

Oct. 4, 1932.

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1,880,217

MOTOR DRIVEN WELL DRILLING APPARATUS

Filed Oct. 22, 1929

3 Sheets-Sheet 1

Fig. 1

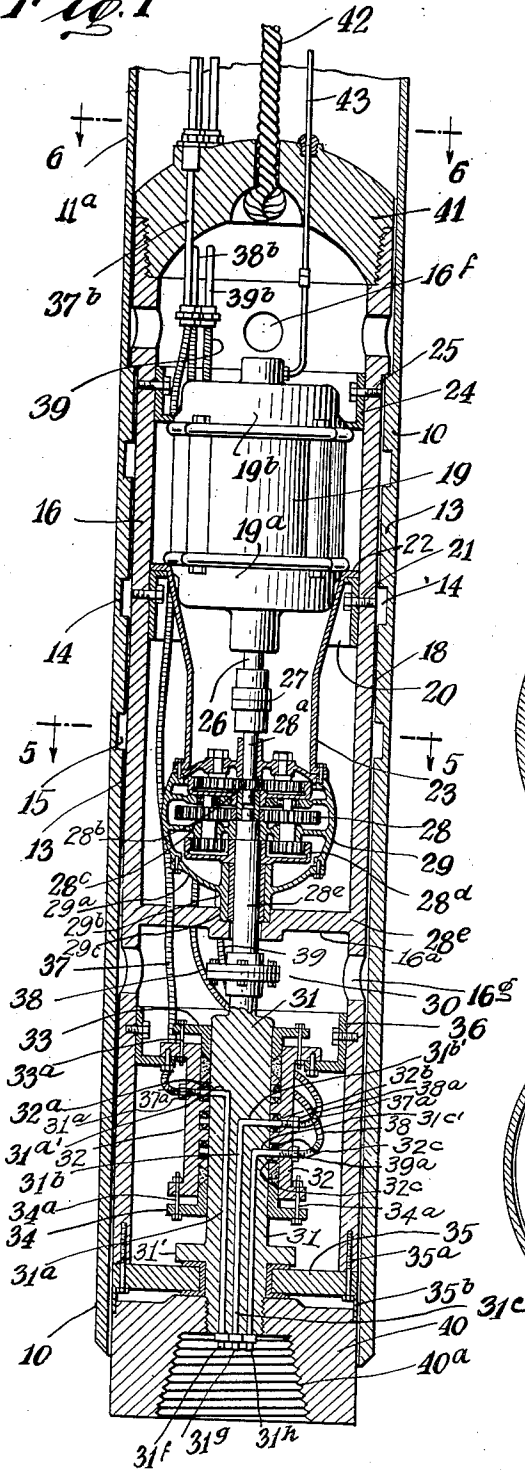


Fig. 4

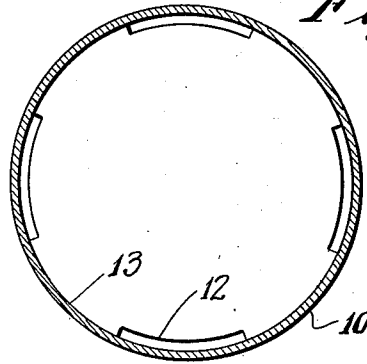


Fig. 5

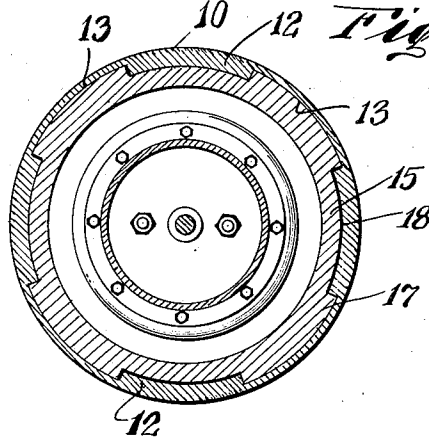
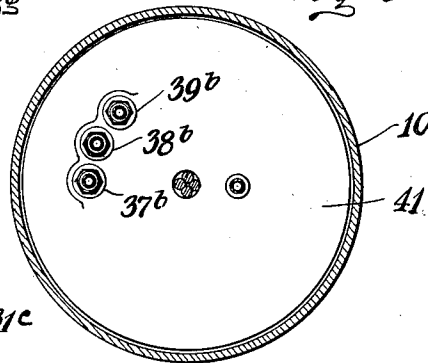


Fig. 6



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Fig. 3

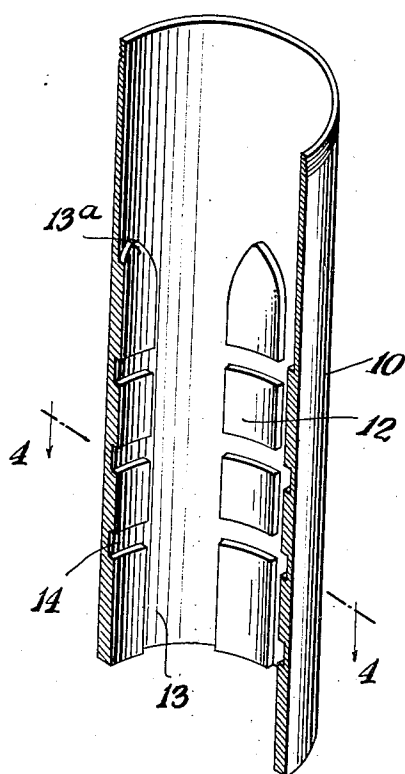
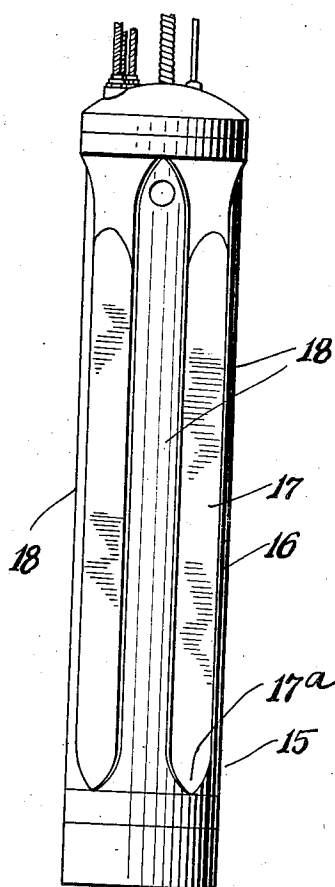


Fig. 2



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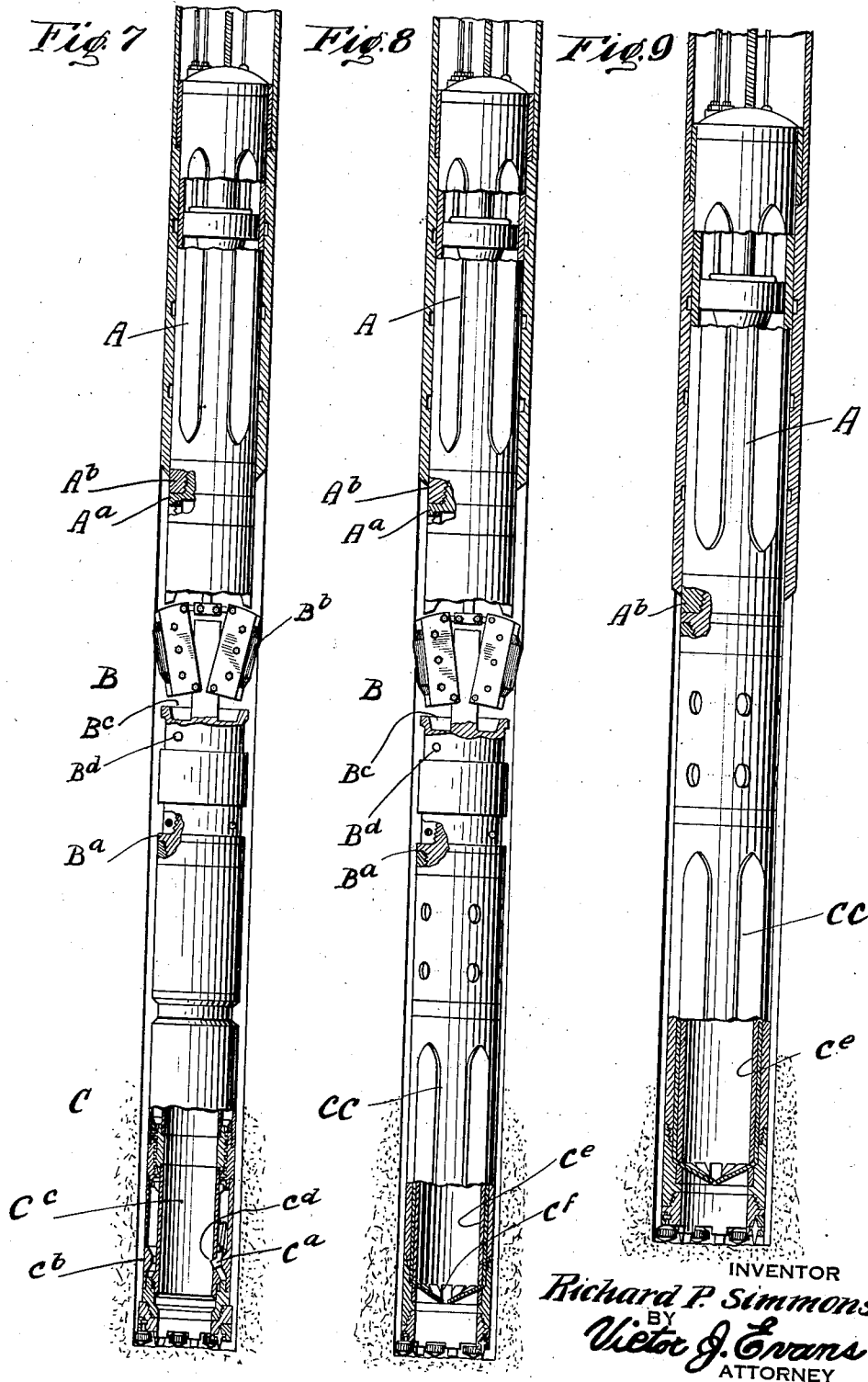
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

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MOTOR DRIVEN WELL DRILLING APPARATUS

Application filed October 22, 1929. Serial No. 401,445.

This invention relates to improvements in means for supporting a motor in a well to drive various units, such as pump, rotary drill, or other equipment, in the well casing, and its leading object is to provide a well casing having a section with which the housing of the motor head or drive may be interlocked against relative rotative movement, but in such manner that the housing and its equipment may be withdrawn from the well casing, leaving the latter disposed in the well to prevent caving of the ground, and to avoid the expense and loss of time involved in the successive withdrawal of the well casing.

Another object of the invention is to provide an improved driving means between the motor and the units which are coupled therewith, constructed to permit the flow of air and oil through ducts disposed in a rotary member and in constant communication with passages opening through a sealed housing, the whole being constructed to permit of the coupling to the rotary member of any other unit required to be operated in the well below the motor head, and also to permit continuous flow of the air and oil through the joint between the coupled head and operated unit.

Other objects and advantages of the invention will be hereinafter specifically pointed out, or will become apparent, as the specification proceeds.

With the above indicated objects in view, the invention resides in certain novel constructions and combinations and arrangement of parts, clearly described in the following specification and fully illustrated in the accompanying drawings, which latter show an embodiment of the invention as at present preferred.

In the drawings:—

Fig. 1 is a vertical sectional view through the slidably coupled well casing and motor head housing, showing the vertical order of the driving units.

Fig. 2 is a side elevation of the motor head housing removed.

Fig. 3 is a perspective view, broken-away, of the interlocking section of the well casing.

Fig. 4 is a transverse sectional view taken

on line 4—4 of Fig. 3, looking in the direction of the arrows.

Fig. 5 is a transverse sectional view taken on line 5—5 of Fig. 1, looking in the direction of the arrows.

Fig. 6 is a transverse sectional view taken on line 6—6 of Fig. 1, looking in the direction of the arrows.

Fig. 7 is a vertical sectional view through a well casing from which a motor head unit supports an under reamer unit and a rock core barrel unit.

Fig. 8 is a similar view showing an earth or soft material core barrel instead of a rock barrel unit.

Fig. 9 is a similar view showing the under reamer unit omitted.

Referring to the accompanying drawings in detail, 10 designates the lower section of the well casing, to which additional sections are coupled, by screw threaded joints.

The lower casing section 10 is formed with internal longitudinal keys 12 and internal longitudinal keyways 13, which are radially spaced from each other. The keys 13 are formed with transverse grooves 14. The upper end portions of the keys 13 are formed with tapered ends 13a so that they will deflect any object engaging the same and force it to one side thereof.

In the well casing section 10 the housing 15 of the motor head is slidably coupled, and for this purpose the cylinder 16 which forms the body of the housing is formed with integral longitudinal keys 17 adapted to have slidable interlocking engagement with keyways 12 and longitudinal keys 13 of the well casing section 10. The lower end portions of the keys 17 are tapered at 17a to readily pass the tapered ends of the keys 12, and these keys 17 are radially separated from each other by means of the longitudinal keyways 18.

This sliding interlocking connection between the housing and the well casing permits the motor head housing to be withdrawn at any time, but prevents the housing from rotating in the well casing, though the well casing itself may be turned.

In the cylinder 16, the electrical motor 19

is mounted upon the shelf ring 20, which is detachably connected with the wall of the cylinder by means of the screws 21. Between the base of the motor and the ring 20 the upper horizontal flange 22 of the tubular supporting member 23 is positioned, the lower end plate 19a of the motor frame projecting into this supporting member.

The upper end plate 19b of the motor frame is engaged by the clamping and retaining ring 24, which is detachably secured to the cylinder 16 by means of the screws 25.

The shaft 26 of the motor extends downwardly and is connected by the shaft coupling member 27 with the shaft 28a of a Foote transmission gearing 28, enclosed by the housing 29 carried by the lower end of the tubular support 23. This transmission is well known and is of the planetary type, embracing the pinion gear 28b on the shaft 28a, the planetary train of gears 28c driven from this pinion, and the driven internal gear 28d on the shaft 28e.

The end plate or cap 29a of the housing 29 of the planetary transmission gearing is provided with a hub 29b which is seated in the recess 29c of the end wall 16a of the cylinder 16. The shaft 28e of the transmission extends through this end wall 16a and is connected by the shaft coupling 30 with the larger shaft 31, which rotates in the housing 32.

The shaft 31 is formed or provided with three longitudinal ducts or passages 31a, 31b and 31c, which open through the lower end of the shaft 31. The upper end of the duct or passage 31a communicates with a short horizontal branch 31a' with an internal circular groove 32a of the housing cylinder 32. The next duct or passage 31b communicates by the short horizontal branch 31b' with the circular internal groove 32b of said housing cylinder 32. The other duct or passage 31c communicates by the short passage 31c' with the internal circular groove 32c of the housing cylinder 32. A packing gland 33 is secured against the upper end of the housing cylinder 32 by means of the adjustable bolts 33a, and a similar packing gland 34 is secured against the lower end of the housing cylinder by means of the adjustable bolts 34a. The shaft 31 is provided with an integral collar 31' which bears against the circular shelf 35, which is detachably connected by the bolts 35a to the lower end of the cylinder 16. The upper end of the housing cylinder 32 is secured to the cylinder 16 by means of the spacing ring 36, the inner end of which is bolted to the housing cylinder 32 and the outer end of which is bolted to the cylinder 16.

An air or oil conduit 37 is connected with the circular groove 32a by the nipple 37a and this extends upwardly and is coupled to the pipe 37b. An air or other conduit 38 is connected by the nipple 38a to the groove 32b and

extends upwardly and is coupled to the conduit 38b. An air or other conduit 39 is connected with the groove 32c by the nipple 39a and also extends upwardly and is connected with the pipe or conduit 39b.

The housing 32 with its air connections never rotates in the cylinder 16, the transfer of the air or other fluids from the flexible conduits to the ducts or passages of the rotary shaft 31 taking place through the circular grooves in the cylinder housing 32.

The lower end of the shaft 31 carries a nipple 31f which surrounds the duct 31a; a second nipple 31g, which surrounds the duct 31b; and a third nipple 31h, which surrounds the duct 31c. To these nipples flexible conduits, not shown, of any equipment to be used below the motor head unit, whether a pump or a battery of pumps, rotary or percussive drilling means, core collecting and removing means, under reaming means, or otherwise, are connected. The lower end of the shaft 31 carries a detachable coupling head 40, which has a snug sliding fit in the lower end of the casing section 10, and is provided with a tapered internal or female screw thread 40a. The upper circular edge portion of the coupling head 40 is sealed against circular shelf 35 by means of the dirt guard 35b.

An end wall 41 is threaded in the upper end of the cylinder 16 and to this end wall the hoisting and lowering cable 42 is coupled through a central opening in said end wall. The electrical wires for controlling the circuit through the motor are carried by the conduit 43 which extends through the end wall 41 to the motor housing.

The cylinder 16 is formed with a series of radially spaced openings 16f to provide access to the connections immediately above the motor, and with another series of radially spaced openings 16g to provide access to the housing 32 and the connections associated therewith.

When the motor drive is coupled to a pumping unit, or similar well operating apparatus, by means of the coupling head 40, the drive of the motor will tend to turn the casing 16 within the well casing 10, but this tendency of relative rotative movement will be resisted and prevented by the longitudinal splines or keys and keyways between the well casing and the housing 15, of which the cylinder 16 forms the body thereof.

This interlocking connection between the housing for the motor head also provides means for supporting the pumping units upon and within the well casing, so that loss of such equipment is completely prevented, and prompt withdrawal of the motor head and any equipment coupled therewith may be accomplished without calling for the successive withdrawal of the well casing, which remains in place to support the earth against collapse.

Referring to Figs. 7, 8 and 9, series unit combinations are illustrated, wherein one or more well drilling units are coupled to the motor head unit and operated thereby. This indicates other combinations of other well drilling units, which may be coupled to the motor head unit.

In Fig. 7 the series combination consists of the motor head unit, which, for convenience, will be indicated unit A, the under reamer unit B, and the core barrel unit C, for trapping and conveying rock cores. The under reamer unit B is coupled to the motor head unit A, by means of the coupling union A^a, which engages the internal thread A^a and the core barrel unit is coupled to the unit B, by means of the coupling union B^a. The under reamer unit is equipped with expansible and contractible reamer tools B^b, which are moved to the two positions, outwardly to trim the wall of the well bore and inwardly to occupy a position within the vertical plane of the housing of the unit B. The core barrel unit C is provided with movable core trapping means C^a, operated by mechanical elements, which include a cam C^b, and a tubular wall section C^c vertically shiftable within the housing of the barrel of the unit C, so that the lever trapping means or device C^a will be moved against the cam C^b and forced into the slot C^d of the barrel or tubular wall section C^c, to pinch the rock core and hold the same against sliding in the core barrel unit.

In Fig. 8 the series combinations consist of the motor head unit A, the under reamer unit B, and the core barrel unit CC, which is designed to trap soft excavated materials. This core barrel unit CC is provided with an earth holding compartment C^e in which earth is trapped by means of the flexible fingers C^f, which are shifted across the chamber C^e by means of a pneumatic or other type of piston enclosed by the housing of said unit. This unit is connected to the under reamer unit by means of the coupling union B^a.

In Fig. 9 the series combination consists of the motor head unit A and the core barrel unit CC, the latter being connected directly to the former by means of the coupling union A^b.

In each of these three combinations of different units a drilling and earth retaining means is combined with and operated by the motor head unit, which is locked to the well casing against relative rotative movement, and which is equipped with a gear reduction mechanism not shown, whereby the under reamer unit and the core barrel unit may be rotated at a reduced speed, considerably below that of the motor itself.

The under reamer unit is provided with an earth trapping compartment B^c, located immediately below the reamer tools thereof, so

that earth detached from the wall of the well bore will be retained in this compartment, by the action of the reamer tools, which engage the wall of the well bore at slight angles from the vertical.

The core barrel unit in each of the three combinations is equipped with drill tools carried by the lower end thereof, which are designed to be rotated against the rock or earth by the action of the motor driven connection with the coupling union A^a, and the rotary shaft head A^b, thereof, which is driven directly by the electrical motor enclosed by said barrel unit.

After the core barrel has been filled the series unit combination is removed from the well, leaving the well casing in place, and the core barrel emptied and returned to place. As the earth or rock is excavated below the well casing the reamer will trim the wall of the well bore, thus cutting a circular plane through which the well casing may be continually lowered, without being deflected to an inclined plane, and without crowding the well casing.

The progressive withdrawal of the earth and rock in the condition it is found, results in the formation of a well having a bore wall of natural stability, which is not disturbed by the packing operation which is usually resorted to in the drilling of wells.

The hereinbefore described construction admits of considerable modification without departing from the invention; therefore, I do not wish to be limited to the precise arrangements shown and described, which are, as aforesaid, by way of illustration merely. In other words, the scope of protection contemplated is to be taken solely from the appended claims, interpreted as broadly as is consistent with the prior art.

I claim as new:—

1. In combination, a well casing having an internal key extending longitudinally thereof, a housing having an external keyway to receive the key, said casing being adapted to support said housing therein against downward movement by the interlocking action of said key with said keyway, and against relative rotative action, an electric motor secured in said housing, a reduction gearing coupled to the shaft of the electric motor, and a wiping joint coupled to the reduction gearing, and providing means for the continuous flow of various streams of pressure fluid therethrough when the same is in rotation.

2. The combination with a well casing of a housing slidably interlocked therewith for upward vertical movement in a withdrawal direction and against downward vertical movement below the well casing and also against relative rotative movement, a coupling union in the lower end of the casing and comprising relatively movable parts con-

structed to pass air under pressure from one to the other, and a motor driven shaft connected to one of the parts of the coupling union and operating in said housing.

5 3. The combination with a well casing of a housing slidably interlocked to the casing against relative rotative movement and to permit of vertical sliding movement in an upward direction only, a shaft journaled for
10 rotation in said housing and provided with a plurality of air passages therein, a housing for said shaft having ports adapted to have constant communication with the air passages of the shaft, a reduction gear coupled to said
15 shaft, and a coupling union coupled to said shaft whereby a well apparatus may be connected to said shaft and operated thereby.

4. The combination with a well casing of a housing having interlocking connection in
20 the casing against downward movement and against relative rotative movement, a shaft journaled in the housing and provided with a series of longitudinal passages therein, a casing enclosing said shaft and secured in
25 said housing and provided with a plurality of separated internal circular passages, the shaft having lateral passages in communication with the internal casing passages and with the longitudinal passages of said shaft,
30 means for coupling a well drilling unit directly to said shaft below said housing to permit compressed air to be passed through said shaft to said drilling unit, and a reduction gear coupled to the upper end of the
35 shaft.

5. The combination with a well casing having internal interlocking elements therein, of a housing having external interlocking elements, said housing having an end wall secured to the lower end thereof, a shaft journaled in said end wall and provided with longitudinal passages, means for supplying compressed air to said passages while the shaft is rotating, and means for coupling a
40 well drilling unit to said shaft to be rotated thereby and be supplied with compressed air through said shaft and coupling means.

6. The combination with a well casing having internal interlocking means, of a housing
50 having corresponding external locking means coupled thereto against relative rotative movement and to permit of relative vertical movement in an upward direction only, means for coupling a drilling unit to said housing to rotate thereunder, means for rotating said
55 coupling means, and means for supplying compressed air to said drilling unit through said coupling means.

7. The combination with a housing of a
60 shaft journaled therein for rotative movement, a coupling union comprising relatively movable elements of which one is mounted on the lower end of the shaft to rotate against the lower end of the housing and
65 the other fixed in the housing, means for ro-

tating the shaft, and means for supplying compressed air to a drilling unit coupled to said union, the elements thereof having registering air ducts.

8 The combination with a housing of a
70 shaft journaled therein for rotary movement, a coupling union mounted on the lower end of the shaft and rotating against the lower end of the housing, a casing enclosing said shaft and secured to the housing, said casing
75 and shaft having air passages for supplying compressed air to said coupling union, means for supplying compressed air to said passages, and means for rotating the shaft.

9. The combination with a housing having a shaft journaled therein for rotary action, a casing enclosing the shaft and secured to the housing, the shaft and the casing having a plurality of independent passages for compressed air, means for coupling
85 a drilling head to said shaft to rotate under said housing and to receive compressed air from said passages, and means for rotating the shaft carried by the housing.

10. The combination with a housing having a shaft journaled to rotate therein, a casing for the shaft secured to the housing, the shaft and the casing having means for supplying independent streams of compressed air to the lower end of the shaft,
90 means for coupling a drilling head to said lower shaft end to receive compressed air through said independent passages, means for supplying compressed air to the casing to maintain a stream of air moving through
100 the coupling means.

11 The combination with a well casing of a housing supported thereby against extreme downward movement in the casing, a shaft rotating in the housing, a core barrel unit
105 coupled to the shaft and provided with air operated earth trapping means for retaining earth forced into said core barrel, and means for conducting compressed air through said shaft to said core barrel when said shaft is
110 being rotated in said housing.

12. The combination with a well casing of a housing supported thereby, a shaft rotating in the housing, an under reamer unit coupled to the shaft, expansible and retractible tools carried by the under reamer, means for operating said tools, a core barrel coupled to said under reamer, means for trapping earth forced into said core barrel, means for operating the earth trapping means, and means for conducting compressed air to the under reamer and the core barrel through said shaft when the same is rotating.

13. In combination, a well casing structure, a housing structure, one of said structure having a key extending longitudinally thereof, and the other structure having a keyway to receive the key, said casing being adapted to support said housing therein against downward movement by the interlocking action of

said key with said keyway, and against relative rotative action, an electric motor secured in said housing, a reduction gearing coupled to the shaft of the electric motor, and a wiping joint coupled to the reduction gearing, and providing means for the continuous flow of various streams of pressure fluid there-through when the same is in rotation.

14. In combination, a well casing, a housing supported in said casing and locked against angular movement with respect thereto but limited in axial movement to the lower end of the casing, a driving motor mounted in said housing, a core barrel coupled to said motor, the core barrel being of relatively great length and hollow and cross-sectionally conforming to and of a size corresponding to the housing, the core barrel drilling in advance of the casing and collecting interiorly the material removed by drilling, and an under reamer interposed between the core barrel and the housing and driven by said motor and enlarging to the size of said casing the hole formed by said core barrel.

15. In combination, a well casing, a housing supported in said casing and locked against angular movement with respect thereto but limited in axial movement to the lower end of the casing, a driving motor mounted in said housing, a core barrel coupled to said motor, the core barrel being of relatively great length and hollow and cross-sectionally conforming to and of a size corresponding to the housing, the core barrel drilling in advance of the casing and collecting interiorly the material removed by drilling, and an under reamer interposed between the core barrel and the housing and driven by said motor and enlarging to the size of said casing the hole formed by said core barrel, the under reamer comprising cutting elements retractable within the periphery of the core barrel upon elevation of the housing through the well casing.

In testimony whereof I hereby affix my signature.

RICHARD P. SIMMONS.

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