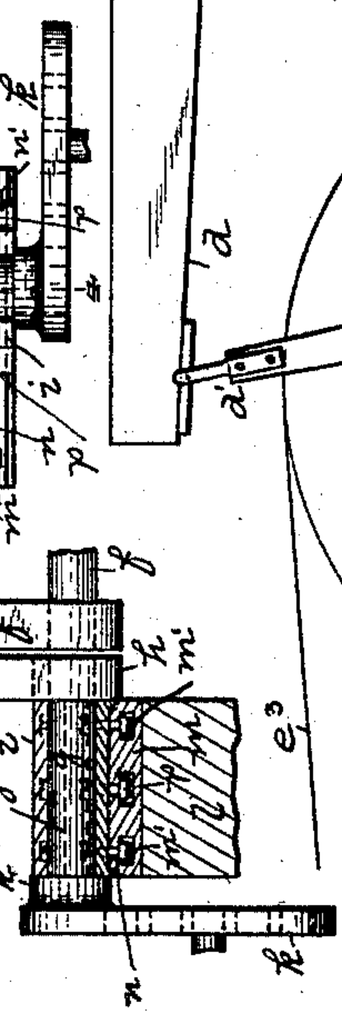

Fig. 1.

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UNITED STATES PATENT OFFICE.

JOSIAH BARRETT, OF ALLEGHENY, PENNSYLVANIA.

OIL-WELL-DRILLING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 495,689, dated April 18, 1893.

Application filed June 10, 1892. Serial No. 436,223. (No model.)

To all whom it may concern:

Be it known that I, JOSIAH BARRETT, a resident of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Oil-Well-Drilling Apparatus; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to oil well drilling apparatus, its object being to provide for the increase, both of power and speed, in the operation of oil well drilling apparatus generally employed. The oil well drilling apparatus generally employed consists of a walking beam which extends over to the derrick in vertical line with the hole to be drilled, and is connected at the opposite end by means of a pitman to a driving shaft having a crank arm, said driving shaft being generally operated from the engine by means of belting. Suspended from the free end of the walking beam is the drilling rope which extends down into the well, and on the lower end of said rope the drilling tools are attached. The operation of drilling is to lift this rope by the movement of the walking beam, and then permit the tools to drop as the walking beam descends, so giving the necessary stroke for cutting or drilling the rock. The speed of movement of such drilling apparatus has always been limited by one factor, namely, the stretching of the rope, it being necessary to operate at such a speed as would draw on the rope sufficiently slowly to enable it by means of the jars to free the tools and lift them, it being found that if the apparatus was run too rapidly the result would be a simple churning of the tools within the well, the quick application of power stretching the rope so rapidly and to such an extent that it would not act to lift the tools. This difficulty in the stretching of the rope is, of course, experienced more particularly in deep well drilling which is found necessary in many of the gas and oil regions, and for this cause it has been necessary to operate at a much slower speed in proportion to the depth of the well. It is, of course, desirable that the tools shall be free to drop as quickly as possible and yet be under control, and the difficulty of slow movement in raising has necessarily prevented as quick a drop as desirable. To obtain the necessary hard blow for drilling in deep wells the weight of the tools has also been increased, and this has necessitated corresponding increase in engine power. The movement of the engine was also necessarily irregular, under the strains of lifting and dropping.

By the present invention I am enabled to provide well drilling apparatus in which the slow movement of the walking beam necessary to raise the tools is obtained, while a quick movement for dropping the tools and causing the drilling stroke is also obtained, with the further advantages of a quicker drilling stroke and increased speed of the drilling apparatus, without further expenditure of power, and consequent saving of steam in proportion to the amount of work done.

To these ends my invention consists, generally stated, in combining with the walking beam and its pitman a crank shaft operating the same, and an auxiliary driving shaft provided with an arm having a sliding connection with the crank shaft, these two shafts being generally set eccentric to each other, so that in order to move the crank shaft for one-half of its stroke, such as in the raising operation, the driving shaft will have traveled a greater part of its stroke, for example, about two-thirds, and to move the crank shaft for the other one-half of its stroke, as in dropping, the driving shaft will only travel over a smaller part, say, the other one-third, of its stroke, and while the driving shaft is traveling at the same speed the tools are lifted by the walking beam during, say, two-thirds of the stroke of the driving shaft and are dropped during, say, one-third of the stroke thereof, the movement of the walking beam and the drilling rope being, however, under the same control as in the ordinary apparatus.

My invention also consists in certain other improvements which will be hereinafter more particularly set forth and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a side view illustrating my invention. Fig. 2 is a top or plan view thereof. Fig. 3 is a longitudinal section of the bearing of the crank shaft and its supporting block

on the line 3—3 Fig. 2. Fig. 4 is a cross section thereof on the line 4—4, Fig. 2. Fig. 5 is a view of a modification of the invention, and Fig. 6 is a diagram view showing the course of the crank movement.

Like letters and numerals indicate like parts in each of the figures.

In applying my invention to well drilling apparatus very little change is required, and practically the old parts are employed, with the addition of the connecting devices hereinafter described.

In the drawings the derrick is shown at A, the derrick platform at *a*, the bull wheel at *b*, the walking beam at *d*, said walking beam being mounted on the standard *c* and extending back in line with the band wheel *e*, said band wheel being mounted in suitable bearings *e'* e^2 and being driven by the belt e^3 from the engine which is not shown. It will be noticed that the band wheel is moved over some distance from its ordinary position, and for that reason the rope pulley *b'* is placed on the inner side of the wheel, so as to bring the same into line, or nearly so, with the like pulley on the bull wheel *b* for proper connection by means of the rope belting b^2, these being practically the only changes as to positions of the parts made.

The driving shaft *f* carrying the band wheel *e* and pulley *b'* has at the end thereof the crank arm *f'* which, instead of connecting to the walking beam by means of a pitman, as in the ordinary construction of drilling apparatus, has a sliding connection with the crank shaft *g*, said crank shaft, shown in Figs. 1 and 2, having the arms *h* and *k*. The arm *k* is connected to the walking beam by the pitman *d'*, the arm *k* of the crank shaft having a series of openings therein by means of which the pin operating the pitman can be connected to the crank arm at any desired distance from the center of the crank shaft, so as to increase or diminish the stroke. The crank arm *h* has the slot *h'* formed therein, longitudinally thereof, which extends for almost the entire length of said arm, and the crank arm *f'* has a pin f^2 which enters within the said slot and travels therein, so connecting the driving shaft *f* and the auxiliary crank shaft *g*.

The apparatus as so constructed embodies all the main features of my invention, and I will describe the same so that the motion can be more clearly understood. As the crank arm *f'* moves in its regular rotation and at its regular speed, being driven through the band wheel *e*, it slides in the crank arm *h* of the crank shaft *g*, and as the two shafts are set eccentric to each other, it will be evident that in proportion to the eccentricities of the shafts, in order to turn the auxiliary crank shaft one-half of a revolution, the motion of the driving shaft will be such as will require it to draw the crank arm *h* of the crank shaft vertically in line with the bearing of the crank shaft, the result of which is that, where, for example, the driving shaft *f* is turning in the direction shown by the arrow and the crank arm *h* extends vertically below its bearing *i*, the arm *f'* will necessarily be in the position shown in Fig. 6, namely, in the downwardly inclined position on the line 1—2, being drawn out of a vertical position for the distance 2—3, the line 3—4 showing the vertical axis of the driving shaft *f*. As the driving shaft *f* is turned in the direction of the arrow, it will travel from said point 2 past the point 3 and the point 4 and over to the point 5, being brought to an incline illustrated by the line 1—5, while it is causing the crank shaft to turn one-half of its stroke, the result of which is that about two-thirds of the time necessary to complete a single stroke of the driving shaft is consumed in moving the crank shaft one-half of its stroke, and during such movement through the crank arm *k* and pitman *d'* the walking beam will be drawn downwardly at that end and upwardly at its free end, and so will act by a slow motion to draw up the drilling tools, the motion being sufficiently slow to raise the tools and take up the stretching of the rope. As soon as the crank shaft *h* has passed said point 5 however, it will, of course, descend, and in its descent will travel for one-half of a revolution, while the arm *f'* of the driving shaft is traveling from the point 5 to the point 2, the result of which will be that the auxiliary crank shaft will travel for one-half of its stroke, while the driving shaft is making, say, one-third of its stroke, and therefore that end of the walking beam is raised, and the free end of the walking beam is lowered during that same time, giving a quick drop to the tools and therefore a quicker stroke in drilling, and a more effective stroke for the cutting of the rock, overcoming the necessity of such heavy tools, or so great engine power. As soon, however, as the crank shaft *h* passes the point 2, it then returns to the slow movement for lifting, which was above described. This stroke does not increase the strain upon the engine, as the power is applied by it to the driving shaft whose center is closer to the end of the crank *h* than the center of the crank shaft during the main part of the lifting movement, such as where the crank *h* is carried toward and from its horizontal position in its upward stroke, and an increase in leverage is therefore obtained, and in addition to this the driving shaft is employed for a greater portion, say, two-thirds of its stroke in lifting the tools the same distance that it has been heretofore employed for one-half its stroke, so that there is necessarily an increase of power in the operation of raising the tools, while the part of the stroke which would naturally bring heavy leverage upon the driving shaft occurs when the tools are dropping within the well, and it is only necessary to control the movement of the crank shaft during such quick drop. The irregular movement of the engine is, also, to a great extent, overcome. A considerable increase of power is thus ob-

tained, and on account of the slow stroke in raising the tools and the quick stroke in dropping the same, the speed of the drilling apparatus may be correspondingly increased, so that the actual speed of the stroke in raising the tools is about what was heretofore employed in operating the walking beam in the ordinary way, and this is obtained without any proportional increased expenditure of power. As a result, the drilling operation can be carried on much more rapidly, a saving of probably twenty (20) per cent. in the time of drilling being obtained, with a proportional saving in engine power.

The bearing *i* for the crank shaft *g* is mounted on the bearing block *l*, and in order that the driving shaft and crank shaft may be adjusted to the best position for working, the bearing *i* is adjustable over the top of the bearing block. This is accomplished in the following way:—On the top face of the bearing block *l* is the plate *m*, which plate is provided with longitudinal grooves on its under surface, as at *m'*, with which grooves the slots *n* communicate for part of the length of the plate, said slots having the enlargements *h'* at the ends thereof, so that the heads of the bolts *p* may pass through such enlargements and fit within the grooves *m*, their body portions sliding in the slots *n*. The said bolts *p* pass upwardly through the body of the bearing *i*, and by means of the same the bearing *i* is clamped firmly to the plate *m* which is secured to the bearing block *l;* and by loosening such bolts the bearing *i* may be drawn over the plate *m* to any desired position, either being brought concentric or placed at any degree of eccentricity with the driving shaft *f*. In the upper face of the plate *m* are one or more serrated portions extending longitudinally of the plate, as at m^2, to give hold to the lever in moving the bearing *i* upon the plate *m*. As the well is drilled deeper by moving this bearing the auxiliary shaft is set at a greater eccentricity to the driving shaft, so giving more time for raising the tools, and permitting a quicker dropping or drilling stroke, and overcoming the necessity of adding to the weight of the tools, and increasing the engine power for such deep wells.

In Fig. 5 I have shown another form of apparatus embodying the invention which overcomes the necessity of two arms on the crank shaft, and obtains practically the same motion. The same driving shaft with its arms *f'* is employed, but the crank shaft *r* has the single crank *s* which is of greater length than the crank arm *h* above described, and to which a vibratory motion is imparted instead of the circular motion above described. In the slot *s'* on this crank arm *s* the pin f^2 of the arm *f'* fits and slides, and clamped to the outer face of the arm *s* is a box *t* having a pin *t'* extending out therefrom to which pin *t'* the pitman *d'* is connected the box *t* being thus made longitudinally adjustable on the crank arm *s*. As so constructed, it will be evident that the crank arm *s* has a vibratory movement from its center or shaft *r*, the highest point of which is a tangent extending from said shaft *r* to the circumference of the circle described by the pin f^2 on the arm *f'*, and the lowest part of which stroke is another tangent extending diagonally down from the shaft *r* and touching such circle of movement. Supposing, therefore, that the crank arm is in the position indicated by the line 6—7. In that case the crank *f'* would be in the position indicated by the line 7—8, and in its course it would raise the crank arm upwardly until it traveled in the course indicated by the arrow over to the point 8—9, bringing the crank arm into the position indicated by the line 6—9, this part of the movement being taken up during the raising of the tools, and requiring the larger part of the revolution of the driving shaft. As, however, the crank *f'* would pass in its course from the point 9 to the point 7, the crank arm would be brought down to its lowest position 6—7, above referred to, in such short movement of the driving shaft, so providing for the quick downward movement or drop of the tools, such drop, however, being controlled by the driving shaft through its connection to the crank arm. In either case, the special advantages of the slow raising movement and quick drop are obtained, and consequently the stroke of the apparatus may be correspondingly increased, and this without any increase of the expenditure of power but a saving; and a material increase in the speed of the drilling operation can be obtained, this being very important in the drilling of many wells, where the saving of time is more valuable than in the mass of mechanical operations.

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

1. In oil well drilling apparatus, the combination of a crank shaft for operating the drilling tools, and an auxiliary driving shaft having a sliding connection with the crank shaft, substantially as and for the purposes set forth.

2. In oil well drilling apparatus, the combination of a crank shaft for operating the drilling tools, and an auxiliary driving shaft provided with an arm having a sliding connection with the crank shaft, said crank shaft being eccentric to the driving shaft, substantially as and for the purposes set forth.

3. In oil well drilling apparatus, the combination of a crank shaft for operating the drilling tools, and an auxiliary driving shaft provided with an arm having a sliding connection with the crank shaft, the crank shaft being mounted in a bearing parallel to and adjustable with relation to the driving shaft, substantially as for the purposes set forth.

4. In oil well drilling apparatus, the combination of a crank shaft for operating the drilling tools, said shaft having the crank arm provided with a slot, and a driving shaft having a crank arm provided with a pin moving

in said slot, substantially as and for the purposes set forth.

5. In oil well drilling apparatus, the combination of a crank shaft for operating the drilling tools, said crank shaft having the crank arm k connected by the pitman d' to the walking beam, and a crank arm h having the slot h' therein, and the driving shaft f having the arm f' provided with a pin f^2 engaging with the slot of the crank arm h, substantially as and for the purposes set forth.

In testimony whereof I, the said JOSIAH BARRETT, have hereunto set my hand.

JOSIAH BARRETT.

Witnesses:
J. N. COOKE,
ROBT. D. TOTTEN.