

Oct. 21, 1952

O. T. BROYLES

2,614,633

BUSHING INSERTING TOOL

Filed Oct. 8, 1947

2 SHEETS—SHEET 1

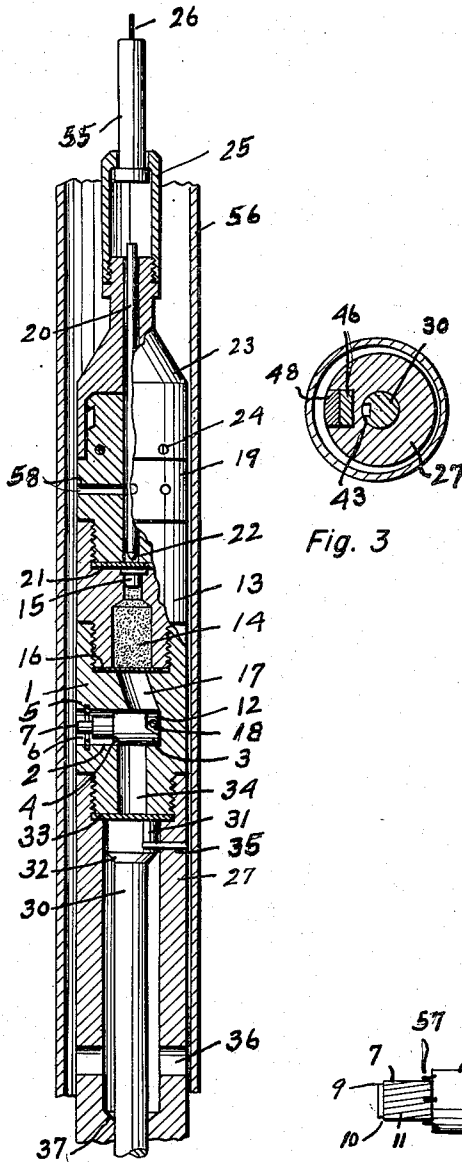


Fig. 3

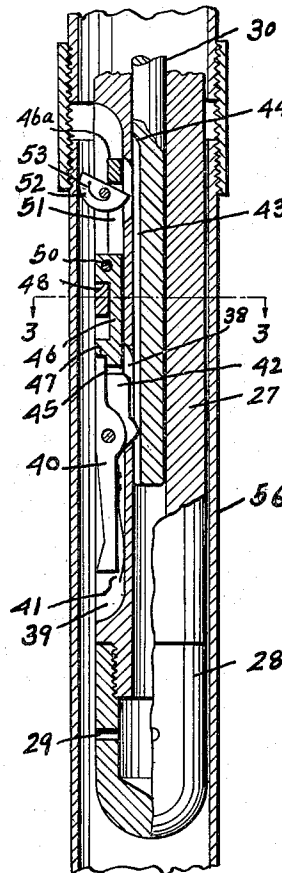


Fig. 2

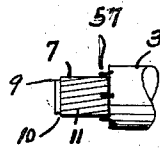


Fig. 4

Fig. 1

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2 SHEETS—SHEET 2

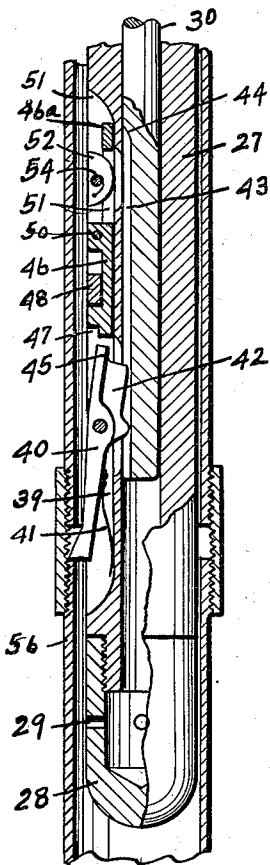


Fig. 5

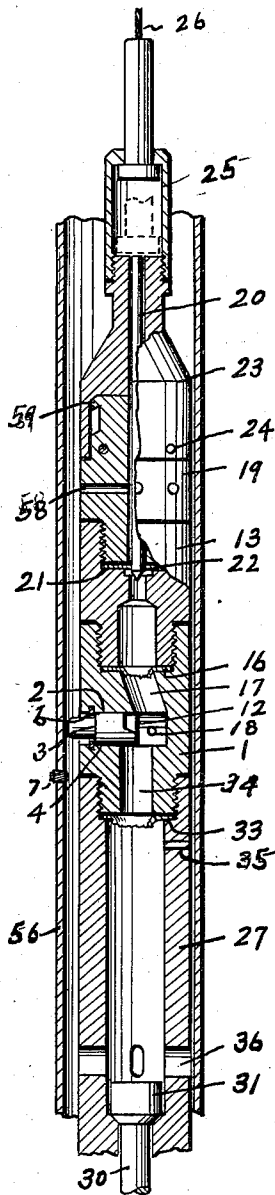


Fig. 6

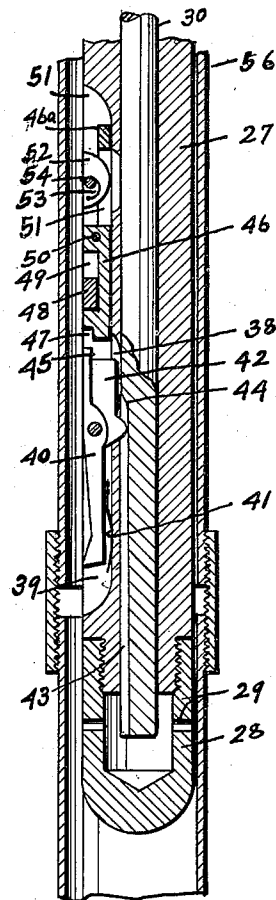


Fig. 7

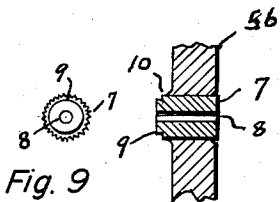


Fig. 9

Fig. 8

334

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UNITED STATES PATENT OFFICE

2,614,633

BUSHING INSERTING TOOL

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3 Claims. (Cl. 166-1)

1

This invention relates to a bushing inserting tool.

An object of the invention is to provide a well tool of the character described adapted to be lowered into a pipe which is located in a well bore and which is operative to punch a bushing through the pipe. This bushing is provided with a flow channel, or orifice, therethrough through which fluid may enter the pipe.

It is, at times, desirable to introduce pressure fluid into the well to assist in the flow of the well fluid through the well tubing and when this becomes necessary the tool herein described may be lowered to the desired location and the bushing punched through the pipe to provide for the inflow of the pressure fluid and, if desired bushings may be inserted at different elevations for the introduction of this pressure fluid.

It is another object of the present invention to provide a tool of the character described which is composed of few movable parts, the essential movable parts being the bushing itself and an explosive actuated plunger for forcing the bushing through the pipe.

It is a further object of the invention to provide, in a tool of the character described, means for quickly relieving the pressure generated by the explosion upon insertion of the bushing through the pipe wall.

A further object of the invention resides in the provision of a novel type of bushing which may be effectively punched through the pipe but which cannot be displaced and which is formed of hard, wear resisting material so that it will not be readily cut out by the inflow of gritty fluid therethrough.

The invention also embodies novel means for anchoring the tool at a selected place in the pipe.

Other objects and advantages will be apparent from the following specification which is illustrated by the accompanying drawings wherein:

Figure 1 is a vertical, sectional view of the upper end of the tool while being lowered into a well pipe.

Figure 2 is a vertical, sectional view of the lower end thereof.

Figure 3 is a cross-sectional view taken on the line 3-3 of Figure 2.

Figure 4 is a fragmentary, side view of the carrier showing the orifice bushing carried thereby.

Figure 5 is a vertical, sectional view of the lower end of the tool supported in position in the well.

Figure 6 is a vertical, sectional view of the upper end of the tool succeeding the punching of

2

the bushing into the well pipe and the tool partly elevated.

Figure 7 is a vertical, sectional, view of the lower end of the tool as shown in Figure 6.

Figure 8 is an enlarged, longitudinal, sectional view of the orifice bushing in the well tubing, and

Figure 9 is an end view of the bushing.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the figures, the numeral 1 designates a cylindrical body having a radially extended barrel 2. Within this barrel there is a plunger 3 whose inner end fits snugly in the barrel but whose outer end is slightly reduced in diameter thus forming an external annular shoulder 4 around the plunger.

Within the outer end of the barrel there is an annular groove 5 and a snap ring 6 is located in this groove and forms a stop against which the shoulder 4 engages to limit the outward movement of the plunger.

Secured to the outer end of the plunger there is a bushing 7 which has a passageway 8 extending longitudinally therethrough. This passageway, or channel, 8 may be of any selected transverse diameter and the bushing is formed of hard wear resisting material so that it will not be readily cut out and enlarged by gritty fluid flowing under pressure therethrough.

Any selected type of bushing may be used but what is now considered a preferred form of the bushing is shown. It is reduced in external diameter at its outer end and formed with the annular cutting edge 9, this reduction forming an external annular shoulder 10 near the outer end of the bushing. It has been found in practice that this type of bushing will more readily penetrate the pipe. Also the bushing is provided with external ribs 11 which, preferably, are parallel but are arranged slightly diagonally with respect to the axis of the bushing and these ribs embed themselves into the material of the pipe around the punched hole to form a very secure anchorage for the bushing when it is inserted through the pipe wall.

The inner end of the plunger 3 is provided with a cavity 12 extending from the upper side of the plunger and terminating just above the lower side thereof for a purpose to be hereinafter stated.

Screwed into the upper end of the body 1 there is a coupling 13 whose lower end is provided with a powder chamber 14. The upper end of this chamber 14 is reduced in diameter to receive a primer cartridge 15.

3

Clamped between the lower end of the coupling 13 and the opposing end of the body 1 there is a frangible disc 16 preferably formed of bronze or copper so as to retain the powder charge in the chamber 14.

The body 1 is provided with an expansion chamber 17 which is separated from the powder chamber by said disc 16 and this expansion chamber 17 communicates with the cavity 12 at the rear, or inner, end of the plunger 3 and the plunger is maintained in position to assure this communication by means of a frangible pin 18.

Screwed into the upper end of the coupling 13 there is an elongated gland 19 through which the firing pin 20 slides axially and clamped between the lower end of the gland 19 and the opposing end of the coupling 13 there is a disc 21 preferably formed of bronze or copper or other relatively soft material.

The lower end of the firing pin 20 is provided with point 22 which rests on the disc 21 opposite the primer cartridge 15 when the tool is assembled ready for firing.

Fitted over the reduced upper end of the gland 19 there is a cap 23 which may be pinned to said gland by means of frangible pins, as 24, or otherwise secured thereto. The firing pin 20 extends up through and beyond said cap.

Threaded onto the upper end of the cap 23 are the jars 25 connected to which there is a cable 26 by means of which the tool may be lowered into and withdrawn from the well. Any conventional type of jars may be employed.

Provision has been made for anchoring the tool at any selected location in the well pipe as well as for efficiently releasing the exhaust pressure at the proper time, which will now be described.

Screwed onto the lower end of the body 1 there is a barrel 27 whose lower end carries a guide point 28 provided with suitable outlet passageways, as 29.

In the barrel there is an elongated solid plunger 30 whose upper end is enlarged, forming a head 31 which fits closely within the barrel. The enlargement of the upper end of the plunger forms an external annular shoulder 32 around the plunger for a purpose which will be herein-after stated.

Clamped between the lower end of the body 1 and an opposing inside shoulder within the upper end of the barrel there is a disc 32 formed of brass or bronze or other suitable soft material and which normally closes the exhaust passage-way 34 which leads downwardly through the body from the cylinder 2.

The plunger 30 is pinned in its upper position, upon assembly of the tool, by means of the frangible pin 35.

The barrel 27 is provided with a plurality of exhaust ports 36 which are spaced beneath its upper end and beneath these exhaust ports the barrel is provided with an inside annular shoulder 37 on which the shoulder 32 lands when the plunger 30 is moved to its lower position.

The barrel 27 is provided with a side slot 38 which is cut through the barrel wall and extending downwardly from said side slot and aligned therewith there is a groove 39 which forms a continuation of the side slot and pivotally mounted in said slot to work on a transverse axis there is a supporting arm 40. There is a leaf spring 41 whose upper end is secured to the inside of the supporting arm 40 and whose lower end is inwardly curved and free and bears against the

4

bottom of the groove 39 so as to tend to hold the lower end of the supporting arm in its outer position extending outwardly beyond the barrel.

The upper end of the arm 40 is extended above the pivot on which said arm works and the inner margin of said upper end is formed into a relatively narrow key 42 which works in a longitudinal keyway 43 in the plunger 30. This keyway extends from the lower end of the plunger up to an intermediate point and terminates in an upwardly and outwardly flared end 44.

The upper end of the arm 40 is provided with an inwardly directed shoulder 45.

Slidably mounted on the barrel 27 above, and in alignment with, the slot 38 there is a latch 46 whose lower end is provided with an external notch 47 to receive the shoulder 45, when the latch is in its lower position, to hold the supporting arm 40 in its inactive position, that is with its lower end retracted into the slot 39. This latch 46 is retained in position by a transverse retainer 48 which is seated in a vertically elongated notch 49 in the latch and which is suitably fastened to the barrel 27.

When the tool is in inoperative, or inactive, position the latch 46 is in its lower position with the shoulder 45 seated in the notch 47 and said latch is temporarily retained in said lower position by means of a shear pin 50, as is best illustrated in Figure 2. The latch 46 slides in a vertical groove 51 cut in the external surface of the barrel 27 and in substantial alignment with the groove 39. The latch 46 has an upward extension 46a which is provided with a vertical slot 51.

Pivotally mounted in the slot 51 and on the body 27 there is a trigger 52. This trigger is of a semi-circular shape with its straight edge normally held in a flush relation with the surface of the barrel 27 by means of a tension spring 53, one end of which is attached to the stationary axis pin 54 on which the trigger works and whose other end is attached to the trigger. The curved margin of the trigger 52 works in the slot 51, as shown in Figures 5 and 7.

When it is desired to run the tool into the pipe in a well the latch 46 will be interengaged with the upper end of the supporting arm 40, as is indicated in Figure 2, and will be maintained in that position by the shear pin 50 and just before the trigger enters the upper end of the pipe it will be swung around in a clockwise direction, as indicated in Figure 2, so that its outer end will ride against the inner surface of the pipe.

As the tool is lowered the trigger 52 will pass the pipe couplings freely without engaging therein and the lower end of the supporting arm 40 will be held retracted into the groove 39, as shown in Figure 2. When a point has been reached where it is desired to operate the tool the tool may be pulled upwardly and the outer end of the trigger 52 will engage in the coupling above and the outer end of said trigger will be thereby held and as the tool is moved further upwardly the inner end of the trigger will engage the upper end of the slot 51 thus exerting an upward pull on the latch, shearing the pin 50 and releasing the latch from the upper end of the supporting arm 40 and thereupon the spring 41 will force the lower end of the supporting arm outwardly into the position shown in Figure 5 and when the tool is then lowered the supporting arm 40 will engage in the next succeeding collar beneath and thus securely support the tool in the well pipe at the desired location, as indicated in Figure 5.

5

The jars may then be operated. Any type of jars may be employed. As shown the jars include a hammer 55 to whose upper end the cable 26 is secured and upon suitable manipulation of the cable the hammer 55 may be dropped against the upper end of the firing pin 20 thus causing the point 22 of said pin to perforate the disc 21 and fire the primer cartridge 15 which ignites the main charge 14. The explosion will rupture the disc 16 and a high pressure will be suddenly created in the expansion chamber 17 which will suddenly drive the plunger 3 outwardly forcing the bushing 7 through the well pipe 56, as is indicated in Figure 6. As hereinbefore indicated, the forward end of the bushing is so formed that the bushing will readily penetrate the pipe and the external ribs on the bushing will embed themselves into the material of the pipe around the punched hole so as to maintain the bushing in the pipe.

The bushing may be detachably secured to the plunger 3 in any preferred manner. As illustrated in Figure 4 it is gripped by the gripping fingers 57 on the forward end of the plunger 3 which will release the bushing when the bushing is punched into the pipe.

The gland 19 is provided with a plurality of radial exhaust ducts 58 to permit an exhaust of a portion of the pressure from the explosion and upon forward movement of the plunger 3 the exhaust passageway 34 will be partially cleared by the plunger and will rupture the disc 33 thus forcing the plunger 30 downwardly, shearing the pin 35 and the head 31 will finally land on the shoulder 37 clearing the exhaust openings 36 to allow a free exhaust.

After the insertion of the bushing the tool may then be elevated and the trigger 42 will assume its normal position, as shown in Figure 7, and the lower end of the slot 38 will engage the lower end of the narrow key 42 operating to retract the supporting arm 40 into the slot 39, as shown in Figure 7, and the tool may then be readily withdrawn from the well pipe.

Should the inserting tool become stuck in the well an upward pull may be exerted on the cable 26 sufficient to shear the pins 24 and remove the cap 23 which may be drawn to the ground surface and any conventional type of grapple, of sufficient strength for the purpose, may then be lowered into the well pipe and engaged over the external annular flange 59, provided for the purpose on the upper end of the gland 19 and the inserting tool may then be withdrawn from the well.

The drawings and description are illustrative merely while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. A well tool for punching an orifice bushing into a pipe in a well comprising, a housing having an expansion chamber therein and an explosion chamber associated with the expansion chamber said housing having a bore in communication with the expansion chamber and opening outwardly through the wall of the housing, a bushing in the bore having an orifice therethrough, a bushing carrier movably positioned in the bore adjacent the inner end of the bushing means releasably connecting the bushing to the carrier, means in the bore engageable with

6

the carrier to limit outward movement of the carrier in the bore, said carrier having a cavity therein positioned to provide an extension of the expansion chamber, means for creating an explosion in the tool to cause expansion of the fluid in the expansion chamber to drive the carrier and bushing radially outwardly to force the bushing to punch the pipe.

2. A well tool for punching an orifice bushing into a pipe in a well comprising, a housing having an expansion chamber therein and an explosion chamber associated with the expansion chamber, said housing having a bore in communication with the expansion chamber and opening outwardly through the wall of the housing, a bushing in the bore having an orifice therethrough, a bushing carrier movably positioned in the bore adjacent the inner end of the bushing, said carrier having a cavity therein positioned in communication with said expansion chamber, means releasably connecting the bushing to the carrier, means in the bore engageable with the carrier to limit outward movement of the carrier in the bore, means for creating an explosion in the tool to cause expansion of the fluid in the expansion chamber to drive the carrier and bushing radially outwardly to force the bushing to punch the pipe.

3. A well tool of the character described comprising, a housing having an expansion chamber therein and an explosion chamber associated with the expansion chamber, said housing having a bore in communication with the expansion chamber and opening outwardly through the wall of the housing, a bushing in the bore having an orifice therethrough, a bushing carrier in the bore adjacent the inner end of the bushing and having a cavity in its inner end, means for positioning said carrier in the bore with said cavity in communication with said expansible chamber, said housing having an exhaust passageway opening into said expansion chamber and normally closed by said carrier, means for creating an explosion in the tool to cause expansion of the fluid in the expansion chamber to drive the carrier and bushing outwardly to force the bushing to punch the pipe and to open the exhaust passageway.

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