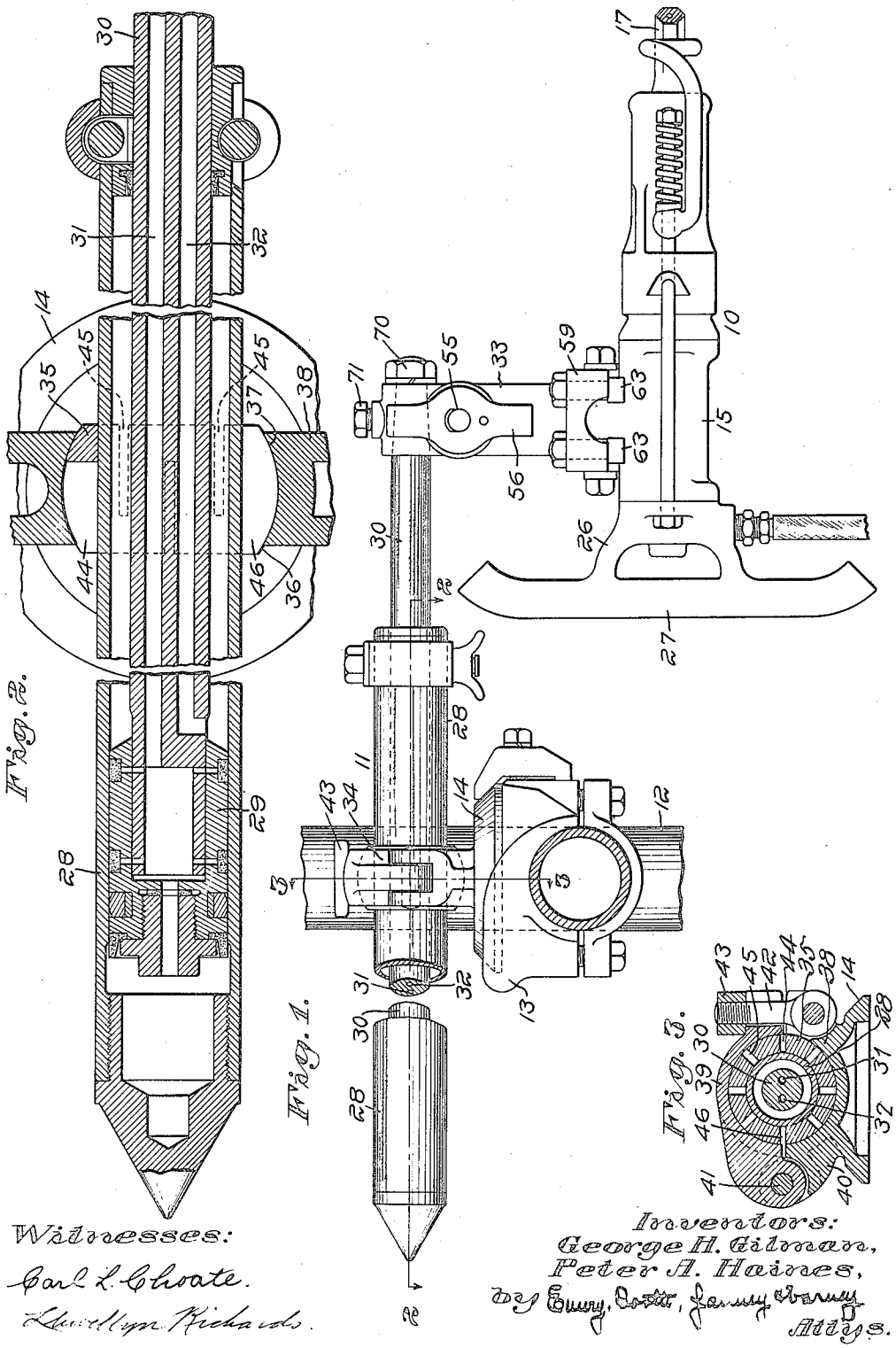
Aug. 7, 1923. 1,464,486

G. H. GILMAN ET AL

DRILLING APPARATUS

Filed June 17, 1914 2 Sheets-Sheet 1



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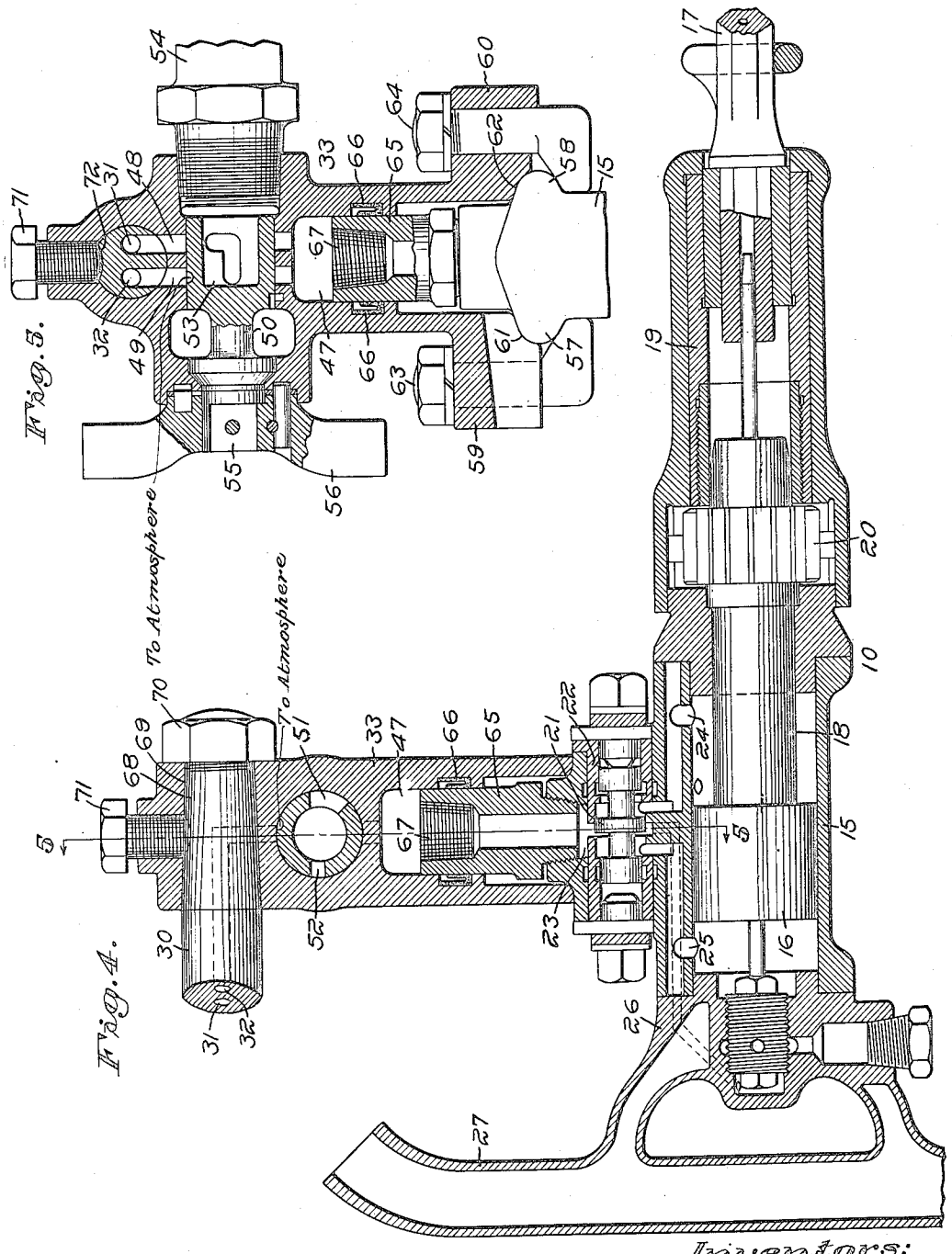

Fig. 3.

Fig. 4.

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UNITED STATES PATENT OFFICE.

GEORGE H. GILMAN, OF CLAREMONT, NEW HAMPSHIRE, AND PETER A. HAINES, OF RIVER MINES, MISSOURI, ASSIGNORS TO SULLIVAN MACHINERY COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

DRILLING APPARATUS.

Application filed June 17, 1914. Serial No. 845,723.

To all whom it may concern:

Be it known that GEORGE H. GILMAN and PETER A. HAINES, citizens of the United States, and residents, respectively, of Claremont, New Hampshire, and River Mines, Missouri, have invented an Improvement in Drilling Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to drilling apparatus, and more particularly, though not exclusively, to a pressure fluid drilling apparatus of the percussive type.

Our invention will be best understood by reference to the following specification, when taken in connection with the accompanying drawings of one illustrative embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a side elevation, partly broken away, of a drilling apparatus embodying our invention;

Fig. 2 is a plan sectional view on an enlarged scale, partly broken away, on line 2—2 of Fig. 1;

Fig. 3 is a detail sectional view on line 3—3 of Fig. 1;

Fig. 4 is a central, vertical, longitudinal sectional view, on a much enlarged scale, of the tool and the supporting arm, with a part of the feed piston rod shown in elevation; and

Fig. 5 is a sectional view on line 5—5 of Fig. 4, a portion of the cylinder, however, being shown in elevation.

Referring to the drawings, and to the embodiment of our invention which we have selected for illustrative purposes, we have there shown a drilling apparatus comprising a drilling tool 10, and a feeding device 11, by which the tool is supported and carried, the feeding device in turn being mounted upon an appropriate support, herein a column 12, having secured thereto a usual saddle 13 to receive a swivel member 14.

The drilling tool may be of any other appropriate construction, but herein is of a pressure fluid actuated type, having a cylinder 15, within which a piston 16 is mounted to reciprocate. The piston may actuate a drill-bit 17 in any appropriate manner, but is herein provided with a reduced portion 18, constituting a hammer bar extension arranged to deliver a rapid succession of blows upon the inner end of the drill-bit, which is loosely held in a chuck 19, having a suitable rotating mechanism 20. The piston is herein reciprocated under the control of a suitable distributing valve 21, mounted in a valve casing 22, having a pressure fluid supply space 23, from which pressure fluid is delivered alternately to ports 24 and 25 at the front and rear, respectively, of the cylinder.

The cylinder 15 is herein provided with a rear cylinder head 26, having a grasping handle or handles 27. The type of drilling tool selected for illustration is a hand tool,—that is to say, it is primarily intended for work of the class where it can be supported and held up to its work within the grasp of the operator, and the construction of the present apparatus is such that the drilling tool may be readily detached and used as a separate instrument, should occasion require.

The feeding device may be of any suitable character, but herein is pressure fluid-operated, and comprises a feed cylinder member 28, and a feed piston member 29, one of which may be attached to the support and the other to the drilling tool. As herein shown, the feed cylinder member is attached to the swivel member 14, while the feed piston member is provided with a piston rod 30, to which the drilling tool is attached.

Preferably, the feeding device is double-acting,—that is to say, it is capable of advancing the drilling tool toward or retracting it from its work, and to that end, the piston rod 30 is herein provided with a passage 31, leading to the rear end of the piston, and a passage 32 leading to its front end, so that if pressure fluid be supplied to the passage 31, the tool will be advanced, and on the other hand, if pressure fluid be supplied to the passage 32, the tool will be retracted.

The drilling tool may be secured to the piston rod 30 by any other appropriate means, but herein a connecting arm 33 forms a rigid connection therebetween. It will be observed that the relation of the drilling

tool to the feeding device is such that the axis of the tool is parallel with that of the feeding device, and hence the tool is capable of shifting its position about the axis of the feeding device. It will also be observed that the pneumatic tool may be swung out of alignment with the hole being drilled to facilitate changing of steels and that the pneumatic tool may be swung about the axis of the feeding mechanism to drill a plurality of holes with one setting of the feeding mechanism. Consequently, the tool has a capacity for shifting its position laterally with relation to the supporting means, in order to accommodate itself to the lateral changes of alignment of the drilled hole, as the drilling operation proceeds. Owing to its mounting, the tool, as it were, constitutes a sort of pendulum, capable of swinging freely toward the right or left of its normal plane.

In order to permit the drilling tool to accommodate itself to changes in direction of the drilled hole as the drilling operation proceeds, the feed cylinder is herein connected by a universal joint 34 to the swivel member 14. This universal joint may be otherwise appropriately constructed, but herein comprises a collar 35, loosely encircling the feed cylinder, and having a spherical external surface 36, engaging a corresponding spherical surface 37 within an encircling collar 38. The latter is preferably formed in two parts 39 and 40, hinged together at 41, and provided with a clamping bolt 42 and a nut 43, by means of which the sections of the collar may be drawn together, thereby to bind the enclosed collar 35 to the desired extent. As herein shown, the section 40 of the collar 38 is formed integral with the swivel member 14.

In order that the feed cylinder may be clamped by the encircling collar 35, the latter may be rendered contractible in any suitable way, as, for example, by providing the same with a plurality of slots 44, extending part-way thereinto from one end, and a plurality of slots 45, extending part-way thereinto from the opposite end, one set of slots being placed out of alignment, or in staggered relation with the other set (see Fig. 2). As herein shown, another slot 46 extends entirely through the collar from end to end. It will now be apparent that, by turning the clamping nut 43 in the proper direction, the collar 38 may be caused to bind the collar 35, and the latter in turn bind the feed cylinder 28.

Owing to the provision of the described universal joint, and the mounting of the tool to swing about the axis of the feeding device, the tool is capable of accommodating itself to changes in direction, as well as alignment, of the drilled hole from time to time, as the drilling operation proceeds. The tool will have a natural tendency to align itself, and may be assisted by the operator by simply exerting a slight pressure in the proper direction.

Preferably, the connecting arm 33 is provided with a pressure fluid passage 47, communicating with the supply space 23 of the drilling tool, and passages 48 and 49 communicating respectively with the passages 31 and 32 in the piston rod 30. These passages may be controlled by any suitable means, as for example, a single throttle valve 50, having ports 51 and 52, communicating with the internal chamber 53 formed within the valve, and receiving its supply of pressure fluid from a pressure fluid conduit 54. The valve is herein provided with a stem 55, to which is secured a handle 56, by means of which the valve may be turned to cause its ports to register respectively with the passages leading to the tool and to the feed cylinder. It will be observed that, owing to the location of the controlling handle with relation to the axis of the piston rod, the operator, by simply grasping the handle, is enabled to move the drilling tool about said axis, while controlling the supply of pressure fluid to the tool, and to the feed cylinder, and is also enabled to swing the latter in any direction upon its universal joint.

The connection 33 may be secured to the cylinder 15 by any other appropriate means, but herein the latter is provided with two laterally projecting lugs 57 and 58, and the connection is provided with laterally projecting lugs 59 and 60, having recesses 61 and 62, to receive the cylinder lugs, whereby the latter may be clamped in place by a pair of hooked bolts 63 passing through the lug 59, and a similar bolt 64 passing through the lug 60, and engaging the under surfaces of the lugs 57 and 58 (see Fig. 5).

The conduit 47, communicating with the pressure fluid supply space 23 is herein connected thereto by a specially formed nipple 65, having one end threaded into the cylinder casting at its valve chest, while its other end is encircled by an appropriate packing ring 66, which serves to prevent leakage, and to provide for any variation in distance between the thread of the inlet nipple on the valve chest and the center line of the throttle valve. By simply providing the inlet nipple 65 with an internal thread 67 to receive the stem of a regular throttle valve, the drilling tool may be detached from the feed cylinder by simply loosening the bolts 63 and 64, and withdrawing the connection 33 from the nipple 65, whereupon the latter may be connected to an ordinary throttle, without any change in the pressure fluid connections. The arm 33 is herein attached to the piston rod 30 by providing the latter with a tapered terminal portion 68, fitted into a corresponding tapered hole 69 in the arm, and held therein

by a nut 70 threaded onto the end of the piston rod, while a set screw 71, entering a depression 72 in the piston rod, ensures the register of the passages 48 and 49 of the arm with the passages 31 and 32 of the piston rod (see Fig. 5).

To adjust the tool relative to the work it is sometimes desirable to shift the cylinder 28, which constitutes a preferred form of thrust member, relative to the saddle 14 which constitutes one form of fixed support. This may be and preferably is performed by the feeding and retraction means typified by the pressure fluid feeding mechanism pushing on the drill bit while the clamp 34 is loosened to move the cylinder 28 away from the work, or pulling on the drill bit while the clamp 34 is loosened to move the cylinder 28 towards the work. By shifting the thrust member relative to the fixed support a maximum depth of hole may be drilled with a minimum number of changes of drill steels, the thrust memberpreferably being moved to its rearward position when a drill steel is first inserted and then shifted to its foremost position after being fed to the work for the full range of the feeding mechanism, the thrust member thereby permitting the drill steel to be fed further to the work without the insertion of an additional drill steel.

While we have herein shown and described one specific form or embodiment of our invention for illustrative purposes, and have disclosed and discussed in detail the construction and arrangement incidental to one specific application thereof, it is to be understood that the invention is limited neither to the mere details or relative arrangement of parts, nor to its specific embodiment herein shown, but that extensive deviations from the illustrated form or embodiment of the invention may be made, without departing from the principles thereof.

Having thus described our invention, what we claim and desire by Letters Patent to procure is:

1. Hole drilling apparatus comprising a support, a feeding mechanism thereon, a hole drilling tool, and means for securing said tool eccentrically to said feeding mechanism for free rotation in either direction about said mechanism during the hole drilling operation.

2. Hole drilling apparatus comprising a pneumatic feeding mechanism including a fixed and a movable element, a hole drilling tool, and means for securing said tool eccentrically to one of the elements of said feeding mechanism for free rotation about the axis thereof during the hole drilling operation.

3. Hole drilling apparatus comprising a support, a hole drilling motor carried thereby, and supporting means therebetween comprising a feeding means pivotally connected to said support and a motor carrying means radially mounted on said feeding means and detachably secured to said motor whereby the later is movable freely about the feeding means as a pivot.

4. A drilling apparatus comprising a feeding mechanism, a tool, a bit operated thereby, and means comprising an arm radially mounted on said feeding mechanism for supporting said tool for movement about said feeding mechanism upon application of a transverse force to said bit.

5. Drilling apparatus for attaching a tool to a standard comprising a feeding mechanism, means for detachably securing said mechanism to the standard in an advanced or retracted position relative thereto, and means carried by the feeding mechanism for supporting the tool eccentrically to the axis of the feeding mechanism for free rotation about said axis.

6. The combination of a drilling tool, feeding means therefor having an axis parallel to but spaced from the axis of the tool, means to support said feeding means, and means supporting said tool from said feeding means whereby said tool may be operated to drill a plurality of holes about the axis of the feeding mechanism.

7. The combination of a drilling tool, feeding means therefor having an axis parallel to but spaced from the axis of the tool, means to support said feeding means, and means supporting said tool from said feeding means whereby said tool may be operated to drill a plurality of holes with one setting of the feeding mechanism.

8. A drill apparatus comprising feeding mechanism, a tool, and means for securing said tool eccentrically to said mechanism whereby said tool may be advanced by the feeding mechanism to drill a hole and may be freely rotated around the axis of the feeding mechanism out of alignment with said hole.

9. Drilling apparatus comprising a fluid pressure feeding mechanism, a complete drilling engine, and means for detachably securing said engine eccentrically to the front end of said mechanism whereby said engine may be advanced by the feeding mechanism to drill a hole and may be freely rotated around the axis of the feeding mechanism out of alignment with said hole.

10. Drilling apparatus comprising a fluid pressure feeding mechanism, a complete drilling engine having a grasping handle, and means for detachably securing said engine to said feeding mechanism for adjusted movement about the axis of said mechanism, said engine being bodily detachable from said mechanism for use independent thereof.

11. Drilling apparatus comprising a feed cylinder, a feed piston movable therein, a

laterally disposed member connected to one of said elements, a drilling engine connected to said member and disposed parallel to said feed cylinder and piston, and means for supplying pressure fluid to said member and therefrom to said feed cylinder and to said drilling engine.

12. Drilling apparatus comprising a feed cylinder, a feed piston movable therein, a laterally disposed member connected to one of said elements, a drilling engine connected to said member and disposed parallel to said feed cylinder and piston, and coordinated controlling means for said cylinder and engine including a single controlling valve carried on said member.

13. In a drilling apparatus, a feed cylinder, a feed piston therein, a laterally extending member fixed to one end of said piston, a drilling engine attached to said member and disposed substantially parallel to said piston, and coordinated controlling means for said piston and engine including cooperating passages in said elements and said member and a single controlling valve therefor.

14. In a drilling apparatus, a feed cylinder, a feed piston movable therein, a laterally disposed member fixed to one end of said piston and rotatable about the axis thereof, a complete drilling engine disposed substantially parallel to said feed piston, and means for removably attaching said engine to said laterally disposed member whereby said engine may be disconnected therefrom and used, independently thereof.

15. In a drilling apparatus, the combination of a drilling tool, and supporting means therefor including a pivot whose axis extends in the same general direction as the axis of said tool and is eccentric thereto, and a mounting in which said pivot is freely rotatable to permit the drilling tool to accommodate itself automatically to changes in alignment of the drilled hole during the drilling operation.

16. The combination of a drilling tool, feeding means therefor; means to support said feeding means; and means pivotally supporting said tool on said feeding means and constituting a freely swinging support without restraint permitting said tool automatically to shift its position with relation to said feeding means eccentric with relation to its own by the mere change of alignment of the drilled hole during the drilling operation.

17. The combination of a drilling tool; feeding means therefor having an axis eccentric with relation to the axis of said tool; means to support said feeding means; and means supporting said tool on said feeding means and constituting a freely swinging support permitting said tool automatically to shift its position without restraint about the axis of said feeding means by the mere change of alignment of the drilled hole during the drilling operation.

18. The combination of a drilling tool; feeding means therefor comprising a feed cylinder member and a feed piston member having an axis eccentric with relation to that of said drilling tool; means to support one of said members; and means to support said tool on the other member and constituting a freely swinging support permitting said tool automatically to shift its position about the axis of said members by the mere change of alignment of the drilled hole during the drilling operation.

19. The combination of a pressure fluid drilling tool; pressure fluid feeding means therefor comprising a feed cylinder member and a feed piston member having an axis eccentric with relation to that of said drilling tool; supporting means for said feeding means; means connecting one of said members to said tool constituting a freely rotatable support permitting the tool to swing about the axis of said members by the mere change of alignment of the drilled hole during the drilling operation, said connecting means having pressure fluid conduits leading to said tool and to said feed cylinder member, respectively; and pressure fluid controlling means having a grasping handle disposed eccentrically with relation to said axis, whereby the operator, by grasping said handle, may move the tool about said axis while controlling the supply of pressure fluid.

20. The combination of a drilling tool, feeding means therefor having an axis eccentric with relation to the axis of the tool, means to support said feeding means, and means supporting said tool from said feeding means below the same and constituting a freely swinging support permitting said tool to swing by gravity and automatically to shift its position without restraint about the axis of said feeding means by the mere change of alignment with the drilled hole during the drilling operation.

21. In a drilling apparatus, the combination of a drilling tool, and supporting means therefor including a pivot whose axis extends in the same general direction as the axis of said tool and is eccentric thereto, and a mounting in which said pivot is freely rotatable to permit the drilling tool to accommodate itself automatically to changes in alignment of the drilled hole during the drilling operation, said drilling tool being suspended beneath said supporting means and swinging freely therefrom.

22. In a drilling apparatus, the combination with a drilling tool, of feeding and supporting means therefor comprising a cylinder, a piston longitudinally movable and freely rotatable therein, a fixed support

for one of said members, and a supporting member connecting the other of said members with said drilling tool, the axis of said cylinder being parallel and eccentric to the axis of said tool, and said tool being freely movable about the axis of said cylinder to accommodate itself automatically to changes in alignment of the drilled hole during the drilling operation.

23. In a drilling apparatus, the combination with a drilling tool, of feeding and supporting means therefor comprising a cylinder, a piston longitudinally movable and freely rotatable therein, a fixed support for one of said members, and a supporting member connecting the other of said members with said drilling tool, the axis of said cylinder being parallel and eccentric to the axis of said tool, and said tool being suspended beneath said feeding means and freely movable about the axis of said cylinder to accommodate itself automatically to changes in alignment of the drilled hole during the drilling operation.

24. In a drilling apparatus, the combination with a drilling tool, of feeding and supporting means therefor comprising a cylinder, a piston longitudinally movable and freely rotatable therein, a fixed support for one of said members, and a single supporting member secured to the forward end of the other of said members and to said drilling tool adjacent the rear end of the latter, the axis of said cylinder being parallel and eccentric to the axis of said tool, and said tool being freely movable about the axis of said cylinder to accommodate itself automatically to changes in alignment of the drilled hole during the drilling operation.

25. In a drilling apparatus, the combination with a drilling tool, of feeding and supporting means therefor including a member whose axis extends in the same general direction as the axis of said tool and is eccentric thereto, a member with respect to which said first named member is longitudinally movable and freely rotatable to permit the drilling tool to accommodate itself automatically to changes in alignment of the drilled hole during the drilling operation, a fixed support for said last named member, and means for connecting said support and member and having provision for permitting longitudinal movement of the latter.

26. In a drilling apparatus, the combination with a drilling tool, of feeding and supporting means therefor including a cylinder, a piston longitudinally movable and freely rotatable therein, a fixed support for one of said members, a releasable clamp for securing said last named member and support whereby said member may be shifted longitudinally relative to said support and clamped in each position, and a supporting member connecting the other of said members with said drilling tool, the axis of said cylinder being parallel and eccentric to the axis of said tool, and said tool being freely movable about the axis of said cylinder to accommodate itself automatically to changes in alignment of the drilled hole during the drilling operation.

27. In a drilling apparatus, the combination with a drilling tool, of feeding and supporting means therefor including a member whose axis extends in the same general direction as the axis of said tool and is eccentric thereto, a member with respect to which said first named member is longitudinally movable and freely rotatable to permit the drilling tool to accommodate itself automatically to changes in alignment of the drilled hole during the drilling operation, a fixed support for said last named member, and means for connecting said support and member and including a universal joint between said member and support.

28. In a drilling apparatus, the combination with a drilling tool, of feeding and supporting means therefor including a member whose axis extends in the same general direction as the axis of said tool and is eccentric thereto, a member with respect to which said first named member is longitudinally movable and freely rotatable to permit the drilling tool to accommodate itself automatically to changes in alignment of the drilled hole during the drilling operation, a fixed support for said last named member, and means for connecting said support and member, said means including a universal joint between said member and support and having provision for permitting longitudinal movement of said member.

29. In a drilling apparatus, in combination, a feed cylinder, a feed piston longitudinally movable and freely rotatable therein, a laterally disposed member connected to one of said elements, a drilling engine connected to said member and disposed parallel and eccentric to said feed cylinder and piston, and coordinated controlling means for said cylinder and engine including a single controlling valve carried on said member.

30. In a drilling apparatus, in combination, a feed cylinder, a feed piston movable therein, a single laterally disposed member secured to the forward end of one of said elements, a drilling engine secured at its rear end to said member and disposed parallel to said cylinder and piston, means including a valve carried by said member for supplying pressure fluid to said cylinder and engine, and an operating handle at the rear end of said drilling engine adjacent to said valve.

31. Drilling apparatus comprising, in combination, a complete drilling engine having a rearwardly located grasping handle, and fluid pressure feeding mechanism connected

with said drilling engine, said feeding mechanism being offset from said drilling engine but aligned substantially parallel with said engine, said parts including means for pivotally supporting said drilling engine to permit the same to accommodate itself automatically to changes in alignment of the drilled hole during the drilling operation, and also including means whereby said drilling engine may be bodily detached from said feeding mechanism and used independently thereof.

32. Drilling apparatus comprising, in combination, a complete drilling engine having a rearwardly located grasping handle, fluid pressure feeding mechanism including a cylinder offset from said drilling engine but aligned substantially parallel therewith and a piston in said cylinder, a single laterally disposed member secured to the forward end of one of said elements, and means for securing said member to said drilling engine adjacent the rear end of the latter, said means having provision whereby said drilling engine may be bodily detached from said member and used independently of said feeding mechanism.

33. In a drilling apparatus, a feeding mechanism comprising a single motor of the expansible chamber type, and a drill adapted to be fed thereby and arranged with its axis parallel to but off-set from the axis of said feeding mechanism and revolvable freely about the axis of the latter.

34. In a driling apparatus, a feeding mechanism comprising concentrically arranged parts, and a drill adapted to be fed by said feeding mechanism and arranged with its axis parallel to but off-set from the axis of said feeding mechanism and secured to one of said parts, said drill being freely revolvable about the axis of said feeding mechanism.

35. In a drilling apparatus, a feeding mechanism, and a drill attached thereto and adapted to be fed thereby, the axis of said drill being off-set from the axis of said feeding mechanism but lying in a plane therewith and said drill being freely revolvable about the axis of said feeding mechanism whereby the axis of the drill may generate a surface of revolution with respect to which the axis of said feeding mechanism constitutes the axis.

36. In a drilling apparatus, a feeding mechanism comprising relatively stationary and movable telescoping parts, and a drill secured to said movable part and arranged with its axis lying in a plane containing the axis of the stationary part but not coincident with the latter, said drill being revolvable about the axis of said stationary part on application of a transverse force to said drill.

37. In a drilling apparatus, a feeding mechanism comprising a stationary member and a movable tool feeding member, and a tool mounted on the latter with its axis in a plane with but off-set from the axis of the stationary member and freely rotatable about the last mentioned axis.

38. In a drilling apparatus adapted to drill a hole in any one of a plurality of angularly different positions about an axis, a feeding mechanism comprising a single cylinder member, a piston member therein, a stationary mounting for one of said members, and a drill movable with the other thereof with its axis in a single plane with but off-set from the axis of one of said members and revolvable about said axis as a pivot.

39. In a drilling apparatus adapted for the drilling of a series of single holes in angularly different positions about an axis, a tool, and feeding mechanism therefor comprising a single cylinder member and a piston member, said tool being connected in off-set relation to one of said members and with its axis parallel to the axis thereof and revolvable about the latter axis as an axis and the other of said members being provided with a stationary mounting.

40. In a drilling apparatus adapted to enable the drilling of a hole in any one of a plurality of angularly different positions with respect to an axis, a single stationary feed cylinder, a piston movable therein, an off-set mounting carried by said piston, and a tool secured to said off-set mounting with the axis thereof in the same plane as the axis of the piston whereby the axis of said tool may generate a surface of revolution about the axis of said piston as an axis.

In testimony whereof, we have signed our names to this specification, in the presence of subscribing witnesses.

GEORGE H. GILMAN.
PETER A. HAINES.

Witnesses to signature of George H. Gilman:
C. J. JONES,
W. R. PRICE.

Witnesses to signature of Peter A. Haines:
O. S. FREEMAN,
GEO. H. TRAUERNICHT.