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PIPE PERFORATOR

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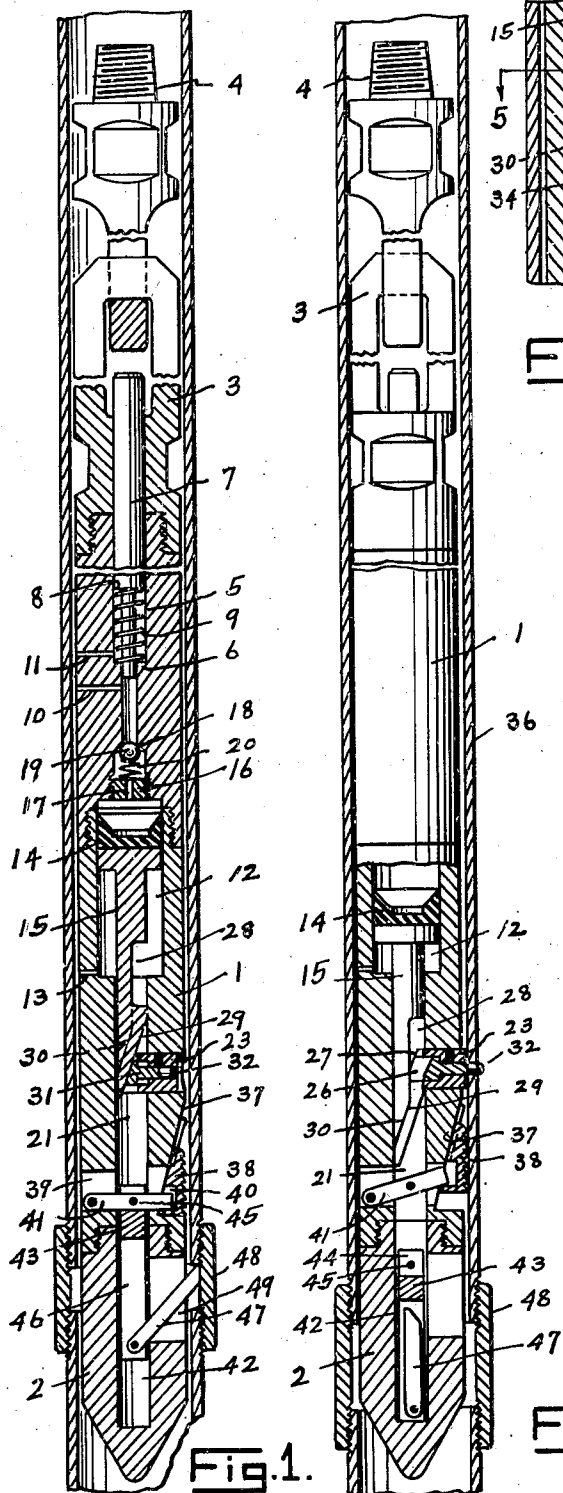


Fig. 4.

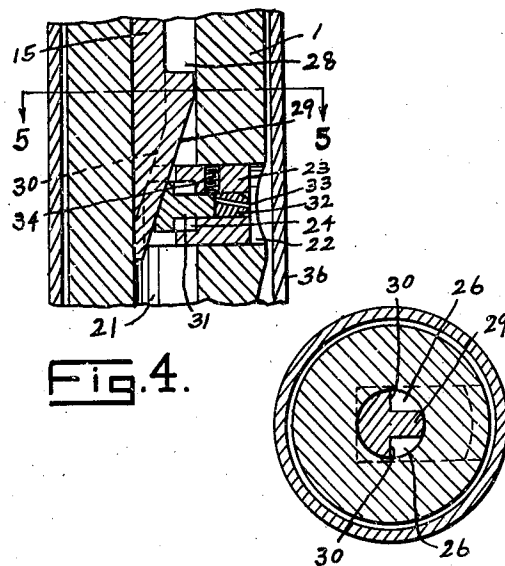


Fig. 5.

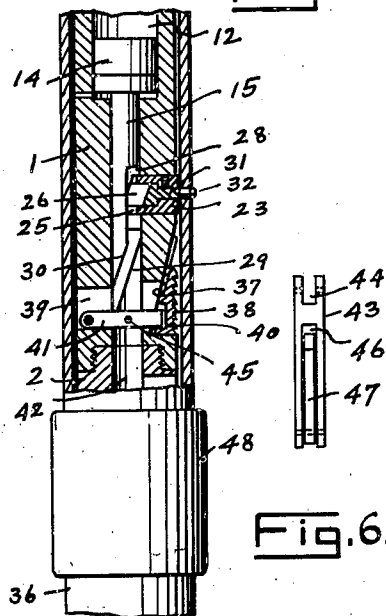


Fig. 6.

Fig.3.

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PIPE PERFORATOR

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4 Claims. (Cl. 166—1)

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This invention relates to a pipe perforator.

An object of the invention is to provide a tool of the character described specially designed for the purpose of perforating a pipe in a well bore to permit the inflow of the surrounding fluid.

A further object of the invention is to provide a pipe perforator of the character described whereby the pipe may be not only perforated but a plug, having an inflow channel therethrough, may be securely set in the perforation. This plug may be formed of material of such nature that the channel through it will not become unduly enlarged by the abrasive influence of grit in the inflowing fluid.

A further object of the invention is to provide a tool of the character described which may be set at a selected place in the pipe and after the pipe has been perforated may be released and withdrawn from the pipe and reloaded for another operation so that as many perforations as desired may be made in the pipe.

It is a further object of the invention to provide, in a tool of the character described, a hydraulically operable perforating mechanism.

With the above and other objects in view, the invention has particular relation to certain novel features of construction, operation and arrangement of parts, an example of which is given in this specification and illustrated in the accompanying drawings, wherein:

Figure 1 shows a vertical, sectional view of the tool in position to be set in the well pipe.

Figure 2 shows a vertical, sectional view of the tool set in the well pipe with the perforating mechanism in active position.

Figure 3 shows a fragmentary, side view, partly in section, showing the tool released and ready to be withdrawn from the pipe.

Figure 4 shows an enlarged, fragmentary, sectional view of the perforating mechanism.

Figure 5 shows a cross, sectional view taken on the line 5—5 of Figure 4.

Figure 6 shows a detached, elevational view of the collar finder.

Referring now more particularly to the drawings wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates the body of the tool which may be formed of sections screwed together. Screwed onto the lower end of the body there is a guide 2 and screwed onto the upper end of the body are the jars 3 comprising interconnecting links slackly linked together. The upper end of the jars are provided with an outwardly threaded pin 4 to

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receive a rope socket by means of which an operating line may be connected to the tool.

In the upper end of the body there is a cylinder 5 which extends on up through the lower jar member and the lower end of this cylinder is reduced forming an upwardly facing shoulder 6. In this cylinder there is a plunger 7 whose lower end is reduced forming a downwardly facing shoulder 8 said reduced lower end fitting into the reduced lower end of the cylinder.

Around said plunger and interposed between said shoulders there is a strong coil spring 9. The cylinder has an intake channel 10 beneath the shoulder 6 and a discharge channel 11 above said shoulder.

Beneath the cylinder 5 there is a larger cylinder 12 whose lower end has a discharge channel 13. In the cylinder 12 there is a piston 14 depending from which there is a stem 15.

Screwed into the body above the cylinder 12 there is a plug 16 having a passageway 17 for fluid therethrough.

The lower end of the cylinder 5 is formed with the valve seat 18 which is normally closed by the downwardly opening valve 19. This valve is held in closed position by means of a coil spring 20 which is supported on the plug 16.

Upon upward movement of the upper jar member the plunger 7 will be elevated by the spring 9 and liquid will be drawn into the reduced lower end of the cylinder 5 through the channel 10. Upon downward movement of the upper jar member the plunger 7 will be forced downwardly, the liquid in the cylinder 5 above the shoulder 6 being forced out through the channel 11 and the liquid in the reduced lower end of said cylinder being forced downwardly past the valve 19 and through the channel 17 into the upper end of the cylinder 12. As the plunger 7 is thus reciprocated additional liquid will be forced into the cylinder 12 and the piston 14 therein will be forced downwardly. As the piston 14 moves downwardly the stem 15 will also move downwardly through the axial bore 21 in the body 1 beneath.

Beneath the cylinder 12 the body 1 is provided with a radial bore 22 which extends inwardly to the bore 21 and mounted in the bore 22 there is a tubular barrel 23 whose inner end is formed with a socket 24. The inner end of this barrel 23 is also provided with a vertical slot 25 thus forming the side flanges 26, 26 one on each side of said slot, whose upper ends are formed with the beveled faces as 27.

The stem 15 has a vertically elongated side

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notch 28 and beneath said notch it is provided with a central downwardly tapering rib 29 and the downwardly tapering side bearing faces 30, 30.

Within the barrel 23 there is fitted a plunger 31 whose inner end is enlarged and located in the socket 24. The inner end of the plunger 31 is tapered to conform to the taper of the rib 29, as shown more clearly in Figure 4.

Mounted in the outer end of the bore of the barrel 23 there is a plug 32 having an axial channel 33 therethrough. When the barrel is loaded, as shown in Figure 4, the plunger 31 and plug 32 are held in fixed position in the barrel by a set screw 34 which is screwed through the barrel and whose inner end abuts against the plunger 31 and plug 32, as shown in Figure 4, with the enlarged inner end, or head, of the plunger 31 in its inward position.

As the piston 14 is forced downwardly, as hereinabove explained, the bearing faces 30 will engage against the inner ends of the side flanges 26 and will force the barrel 23 outwardly into contact with the pipe 36 to be perforated and thereupon the tapering faces 30 will pass by said flanges and the barrel will not be forced further outwardly but the tapering face of the rib 29 continues to operate against the plunger 31 to force the same further outwardly into the position shown in Figure 2 and the plug, or insert, 32 is forced through the pipe 36, as shown in Figures 2 and 3. The outside fluid may thereupon flow in through the channel 33 into the pipe 36.

Means have been provided for anchoring the tool in the pipe 36 and for releasing the same therefrom. Said anchoring and releasing means will now be described.

The lower end of the body has a downwardly and inwardly tapering face 37 with which the wedge shaped jaw 38 has a dovetailed slidable connection. The inner side of the jaw 38 is tapered to conform to the taper of the face 37 and its outer side has pipe engaging teeth. The lower end of the body has a transverse slot 39 and opposite said slot the inside of the jaw 38 has a recess 40. There is a retaining arm 41 whose free end extends into the recess 40 and whose other end is pivoted to the body. This arm works in the slot 39. The guide 2 has an axial socket 42 therein in which there is located a carrier 43. The upper end of this carrier has a slot 44 to receive the arm 41 and said arm is pinned to the carrier and the body by means of a frangible pin 45. The lower end of the carrier has a deep slot 45 in which the finger 47 is located. The lower end of this finger is pivoted to the carrier and its upper end is free and beveled, as shown in Figures 1 and 2.

The sections of the pipe 36 are usually connected by outside couplings as 48 said ends being spaced apart, as shown in Figures 1 and 2.

The tool may be assembled, as shown in Figure 1, and let down into the pipe to be perforated. The pin 45 and arm 41 will hold the jaw 38 in its lower inner position so that it will not engage the pipe 36 and prematurely set the tool, and the finger 47 will extend through the side slot 49 of the guide 2 and its beveled end will ride against the inside of the pipe 36. When the tool has been lowered to the desired location it may then be elevated and the free end of the finger 37 will engage in the pipe coupling 48 above and against the lower end of the corresponding pipe section, as shown in Figure 1 and upon further upward movement of the tool the pin 45 will be sheared and the carrier will drop down into the socket 42, as shown in Figure 2, thus retracting the finger 47,

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as shown in said figure. The jaw 38 will then be free to move upwardly. Thereupon the tool may be elevated and suddenly dropped and the inertia of the jaw 38 will allow the face 37 to move downwardly relative thereto and force the jaw outwardly into the position shown in Figure 2 and said jaw will engage the pipe 31 and support the tool against further downward movement. The jars 3 may be manipulated to pump fluid against the piston 14, as hereinabove explained, to force said piston and stem 15 downwardly to force the plug, or insert, 32 through the wall of the pipe 36, as hereinabove explained. The pumping operation may then be continued to force the plunger 14 on downwardly into the position shown in Figure 3. The inner end of the barrel and plunger assembly 23, 31 will be received in the notch 28 and the lower end of the stem 15 will engage the arm 41 and force it downwardly thus forcing the jaw 38 downwardly and inwardly and out of engagement with the pipe 36, as shown in Figure 6, so that the tool may then be withdrawn from the well and reloaded and reset for another operation.

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

What I claim is:

1. A pipe perforator comprising, a body shaped to be lowered into a pipe in a well and having a radial bore opening outwardly thereof, a tubular barrel slidable in the bore of the body, a plug mounted in the barrel and having an inlet channel therethrough, a slidable plunger in the barrel behind the plug, means retaining the plunger and plug initially in inner position, means for forcing the barrel and plug assembly radially outwardly, as a unit to contact the barrel with the well pipe, and means for forcing the plug further radially outwardly, independent of the barrel, to cause the plug to penetrate the wall of the pipe.

2. A pipe perforator comprising, a body adapted to be inserted into a pipe in a well and having a radial bore opening outwardly thereof, releasable means for anchoring the body in the pipe, an assembly slidable in the bore including a tubular barrel, a plug in the barrel and a plunger in the barrel inwardly of the plug, means adapted to retain the plug and plunger initially in their inner position in the barrel, hydraulically operable wedge means associated with the body and adapted to force the assembly outwardly as a unit to contact the barrel with the well pipe, upon initial actuation thereof, and upon further actuation thereof to force the plug outwardly of the body and into and through the pipe, said hydraulically operable means being adapted, upon final movement thereof, to positively release the anchoring means to permit the withdrawal of the tool from the well.

3. A pipe perforator comprising, a body adapted to be inserted into a pipe in a well and having a radial bore opening outwardly thereof, a pipe engaging jaw mounted on the body, means for positively retaining the jaw in retracted, or inner, position while the tool is being lowered into the pipe, means engageable with the pipe, upon upward movement of the tool therein, and effective to release the jaw, means for moving the jaw outwardly into engagement with the pipe upon subsequent downward movement of the tool, a barrel slidable in the bore of the body, a channeled plug in the barrel, a plunger in the barrel behind the plug, means retaining the plunger and plug, initially in inner position in the barrel,

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hydraulically operable means associated with the body and adapted to force said barrel outwardly against the pipe and to force the plug further outwardly into and through the pipe, said hydraulically operable means being adapted, upon final movement thereof, to release the jaw from the pipe to permit the withdrawal of the tool from the well.

4. A pipe perforator comprising, a body adapted to be inserted into a pipe in a well and having a radial bore opening outwardly thereof, a pipe engaging jaw mounted on the body, means for positively retaining the jaw in retracted, or inner, position while the tool is being lowered into the pipe, means engageable with the pipe, upon upward movement of the tool therein, and effective to release the jaw, means for moving the jaw outwardly into engagement with the pipe upon subsequent downward movement of the tool, a barrel slidable in the bore of the body, a channeled plug in the barrel, a plunger in the barrel behind the plug, means retaining the plunger and plug initially in their inner position in the

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barrel, operable means associated with the body and adapted to force said barrel outwardly against the pipe and to thereafter force the plug outwardly of the body and into and through the pipe, said operable means being adapted, upon final movement thereof, to release the jaw from the pipe to permit the withdrawal of the tool from the well.

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