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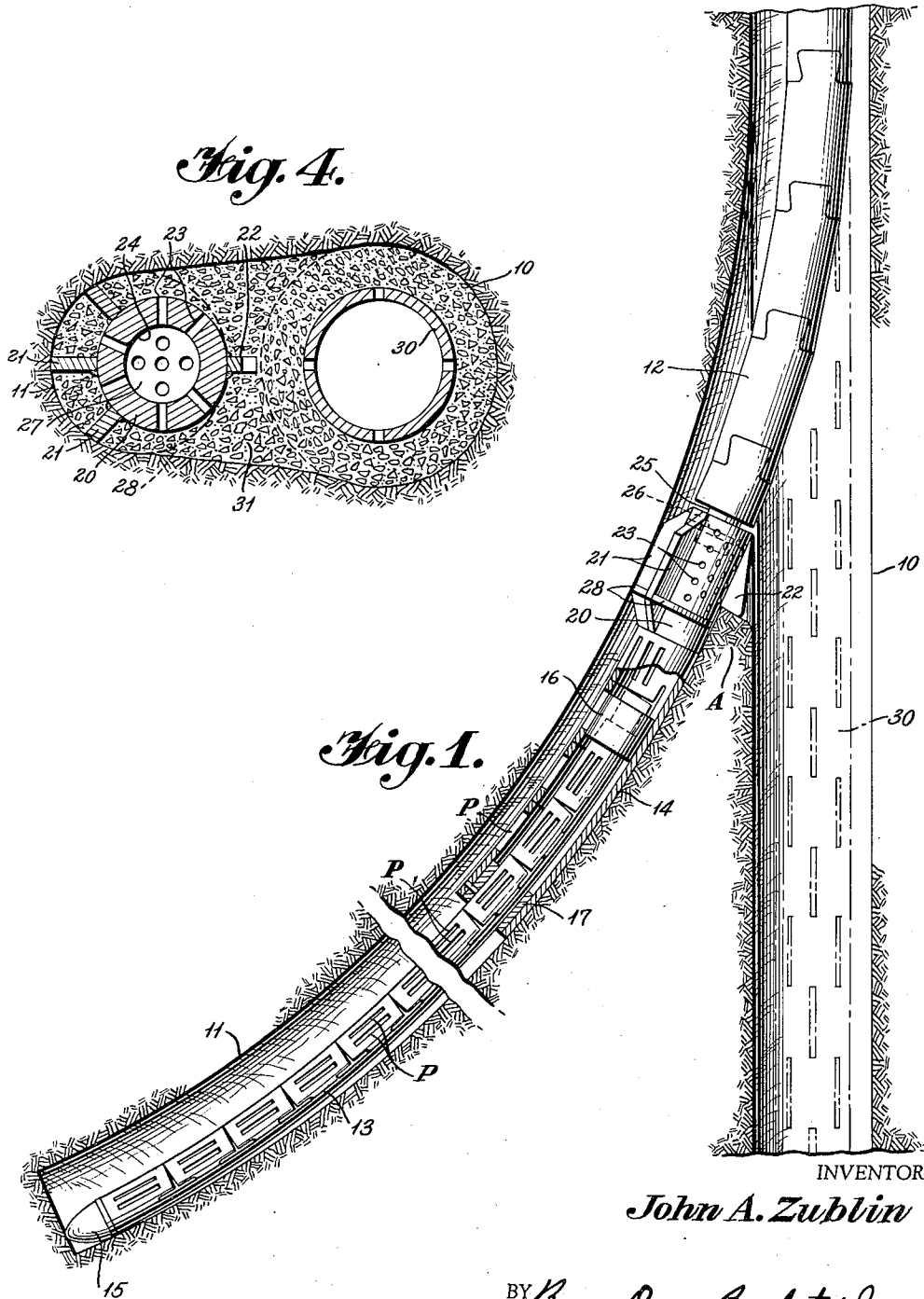
J. A. ZUBLIN

2,804,926

PERFORATED DRAIN HOLE LINER

Filed Aug. 28, 1953

2 Sheets-Sheet 1



INVENTOR

John A. Zublin

BY *Burns, Doane, Benedict & Doane*
ATTORNEYS

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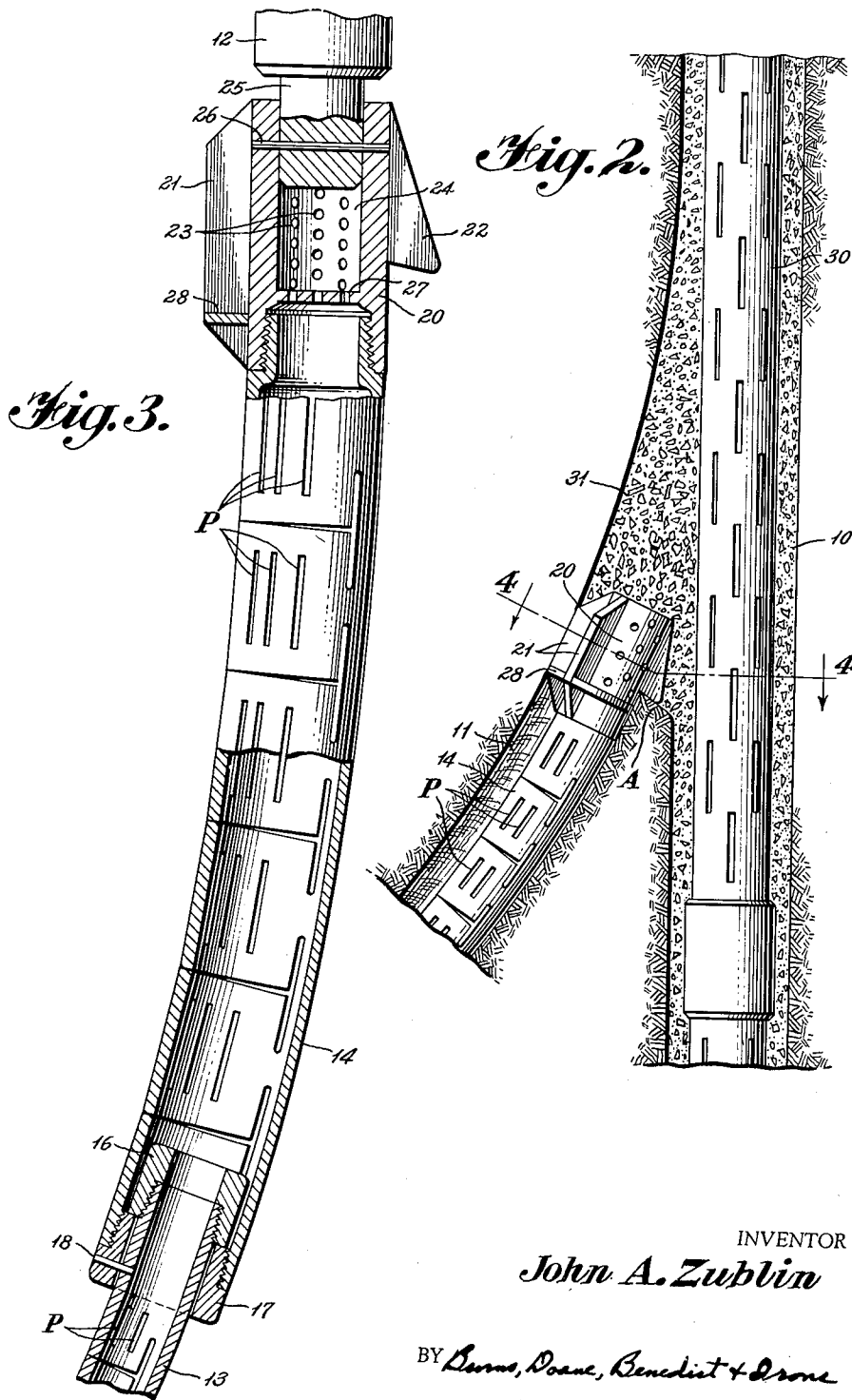
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PERFORATED DRAIN HOLE LINER

John A. Zublin, Los Angeles, Calif.

Application August 28, 1953, Serial No. 377,183

4 Claims. (Cl. 166—50)

This invention relates generally to a perforated liner for insertion into deviating drain holes which have been previously drilled. More specifically, the invention relates to a flexible perforated drain hole liner which may be expeditiously varied in length within predetermined limits so as to accommodate correspondingly different drain hole lengths such that it may be properly adjusted to correspond to the length of the deviating drain holes in which it is positioned.

In recent years it has become the established practice to drill a series of drain holes deviating from a vertical main well bore into the surrounding oil bearing formations to substantially increase the oil production from a single well. In many oil fields perforated liners, pre-fabricated liners or gravel packed liners have been installed in the vertical well bores to filter from the oil the floating sand and other impurities which travel with the oil to the well bore. These structures prevent the tubing and pumping means for the well from sanding up, which would naturally interrupt the continuous steady oil production of the well. Similarly, flexible, perforated liners must be inserted into the curved bores of drain holes which deviate from the initial main well bore, such flexible perforated liners in the drain holes also helping to prevent sanding up of the equipment used in recovering oil from the well.

In providing drain holes deviating from the main straight well bore, such drain holes will take off from the main well bore at different points along the length of the well bore extending out into the oil bearing strata to increase the productivity of the well by promoting draining of the oil from the oil bearing strata through which the well bore extends. With these many drain holes deviating at various points along the length of the main well bore, it is necessary that a perforated liner be inserted in each of the deviating curved bores to receive the oil as it drains from the particular stratum in which the curved bore is located and conduct it to the perforated liner inserted in the vertical well bore.

To effectively conduct the oil from these drain holes the curved liner must be of the proper length so as to fit accurately into the drain hole in such a manner that the end thereof is at the furthestmost outer point along the length of the drain hole and its inner or upper end lies as close as possible to the vertical liner. This inner end, however, must not protrude into the vertical bore so as to obstruct the free movement of a liner being inserted into the vertical bore following the insertion of the curved perforated liners in each of the many drain holes.

It has been found to be extremely difficult to accurately determine the length of the curved flexible perforated liner necessary to most effectively occupy the full length of a particular drain hole and yet not protrude into the vertical well bore so as to obstruct or hinder the insertion of the main perforated liner into such vertical well bore. The length of a drain hole starting from a vertical bore at depths ranging from 3,000 to 9,000 feet can only be determined by measuring the length of the flexible drill pipe which has entered into the deviating bore. Unfor-

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tunately the take-off point of the curved bore cannot always be accurately determined, since the drill bit, pressed against the wall of the straight bore by the resiliency of the curved drill guide, may have slipped several feet before it actually takes hold of the formation to form a definite shoulder from which the deviating curved bore proceeds.

For obvious reasons of economical operation, drain holes deviating from a vertical well bore are not always made of the same length. Oil bearing formations are frequently interrupted by layers of hard shale which do not contain oil, so that continued drilling of the deviating drain hole into such layer of shale becomes a waste of time and money. Thus it has become the practice to employ a shorter drain hole when such layers are encountered and spend the time saved in drilling more or longer drain holes in other more prolific layers of oil-bearing formation.

In the light of the above-noted problems encountered in applying perforated liners to previously drilled drain holes deviating from a vertical bore, it can well be appreciated that standard unit length perforated liners produced in a factory away from the oil field cannot be quickly adjusted on the derrick floor to accommodate the differences in length encountered in the various drain holes. Nor is it entirely practical to attempt to adjust the liner length on the derrick floor since the drain hole length cannot be determined with complete accuracy. Accordingly, the invention hereinafter described provides a flexible perforated liner which is adjustable in situ to accommodate the various lengths of drain holes encountered in actual practice.

It is a principal object of this invention to provide a perforated liner insertable into a deviating drain hole bore so that the uppermost end of such liner is properly aligned with the mouth of the drain hole, while the lower end thereof contacts the outermost end of the drain hole and thus utilizes the entire drain hole length for recovery of oil from the oil bearing strata.

It is another object of this invention to provide a flexible perforated liner which is self-adjusting to the unknown length of the drain hole after the liner has been inserted thereto and will securely position itself in the drain hole with one end seated in the mouth of the drain hole adjacent the main well bore.

It is also an object of this invention to provide a flexible drain hole liner having a telescoping section at one end thereof to enable variation of the length of such liner to accommodate the particular length of drain hole with which such liner is associated.

It is a further object of this invention to provide a flexible perforated drain hole liner lowerable into a curved drain hole having a head at the upper end thereof which snugly engages with the mouth of the drain hole to retain the liner properly positioned within the drain hole.

The foregoing objects of the present invention and others which will be apparent from the description of a preferred embodiment set forth hereinafter, are obtained through provision of the variable length liner construction. The details of the invention will become apparent as the description proceeds, which will be given by reference to the accompanying drawings which form a part hereof, and in which:

Figure 1 illustrates the positioning of the adjustable drain hole liner of the present invention in an oil well drain hole deviating from the main well bore.

Figure 2 illustrates the relationship between the inserted perforated drain hole liner and main well bore perforated liner subsequent to the insertion of such liners into the well bores.

Figure 3 is a detailed view partially in section illustrat-

ing the length-adjusting structure of the perforated liner.

Figure 4 is a sectional view taken on line 4—4 of Figure 2.

In general it may be stated that the invention hereinafter specifically described embodies an assembly of one perforated liner section positioned inside another somewhat larger perforated liner section. A plurality of standard unit lengths of the smaller diameter liner are connected together to make up a perforated liner section approximating the overall length, but less than the length, of the drain hole in which the liner assembly is to be inserted. The balance of the length necessary for the liner assembly to completely occupy the full length of the drain hole is supplied by the larger diameter perforated liner section which is slidably mounted to telescope over the upper end of the smaller diameter perforated liner section. A shear pin is utilized during the lowering of the liner into the deviating drain hole to maintain the larger telescoped section in extended position relative to the smaller diameter perforated liner and permit desired orientation of the assembly so as to properly guide the lower end thereof into the deviating drain hole.

When the lower end of the liner assembly, which is the end of the series of unit lengths of interconnected smaller liners, strikes the bottom of the drain hole, the weight indicator on the derrick floor provides an indication to the operator that the bottom of the drain hole has been reached as shown by the reduced weight indication. The drill string, which suspends the flexible liner assembly, is lowered for a further distance to cause the shear pin to be sheared and allow the larger liner section to slide over the upper end of the smaller liner section into the drain hole until the upper end of such larger liner section becomes seated within the mouth of the drain hole. Such fitting of the upper end of the larger liner section in the mouth of the drain hole will create a second weight change on the weight indicator on the derrick floor, and as such will inform the operator that the liner has been seated and that the means used to lower and guide the liner into the drill hole can be withdrawn from the vertical well bore.

The seating means for the upper end of the larger liner section which telescopes over the end of the smaller diameter perforated liner section consists largely of ribs or fins on the outer end of the liner, of such dimensions that they position the head of the larger diameter liner section securely within the mouth of the drain hole while preventing any downward slippage of the assembly.

Since the liners must be lowered through a vertical straight bore before entering the curved bore of the drain hole, it is possible to either utilize a normally curved flexible liner which is forcibly lowered through the straight vertical bore and allowed to assume its normal curvature on entry into the curved drain hole, or to utilize a normally straight flexible liner which is lowered freely through the vertical straight bore and forced into the curved deviating drain hole to assume the curvature of such drain hole. In the actual practice of inserting perforated liners into previously drilled drain holes, due to the problems encountered in such operations, the use of a normally curved resilient perforated liner is more desirable than the use of a normally straight resilient liner.

Hereinafter only a general description of the significant features of this invention has been set forth, the basic elements of which it will be readily appreciated are susceptible of wide variation within the scope of this invention. Broadly, it may be stated that the apparatus of this invention is characterized by a perforated liner assembly of a normal unit length but adaptable to drain holes of different lengths by a slidable telescopic construction between the parts of the flexible liner assembly.

Referring to the specific embodiment illustrated on the drawings, Figure 1 illustrates a main well bore 10 and a drain hole 11 deviating from the main well bore.

A flexible perforated liner assembly is shown being positioned in the drain hole 11 by being lowered therein by means of a suitable flexible drill string 12 controlled from the well derrick floor.

The flexible perforated liner assembly comprises a relatively small diameter perforated liner section 13 which is made up of a plurality of standard unit length sections suitably secured together to approximate the required length of drain hole liner necessary to completely fill the drain hole in which it is to be inserted. A larger diameter perforated liner section 14 telescopically engages one end of the liner section 13 and thus is slidable thereover to vary the over-all length of the flexible liner assembly.

The perforated liner sections 13 and 14 are provided with perforations P to admit oil draining from the surrounding formation into the liner. These liner sections may be made flexible by cutting slots in pipe sections in a form such as illustrated and disclosed in my copending application, Serial No. 377,184, filed August 28, 1953.

The opposite end of the series of interconnected liners which make up the smaller perforated liner section 13 is provided with a plug 15 which may be suitably threaded into such end to close off the end of such liner section and in use serve as an abutment to engage the end of the drain hole 11. The upper end of the liner section 13 positioned within the liner section 14 has threaded thereonto a collar 16 which cooperates with a similar collar 17 threaded into the lower end of the larger liner section 14 to retain the two sections 13 and 14 against disengagement and limit the elongation of the liner assembly.

A shear pin 18 is inserted into aligned holes provided, respectively, in the collar 17 and the adjacent end of liner section 13 when the liner assembly is at its maximum length. This shear pin functions to retain the flexible liner assembly in its extended longest position during lowering of the assembly into position into the deviating drain hole. Upon engagement of the plug 15 carried by the outer end of liner section 13 with the end of the drain hole, continued lowering of the assembly will cause the shear pin 18 to be sheared and the larger liner section 14 to telescope over the end of the liner section 13 while the collar 17 slides along the outer surface of the liner section 13. Thus the liner assembly will be appropriately shortened to adjust itself to the length of the drain hole in which it is being positioned. The sliding fit between the liner section 13 and the inner bore of collar 17 precludes any undesirable entry of sand particles into the perforated liner assembly.

The upper end of the outer larger liner section 14 carries a head 20 suitably threaded thereonto. The head 20 is provided with a plurality of longitudinal radial fins 21 at circumferentially spaced positions along one side of the head. These fins are tapered at both ends and are made of such a size according to the diameter drill bit used in drilling the drain hole so as to fit snugly into the mouth of the drain hole 11 in properly positioning the liner assembly therein. A tapered hook-like rib 22 extends radially from the side of the head 20 opposite the spaced longitudinal fins 21 and is shaped so as to engage the formation within the well immediately at the junction of the deviating drain hole 11 with the main bore hole 10. Thus this rib 22 engages the shoulder at point A so as to retain the head 20 and the liner sections 13 and 14 suspended therefrom in fixed position within the drain hole 11.

The head 20 is provided with a plurality of small openings 23 which allow the oil to flow from the perforated liner assembly outwardly into the main well bore. The head 20 has formed therein a socket 24 which is engaged by a stud 25 secured to the lower end of the flexible drill string 12 which is utilized in lowering the perforated liner assembly into position in the drain hole 11. A shear pin 26 interconnects the socket 24

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in the head 20 and stud 25 through aligned holes provided in the respective members to be interconnected.

It will be readily appreciated that the socket 24 shown as being located in the head 20 may, if desired, be formed in the lower end of the drill string 12. With such an arrangement the stud 25 would be carried by the head 20 so as to engage the socket on the end of the drill string and be retained thereon by a shear pin in a manner such as illustrated on the drawings. Likewise it will be recognized that within the scope of this invention any suitable connecting means may be utilized to suspend the liner assembly from the end of the drill string which is disconnectible from such assembly to permit withdrawal of the flexible drill string after positioning of the liner assembly in a drain hole.

The perforated liner assembly is lowered into its fully seated position within the drill hole 11 by shearing the pin 18 and telescoping the liner sections 13 and 14. The rib 22 seats on the shoulder at point A and additional weight applied to the drill string 12 effects shearing of pin 26. The flexible drill string 12 can then be raised and removed from the well bore in readiness for insertion of the next perforated liner into another drain hole or insertion of a vertical perforated liner 30 into the well bore as is done after all of the drain holes drilled have been equipped for flexible perforated liner assemblies.

The embodiment of the invention illustrated on the drawings shows shear pins 18 and 26 to releasably retain the liner assembly in its extended condition and detachably connect the assembly to the end of the drill string used in lowering the assembly into the drain hole. It will be readily recognized, however, that within the scope of this invention any suitable device or devices may be utilized with the telescoping liner assembly to perform the function of these two shear pins.

Since the socket 24 after removal of the stud 25 is exposed and opened at its upper end a perforated partition 27 is disposed across an end of the socket 24 to prevent the entrance of packing gravel 31 which is applied around the perforated liner 30 at its junction with the upper end of the flexible perforated liner assembly. Furthermore, to prevent such gravel packing from entering the drain hole proper and filling the space around the perforated liner sections 13 and 14 transverse baffle plates 28 are suitably secured between the fins 21.

In oil well drilling operations it may be necessary to fill the annular space between the vertical perforated liner 30 and the walls of the well bore 10 with gravel. However, it is desirable to prevent such gravel from entering into the drain hole so as to fill in part of the void between the flexible liner and the deviating bore. The baffle plates 28 thus allow the gravel to fill all of the empty space created adjacent the junction of the deviating drain hole with the main well bore without entering the drain hole proper. The openings 23 in the head 20 permit the free flow of oil from the flexible perforated liner assembly through the gravel fill into the openings of the vertical perforated liner 30.

The method of positioning the perforated flexible liner assembly described hereinbefore comprises lowering the assembly, suspended from the end of a flexible drill string, to the location of the deviating drain hole in which the liner is to be inserted, orienting the liner assembly so the lower end will be directed to enter the drain hole, and lowering the liner assembly into this drain hole until the end thereof engages the outermost end of the drain hole. Continued lowering of the assembly effects telescoping of the two liner sections so that the length of the liner assembly is effectively shortened to a length equal to the previously drilled drain hole. At the moment that the liner assembly reaches the proper length, the hook rib on the head carried by the upper end of the assembly engages the shoulder

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formed between the vertical well bore and the drain hole. Further lowering of the flexible drill string effects shearing of the interconnecting pin suspending the liner assembly from such drill string, and thus severs the connection between these members to enable withdrawal of the flexible drill string from the well bore.

Having thus described my invention, what I claim is:

1. A perforated liner assembly for insertion into a curved oil well drain hole comprising, a plurality of perforated pipe sections telescopically engaged so as to be slidable into one another to vary the overall length of the assembly to accommodate the drain hole length into which the assembly is to be inserted, engaging means carried by the adjacent ends of said sections to maintain said sections telescopically interconnected, and a head secured to the outer end of one of said sections for engaging the mouth of the drain hole into which the assembly is inserted to retain said assembly properly positioned within the drain hole, said head having a radial rib extending from one side thereof to engage the shoulder at the junction of the curved drain hole and the well bore and at least one radial fin extending from the opposite side of said head to engage the drain hole bore to position said head in the mouth of said drain hole.

2. A perforated liner assembly as recited in claim 1 wherein said head is further provided with perforations to permit free egress of oil from the liner assembly and transverse baffles positioned intermediate the radial rib and radial fin to prevent packing fill in the main well bore from entering the curved drain hole bore.

3. A perforated liner assembly as recited in claim 1 wherein releasable coupling means are provided on said head for detachably suspending said assembly from a drill string utilized in lowering said assembly through the main bore hole into position within the drain hole bore.

4. A flexible perforated liner assembly for insertion into a curved oil well drain hole deviating from a well bore of a diameter substantially larger than the diameter of the drain hole comprising at least one perforated flexible pipe section having an outer diameter smaller than the diameter of the drain hole, a head secured to one end of said pipe section and having means imparting a larger lateral dimension thereto than the diameter of said pipe section and the drain hole so as to substantially fill the mouth of the drain hole when in use, said means at the surface thereof which advances into the drain hole having a beveled portion extending inwardly toward the peripheral surface of said pipe section so that the head may be snugly engaged in the drain hole at the junction of the curved drain hole and the well bore to securely retain said assembly positioned with the end thereof immediately adjacent the mouth of the drain hole, said head having perforations communicating with the interior of the pipe section and permitting egress of oil from the drain hole while preventing extraneous material from entering the drain hole and liner assembly, and means on said head for detachably connecting said assembly to the end of a drill string to lower said assembly into position within the drain hole and release said assembly from the drill string after it is positioned within the drain hole.

References Cited in the file of this patent

UNITED STATES PATENTS

1,886,820	Lee	Nov. 8, 1932
2,365,052	Chamberlain	Dec. 12, 1944
2,397,070	Zublin	Mar. 19, 1946
2,452,920	Gilbert	Nov. 2, 1948
2,664,270	Zublin	Dec. 29, 1953