

June 7, 1932.

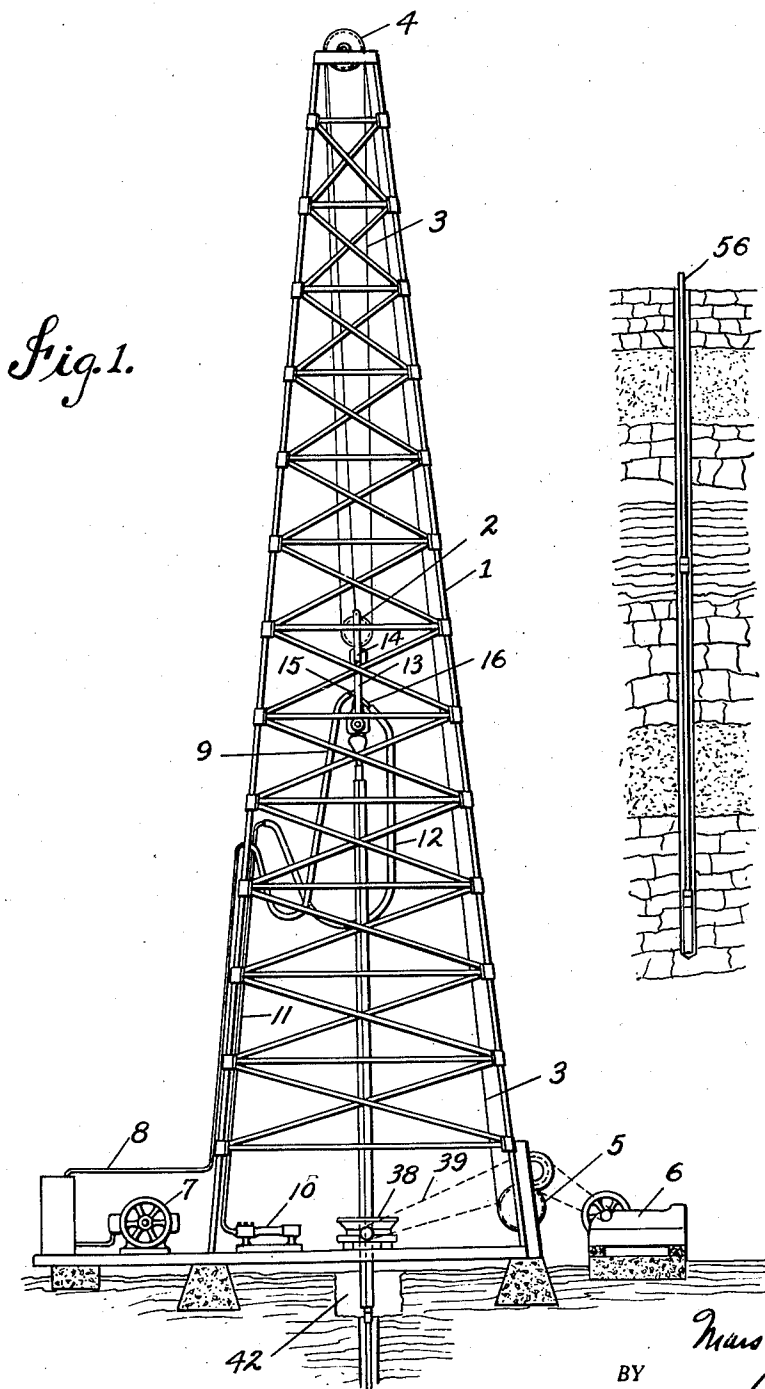
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1,862,260

PNEUMATIC WELL DRILLING APPARATUS

Filed Nov. 10, 1930

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

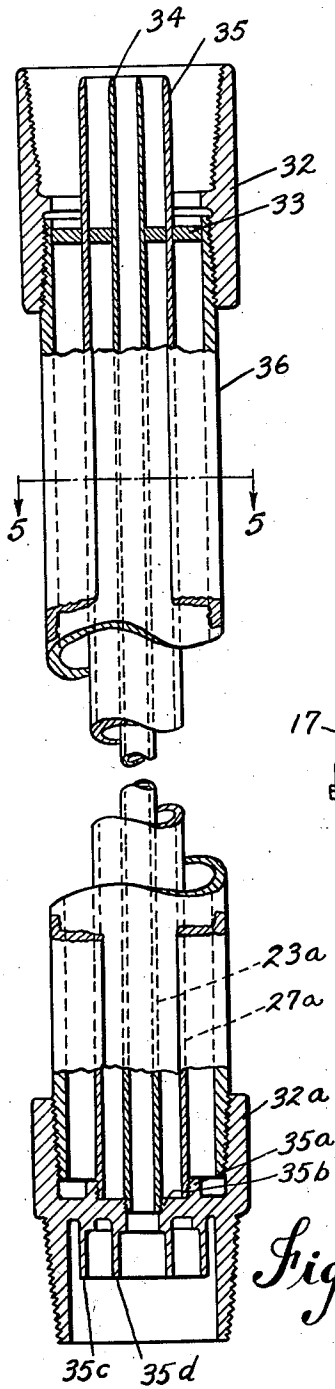


Fig. 4.

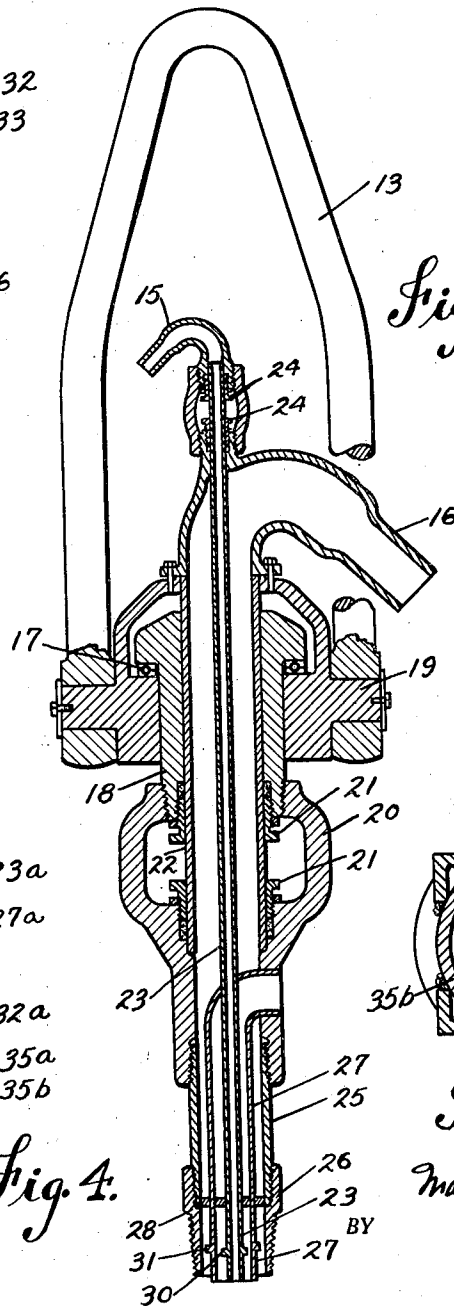


Fig. 3.

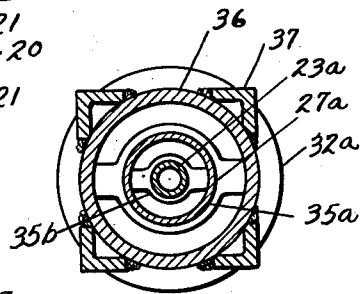


Fig. 5.

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4 Sheets-Sheet 3

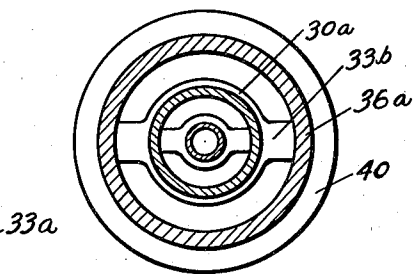
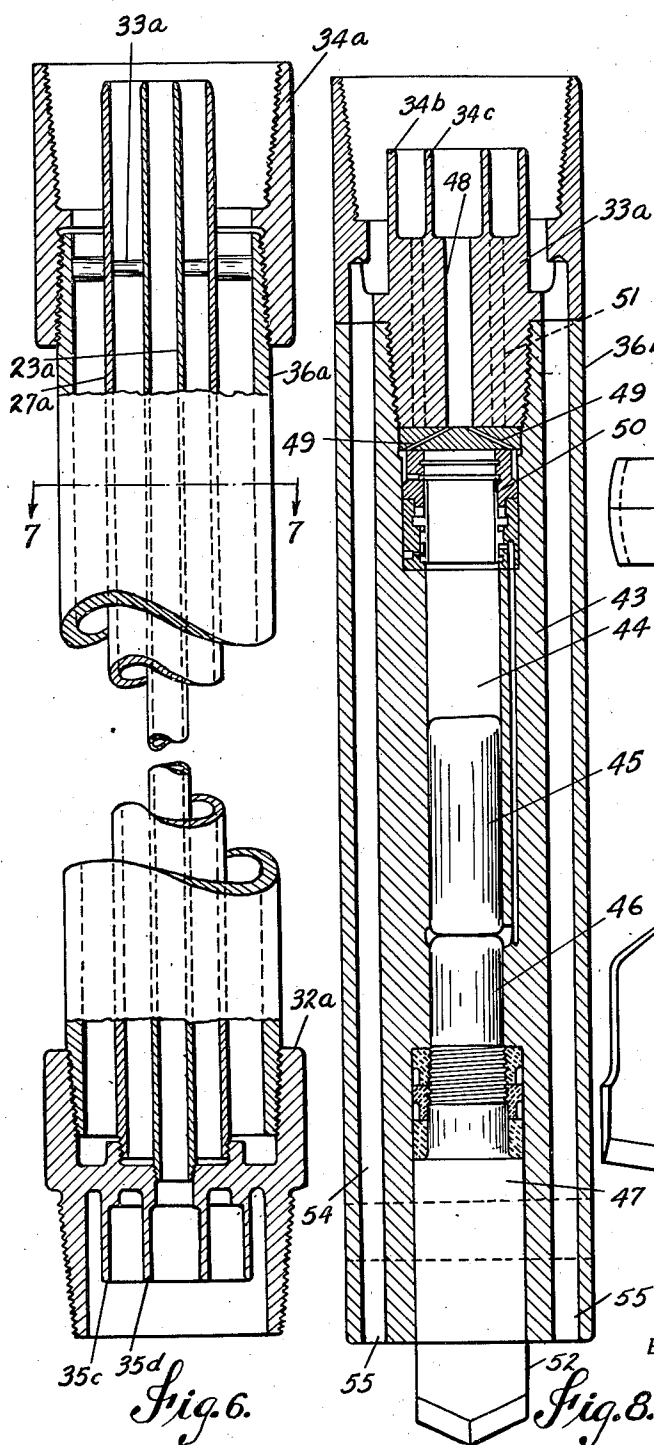


Fig. 7.

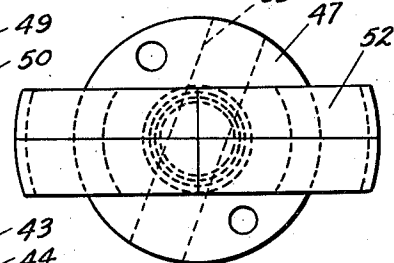


Fig. 9.

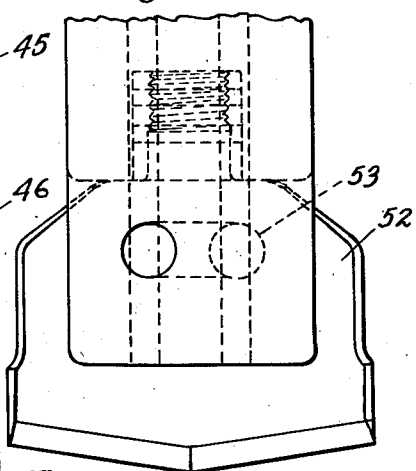


Fig. 10.

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4 Sheets-Sheet 4

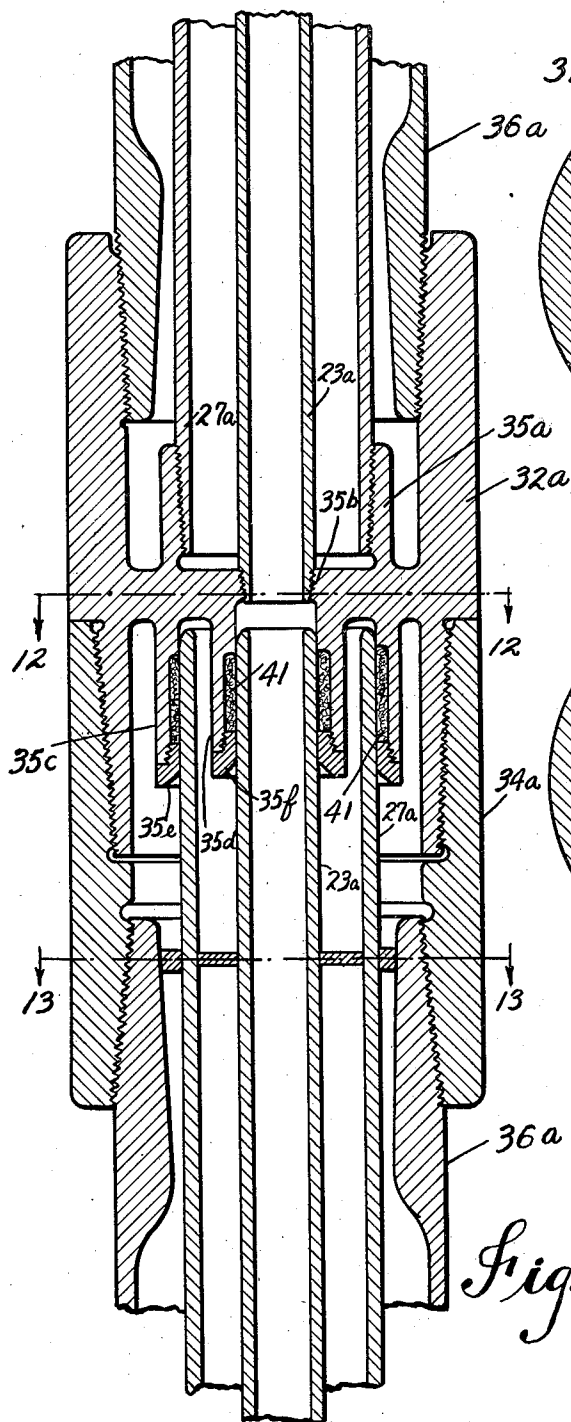


Fig. 11.

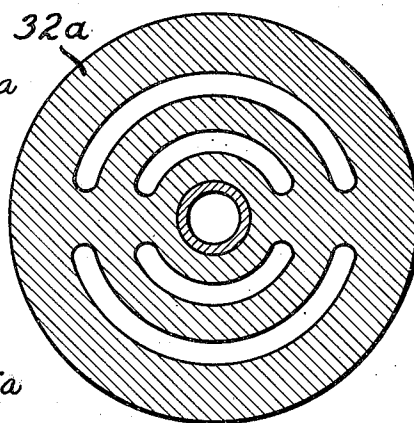


Fig. 12.

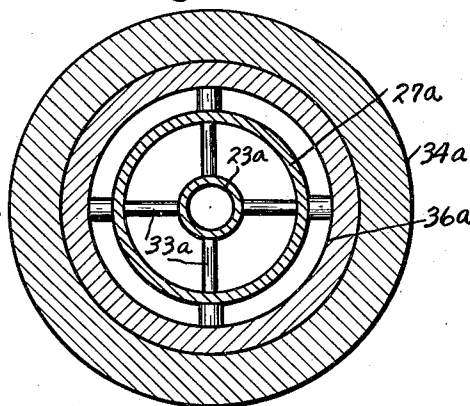


Fig. 13.

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UNITED STATES PATENT OFFICE

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PNEUMATIC WELL DRILLING APPARATUS

Application filed November 10, 1930. Serial No. 494,590.

My invention relates to pneumatic well drilling apparatus, and particularly to improvements in the construction of the well pipe assembly, the arrangements for lowering the well pipe into the well, and to the arrangement for supplying slush to the drilling bit.

In the art it has been suggested to employ the well known principles of pneumatic drilling and apply these principles to the drilling of deep wells, but as far as I am aware, no one has provided a well pipe or drop pipe assembly which enables well pipe sections to be conveniently connected so as to allow an extension of the compressed air supply pipe, the exhaust pipe from the pneumatic hammer, and the provision of a slush supply passage in a simple operation.

It is the object of my invention, therefore, to provide a pneumatic well drilling assembly in which previously assembled well drill pipe sections may be coupled together by a simple threading and packing operation, in which a continuous passage is provided for the supply of compressed air, for the exhaust of the air from the pneumatic hammer, and for the supplying of slush to lubricate the drill bit so that it can efficiently perform its drill function.

It is further my object to provide drill pipe sections in which sleeve packers are formed, in which packing can be compressed so as to form air tight connections between the supply of pneumatic fluid, the exhaust, and the mud supply.

It is further a specific object of my invention to provide a novel pneumatic hammer and drill bit assembly in which the mud supply is directed close to the drill bit so as to properly lubricate the same, and at the same time to have a cooling effect.

The above objects and other objects to which reference will be made in the ensuing disclosure, I accomplish by that certain combination and arrangement of parts of which I have shown a preferred embodiment.

Referring to the drawings:—

Figure 1 is a diagrammatic representation of a preferred type of rotary hoist for lowering the drill during the drilling operation.

Figure 2 is a diagrammatic view showing the drill bit assembly and continuation of the well under the general lay out view shown in Fig. 1.

Figure 3 is a sectional view of a preferred type of swivel joint to be attached to the pulley for raising and lowering same in the well.

Figure 4 is a sectional view of the drill stem through which rotary movement is communicated to the drill pipe.

Figure 5 is a sectional view taken along the lines 5, 5 in Figure 4.

Figure 6 is a sectional view of a preferred type of drill pipe.

Figure 7 is a sectional view taken along the lines 7, 7 in Figure 6.

Figure 8 is a sectional view of the drill bit assembly.

Figure 9 is a bottom plan view of the drill bit.

Figure 10 is a side elevation of the drill bit.

Figure 11 is a sectional view of a connecting joint between two sections of drill pipe.

Figure 12 is a sectional view taken along the lines 12, 12 in Fig. 11.

Figure 13 is a sectional view taken along the lines 13, 13 in Fig. 11.

Referring first to Figure 1, I have shown the usual supporting frame work 1 in which a pulley 2 is suspended by a cable 3 which passes over a pulley 4, and in which the cable may be raised and lowered by means of a hoist drum 5 operatively connected with a rotary engine indicated at 6.

I provide an air compressor 7 through which compressed air is delivered through the pipe 8 to a hose connection 9. A slush pump 10 pumps the mud or slush through a pipe 11 to the slush hose 12.

Referring to Figure 3, it will be observed that the swivel connection for the inlet air supply and the slush is supported by a bail 13, extending down as shown in Figure 1 from a yoke 14 extending down from the pulley 2, and that the air supply hose connects with a goose neck 15, and that the slush apply hose 12 connects with the goose neck 16.

The bail 13 is ordinarily non-rotatable so

that in order to insure easy rotation of the drill pipe, the swivel connection has ball bearings 17 which enable the bushing 18 to swivel freely in the casing 19, to which the goose necks 15 and 16 are connected.

A coupling member 20 is provided which has packing nuts 21 which prevent leakage of the slush from the nipple 22, which is a continuation of the inlet goose neck 16.

The passage for the air supply is through a pipe 23 to which the goose neck 15 is connected, and from which the leaking of air is prevented by the packing nuts 24. To the lower end of the casing 20 a short nipple 25 is threaded, to which the rotary section of the drill pipe is connected by means of a coupling 26.

The exhaust air from the pneumatic hammer passes upwardly through the intermediate annular opening between the outer wall of the pipe 23 and the exhaust pipe 27 which is concentric with the pipe 23.

Referring to Figure 3, it will be noted that a reinforcing disc 28 is welded to the nipple 25, and that there are extensions of the pipes 23 and 27 which have annular shoulders 30 and 31 respectively.

Referring now to Figure 4, it will be noted that the first section of the well pipe is coupled with a coupling 32, and that the first section of the well pipe has a reinforcing disc 33 welded within it through which the pipes 34 and 35 extend. The extensions of the pipes 23 and 27 fit within the pipes 34 and 35, and the shoulders 30 and 31 provide packing chambers which are suitably packed.

The driving pipe 36, which is connected to the swivel connection by means of the coupling 32, has a series of angular plates 37 welded to it so as to form a pipe which is square in shape so that it will fit within a rotary table 38 (shown in Fig. 1) and be driven at a desired rate of speed by a belt or chain 39 which, like the cable 3, is driven by the engine indicated at 6.

With the exception of the bottom or drill bit section of pipe, the other pipe sections are similar to the sectional view shown in Figure 6, and the connections between the pipes, with the preferred method of packing the joints, is best indicated in Fig. 11.

Referring to Figure 6, the outer casing is indicated at 36a. Within the casing are the air supply pipes 23a and the exhaust supply pipes 27a secured in position by reinforcing devices which, as shown in Fig. 13, may take the form of pins 33a which extend through pipes 27a and have inner ends bearing against the pipes 23a and outer ends bearing against the pipes 36a.

The upper end of each pipe 36a is threaded as indicated in Figure 6, and a steel female coupling member 34a may be employed for providing a tight connection with the coupling 32a secured to the lower end of each

drop piece assembly. The couplings 32a have upwardly extending internally threaded integrally formed sleeves 35a, 35b, into which the threaded lower ends of the pipes 23a, 27a are threaded. The couplings 32a also have downwardly extending integrally formed packing sleeves 35c, 35d with which the upper ends of the next lower pipe section 27a, 23a form packing chambers filled with packing. Ring nuts 35e, 35f may be employed to hold the packing in position. Referring to Figure 6, the pipes are assembled at the factory and comprise the pipes 36a to the lower end of which is threaded the steel male coupling 32a, with which are integrally formed the elements 35a, 35b, 35c, and 35d which have just been described. The upper end of each drop pipe section is provided with a female coupling 34a.

During the construction of the well, as soon as the drill bit has been sufficiently lowered into the well, a new section of pipe may be coupled on in accordance with the usual method of coupling pipes for driving deep wells, the only difference being that the packing 41 must be inserted to provide sealed joints for the air lines. The driving pipe 36, which is rotated by the table, is first elevated and disconnected from the drop pin section which is held up out of the well by suitable clamps. The driving pipe is then further elevated and lowered out of the way. A new drop pipe section is then connected to the drop pipe extending within the well. The coupled drop pipes are then lowered, after which the driving pipe 36 is again elevated and connected onto the new drop pipe section, after which drilling operations may again be started.

Referring now to the drill bit casing, I have illustrated the outer pipe 36b within which is preferably welded a casing 33a which has upwardly extending annular sleeves 34b and 34c which form a packing seal with the downwardly extending packing sleeves 35c, 35d at the lower end of the pipe section to which the drill bit casing is connected.

A cylinder 43 is welded or formed integrally with the pipe 36b which provides a cylinder 44 within which the piston 45 is reciprocated with a vibratory motion, thus vibrating the upper end 46 of the drill bit housing 47.

Compressed air passing down through pipe 23a passes through the central passage 48 in the supporting member 33a, and thence through the ports 49 to the valve mechanism (which is of usual type and is indicated at 50) and causes a vibratory reciprocation of the piston 45. The exhaust passes up through the passage 51 into the pipe 27a and thus is returned up through the casing.

The drill bit 52 is secured to the housing 47 by means of pins 53 in the usual manner.

The slushing mud passing down through

the annular passage between the inner wall of the pipes 36a and the outer walls of the pipes 27a, extends down through passages 54 arranged on opposite walls of pipe 36b and is thus discharged through the ports 55 close to the drill bit so that the slushing mud is conducted to a position in which it lubricates the drill bit freely, and being discharged close to the drill bit is not readily blocked up and further tends to keep the drill bit cool.

It will be observed from the construction described that I have provided well drilling apparatus in which the pipe sections may be readily coupled together and in which leak-proof joints are provided so that there is little chance of the apparatus getting out of order. The waste mud passes upwardly in the annular passage between the outer walls of the well pipe and the inner walls of the drilled hole. Referring to Figure 2, the waste slushing mud would pass upwardly through the annular channel 56 and be returned to the sump 42.

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

1. In pneumatic well drilling apparatus, a well drop pipe comprising an outer casing, concentric inner pipe casings retained permanently within said outer casing, and reinforcing members permanently secured at the ends of the drop pipe provided with means for forming packed joints between the several casing sections forming said drop pipe.

2. In pneumatic well drilling apparatus, a well drop pipe comprising an outer casing, concentric inner pipe casings retained permanently within said outer casing, and reinforcing members permanently secured at the ends of the drop pipe provided with means for forming packed joints between the several casing sections forming said drop pipe, said means comprising packer sleeves extending from said reinforcing members.

3. In pneumatic well drilling apparatus, a well drop pipe comprising an outer casing, concentric inner pipe casings retained permanently within said outer casing, and reinforcing members permanently secured at the ends of the drop pipe provided with means for forming packed joints between the several casing sections forming said drop pipe, said means comprising packer sleeves extending from said reinforcing members, said sleeves at one end of said drop pipe being spaced from the sleeves at the other end of said pipe.

4. In pneumatic well drilling apparatus, a series of well drop pipes coupled together, each pipe comprising an outer casing, concentric inner casings retained within said outer casing and having coupling members secured at the ends of the pipe provided with means for forming packed joints between the coupled drop pipes.

5. In pneumatic well drilling apparatus, a series of well drop pipes coupled together, each pipe comprising an outer casing, concentric inner casings retained within said outer casing and having coupling members secured at the ends of the pipe provided with integrally formed means for forming packed joints between the coupled drop pipes, said means comprising spaced packing sleeves at opposite ends of each pipe.

6. In pneumatic well drilling apparatus, a series of well drop pipes coupled together, each pipe comprising an outer casing, concentric inner casings retained within said outer casing and having reinforcing members secured at the ends of the pipe provided with means for forming packed joints between the coupled drop pipes, said means comprising spaced packing sleeves at opposite ends of each pipe, said packing sleeves at one end of the pipe having annular flanged ribs forming packing chambers.

7. In pneumatic well drilling apparatus, a series of well drop pipes coupled together, each pipe comprising an outer casing, concentric inner casings retained within said outer casing and having reinforcing members secured at the ends of the pipe provided with means for forming packed joints between the coupled drop pipes, means for supplying compressed air to the inner of said casings, means for passing exhaust air through an intermediate casing, and means for supplying slushing mud to the outer of said casings.

8. In pneumatic well drilling apparatus, a series of well drop pipes coupled together, each pipe comprising an outer casing, concentric inner casings retained within said outer casing and having reinforcing members secured at the ends of the pipe provided with means for forming packed joints between the coupled drop pipes, and a pneumatic hammer drilling unit coupled to a lowermost well drop pipe for the purposes described.

9. In pneumatic well drilling apparatus, a series of well drop pipes coupled together, each pipe comprising an outer casing, concentric inner casings retained within said outer casing and having reinforcing members secured at the ends of the pipe provided with means for forming packed joints between the coupled drop pipes, and a pneumatic drilling unit coupled to a lowermost well drop pipe for the purposes described, and a passage extending through said drilling casing from said outer casing, said passage extending into proximity to the lower end of said drilling casing.

10. Pneumatic well drilling apparatus comprising in combination, a series of well pipes coupled together, each well pipe having an integrally welded compressed air passage, an outer lubricating passage and an intermediate exhaust air passage.

11. Pneumatic well drilling apparatus

comprising in combination, a series of well pipes coupled together, each well pipe having an integrally welded compressed air passage, an outer lubricating passage and an intermediate exhaust air passage, each of said pipes being provided at its ends with means for sealing said passages when one pipe is coupled to another.

12. Pneumatic well drilling apparatus comprising in combination, a series of well pipes coupled together, each well pipe having an integrally welded compressed air passage, an outer lubricating passage and an intermediate exhaust air passage, each of said pipes being provided at its ends with means for sealing said passages when one pipe is coupled to another, said means comprising bracing members having concentrically arranged packer sleeves.

13. Pneumatic well drilling apparatus comprising in combination, a series of well pipes coupled together, each well pipe having an integrally welded compressed air passage, an outer lubricating passage and an intermediate exhaust air passage, and a well drill casing secured to a lowermost well pipe provided with a passage therein extending to the lowermost end of said well drill casing.

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