(No Model.) 3 Sheets—Sheet 1.

W. FORGIE.

WRENCH FOR OIL WELL TOOLS.

No. 422,879. Patented Mar. 4, 1890.

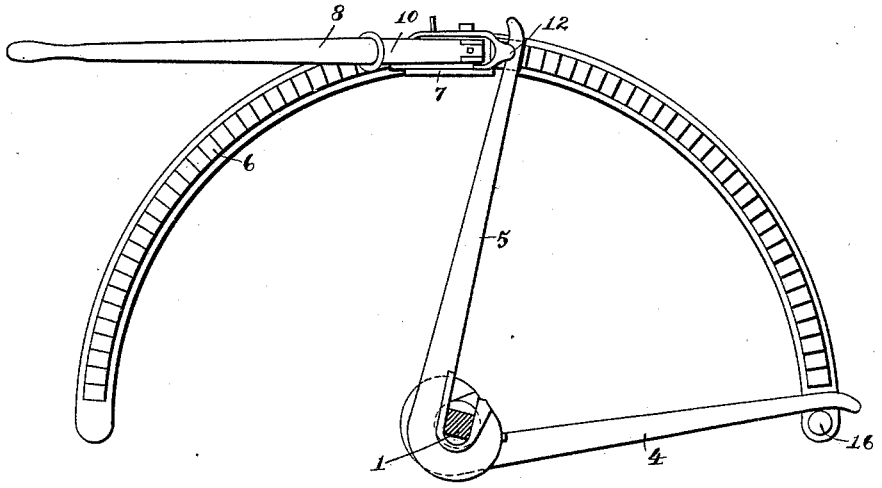

Fig. 1.

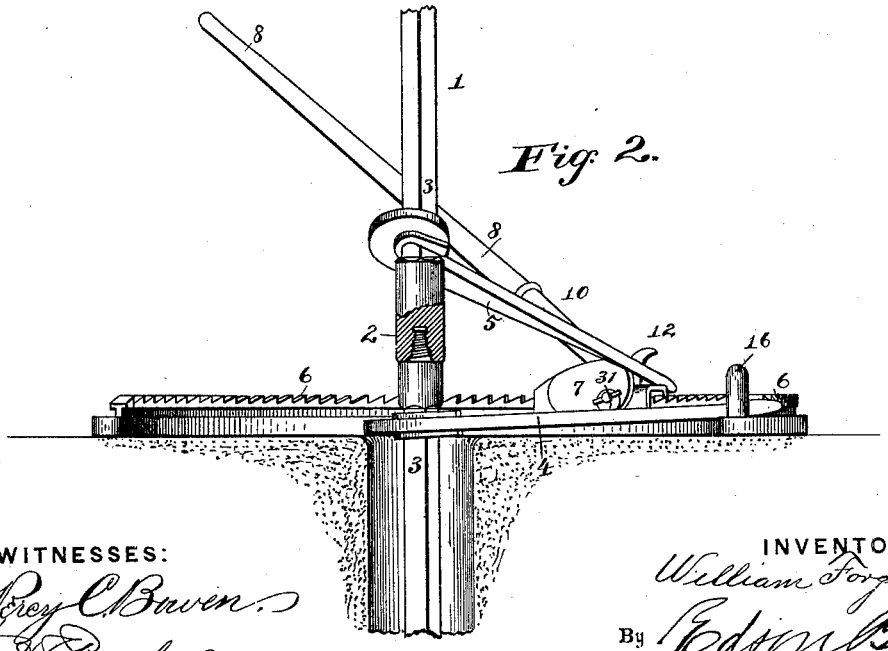

Fig. 2.

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Fig. 3.

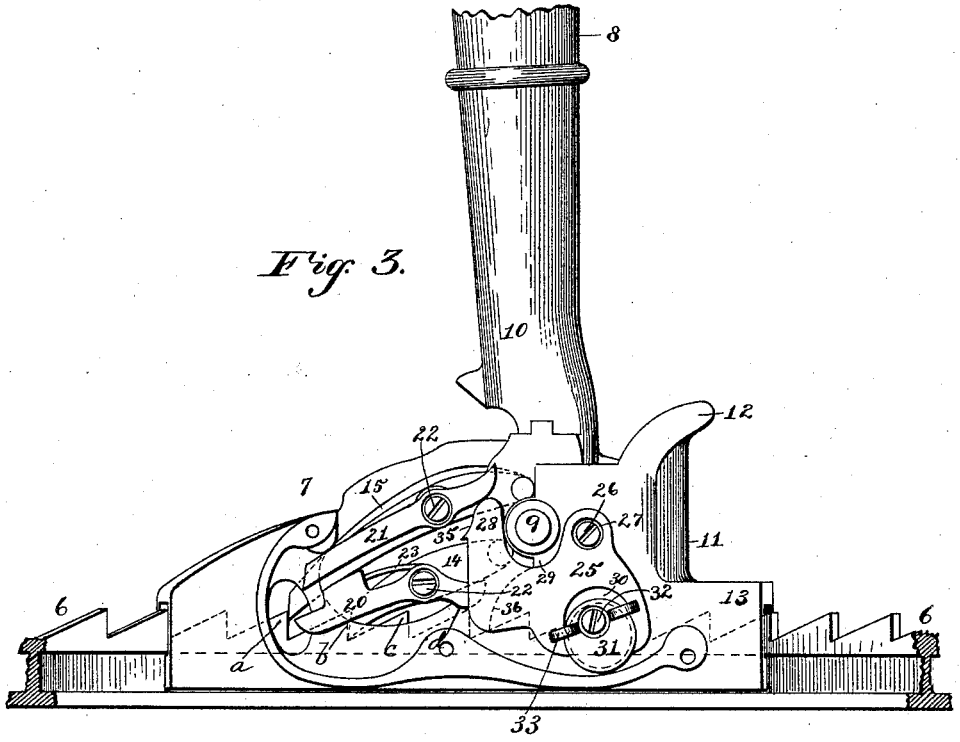

Fig. 8.

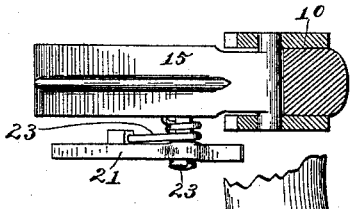

Fig. 5.

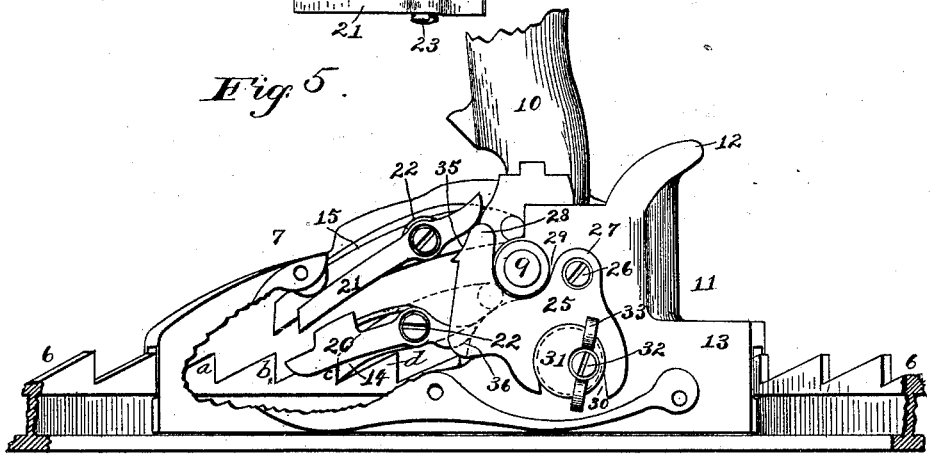

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Fig. 4.

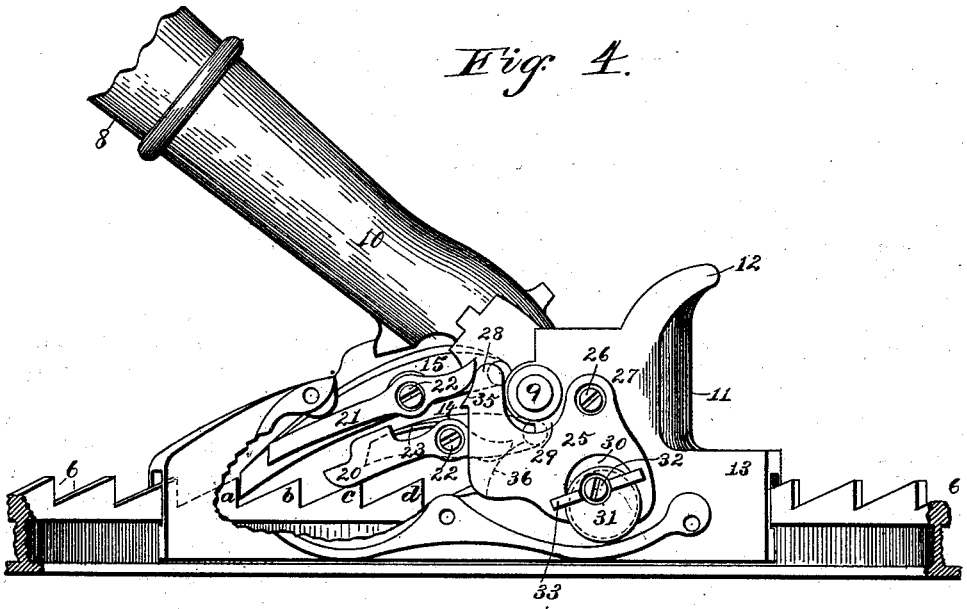


Fig. 6.

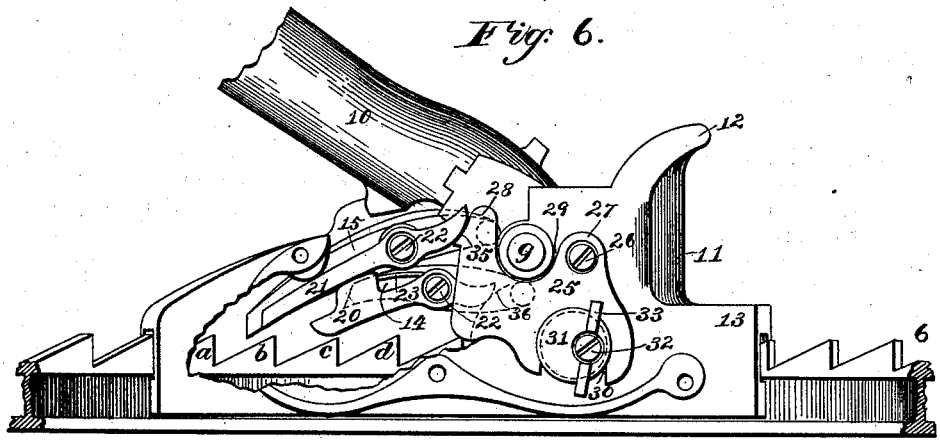
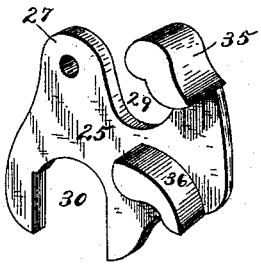


Fig. 7.



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UNITED STATES PATENT OFFICE.

WILLIAM FORGIE, OF WASHINGTON, PENNSYLVANIA.

WRENCH FOR OIL-WELL TOOLS.

SPECIFICATION forming part of Letters Patent No. 422,879, dated March 4, 1890.

Application filed January 28, 1888. Serial No. 262,300. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM FORGIE, a citizen of the United States, residing at Washington, in the county of Washington and State of Pennsylvania, have invented certain new and useful Improvements in Automatic Wrenches for Coupling and Uncoupling the Tools or Drill-Rods of Well-Boring Apparatus; and I do hereby declare that the following is a full, clear, and exact specification of the same, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an automatic wrench for coupling and uncoupling the sections of a drill-rod for a well-boring or drilling apparatus, the coupling upon which my invention is especially adapted for use consisting of a tapered or conical screw and socket which are fitted tightly and securely together, although I would have it understood that the wrench is applicable to any kind of screw-joint for rods or shafts.

The ordinary method practiced in the oil regions of this country to couple and uncouple a screw-joint for a drill-rod is to apply a wrench-bar to each section or member of the joint, said wrenches occupying a position to each other relatively at right angles, and then move one wrench by means of a pinch-bar, which is inserted in apertures in a segmental bar which is fixed to the floor of the drill-house, this movement of the wrench serving to turn one of the members of the screw-joint, and thus effect the coupling of the joint. This method and means for coupling and uncoupling the joint is both laborious and crude and requires time; and it is the object of my invention to overcome these objections by providing an apparatus or wrench whereby the screw-joint can be very expeditiously coupled or uncoupled with a comparatively slight exertion by the operator.

An understanding of the construction and operation of my invention can be had to better advantage by a detailed description thereof, in connection with the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a plan view illustrating my apparatus in position for use. Fig. 2 is a side elevation, partly in section, of the apparatus shown in Fig. 1. Fig. 3 is an enlarged end view, in side elevation, of the carriage or cage of my improved apparatus and the several pawls and other parts carried by said carriage. Fig. 4 is a side elevation of the machine on the scale of Fig. 3 with the lever depressed to show the position assumed by the parts when the carriage is fed forward one notch or tooth and with the lever in the depressed position. Fig. 5 is a side elevation of the carriage and its several parts with the lever raised and the reversing-plate elevated to throw the pawls into such position that when the lever is operated or depressed the carriage can move a limited distance rearwardly under the pressure of the wrenches. Fig. 6 is a view corresponding to Fig. 5, showing the lever depressed and the parts in position to allow the carriage to move another step rearwardly under the pressure of the wrenches. Fig. 7 is a detail perspective view of the reversing-plate detached from the carriage and reversed to show the rear side thereof. Fig. 8 is a detail view illustrating in plan view one of the main feeding-pawls, the supplemental pawl carried thereby, and the spring intermediate of said main and supplemental pawls.

Like numerals of reference denote corresponding parts in all the figures of the drawings.

In order that my invention may be more readily understood and its advantages appreciated by those skilled in the art to which it relates, I have deemed it advisable to illustrate in Figs. 1 and 2 of the accompanying drawings a screw-joint for a drill-rod of a well-boring apparatus upon which my improved apparatus is adapted for operation in coupling or uncoupling in an expeditious and easy manner the members or parts of said joint.

The drill-rod is designated by the numeral 1, and 2 is the joint, which consists of an internally-threaded conical socket on one section of the drill-rod and a similarly-shaped threaded projection on the other section of the drill-rod, the drill-rod sections or members being squared, as at 3, on both sides of the joint 2 to adapt the wrenches 4 and 5 to be fitted around said squared portions of the drill-rods. The wrenches are each provided

with a solid open jaw at one end, which jaw is shaped and proportioned to fit snugly around the squared portion of the drill-rod, so as to cause the drill-rod to move or turn with the wrench or remain at rest, according as the wrench is moved or held stationary.

6 designates the segmental rack-bar, and 7 the movable carriage, of my improved apparatus for operating the wrenches 4 5 to turn the members of the screw-joint. The segmental rack-bar is fixed to the floor concentric with the drill-rod, and this bar is made T-shaped in cross-section (see Figs. 3 and 4) to receive the inwardly-projecting flanges on the base of the carriage or cage 7, said flanges serving as the supports for the carriage and to confine said carriage against lateral or sidewise play, while permitting it to move freely around the segmental rack-bar. The carriage is made hollow or provided with a chamber, and in the forward end thereof is fulcrumed a lever 8 on a pin or shaft 9, said lever having a socket 10, through which said shaft 9 passes, and which receives the lower extremity of the bar that serves to actuate or rock the socket on the fulcrum or shaft. The forward end of the carriage is made very solid and substantial at 11 to enable it to withstand the strain of the wrench, which wrench has its outer extremity applied directly against said solid end of the carriage, the end or shank of the wrench being confined against displacement and accidental separation from the carriage by means of an overhanging lip 12 at the top of the solid end of the carriage and the extension 13 of the base of said carriage, as is obvious by an inspection of Figs. 3 and 4. The lever carries two feeding-pawls 14 and 15, which are arranged one beneath the other, and are pivoted or fulcrumed on the lever, the fulcrum of the lower shorter pawl 14 being arranged on one side (the lower) of the fulcrum 9 of the lever, while the fulcrum of the longer upper pawl is located on the other side of the fulcrum of the lever, whereby the two pawls are caused to successively engage the teeth of the segmental rack-bar to feed the carriage forward, as will presently be described more fully, one pawl being always engaged with the rack as the lever is operated to feed the carriage forward, and thus prevent retrograde movement of the carriage.

In Figs. 3 and 4 I have shown in different positions the parts of the apparatus as adjusted and adapted for feeding the carriage forward, Fig. 3 illustrating the positions of the parts when the operating-lever is raised, and Fig. 4 the positions of the parts when the lever is depressed. Referring more particularly to Fig. 3, it will be observed that when the lever is raised the longer upper feeding-pawl 15 bears against the upper part of the abrupt side of the tooth *a* of the series of teeth *a b c d* of the segmental rack-bar, while the lower short feeding-pawl 14 takes into the base of the succeeding tooth *b* of the series of pawls. Now, if the operating-lever is depressed from its vertical position shown in Fig. 3 to the inclined position shown in Fig. 4, it is evident that the lower end of the lever below the fulcrum 9, to which the lower short pawl 14 is attached, will be moved forward, while the upper longer pawl 15 will be forcibly pressed against the abrupt side of the tooth *a*, the upper pawl 15 thus serving to force the carriage forward one step, while the short pawl 14 is brought by the lever into position over the third tooth *c* of the series of teeth *a b c d*, as indicated in Fig. 4, (the lower pawl having passed or "skipped" over the second or intervening tooth *b* of the series,) which is due to the fact that the carriage has been moved one step and to the forward movement of the lower end of the lever and the attached pawl. The pawl 14 is held in the raised position (indicated by Fig. 4) by a supplemental pawl 20, a spring, and a cam-surface 36 on an adjustable plate 25, all to be hereinafter described. When the lever is again elevated, the lower pawl is immediately lowered at the beginning of the upstroke of the lever and before the upper pawl is withdrawn from the tooth *a*, so that said lower pawl 14 engages the abrupt side of the tooth *c* and forces the carriage forward one step as the upstroke of the lever takes place. The upper pawl is carried forward as the lever is raised, and on the completion of the upstroke the end of said upper pawl takes against the tooth *b*, so as to be in position to force the carriage forward when the lever is again depressed. The two pawls are thus successively engaged with the rack-bar at each complete swing of the lever backward and forward on its fulcrum and the carriage fed or moved with a step-by-step motion, whereby the movable wrench 5 on the carriage is forcibly turned with very little effort by the attendant or operator.

To couple the joint together one of the wrenches 4 is fitted around the squared portion of the lower member of the drill-rod and the outer end thereof fitted against a fixed post 16 at one end of the segmental rack-bar. To the squared portion of the other member of the drill-rod the other wrench 5 is applied and the carriage is drawn back to the opposite extremity of said segmental rack-bar, the outer end of the movable wrench 5 being fitted against the solid end 11 of the carriage. The lever is now rocked backward and forward to successively throw the feeding-pawls into engagement with the segmental rack-bar in the manner heretofore described, and thereby feed the carriage with a step-by-step motion. The carriage thus forces the movable wrench 5 around the rack toward the stationary wrench 4, and turns one section of the drill-rod so as to couple the screw-joint, and this operation of turning the wrench and joint by the carriage is repeated until the joint has been firmly screwed up.

To uncouple the joint the two wrenches are

reversed—that is to say, the stationary wrench 6, which was previously applied to the fixed post 16, is detached from the post and applied against the forward end of the carriage, so that the wrench 6 engages the lower section of the drill-rod and the movable carriage, while the wrench 5, which previously engaged the carriage, is removed from the latter and fitted against the fixed post 16, the wrench 5 thus engaging the upper section of the drill-rod and the fixed post. The carriage, having been previously moved at the rear end of the rack, is now fed forward by operating the lever in the same manner as when coupling the joint, in order to feed the carriage in the same direction, which movement of the carriage turns the wrench 6 and the lower section (instead of the upper section) of the drill-rod in the same direction as when coupling the joint. This rotation of the lower section of the screw-joint serves to uncouple or unscrew the members of the joint, because the rotation of the lower member of the joint in the same direction to uncouple the joint as the plane of rotation of the upper member of the joint when coupling the two members together is equivalent to rotating the upper member of the joint in the reverse direction in order to uncouple the joint.

It is evident that when the joint is tightly and firmly coupled together and the wrenches are still applied thereto the wrenches exert a very strong pressure or force against the carriage and the fixed post 16, and that it is an extremely difficult and laborious operation to remove the wrenches from the drill-rod to permit the latter to be used. To overcome this difficulty I have provided mechanism for permitting a limited retrograde movement of the carriage under the pressure of the wrenches, the mechanism for accomplishing which retrograde movement I will now proceed to describe.

Each of the feeding-pawls 14 15 carries a supplemental pawl 20 and 21, respectively, said supplemental pawl being pivoted to its feeding-pawl at an intermediate point of its length, as at 22. Each supplemental pawl is further connected to the feeding-pawl by means of a spring 23, which is coiled around the pivot 22 of the supplemental pawl (see Fig. 5) and connected at opposite ends to the main and supplemental pawls, the points of connection of the spring with said pawl being on the same side of the pivot 22. These springs are strong enough to raise the free end of the main feeding-pawl out of engagement with the rack-teeth of the segmental rack-bar when the supplemental pawl rides against its cam-surface on a reversing-plate 25. This plate 25 is arranged in the same vertical plane as the supplemental pawls in advance of the latter, and it is pivoted at 26 by means of a pin or screw which passes through an aperture in an extended lug 27 at the upper edge of said plate. The plate is provided with an extended arm 28, which is curved or shaped to form a recess 29 between itself and the rear edge of the plate, in which recess fits the extended end of the shaft or pin that constitutes the fulcrum of the operating-lever, and in its lower edge the reversing-plate is formed with another recess 30, in which is fitted an eccentric 31, that can be operated manually to raise or lower the reversing-plate into or out of position for operating the supplemental pawls. This eccentric consists of a flat disk, through which a shaft or pin 32 passes at one side of its center, and at diametrically-opposite points in the perimeter of the disk it has ears 33, by means of which the eccentric can be turned by hand to cause the periphery of said eccentric to ride against the edges of the recess in the reversing-plate to elevate the latter, the upward movement of the plate being limited by the extended end of the fulcrum-shaft, which fits snugly in the recess 29 when said plate is elevated. (See Fig. 4.)

At the rear edge of the reversing-plate and its extended arm 28, I provide two cam-surfaces 35 36, the former 35 being indicated very clearly by full lines at the top of the arm 28 in Figs. 3 and 4, while the latter cam-surface 36 is indicated by dotted lines in the same figures, said surface 36 being formed by an integral rib or flange located on the rear side of the reversing-plate on a horizontal plane below the other surface 35, but in substantially the same vertical plane.

The heel or one end of the upper pawl 14 rides against the upper cam-surface 35, and the corresponding end of the lower pawl 15 rides against the other cam-surface 36, and said pawls 14 15 are normally held in contact with said cam-surfaces on the reversing-plate.

The operation of this part of my invention is as follows: When it is desired to feed the carriage forward with a step-by-step motion in the manner and for the purpose described, the reversing-plate is lowered by turning the eccentric to the position shown in Fig. 3, and the supplemental pawls ride freely over the cam-surfaces of the reversing-plate without influencing or affecting the proper operation of the feeding-pawls on the segmental rack-bar. When, however, the joint is coupled tightly together and the wrenches are firmly held in place, so that it is difficult to remove them by reason of their engagement with the squared portions of the drill-rod, the forward end of the carriage, and the fixed stud or post 16, the apparatus is adjusted and operated to permit the carriage to move rearwardly under the pressure of force exerted by the wrenches for a limited distance, so that the wrenches can be easily and readily removed from the drill-rod. With the lever in the vertical position shown in Fig. 5 and the upper and lower pawls in engagament with the teeth *b c*, respectively, the eccentric 31 is turned and raises the plate 25, which causes the cam-surface 35 to raise the heel of the upper supplemental pawl 20, the spring

25 of which raises the upper feeding-pawl 15 out of engagement with the tooth *b* of the rack-bar, the lower pawl 14 in this instance bearing against the tooth *c* to sustain the backward pressure of the wrenches and prevent the carriage from being forced backward. In this adjustment of parts the upper longer pawl 15 is raised clear of the tooth *b* and inclines toward the tooth *a* of the series of teeth in such position with relation to said tooth *a* that it engages therewith when the lever is depressed and the carriage forced backward one step or notch by the pressure of the wrenches. As the lever is depressed from its vertical position to the inclined position shown in Fig. 6 the lower end of the lever below the fulcrum thereof is drawn or moved forward, so that the lower short pawl 14 is withdrawn from the abrupt side of the tooth *c* by the forward movement of said end of the lever, and on this depression of the lever the two pawls 14 15 are simultaneously actuated, as follows: The lower pawl 14 having been disengaged from the tooth *c*, it is instantly elevated above the same by its spring 25 and the heel of the pawl 20, riding on the cam-surface 36 of the plate 25, thus allowing the carriage to be moved rearward under the pressure of the wrenches a short distance, or until the end of the pawl 15 strikes the tooth *a*, which pawl 15 arrests the further rearward motion of the carriage on the depression of the lever. The carriage thus moves one step rearward on the downstroke of the lever, and on the upstroke or return of the lever to the vertical position the carriage can move rearward another step under the pressure of the wrenches, the operation of which is as follows: With the lever depressed the pawl 15 engages with the tooth *a* and the pawl 14 is raised above the tooth *c*, so as to clear the latter, and inclines toward the tooth *b* of the series of teeth. Now, when the lever is raised the pawl 15 is withdrawn from the tooth *a* by the upward movement of the lever, while the pawl 14 is thrust rearward by the rearward movement of the carriage and the movement of the lever, said pawl 14 being simultaneously depressed with its rearward thrust by the heel of the supplemental pawl 20 thereof riding down the cam-surface 36 of the plate 25, so that said pawl 14 engages the tooth *b* on the second step of the rearward movement of the carriage, and thus arrests the further motion of the same on the upstroke of the lever. It is evident from the foregoing that the pawls 14 15 successively engage the teeth of the rack on the backward and forward swing of the lever and that the retrograde movement of the carriage under the pressure of the wrenches is controlled by the movement of lever and the action of the spring-pressed supplemental pawls and cam-plate on the feeding-pawls.

It is evident that the wrenches can be easily and quickly removed after the retrograde movement of the carriage has been accomplished, that the action of the parts is automatic and effective, and that the apparatus can be easily and quickly adjusted by the simple manipulation of the eccentric to adapt the carriage to move in either direction.

To enable the carriage to be quickly and easily moved to its original position, I have provided a lift-pin 40 (shown in Fig. 1) on the lower main pawl, said pin projecting through a slot in the side of the carriage within convenient reach of the operator, so that both feeding-pawls can be lifted out of engagement with the rack-bar and the carriage moved freely over the same.

I am aware that changes and alterations in the form and proportion of parts and details of construction can be made without departing from the spirit or sacrificing the advantages of my invention, and I would therefore have it understood that I do not restrict myself to the exact construction herein shown and described as an embodiment of my invention, but hold myself at liberty to make such changes as fall within the scope thereof.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a bar having a stationary wrench mounted thereon, of a carriage movable on the bar and a wrench mounted on said carriage.

2. The combination, with a bar having a fixed bearing for a wrench-handle, of a carriage mounted on the bar and also having a bearing for a wrench-handle, and devices, substantially as described, for moving the carriage on the bar, for the purpose set forth.

3. In an apparatus for operating the couplings of drill-rods for well-boring apparatus, the combination of a segmental rack-bar, a carriage fitted thereon and having mechanism, substantially as described, arranged to engage the rack-bar and feed or move the carriage with a step-by-step motion, a stationary wrench, and a movable wrench fitted on or connected to the carriage to be moved by the latter, substantially as and for the purpose described.

4. In an apparatus for operating the couplings of drill-rods for well-boring apparatus, the combination of a segmental rack-bar, a carriage fitted thereon, a lever fulcrumed in the carriage, the feeding-pawls pivoted to the lever on opposite sides of its fulcrum and arranged to engage the rack-bar to feed the carriage with a step-by-step motion, and the wrenches, substantially as and for the purpose described.

5. In an apparatus for operating the couplings of drill-rods for well-boring apparatus, the combination of a segmental rack-bar substantially T-shaped in cross-section, a carriage fitted on said rack-bar and having the inwardly-extending flanges which fit in the recesses in the sides of said bar, a lever fulcrumed in the carriage, the feeding-pawls pivoted to the lever on opposite sides of the

fulcrum and arranged to engage the rack-bar to feed the carriage with a step-by-step motion, and the wrenches, substantially as and for the purpose described.

6. In an apparatus for operating the couplings of drill-rods for well-boring apparatus, the combination, with a segmental rack-bar and the wrenches, of a traveling carriage, a lever, the feeding-pawls carried by the lever, and mechanism, substantially as described, for controlling the feeding-pawls to permit them to be temporarily disengaged from the rack-bar when the lever is operated and allow the carriage to be forced backward a limited distance under the pressure of the wrenches, substantially as and for the purpose described.

7. In an apparatus for operating the couplings of drill-rods for well-boring apparatus, the combination, with a rack-bar and the wrenches, of a carriage, a lever, the feeding-pawls, a supplemental pawl carried by each feeding-pawl, and a reversing-plate arranged to be lifted vertically to control the supplemental pawls to such an extent that they lift both feeding-pawls temporarily out of engagement with the rack-bar during a portion of each movement of the lever, substantially as and for the purpose described.

8. In an apparatus for operating the couplings of drill-rods for well-boring apparatus, the combination, with the rack-bar and the wrenches, of a carriage, a lever carrying the feeding-pawls, a reversing-plate having the cam-surfaces, as described, and a spring-controlled supplemental pawl carried by each feeding-pawl and riding against one of the cam-surfaces on the reversing-plate, substantially as described, for the purpose described.

9. In an apparatus for operating the couplings of drill-rods for well-boring apparatus, the combination, with a rack-bar and the wrenches, of a carriage, a lever carrying the feeding-pawls, a supplemental pawl pivoted to each feeding-pawl, a spring intermediate of the feeding and supplemental pawls, a pivoted reversing-plate having the cam-surfaces against which ride the heels of the supplemental pawls, and an eccentric for lifting the reversing-plate vertically, substantially as described.

10. In an apparatus for operating the couplings of drill-rods for well-boring apparatus, the combination of a segmental rack-bar, the wrenches, a carriage fitted on the rack-bar, a lever fulcrumed in the carriage, the upper and lower feeding-pawls pivoted to the lever on opposite sides of its fulcrum, and a lift-pin projecting laterally from the lower feeding-pawl, substantially as described.

11. The combination, with a bar, a movable carriage or its equivalent, and a lever having means, substantially as described, which engage said bar to move the carriage, of the supplemental pawls, and a plate against which said pawls ride or impinge, for the purpose set forth, substantially as described.

12. The combination, with a bar, a movable carriage or its equivalent, and a lever having feeding devices, substantially as described, which engage said bar to move the carriage thereon, of an adjustable plate connected to said carriage, the supplemental pawls attached to the feeding devices on the lever and riding or bearing against the adjustable plate, and a device, as described, for moving the adjustable plate, as and for the purpose set forth.

13. The combination, with a rack-bar, a sliding part or carriage, and a lever suitably supported on said sliding part or carriage, of the feeding-pawls and mechanism, substantially as described, for controlling the movement of said feeding-pawls so as to allow the sliding part or carriage to be moved in either direction by swinging the lever on its fulcrum, as and for the purpose described.

In testimony whereof I hereunto set my hand in the presence of two witnesses.

WILLIAM FORGIE.

Witnesses:
M. E. HARRISON,
C. C. LEE.