

March 30, 1965

J. M. HILLARD

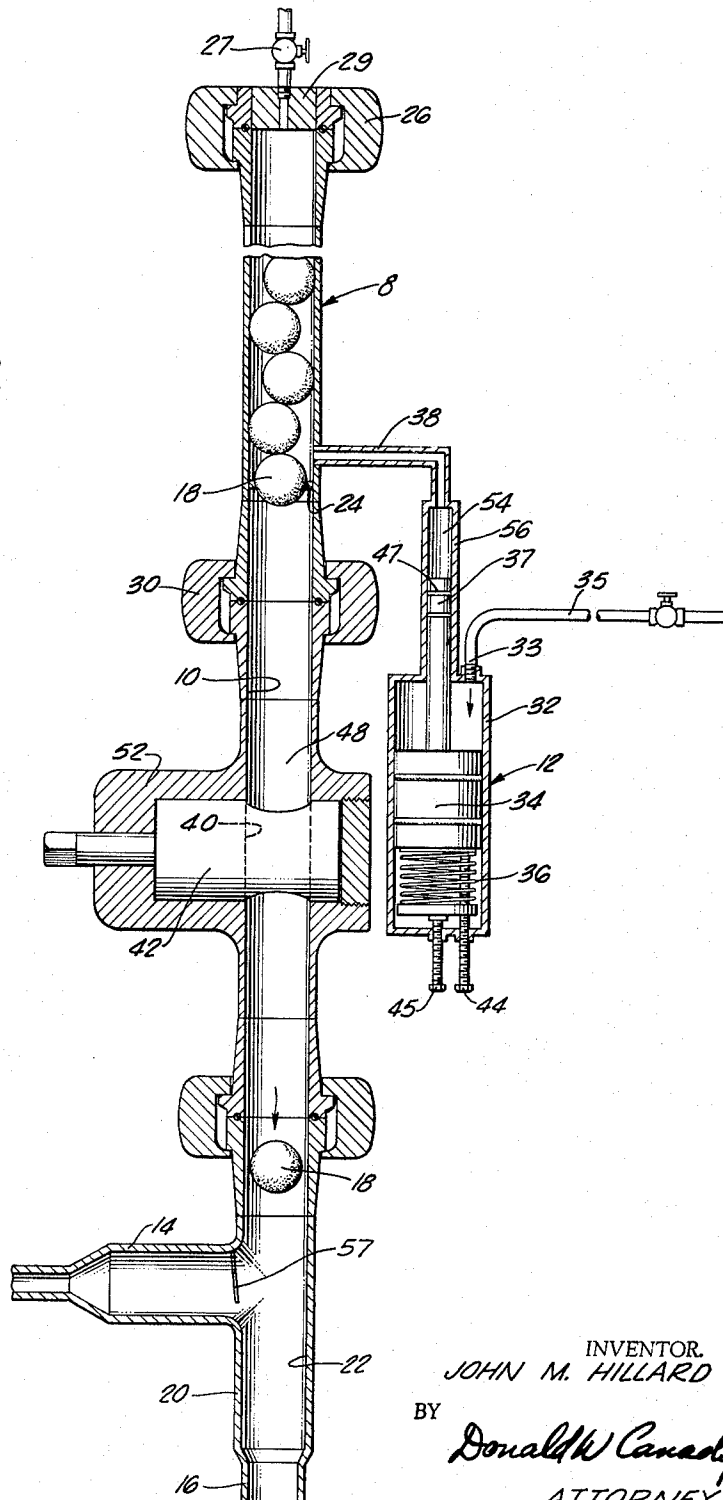
3,175,240

HYDRAULIC FIG INJECTOR

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2 Sheets-Sheet 1

FIG. 1.



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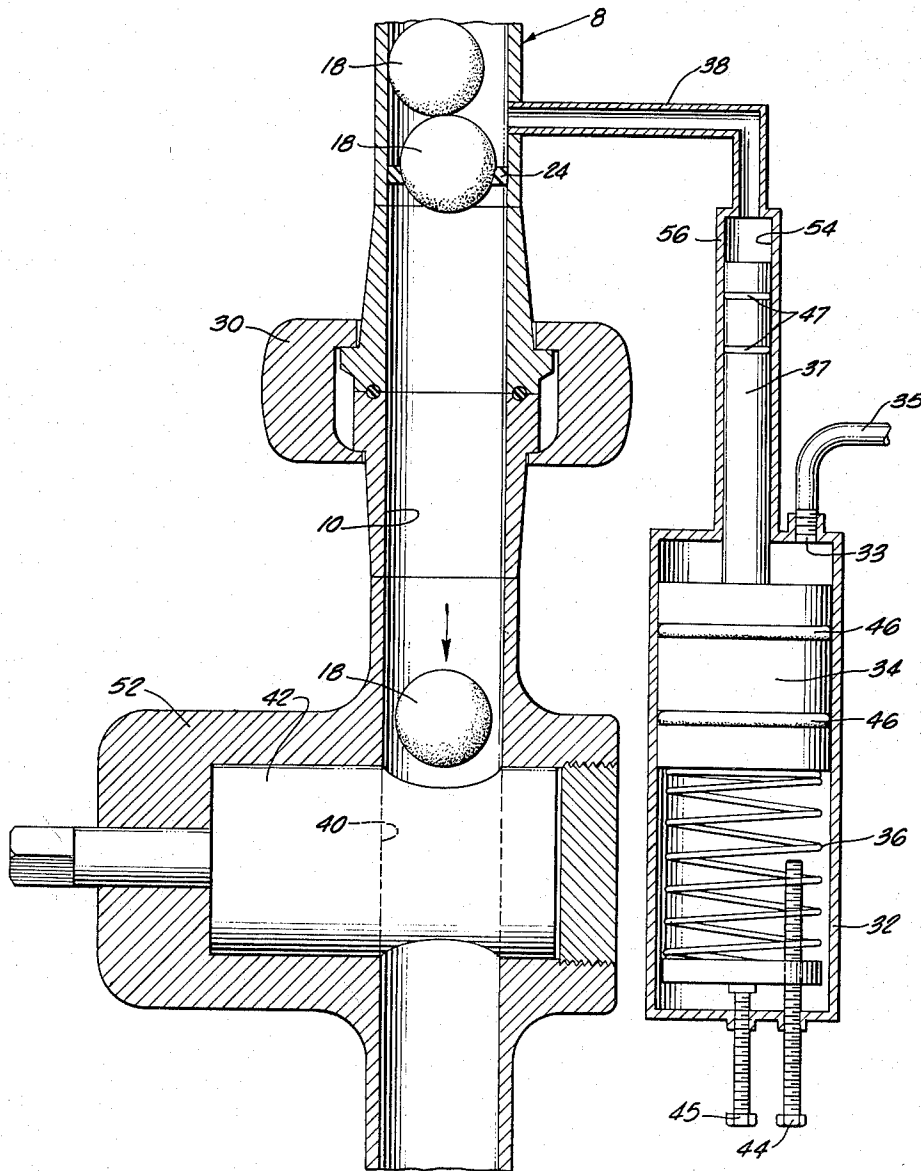


FIG. 2.

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HYDRAULIC PIG INJECTOR

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6 Claims. (Cl. 15—104.06)

My present invention relates to means for cleaning flow lines and, more particularly, relates to a cleaning plug or "pig" injector system for automatically injecting such pigs into a flow line used to transport oil and gas.

The accumulation of waxes, asphaltines, and scale in flow lines tends to restrict flow through such lines. Various chemical, mechanical and heating methods have been proposed for removing deposits from the internal surfaces of flow lines, tubing pipes and the like. This invention relates generally to the mechanical method for removing such deposits with a cleaning plug or "pig" which is inserted into a flow line, pipe line, or the like and forced through the line by the pressure of the fluid flowing there-through to thereby clear the pipe of the aforementioned restrictions. This invention is more specifically concerned with providing a device for inserting a pig into a flow line at or near the well head of an underwater oil well without interrupting flow of the well. The embodiment of my present invention described herein relates to offshore operations, however, my present invention may also be utilized in onshore operations.

The pig utilized in my present invention may be of any resilient material which is resistant to swelling upon contact with well fluids or moisture and may also be of the type which is soluble in the well fluids. Generally, the shape of the pig should conform to the cross sectional configuration of the flow line to be cleaned and preferably is either spherical or cylindrical.

The cleaning plugs have been manually injected into the flow lines; however, excessive labor is encountered in cleaning flow lines with manually injected pigs when the wells are widely separated. On the other hand, certain wells because of their inaccessibility have not previously been considered amenable to plug cleaning.

It is an object of the present invention to provide a means for remotely injecting a pig into a flow line to remove scale and other accumulations therefrom.

It is also an object of the present invention to provide a means for remotely injecting a pig into a flow line with the use of fluid pressure.

Other objects and a more complete understanding of my present invention may be had by reference to the following specification and the appended claims when taken in conjunction with the accompanying drawing, wherein:

FIG. 1 shows an elevation of the pig injector apparatus of my present invention in cross-section;

FIG. 2 shows in cross-sectional elevation an enlarged view of the plug injecting mechanism of my present invention when a plug is ejected from the storage chamber.

With reference to the drawing generally, the pig injector of my present apparatus may be installed on the flow line between the well head (not shown) and the flow control valve (not shown) and consists of a pig storage chamber 8 and a pig injector 12 for moving a pig from the chamber 8 into the flow line 16 where it is moved by the flow of well fluids through the flow line to remove and prevent the accumulation of deposits in the flow line.

Referring now more particularly to the drawing, a pig injector assembly is installed in a flow line downstream from the well head (not shown). The production from the well head flows from well flow line 14 out through pipe 16 to conventional master valve and metering facilities (not shown). A pig 18 is forced from the pig storage chamber 8 through channel 10 into the flow line T adapter

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20 where it enters the flow line 16. The bore of the flow line T adapter and the pig chamber are enlarged so that the pig may readily be run from the pig chamber into the throat 22 of the T adapter where it may then be forced through the narrower flow line 16 by the pressure of production flow, as previously stated.

Several pigs may be stored in the pig chamber 8 and are supported therein on a suitable restriction such as orifice 24. The pigs are inserted into the pig chamber 8 and the chamber sealed with a unbolt coupling 26. Pigs may be inserted into the pig chamber 8 by first closing shutoff valve 42, bleeding off the hydraulic pressure in the pig chamber 8 above valve 42 by opening bleeder valve 27 and then removing the unbolt coupling 26. The bleeder valve is incorporated in a cap member 29. After the pig chamber 8 has been loaded and the coupling 26 and cap 29 replaced, the chamber may be pressurized by opening valve 42. Pressure is also built up against the piston 34 in the pig injector cylinder 32 by pressurizing the hydraulic control system through line 35, thus moving the piston 34 in cylinder 32. The pig chamber 8 together with injector assembly 12 may be removed by uncoupling the unbolt coupler 30.

The pig injector 12 consists of a hydraulic cylinder 32 which has a piston member 34 therein. The piston 34 is normally maintained at the bottom of the cylinder against the force of spring 36 by hydraulic pressure from the well head hydraulic control line 35 supplied to the cylinder 32 through inlet port 33. In order to inject a pig into the flow line 16, the pressure on the hydraulic control fluid is bled from the hydraulic control line downstream, which closes the main hydraulically operated valve in the well head upstream of the pig injector. Bleeding hydraulic pressure from cylinder 32 permits the pig injector piston 34 to travel upwards in the cylinder 32 to the position shown in FIG. 2 thereby forcing a predetermined amount of fluid through the top 54 of the upper cylinder 56 and into the pig chamber 8 through pipe 38 which is positioned above the lowest pig in the chamber, thus forcing pig 18 through the orifice 24 and into the chamber 10. Pig 18 seats in orifice 24 so as to form a seal in the storage chamber 8 until sufficient fluid pressure is built up therein to force the seated plug 18 through the orifice and thereby relieve the fluid pressure built up in the storage chamber 8 so that only one plug is injected into the flow line by actuating the piston 34 as aforesaid.

A pig 18 may be forced from the pig chamber 8 through channel 10 and through the plug valve bore 40 when the plug valve 42 is in open position. The plug valve 42 seals off the channel 10 and chamber 8 against well head pressure. Thus, fluids cannot pass from the flow line into the pig chamber when the plug valve 42 is closed. To open valve 42, the valve is rotated about 90° within valve body 52 so that the bore 40 of the valve 42 is aligned with the bore 48 of the valve body 52. The plug valve 42 may be operated either manually or hydraulically with a conventional remote valve drive mechanism.

A bar trap 57 may be provided at the T section to prevent pigs 18 from entering flow line 14.

The pig injector 12 may be calibrated so that only a certain amount of hydraulic fluid is discharged into the pig chamber to release a pig. The compression on the spring 36 may be adjusted with a suitable bolt 45 to be slightly less than the hydraulic pressure exerted on piston 34, so that the piston 34 will rest at the bottom of cylinder 32 when hydraulic pressure is exerted through line 35. A second adjustment screw 44 may be used to limit the downward movement of the piston 34. The piston 34 and plunger 37 are provided with suitable sealing rings 46 and 47, respectively.

Although I have described my present invention with a certain degree of particularity, it is to be understood

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that the scope of my invention is not to be limited by the details set forth, but should be afforded the full breadth of the appended claims.

I claim:

1. An apparatus for injecting a cleaning plug into a flow line, comprising:
 - a channel communicating with said flow line,
 - a plug storage chamber communicating with said channel,
 - means for restricting the passage of said plug from said storage chamber into said channel,
 - said restricting means being sealingly engageable by said plug,
 - means for exerting fluid pressure in said storage chamber on said plug to force said plug from said storage chamber through said restricting means, and
 - valve means in said channel for sealing said channel against the passage of fluid therethrough, said valve means being adapted for transporting said plug forced through said restricting means into said flow line through said channel.
2. An apparatus for injecting a cleaning plug into a flow line, comprising:
 - a channel communicating with said flow line,
 - a plug storage chamber communicating with said channel,
 - means for restricting the passage of said plug from said storage chamber into said channel,
 - said restricting means being sealingly engageable by said plug,
 - means for exerting fluid pressure in said storage chamber on said plug to force said plug from said storage chamber through said restricting means,
 - said fluid pressure means including a cylinder and a piston therein adapted to displace a predetermined volume of fluid into said plug chamber, and
 - valve means in said channel for sealing said channel against the passage of fluid therethrough, said valve means being adapted for passing said plug forced through said restricting means into said flow line.
3. An apparatus for injecting a cleaning plug into a flow line, comprising:
 - a channel communicating with said flow line,
 - a plug storage chamber communicating with said channel,
 - means for restricting the passage of said plug from said storage chamber into said channel,
 - said restricting means being sealingly engageable by said plug,
 - means for exerting fluid pressure in said storage chamber on said plug to force said plug from said storage chamber through said restricting means,
 - said fluid pressure means including a cylinder having a piston therein and hydraulic means for moving said piston in one direction in said cylinder and spring means within said cylinder barrel whereby said piston is moved in the opposite direction in said cylinder a predetermined distance when said hydraulic pressure on said piston is released to thereby displace a predetermined volume of fluid into said

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- plug chamber, and valve means in said channel, said valve means including means for passing said plug forced through said restricting means into said flow line.
- 4. An apparatus for injecting a cleaning plug into a flow line, comprising:
 - a conduit communicating with said flow line,
 - a plug storage chamber communicating with said conduit,
 - means for restricting the passage of said plug from said storage chamber into said conduit,
 - said restricting means being sealingly engageable by said plug, and means for exerting fluid pressure in said storage chamber on said plug to force said plug from said storage chamber through said restricting means.
- 5. An apparatus for injecting a cleaning plug into a flow line, comprising:
 - a conduit communicating with said flow line,
 - a plug storage chamber communicating with said conduit,
 - means for restricting the passage of said plug from said storage chamber into said channel,
 - said restricting means being sealingly engageable by said plug,
 - means for exerting fluid pressure in said storage chamber on said plug to force said plug from said storage chamber through said restriction means,
 - said fluid pressure means including a cylinder having a piston therein and fluid means for moving said piston into one direction in said cylinder and spring means within said cylinder whereby said piston is moved in the opposite direction in said cylinder when said fluid pressure on said piston is released to thereby displace fluid into said plug storage chamber.
- 6. An apparatus for injecting a cleaning plug into a flow line comprising:
 - a conduit communicating with said flow line,
 - a vertically disposed plug storage chamber for communicating with said conduit,
 - means for restricting the passage of said plug from said storage chamber into said conduit,
 - said restricting means being sealingly engageable by said plug, means for exerting fluid pressure on said plug in said storage chamber at a point sufficiently above said restricting means to exert sufficient fluid pressure on said plug when said plug is sealingly engaged with said restricting means to force said plug from said storage through said restricting means.

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