July 25, 1933. L. P. KINNEAR 1,919,845

WELL DRILLING APPARATUS

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Fig. 1.

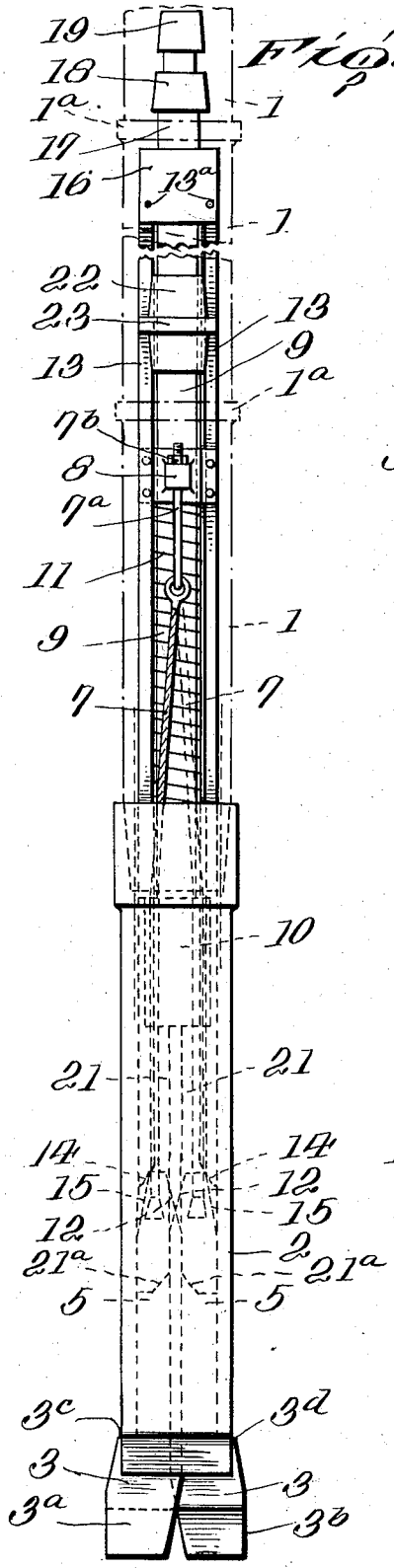


Fig. 3.

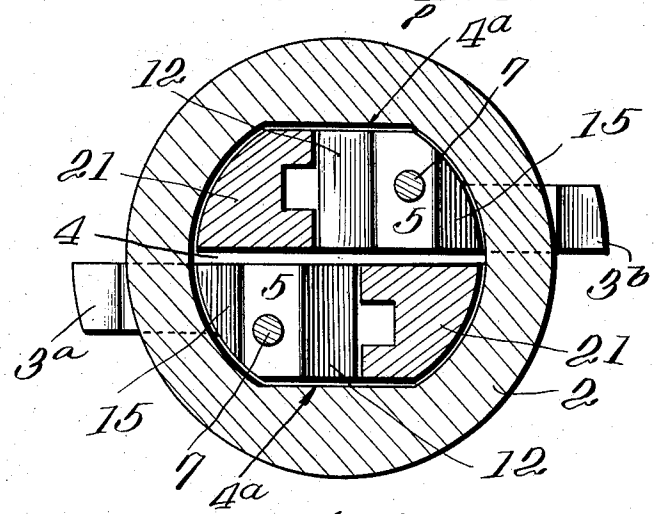


Fig. 4.

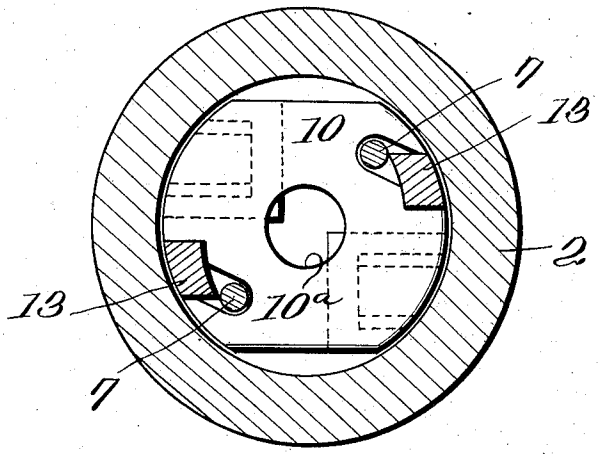
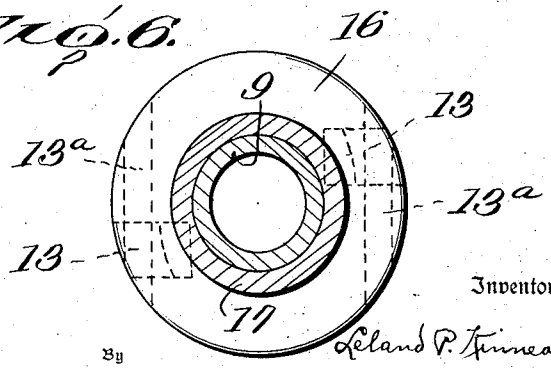


Fig. 6.



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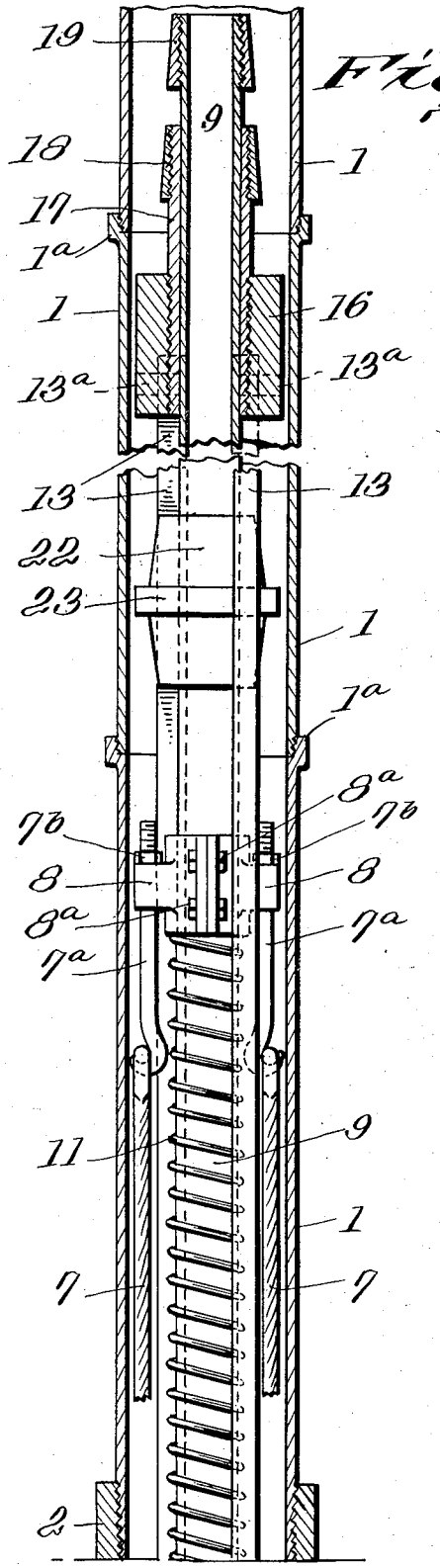


Fig. 2.

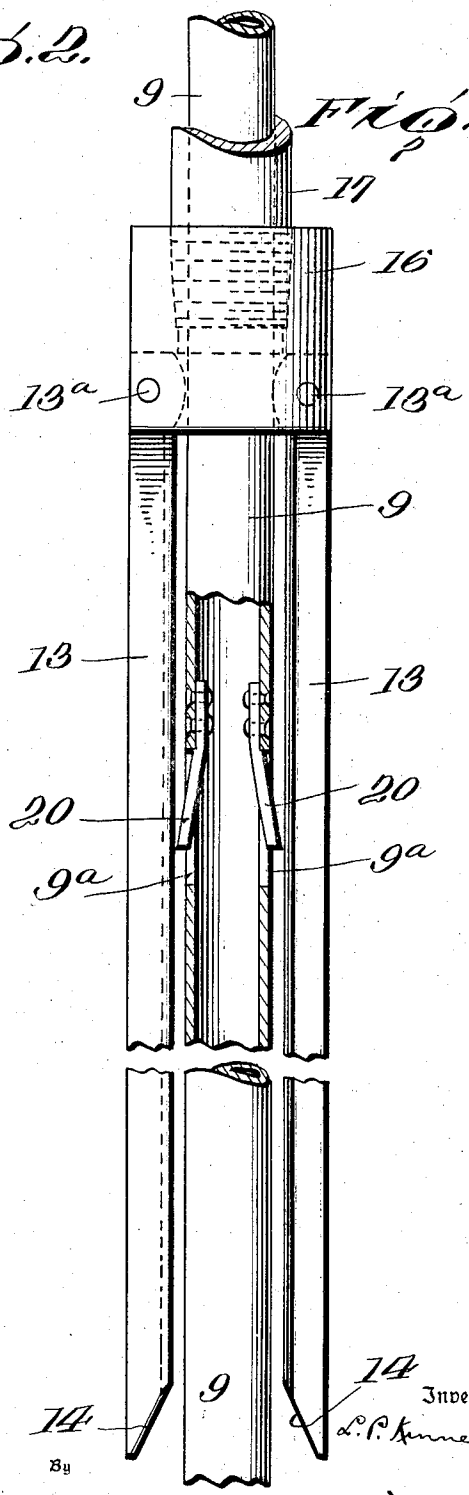


Fig. 5.

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FIG. 2a.

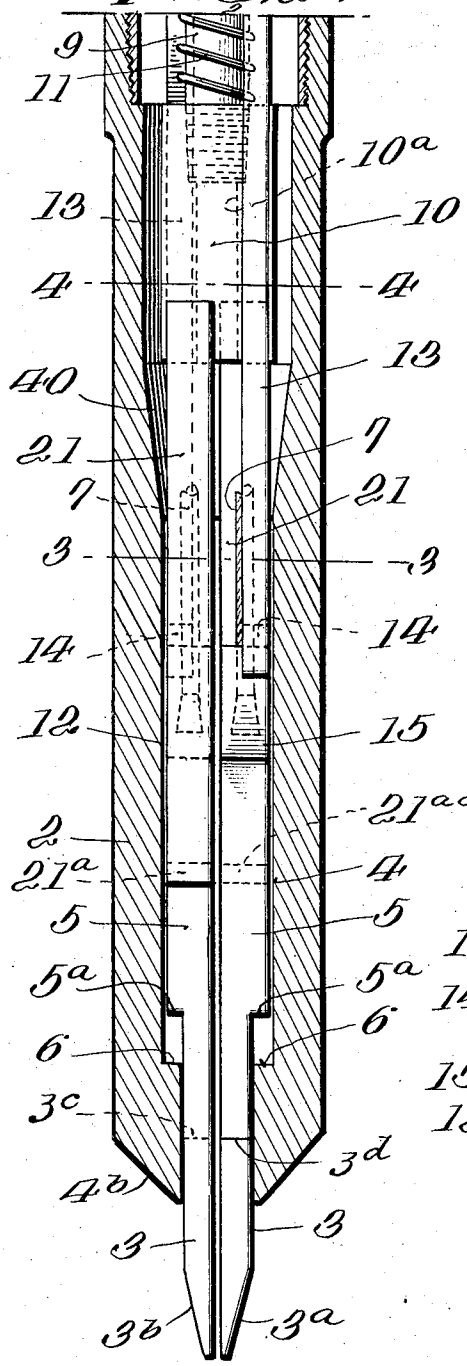


FIG. 7.

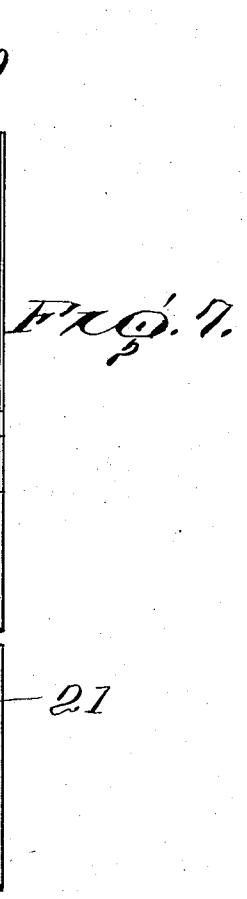
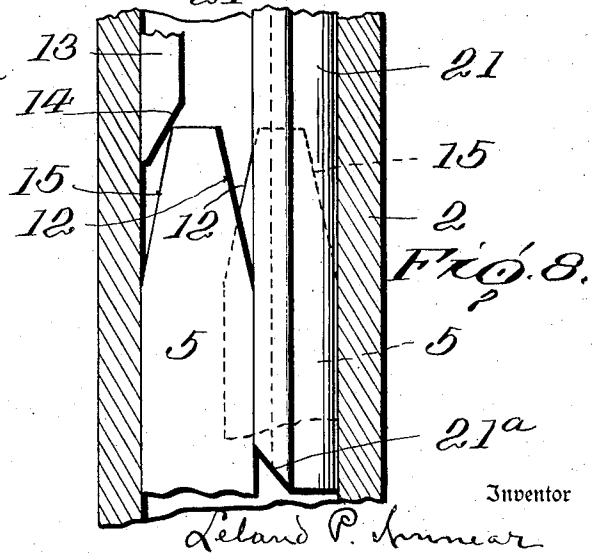


FIG. 8.



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UNITED STATES PATENT OFFICE

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WELL DRILLING APPARATUS

Application filed October 9, 1931. Serial No. 567,941.

The invention relates to new and useful improvements in a well drilling apparatus, and more particularly to a well drilling apparatus which is adapted for the drilling of deep wells, such as oil wells or artesian wells.

An object of the invention is to provide a drilling apparatus wherein well casing members may be used for operating the drill bits.

Another object of the invention is to provide a drilling apparatus of the above type wherein the drill bits are carried by a chuck attached to the well casing members through which the bits are rotated and fed forward.

A further object of the invention is to provide a drilling apparatus wherein drill bits are carried by a chuck through which the drill bits are rotated and fed forward, and wherein said drill bits are attached to the chuck and detached therefrom by a mechanism including wedge members for positively seating the bits and positively unseating the bits, which mechanism is controlled by a lifting cable passing through the pipe sections which are attached to and carry the chuck.

In the drawings which show by way of illustration one embodiment of the invention—

Figure 1 is a side view of a drilling apparatus embodying the invention, the well casing member being shown diagrammatically;

Fig. 2 is a vertical sectional view through a casing member and the upper end of the holding chuck at right angles to the view shown in Fig. 1;

Fig. 2ª is a vertical sectional view through the chuck with the drill bit seated and viewed in a direction at right angles to the view in Fig. 1;

Fig. 3 is a sectional view on the line 3—3 of Fig. 2ª;

Fig. 4 is a sectional view on the line 4—4 of Fig. 2ª;

Fig. 5 is a view showing a portion of the control mechanism, and particularly the wedge members for unseating the bits from the chuck;

Fig. 6 is a sectional view through the pipe supporting the collar carrying the wedge bars and showing the collar in end elevation;

Fig. 7 is a side view showing the wedge members for seating the bits on the chuck, and

Fig. 8 is a sectional view through the chuck showing the position of the wedge bars with the bits seated.

The invention is directed to a drilling apparatus for drilling deep wells, and includes a pair of drilling bits which are rotated and fed forward during the drilling of the well. These drilling bits are attached to a chuck, which in turn is attached to pipe sections extending all the way to the surface of the ground, where they are supported by a turning table so that the chuck may be rotated and fed forward through these connected pipe sections. These pipe sections are preferably constructed so that they may be used as well casings and are therefore of uniform diameter throughout. The drilling bits are provided with shanks which are associated with each other, so that one may be moved laterally relative to the other to an expanded operating position or to a contracted position for detachment from the chuck. Wedge bars are provided, one pair of which is utilized for positively moving the bits to expanded position in the chuck and for holding the bits thus expanded and positively locked to the chuck during the drilling operation. The other pair of wedge bars is utilized for moving the bits to collapsed position, where they are detached from the chuck so that they may be removed from the well. The construction of the casing members, the chucks and mechanism for operating these wedge bars will possibly be better understood by a detailed description of the present embodiment of the invention.

The drilling apparatus includes a series of pipe sections 1 which are adapted to be connected and joined to the chuck 2 which carries the drilling bits. It is understood that these pipe sections extend all the way from the chuck at the bottom of the well being drilled to the surface of the earth where these pipe sections are suitably connected to

the turning table for rotation and for feeding the chuck and bits carried thereby. Each pipe section is formed on its outer face at one end thereof with an integral collar 1^a which is recessed and threaded to receive an end of another pipe section. The pipe sections may be otherwise shaped and connected. The essential feature resides in forming connected sections which are of uniform diameter. The drill bits are indicated at 3^a, 3^b in the drawings. The chuck 2 is provided with a central chamber 4. Each drill bit is provided with a shank 5. These shanks 5, 5 are side by side in the chamber 4 of the chuck 2. It will be noted from Fig. 3 of the drawings, that this chamber 4, in the region of these shanks, is in part cylindrical, and in part is provided with parallel side walls 4^a. The shanks are so dimensioned that they are capable of lateral movements in this chamber 4 of the chuck. That is, one slides by the other from one side of the chamber to the other. Each shank has a shoulder 5^a adapted to engage an abutment 6 on the chuck. The lower end of the chuck is tapered as indicated at 4^b. One side of the chuck is cut away along the broken line 4^c. The bit 3^a has a portion projecting from the shank which provides a shoulder 3^e. When the shank of the bit 3^a is moved laterally to the full extent of its movement in the chamber 4, the bit will engage in the cut-away portion in the shank beyond the broken lines 4^c, and the shoulder 3^e will abut against the end of the chuck wall. The bit 3^b is likewise provided with a shoulder 3^d and a projecting portion which extends into the cut-away portion in the lower end of the chuck, so that this shoulder 3^d abuts against the lower end of the wall of the chuck. When the bits are in their lowered position, the shoulders 5^a, 5^a will engage the abutments 6, 6, and will slide along the same during the lateral shifting of the bit shanks, until the parts are positioned as shown in Fig. 1.

The bit shanks are positively moved laterally for seating the bits by a pair of wedge bars, the construction and operation of which will be described later. The bit shanks are positively moved laterally for unseating the bits also by a pair of wedge bars which will likewise be described later. Attached to each bit shank is a cable 7. This cable 7 extends into a recess in the upper end of the shank and is babbitted in place. The cables 7 are attached to hooks 7^a which pass through lugs in a sleeve 8. Nuts 7^b, 7^b are threaded on to these bolts and serve as a means for adjusting the position of the hooks. The sleeve 8 is in the form of a split sleeve, the parts of which are secured together by bolts 8^a. This sleeve 8 is freely mounted on the pipe 9 which is threaded into a collar 10 fitting within the chuck 2 and carrying the wedge bars which serve to seat the bits in the chuck. Between the collar 10 and the sleeve 8 is a compression spring 11 which normally moves the sleeve to a set position on the pipe 9. This spring is substantially free from compression when the wedges are in position for seating the bits in the chuck. The upper ends of the shanks 5, 5 are tapered on their inner faces as indicated at 12. Wedge bars 13, 13 having inclined faces 14, 14 opposing each other are movable through the collar 10 and adapted to engage the inclined faces 15, 15 on the shanks of the bits, for moving said shanks inwardly so as to unseat the bits and disconnect the same from the chuck. These bars 13, 13 are pivotally attached to a sleeve 16 by suitable pivot bolts 13^a, 13^a. This permits the bars to swing freely without binding, and when they are forced downwardly against the inclined faces 15, 15, they will wedge between these faces and the inner surface of the chamber 4 of the chuck, and thus it is that the shanks are forced inwardly toward each other by these freely suspended bars 13, 13. The sleeve 16 is connected to a short pipe section 17 carrying a collar 18, and the pipe section 17 moves freely on the pipe 9. When the bits are in seated position, this sleeve 16 and the parts connected thereto, due to the weight thereof, will force the bars 13, 13 downwardly, until their lower ends rest on the shanks of the bits. At this time, the holding wedges which seat the bits are in place, and until they are removed, the bars 13, 13 do not operate to unseat the bits. The pipe 9 is provided with slots 9^a, 9^a. Riveted to the inner face of the pipe are dogs 20, 20, which are shaped so as to spring out through these slots 9^a. These are holding dogs which serve to hold the wedge bars 13 in contact with the shanks so that the bits are held in unseated position while being withdrawn from the well. At the upper end of the pipe 9 is a tapered collar 19 which is adapted to be connected to grab hooks for the removing of the bits from the chuck.

Coming back again to the wedge bars which are carried by the collar 10 and which serve to seat the drill bits on the chuck, these wedge bars are indicated in the drawings at 21, 21. Each wedge bar is pivoted to the collar 10 by a suitable pivot bolt, and are provided at their outer ends with inclined tapered faces 21^a, 21^a which are adapted to cooperate with the tapered faces 12, 12 of the respective bit shanks 5, 5. When the collar 10 with the parts connected thereto move downward through the weight of these parts, the wedge bars 21, 21 will move along the inclined faces and as the wedge bars on their outer faces bear against the inner wall of the chuck member 4, the drill bit shanks will be forced laterally so as

to seat the drill bits on the chuck, and the shanks will be positively locked in this position so long as the wedge bars are in their lowered position.

When it is desired to disconnect the drill bits from the chuck, a grab hook is lowered through the pipe sections 1, and is engaged with the collar 19 at the upper end of the pipe 9. On drawing up on the cable, the pipe 9 will be raised, and this will positively lift the collar 10 and withdraw the wedge bars 21, 21 from their locking position relative to the shanks 5, 5 and release the same. This upward movement of the collar 10 compresses the spring 11, forcing upwardly on the sleeve 8. The sleeve 8 cannot move until the bits are shifted to unseated position, as the shoulders 3^c, 3^d on the bits are in engagement with the end of the wall of the chuck. After the locking wedges have been released, the collar 16 and the parts associated therewith move downward through the weight of these parts, forcing the bars 13 downwardly, and the lower inclined ends thereof engaging the inclined faces 15, 15 of the shanks of the bits will force the shanks inwardly to unseated position, thus releasing the bits from the chuck. The spring 11 will then expand to its normal position. The downward movement of the sleeve 16 carrying the releasing bars 13 will position the dogs 20, 20 above the end of the pipe 17 so that the releasing bars will be held in a position holding the bits in collapsed position, while the bits and the mechanism associated therewith are being lifted from the well. After the bits have been re-conditioned, the bits and the mechanism associated therewith are lowered into the pipe sections 1, and into the chuck, and when the shoulders 5^a on the shanks engage the shoulders 6 on the chuck, and the pipe 9 is released, the weight of the pipe and the collar 10 will force the holding wedge bars 21 downwardly, thus expanding the bits and seating the same on the chuck. The wall of the chamber 4 at the upper end of the chuck is cylindrical, and there are inclined faces 40 leading from this cylindrical portion to the portion of the chamber where the walls are parallel. These inclined faces tend to turn the drill bits so as to align said drill bits and shanks with the portion of the chamber with the parallel walls, and thus the drill bits are guided into position where they can be seated by the wedge bars. Before lowering the bits into the pipe, the dogs 20 are released, and the releasing bars 13 restored to their normal position. These wedge bars 13 as noted above, pass through suitable ways provided in the collar 10. There are also suitable passages through this collar 10 for the cables 7, 7. There is a central passage 10^a through this collar, and passages 21^a, 21^a through the wedge bars 21, 21, so that flushing fluid may be forced down through the pipe 9 and through the chuck. When this flushing fluid, which may be of any well known character, is forced down through the pipe under pressure, it will aid in the forcing of the collar 10 downward, and the seating of the bits in the chuck. Attached to the pipe 9 is a sleeve 22 having a central projecting circular flange 23 which serves as a guide for guiding the parts as they pass through the pipe sections 1.

From the above it will be apparent that a drilling apparatus has been provided wherein the drill bits are attached to a chuck at the lower end of a series of pipe sections which do not have to be removed from the well for the conditioning of the bits. The bits may be readily detached from the chuck and removed and this is accomplished by a positive means which forces the bits to unseated position. The bits may be attached to the chuck, when replaced, by positively operating seating wedges which hold the bits in their expanded seated position on the chuck for the drilling operation. Inasmuch as the pipe sections are of uniform diameter the bits and associated devices can be readily removed and replaced through the pipe sections. The construction above described lends itself readily to carrying out the following method of drilling. After the well has been drilled to a desired depth, the bits are removed and a seal formed at the lower end of the pipe sections in any well known way. Suitable tools are used for cutting an enlarged opening through the chuck and seal, thus converting the pipe sections and chuck into a casing for the well. Smaller pipe sections and bits are used for continued drilling of the well. The chuck might be constructed so that the well could be sealed and the drilling continued through the chuck by the aid of smaller pipes and bits. The method of drilling, however, forms no part of the present invention, but is disclosed and claimed in a companion application Serial No. 567,280 filed of even date herewith.

It is obvious that minor changes in the details of construction and the arrangement of the parts may be made without departing from the spirit of the invention as set forth in the appended claims.

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

1. A drilling apparatus comprising a chuck, drill bits adapted to be inserted through said chuck into position for drilling, means for imparting a bodily lateral shifting movement to said drill bits in opposite directions outwardly of the chuck for seating the same on said chuck, and means for positively imparting a bodily lateral shifting movement of the drill bits in opposite

directions inwardly of the chuck for unseating the same for removal from the chuck.

2. A drilling apparatus comprising a chuck, drill bits adapted to be inserted through said chuck into position for drilling, wedge bars associated with said drill bits for imparting a bodily lateral shifting movement to said drill bits in opposite directions outwardly of the chuck for seating the same on the chuck and for holding said drill bits in seated position, and wedge bars for positively shifting said drill bits in opposite directions inwardly of the chuck for unseating the same for removal from the chuck.

3. A drilling apparatus comprising a chuck, drill bits adapted to be inserted through said chuck into position for drilling, a pipe having a collar attached to the lower end thereof, wedge bars carried by said collar adapted to engage the drill bits for expanding and seating the same, a sleeve freely mounted on said pipe, cables connecting said sleeve to said drill bits, a compression spring disposed between said collar and said sleeve for lifting the drill bits after the wedge bars are removed, wedge bars mounted on said pipe for engaging said drill bits for positively contracting the same for removal from said chuck, and means carried by said pipe whereby the same may be drawn on and lifted by a grab hook lift.

4. A drilling apparatus comprising a chuck, drill bits having shanks adapted to be inserted through the chuck into position for drilling, said drill bits having horizontal shoulders adapted to engage the end wall of the chuck when seated, a collar, a pipe attached to said collar, wedge bars attached to said collar and adapted to engage tapered ends on the shanks for positively forcing the shanks bodily laterally outwardly in the chuck for seating the drill bits on the chuck.

5. A drilling apparatus comprising a chuck, drill bits having shanks adapted to be inserted through the chuck into position for drilling, said drill bits having horizontal shoulders adapted to engage the end wall of the chuck when seated, a collar, a pipe attached to said collar, wedge bars attached to said collar and adapted to engage tapered ends of the shanks for positively forcing the shanks laterally in the chuck for seating the drill bits on the chuck, a sleeve freely movable on said pipe, a spring between the collar and said sleeve, cables connecting the sleeve to the shanks of the drill bits, a second sleeve mounted for free movement on said pipe, wedge bars attached to said last-named sleeve and passing through said collar into said chuck for engaging the shanks of the drill bits for contracting and unseating the drill bits from the chuck, and means whereby said pipe may be drawn on for unseating and lifting the drill bits from the chuck.

6. A drilling apparatus comprising a chuck, drill bits having shanks adapted to be inserted through the chuck into position for drilling, said drill bits having horizontal shoulders adapted to engage the end wall of the chuck when seated, a collar, a pipe attached to said collar, wedge bars attached to said collar and adapted to engage tapered ends on the shanks for positively forcing the shanks laterally in the chuck for seating the drill bits on the chuck, a sleeve freely movable on said pipe, a spring between the collar and said sleeve, cables connecting the sleeve to the shanks of the drill bits, a second sleeve mounted for free movement on said pipe, wedge bars attached to said last-named sleeve and passing through said collar into said chuck for engaging the shanks of the drill bits for contracting and unseating the drill bits from the chuck, dogs carried by said pipe and adapted to lock said sleeve with the releasing wedge bars in a position for holding the drill bits in contracted position while the drill bits are being removed from the well, and means whereby said pipe may be drawn on for unseating and lifting the drill bits from the chuck.

7. A drilling apparatus comprising a chuck, drill bits adapted to be inserted through said chuck into position for drilling, wedge bars for positively expanding and seating said drill bits, a collar in the chuck to which said wedge bars are attached, wedge bars for positively contracting and unseating said drill bits, said collar having passages for the unseating wedge bars, and said collar and seating wedge bars having passages for the flushing water whereby when water under pressure is directed into the chuck, it will operate upon said collar and force the wedge bars downwardly, thus aiding in seating the drill bits.

8. A drilling apparatus comprising a chuck, drill bits adapted to be inserted through the chuck into position for drilling, said drill bits having shanks extending into the chuck and mounted therein for free bodily lateral movement, means adapted to engage the shanks of the bits for forcing the same bodily laterally outwardly of the chuck for seating the bits on the chuck and for holding said bits seated, and means for shifting the bits bodily laterally inwardly of the chuck when released by the first-named means for unseating the bits from the chuck.

9. A drilling apparatus comprising a chuck, drill bits adapted to be inserted through said chuck into position for drilling, said drill bits having shanks extending into said chuck, said chuck having flat faces at the opposite sides of said shanks and adapted to engage the shanks for positively rotating the bits, means for support-

ing said shanks whereby said bits may be moved bodily laterally outwardly of the chuck into seated position, and means adapted to engage the shanks of said bits for positively forcing said bits laterally into seated position and for holding said bits seated.

10. A drilling apparatus comprising a chuck, drill bits adapted to be inserted through said chuck into position for drilling, said drill bits having shanks extending into said chuck, said chuck having flat faces at the opposite sides of said shanks and adapted to engage the shanks for positively rotating the bits, means for supporting said shanks whereby said bits may be moved bodily laterally outwardly of the chuck into seated position, means adapted to engage the shanks of said bits for positively forcing said bits laterally into seated position and for holding said bits seated, and means for engaging the shanks of said bits for moving the same laterally when released from the first-named seating means for unseating the bits.

11. A drilling apparatus comprising a chuck, drill bits adapted to be inserted through the chuck into position for drilling, a shank formed integral with each drill bit and extending upwardly into the chuck, said chuck having parallel faces contacting with the shanks of the bits for rotating the same, said bits having shoulders adapted to engage the end wall of the chuck when seated, wedge bars adapted to engage tapered ends on the shanks for positively forcing said shanks bodily laterally outwardly on the chuck for seating the drill bits on the chuck and for holding said drill bits seated, and means connected to the wedge bars for operating the same.

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