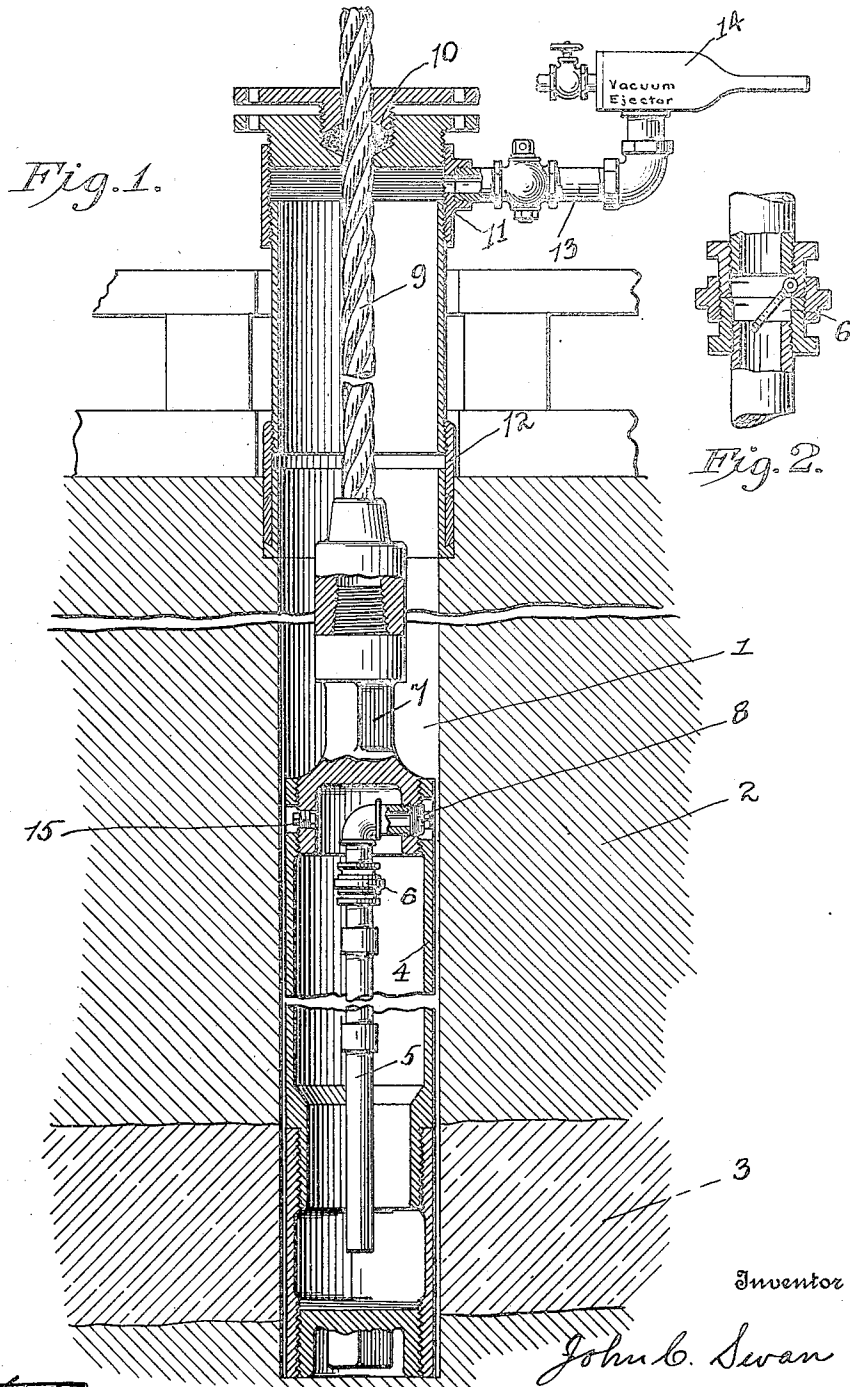


J. C. SWAN.
METHOD FOR PREVENTING CAVING IN WELLS.
APPLICATION FILED SEPT. 30, 1919.

1,379,656.

Patented May 31, 1921.



Witness
A. H. [Signature]

Inventor
John C. Swan
By *Reynolds Townsend Brickman*
Attorneys

UNITED STATES PATENT OFFICE.

JOHN C. SWAN, OF MARIETTA, OHIO.

METHOD FOR PREVENTING CAVING IN WELLS.

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Specification of Letters Patent. Patented May 31, 1921.

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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 for Preventing Caving in Wells, of which the following is a specification.

My invention relates to a method for preventing caving in wells drilled by the cable tool process.

In drilling wells, as the drilling proceeds, strata are encountered which are of such character that they are liable, if unprotected, to cave in and block the well or interfere with subsequent drilling. Heretofore, this difficulty has been overcome only by the use of iron or steel casing, at great cost for both material and labor, and this invention will supersede and obviate the need for and the use of such casings.

By my new method of operation, as soon as such a stratum has been wholly or partially drilled through, I suspend the drilling and apply a protective coating which will prevent any such caving in. This I may effect by drying the wall of the well at the place or section where caving is likely to occur, preferably by applying heat thereto, and then after the wall is dry, apply any suitable protective coating which will prevent weathering or disintegration likely to cause caving.

As a coating medium, I may employ coal tar of the proper consistency, asphalt dissolved in benzol, mixtures of linseed oil, rosin, paraffin, etc., or other material which is insoluble in and immiscible with water my invention not being limited to any particular composition. To give additional tenacity to the solution, whatever solution is used, there may be admixed with it any suitable fibrous material, *e. g.* wool-felt, hair or old Manila fiber cut into short lengths, for example the remnant of worn out drilling cables.

I preferably also employ a partial vacuum to remove from the well bore the vapors of evaporation produced by the heating, as well as to facilitate evaporation of any liquid present either naturally or otherwise on the well wall.

Any suitable means for applying heat at the place desired, may be employed, one form of apparatus which I have devised, being shown in the accompanying drawings, in

which Figure 1 is an elevation, partly in section, of the apparatus and Fig. 2 is a sectional view of the check valve.

1 is the bore of the well, 2 is a stratum of rock and 3 a stratum of shale or other rock liable to disintegrate. The heating means comprises a pressure tight chamber 4, made up of a string of special casing tubes preferably flush on the outside and having extending into its interior a string of piping 5, provided with an inwardly opening check valve 6, and an L connection screwed into the head, 7, closed by a screw-plug 8. A second screw plug 15 fits an opening through which air may escape when water is introduced into the chamber.

The head is secured by the usual means to the drilling cable 9 which has been passed through a stuffing box, 10, in the casing head, 11. The head 11 is provided with an extension, 12, which extends downwardly for a sufficient distance to make an air-tight joint with the wall of the well. The head, 11, is provided with an exit pipe, 13, to which is attached any suitable type of vacuum ejector, or other vacuum producing apparatus, or any suitable pressure producing means.

In carrying out my method, the chamber 4 is filled or partly filled with preferably hot water, and the pipe 5 is connected to a source of steam supply. Steam at say 150 pounds pressure is then allowed to blow into the water and heats it to a temperature approximating that of the steam (358° F.), the condensed steam and water originally present practically filling the entire chamber. When the steam is cut off, the check valve closes, and the plug 8 is inserted. The chamber is thus full of highly heated water which will retain its heat for a considerable length of time.

The chamber is now attached to the rope socket of a drilling cable in the derrick over the well and lowered to the bottom of the bore, and allowed to remain there for a time sufficient to evaporate the water present in the bottom of the bore or on the walls thereof.

The packing gland 10 is then applied to the cable and screwed into the head portion 11. When the vacuum ejector or other suitable apparatus is put into operation, a lowering of the pressure occurs, whereby evaporation of any moisture within the bore is promoted, and these vapors are largely

removed, thus preventing condensation by contact with the upper cold wall of the bore.

By this procedure, the wall of the bore is dried and the moisture naturally present on the face of the well wall and adjacent rock, as well as that which has been introduced in the drilling process, is removed.

The purpose of the procedure thus far described is to put a section of the wall of the well in condition to receive and retain a suitable composition for sealing it against further contact with air, water, water-vapor, or oil, as the case may be, thus preventing disintegration which naturally takes place in certain shale rocks when in contact with air, water, moisture, or crude petroleum.

After the section of wall that is to be coated has been dried to the proper degree to receive the coating, the heater will be removed by means of the drilling cable and the usual hoisting apparatus of the derrick, and the coating fluid will then be lowered in a dump bailer to the bottom of the well. The water in the heating device may be reheated if desired, or if still warm enough need not be reheated and the heating device will be again lowered to the bottom of the well displacing the coating fluid, thus causing it to rise on the exterior of the heating device and the interior of the well wall and causing it to flow into and penetrate all checks, crevices, caves, etc., that may exist as well as varnishing the face of the wall where it is still intact. After this has been done the heater will be again withdrawn from the well and the excess fluid which has drained off the well wall will be lifted to the surface by the usual oil well bailer and recovered for use again.

The coating fluid may be applied in any other suitable manner, as by spraying.

The wall of the well which before had a tendency to cave is thus prevented from further weathering and caving and no casing need be employed for a section of the well treated according to the method herein described. The ordinary operations of drilling are then continued, each portion of the well whose walls have caving characteristics being treated preferably as soon as drilled through.

I may employ as a protective coating solution, a rubber solution capable of being vulcanized. Thus, after the wall of the well has been dried, I introduce the solution by a dump-bailer, the surplus solution being withdrawn after a suitable film or coating has been formed. This film or coating may also be produced by spraying. I then vulcanize the coating in place by lowering the heating device, which is at a vulcanizing temperature, into proximity to the coating and maintain within the well-bore a suit-

able air of gas pressure (*e. g.* 100 lbs. or upward), the heat and pressure being maintained until vulcanization is completed. The pressure secures adhesion of the coating to the wall and prevents the formation of gas bubbles during the vulcanization.

The method first described is preferred for wells of large diameter of bore. I wish it to be understood, however, that for wells of smaller diameter, such as those less than 6½ inches in diameter, it is quite feasible to dehydrate the wall of the well to a sufficient degree to produce a practically good protective adhesion of the coating substance by introducing into a well, whose wall has not been previously dried, the coating solution at very high temperature. For this purpose a coating solution heavier than water is desirable, so that the solution will displace any water that may be present in the bottom of the hole, the water being evaporated from the surface of the solution. This evaporation may be expedited by the use of a partial vacuum as already described. In this case there is a simultaneous drying and coating of the well wall. The coating solution is allowed to remain in the well for a sufficient time to effect the coating desired, and the surplus fluid is then withdrawn by a bailer.

I may attain this same object of preventing caving in the well wall, without the use of heat, by using a protective coating of suitable character which may be applied without drying the well wall. For example, a solution of silicate of soda may be directly applied to that portion of the well wall in which caving is to be prevented. Silicate of soda will adhere to and penetrate the crevices of the wall without the necessity of drying. After the solution of silicate of soda has been applied I may facilitate the drying or hardening of the applied coating by the use of a partial vacuum in the manner above described, or I may supply heat in the manner above described or by other suitable means, or I may use both heat and reduced pressure. After the silicate coating has been applied and hardened in place, it is necessary to protect it from re-solution by the presence of water used in the process of drilling. I therefore apply a coating of any water-proof varnishing material such as those referred to in connection with the drying method. This varnish may be applied by floating on or spraying.

I claim:

1. The method of preventing caving in drilled or drilling wells which consists in first drying the wall of the well at that portion where caving is likely to occur or has occurred and then applying a protective coating to such dried portion.

2. The process as claimed in claim 1 in which the drying is effected by heat.

3. The process as claimed in claim 2 in which the vapors produced are removed by establishing a partial vacuum within the well, before the protective coating is applied.
- 5 4. The method of preventing caving in drilled or drilling wells which consists in first drying the wall of the well at that portion where caving is likely to occur or has occurred and then applying a protective coating having a fiber binder incorporated therewith to such dried portion.
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In testimony whereof, I affix my signature.

JOHN C. SWAN.