

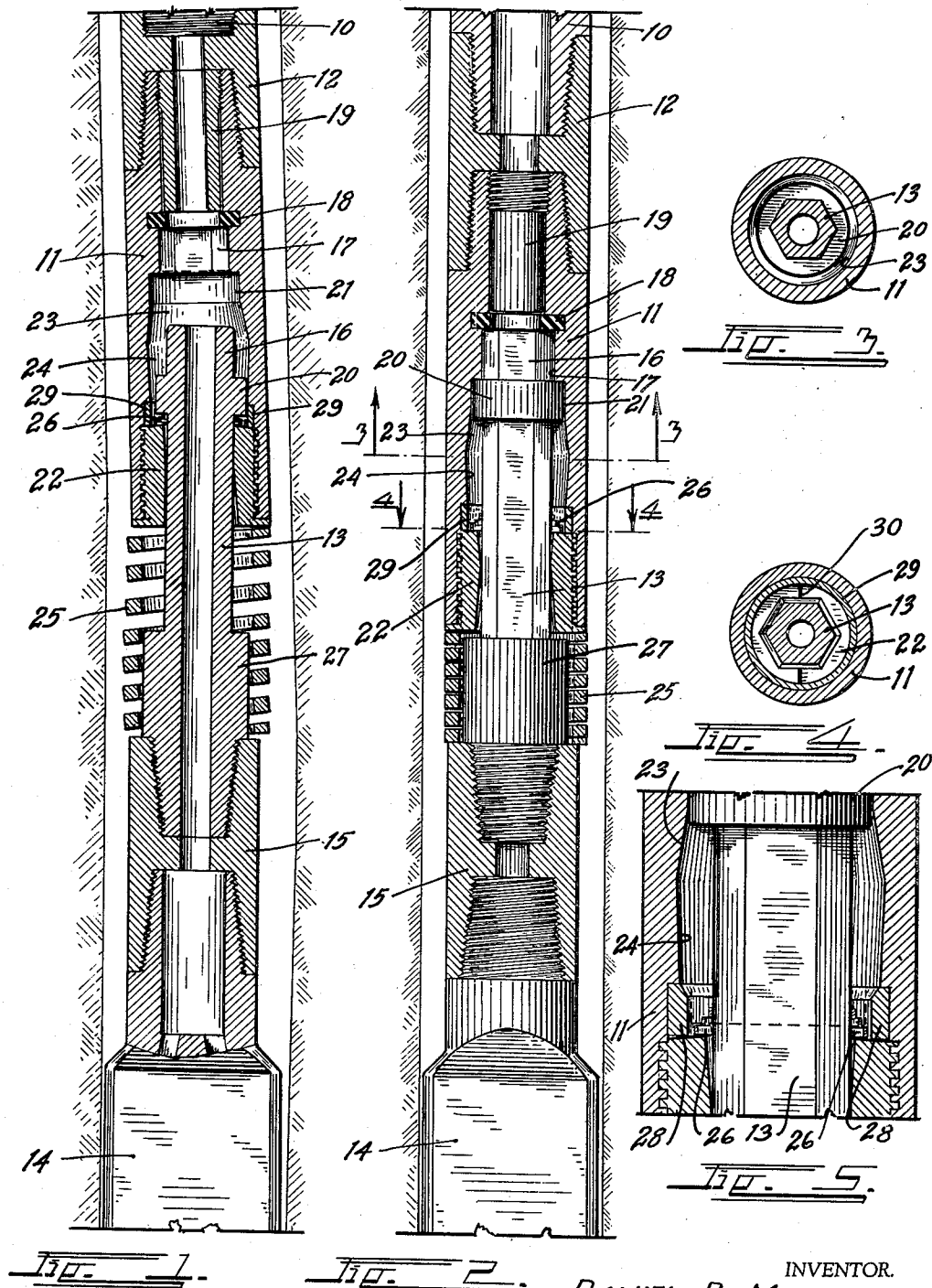
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DRILL GUIDE FOR ROTARY RIGS

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DRILL GUIDE FOR ROTARY RIGS

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This invention relates to a drill guide for use with rotary oil well drilling rigs and has for its principal object the provision of means to be carried by the drill stem of a drilling rig which will act to automatically maintain the drill stem in a vertical position.

Other objects of the invention are to provide a device of this character which can be used for straightening inclined drill holes, that is, bringing them to the vertical position; which will operate automatically without requiring pre-setting at the surface; and which can also be used for the usual straight drilling.

A further object of the invention is to so construct the device that the drill bit may be freed from alignment with the drill stem, so that it can swing in any direction, and then be brought into rigid alignment with the drill stem, for drilling purposes, without necessitating the withdrawal of the tool from the well.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention reference is had to the accompanying drawing which forms a part hereof. Like numerals refer to like parts in all views of the drawing and throughout the description.

In the drawing:

Fig. 1 is a vertical section through the improved drill guide in the released or angular position.

Fig. 2 is a similar view showing the guide in the aligned position. In this figure the drill shaft has been shown in side elevation.

Fig. 3 is a horizontal cross section looking upwardly on the line 3—3, Fig. 2.

Fig. 4 is a similar cross section looking downwardly on the line 4—4, Fig. 2.

Fig. 5 is a detail section illustrating an alternate form of guide bushing.

In Fig. 1, the device is illustrated as it would appear when bringing an inclined drill hole to the vertical position. In Fig. 2, the device is illustrated in position for regular drilling in a vertical hole. The lower extremity of the usual rig drill pipe is indicated at 10.

The improved drill guide comprises a socket member 11 which may be attached to the drill collar 10 of the regular drill pipe in any desired manner, such as by means of a tool joint coupling 12. The socket member receives the upper extremity of a hexagonal drill shaft 13, to the lower extremity of which any one of the usual

drilling bits, such as indicated at 14 may be attached by means of a second tool joint coupling 15.

The upper extremity of the shaft 13 is formed with a non-circular head 16, preferably hexagonal, of a size and shape to fit into an axially positioned receiving socket 17 of similar contour. When in place in the socket, the head 16 rests against a sealing gasket 18 which is held in place in the member 11 by means of a sleeve bushing 19.

A circular enlargement or ring band 20 surrounds the drill shaft 13 immediately below the head 16. When the head 16 is in the socket 17 the band 20 rests in a cylindrical receiving pocket 21.

A threaded bushing 22 coacts with the boss 20 to prevent removal of the shaft 13 from the socket member 11. The bushing 22 is split, as shown at 30, to allow it to be placed over the enlarged extremities of the shaft 13.

The interior of the socket member between the bushing 22 and the channel 21 is enlarged by having its upper surface tapered outwardly on an incline, as shown at 23; and its lower surface tapered inwardly on an incline, as shown at 24, to form an enlarged chamber which will allow the head 16 and its band 20 to move freely away from the axis of the drill pipe in any direction.

The opening through the bushing 22 for the passage of the shaft 13 is enlarged at one or both extremities, as illustrated, to serve as a universal joint between the socket member and the shaft 13 so that the latter will be free to swing at this point in any desired direction. This opening has the same cross section as the shaft, preferably hexagonal, to prevent relative rotation between the socket member and the shaft.

A helical compression spring 25 is compressed between the second coupling 15 and the socket member so as to continually urge the shaft 13 downwardly. The downward movement of the shaft is cushioned by means of a cushioning spring 26 between the bushing 22 and the band 20. The spring 26 is of a type which may be compressed completely flat, that is, it is of a spiral-helical type which will not interfere with the flat seating of the band 20 on the bushing 22. The lower extremity of the shaft 13 is formed with a cylindrical enlargement 27 which acts as a guide for the spring 25.

The drilling water may pass through the entire device, since the upper bushing 19 and the drill shaft 13 are both cored for the passage of the water to the drill bit.

It will be noted that the action of the spring 25 is to continually urge the band 20 against the bushing 22 so that the head 16 and the band

20 are normally in the enlarged chamber in the socket member 11 and the drill is free to swing in any direction.

Let us assume that the device is lowered into an inclined drill hole. As the bottom of the hole is approached, the weight of the lower extremity of the shaft 13 and the bit 14 will cause the latter to lie against the low side of the hole regardless of the angle of the drill stem, as shown in Fig. 1. If the drill stem be now rotated, the bit will cut toward that side of the hole so as to tend to bring the hole back to the vertical position. When the vertical position has been reached, the operator allows greater weight to rest upon the drill pipe causing the socket member 11 to move downwardly compressing the spring 25 until the head 16 enters the socket 17. As the head approaches the socket, the band 20 will ride against the inclined surface 23 gradually bringing the drill collar 10 and the drill shaft 13 into alignment. In the final position of Fig. 2, the device is in perfect axial alignment as the regular drilling is resumed.

Should the operator at any time suspect the hole may not be vertical, or at regular intervals he can relieve the pressure of the drill pipe to again free the shaft 13 and then continue drilling with light pressure allowing gravity to straighten the hole, if inclined, after which the weight is again increased and the straight drilling is continued.

The spring 25 is preferably set to require 4,000 pounds pressure to compress it sufficiently to place the head in its socket. Thus, the hole may be drilled with any pressure less than this while the shaft is free and with any pressure greater than this when shaft alignment is desired.

Under unusual conditions, it may be impractical to place sufficient weight upon the drill to bring it into alignment. Should such conditions be encountered, a guide ring 28 may be placed in the bottom of the chamber in the socket member, as shown in Fig. 5, having an internal diameter to snugly receive the band 20. With this ring in place, the drill shaft 13 will be held in alignment with the drill stem until sufficient weight is placed thereon to force this ring 28 below the band 20. The drill shaft is then freed for a swinging direction and may again be brought into alignment by either decreasing or increasing the weight on the socket member.

In the majority of cases, however, the ring 28 will be replaced by a flush ring 29, as shown in Fig. 2, the inner surface of which is in alignment with the inner surface 24.

It can be readily seen that the operator can at any time free the drill shaft from alignment with the drill pipe or bring it back into alignment by simple weight control without requiring withdrawal of the drill pipe.

It will be noted that when the drill shaft is freed from alignment with the drill pipe, it is absolutely unhindered from swinging in any direction. This enables the operator, at any time, to free the drill and then rapidly rotate the drill pipe which will cause the drill to swing outwardly around the drill hole due to the centrifugal action so that it will enlarge the hole and cut an annular shelf thereabout to form a bottom for the drill when the latter has been cocked to the new direction.

While a specific form of the improvement has been described and illustrated herein, it is desired to be understood that the same may be varied, within the scope of the appended claims,

without departing from the spirit of the invention.

Having thus described the invention, what is claimed and desired secured by Letters Patent is:

1. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; enclosing means surrounding said shaft at the entrance to said chamber, said latter means having a tapered passage for said shaft to allow a free swinging movement of the latter, said chamber being sufficiently large to allow oscillation of said shaft above said enclosing means; said shaft and the passage through said enclosing means being non-circular in outline to prevent relative rotation between said socket member and said shaft; and an axially positioned socket at the upper extremity of said chamber for receiving the head of said shaft.

2. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; enclosing means surrounding said shaft at the entrance to said chamber, said latter means having a tapered passage for said shaft to allow a free swinging movement of the latter, said chamber being sufficiently large to allow oscillation of said shaft above said enclosing means; means for preventing relative rotation between said socket member and said shaft; an axially positioned socket at the upper extremity of said chamber for receiving the head of said shaft; and spring means for urging said head downward from said socket and into said enlarged chamber.

3. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; enclosing means surrounding said shaft at the entrance to said chamber, said latter means having a tapered passage for said shaft to allow a free swinging movement of the latter, said chamber being sufficiently large to allow oscillation of said shaft above said enclosing means; said shaft and the passage through said enclosing means being non-circular in outline to prevent relative rotation between said socket member and said shaft; an axially positioned socket at the upper extremity of said chamber for receiving the head of said shaft, said socket and said head being non-circular in outline to prevent rotation of said socket on said shaft; and a tapered surface in said chamber positioned to guide the head of said shaft into said socket.

4. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; enclosing means surrounding said shaft at the entrance to said chamber, said latter means having a tapered passage for said shaft to allow a free swinging movement of the latter, said chamber being sufficiently large to allow oscillation of said shaft above said enclosing means; means for preventing relative rotation between said socket member and said shaft; an axially positioned socket at the upper

extremity of said chamber for receiving the head of said shaft; a projecting ring band about the said shaft within said chamber preventing withdrawal thereof through said passage; and a tapered surface in said chamber positioned to be contacted by said ring band to guide the head of said shaft into said socket.

5. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; enclosing means surrounding said shaft at the entrance to said chamber, said latter means having a tapered passage for said shaft to allow a free swinging movement of the latter, said chamber being sufficiently large to allow oscillation of said shaft above said enclosing means; means for preventing relative rotation between said socket member and said shaft; an axially positioned socket at the upper extremity of said chamber for receiving the head of said shaft; a drill coupling secured on the lower extremity of said shaft for receiving a drill bit; and a spring compressed between said coupling and said socket member for drawing said head downwardly from said socket.

6. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; means for slidably supporting and universally hinging said shaft in said socket member at a point below the extremity of said shaft so that the head of the latter will oscillate in said chamber; and means for locking said shaft in an axial position when said socket member is lowered on said shaft.

7. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; means for slidably supporting and universally hinging said shaft in said socket member at a point below the extremity of said shaft so that the head of the latter will oscillate in said chamber; and an axially positioned socket in the upper extremity of said chamber for receiving the head of said shaft.

8. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; means for slidably supporting and universally hinging said shaft in said socket member at a point below the extremity of said shaft so that the head of the latter will oscillate in said chamber; and an axially positioned socket in the upper extremity of said chamber for receiving the head of said shaft, said head and said socket being non-circular in outline to prevent rotation of said socket on said shaft.

9. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; enclosing means surrounding said shaft at the entrance to said chamber, said latter means having a tapered passage for said shaft to allow a free swinging movement of the latter, said chamber being sufficiently large to

allow oscillation of said shaft above said enclosing means; means for preventing relative rotation between said socket member and said shaft; an axially positioned socket at the upper extremity of said chamber for receiving the head of said shaft; and a resilient gasket in said socket for receiving said head.

10. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; enclosing means surrounding said shaft at the entrance to said chamber, said latter means having a tapered passage for said shaft to allow a free swinging movement of the latter, said chamber being sufficiently large to allow oscillation of said shaft above said enclosing means; means for preventing relative rotation between said socket member and said shaft; an axially positioned socket at the upper extremity of said chamber for receiving the head of said shaft; a projecting ring band about the shaft within said chamber and below the head thereof; and an axially positioned socket at the bottom of said chamber for receiving said ring band.

11. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; enclosing means surrounding said shaft at the entrance to said chamber, said latter means having a tapered passage for said shaft to allow a free swinging movement of the latter, said chamber being sufficiently large to allow oscillation of said shaft above said enclosing means; means for preventing relative rotation between said socket member and said shaft; an axially positioned socket at the upper extremity of said chamber for receiving the head of said shaft; a projecting ring band about the shaft within said chamber and below the head thereof; and an axially positioned socket at the bottom of said chamber for receiving said ring band, said chamber being tapered inwardly toward its top and bottom to guide either said head into the upper socket or the ring band into the second mentioned socket.

12. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; enclosing means surrounding said shaft at the entrance to said chamber, said latter means having a tapered passage for said shaft to allow a free swinging movement of the latter, said chamber being sufficiently large to allow oscillation of said shaft above said enclosing means; means for preventing relative rotation between said socket member and said shaft; an axially positioned socket at the upper extremity of said chamber for receiving the head of said shaft; a projecting ring band about the shaft within said chamber and below the head thereof; an axially positioned socket at the bottom of said chamber for receiving said ring band; and resilient means in said latter socket for supporting said ring band.

13. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket

member to a drill pipe; a drill shaft depending from said chamber; enclosing means surrounding said shaft at the entrance to said chamber, said latter means having a tapered passage for said shaft to allow a free swinging movement of the latter, said chamber being sufficiently large to allow oscillation of said shaft above said enclosing means; said shaft and the passage through the said enclosing means being non-circular in outline to prevent relative rotation between said socket member and said shaft; a socket at the upper extremity of said chamber to receive the head of said shaft; and means urging said head downward from said socket into said enlarged chamber.

14. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; enclosing means surrounding said shaft at the entrance to said chamber, said latter means having a tapered passage for

said shaft to allow a free swinging movement of the latter, said chamber being sufficiently large to allow oscillation of said shaft above said enclosing means; said shaft and the passage through the said enclosing means being non-circular in outline to prevent relative rotation between said socket member and said shaft; a socket at the upper extremity of said chamber to receive the head of said shaft; and a drill coupling secured on the lower extremity of said shaft for receiving a drill bit.

15. A device for guiding the drill bit of a rotary well drilling rig comprising: a socket member having a downwardly directed chamber; means for securing the upper extremity of said socket member to a drill pipe; a drill shaft depending from said chamber; and means for slidably supporting and universally hinging said shaft in said socket member below the extremity of said shaft so that the head of the latter will oscillate in said chamber.

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