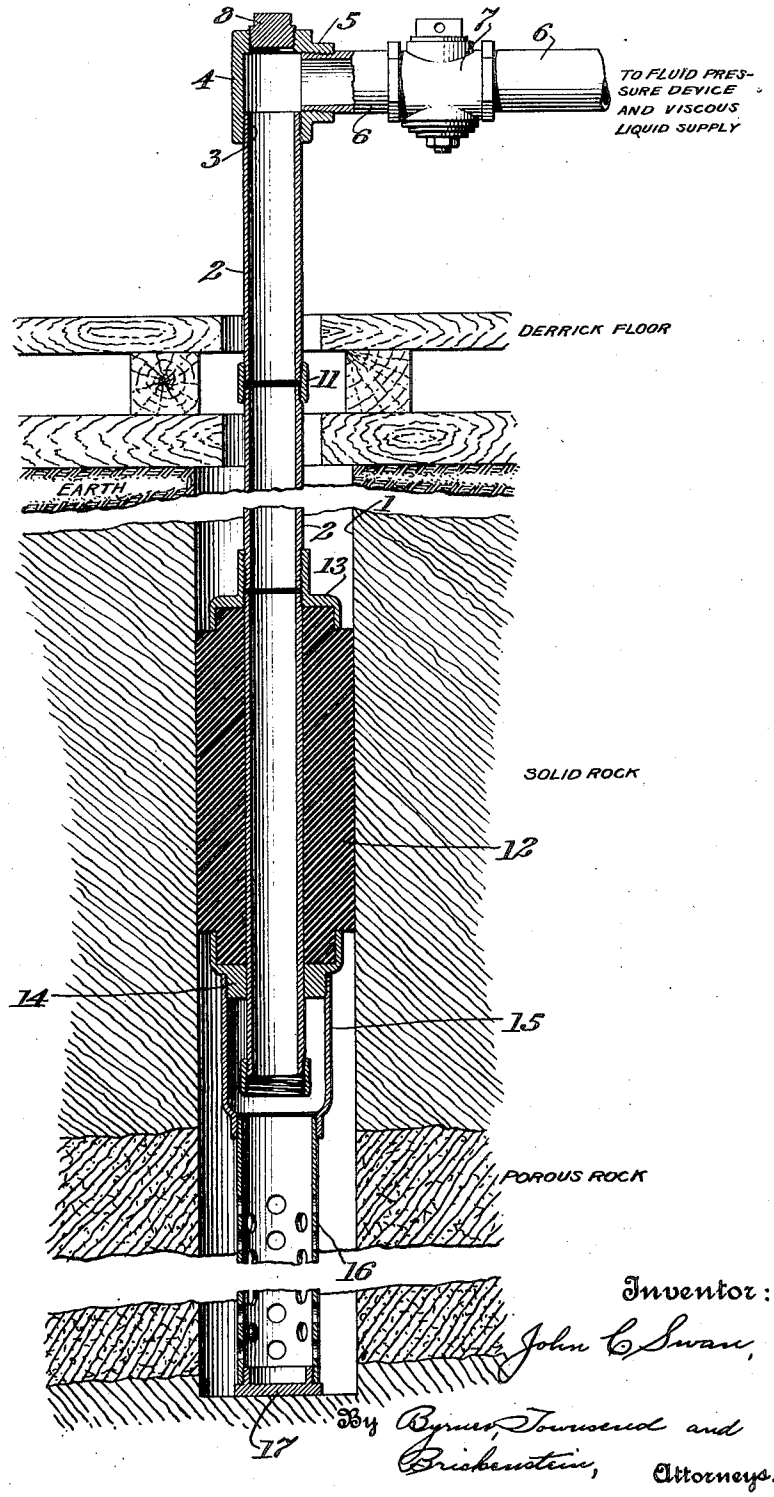
J. C. SWAN.

METHOD OF EXCLUDING EXTRANEOUS FLUIDS FROM WELLS.

APPLICATION FILED JULY 2, 1919.

1,317,462. Patented Sept. 30, 1919.



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UNITED STATES PATENT OFFICE.

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METHOD OF EXCLUDING EXTRANEOUS FLUIDS FROM WELLS.

1,317,462. Specification of Letters Patent. Patented Sept. 30, 1919.

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To all whom it may concern:

Be it known that I, JOHN C. SWAN, a citizen of the United States, residing at Marietta, in the county of Washington and State of Ohio, have invented certain new and useful Improvements in Methods of Excluding Extraneous Fluids from Wells, of which the following is a specification.

In the usual methods of drilling wells, particularly oil wells, it is the custom when a water-bearing stratum is encountered and drilled through, to insert into the bore a casing consisting of a series of lengths of connected steel or iron pipes of suitable diameter, this casing extending beneath the water-bearing stratum and thereby shutting off the water from the bore. As successive waterbearing strata are encountered, additional strings of casing are inserted. These successive strings extend one inside the other from the surface to a location below the water and the use of them necessitates the starting of the bore with a sufficient diameter to permit the insertion of as many strings of casing as may be necessary.

Obviously, large quantities of steel and iron in the form of pipes, are used, and the cost of transportation to the location where the hole is being bored and the cost of labor for their installation is very large in addition to the purchase cost. Further, the drilling of an initially large hole is necessitated, which adds to the cost of the well.

It is the object of this invention to obviate the necessity for using successive strings of casing and the necessity and expense of large hole drilling and these objects I attain by sealing up the successive fluid-bearing strata in the bore in a manner presently to be described.

In my prior Patent, No. 1,307,027, dated June 17th, 1919, I have described and claimed a method of sealing up these strata which comprises forcing into the interstices thereof a hot liquid filling material which is insoluble in and substantially immiscible with water but which will solidify when it cools to the natural temperature of the stratum, and thus form an effective barrier against the further entrance of water.

I have discovered that in closing up interstices, other than seams, such as occur in porous rock, etc., it is not necessary to employ heat if the filling material used is a viscous liquid and adequate pressure is applied. I have discovered that it is quite possible to drive a viscous liquid into the pores of the rock to such an extent that on account of its viscous nature it offers such resistance to the flow of water that it serves as a barrier fully capable of withstanding the hydrostatic head of the water.

Any one of several methods of introducing the viscous liquid into the interstices under pressure may be employed, but for certain reasons I prefer the method which will now be described by way of illustration, reference being had to the accompanying drawing, wherein the figure represents a sectional view of a well with a string of tubing and packer in place and showing the necessary connections.

In the drawing, the numeral 1 indicates the bore of the well, into which extends a string of steel or iron tubing 2. The upper portion 3 of the tubing is provided with a T-coupling 4, to the stem-end 5 of which is connected a pipe 6 having a valve 7. The pipe 6 leads to a suitable source of fluid pressure, such as hot or cold water, steam, gas or air and a suitable source of supply of a viscous or colloidal liquid. A removable screw-plug 8 is located in the arm of the T, 4, opposite that which connects the coupling to the pipe 2.

The various sections of the string of tubing 2 are joined by suitable coupling-sleeves 11.

Around the pipe 2 and between the pipe and the wall of the bore is inserted a suitable packer 12 of the construction commonly used in oil wells, or of any special construction which the circumstances of use may require. As shown, the packer consists of a rubber tube compressed between flange-couplings 13, 14, the coupling 13 being secured to the pipe 2, while the coupling 14 rests upon a casing 15, the lower end of which is screwed onto a perforated pipe 16 which constitutes in effect a continuation of tubing 2. There is thus provided a slip-joint for the pipe 2 whereby the weight of the string of tubing will compress the rubber of the packer and force it into fluid-tight engagement with the pipe 2 and the wall of the bore. The perforated pipe 16 is provided at its bottom with a screw-cap closure 17. In operation, a suitable viscous liquid or colloid which is insoluble in and substantially immiscible with water is introduced through the pipe 6 into the pipe

2 under pressure of the water, either hydrostatic head or otherwise produced, or by steam, gas or air, and out through the perforations of the pipe 16 into the bore of the well below the packer 12 and finally into the interstices of the porous stratum, forcing the water or other extraneous fluid back in the stratum away from the bore, the pressure being maintained for the necessary period of time.

The pressure required and the amount of filling liquid which it will be necessary to supply will depend largely on the character of the stratum being sealed and partly upon the consistency and viscosity of the filling liquid, so that these factors must be considered by the operator. The pressure required will, however, always be materially above that of the head of the fluid to be excluded from the well and while it may be that one hundred pounds above will be sufficient in many cases, I consider a pressure of substantially twice the pressure upon the fluid being excluded to be a safe or ample working-pressure in the great majority of operations.

The regulation of the supply of the fluid and of the pressure can easily be determined by the operator with a little practice.

Any of a number of viscous or colloidal liquids may be employed. Rosin dissolved in an oily medium such as linseed oil or rosin oil or in any other suitable solvent, in such proportions as to produce a viscous body, is quite suitable.

Coal-tar pitch dissolved in a suitable solvent, to produce a body which is a viscous liquid at the natural temperature of the stratum, may be used. The same is true of asphalt.

Obviously, other methods than the one described may be employed for introducing the viscous liquid into the interstices. For instance, where the liquid filler is heavier than water, a sufficient quantity may be dumped directly into the bottom of the bore from what are known as bailers, and pressure applied above the supernatant water. The liquid must in this case be used in such quantity that it will be raised a suitable distance above the top of the porous stratum.

While I have described my present invention as especially applicable to the exclusion of water from oil-wells, it is to be understood that I do not thereby intend to limit myself thereto. For instance, the method is applicable to the sealing of gas-producing sands against the passage of natural gas into a well or shaft.

I claim:—

1. The method of excluding extraneous fluids from wells, which consists in introducing into the interstices of the fluid-bearing stratum in the vicinity of the well, under pressure, a liquid viscous at the natural temperature of the stratum.

2. The method of excluding extraneous fluids from wells, which consists in introducing into the interstices of the fluid-bearing stratum in the vicinity of the well, a liquid which is viscous at the natural temperature of the stratum, under a pressure considerably above that of the extraneous fluid.

3. The method of excluding water from drilled oil-wells, which consists in introducing into the interstices of the water-bearing stratum in the vicinity of the well a water-insoluble and water-immiscible liquid which is viscous at the natural temperature of the stratum, under a pressure considerably above the hydrostatic pressure of the water to be excluded.

4. The method of excluding extraneous fluids from wells, which consists in introducing into the interstices of the fluid-bearing stratum in the vicinity of the well a liquid which is viscous at the natural temperature of the stratum, under a pressure considerably above that of the extraneous fluid, and maintaining such pressure until the resistance to the flow of the extraneous fluid through such interstices is sufficient to withstand permanently the pressure on said extraneous fluid.

5. The method of excluding water from drilled and drilling oil-wells, which consists in introducing into the interstices of the water-bearing stratum in the vicinity of the well a water-insoluble and water-immiscible liquid which is viscous at the natural temperature of the stratum, under a pressure considerably above the hydrostatic pressure of the water, and maintaining such pressure until the resistance to the flow of the water through such interstices is sufficient to withstand permanently the hydrostatic pressure of the water.

6. The method of excluding water from drilled and drilling oil-wells, which consists in introducing into the interstices of the water-bearing stratum in the vicinity of the well a solution of rosin which is viscous at the natural temperature of the stratum, under a pressure considerably above the hydrostatic pressure of the water to be excluded.

In testimony whereof I affix my signature.

JOHN C. SWAN.