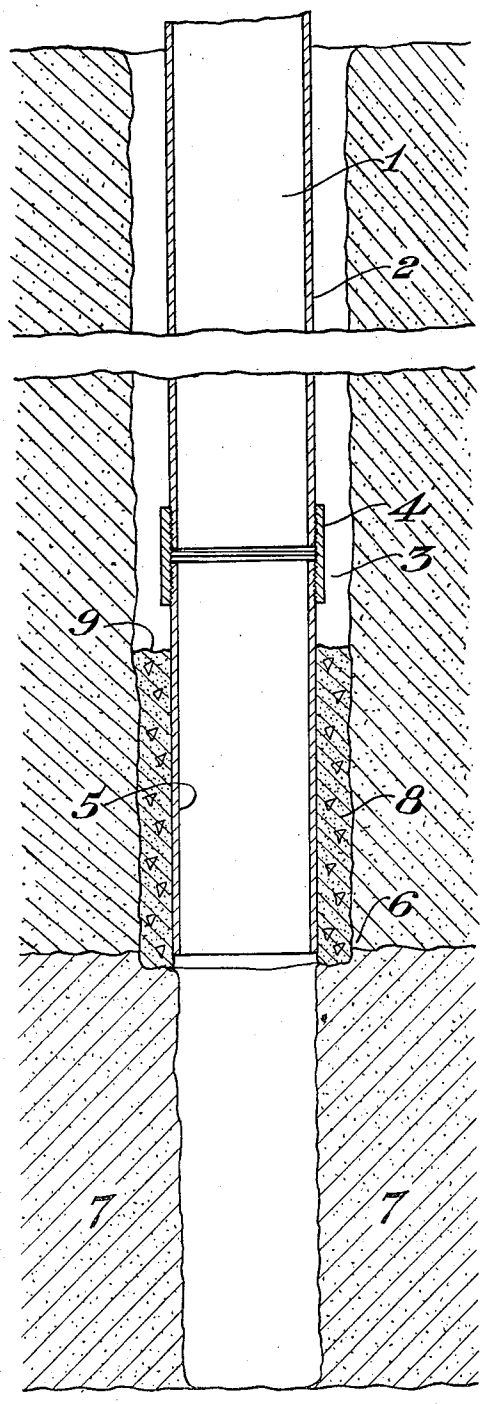
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METHOD OF COMPLETING WELLS

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INVENTOR
James H. Adkison
BY Griswold & Burdick
ATTORNEYS

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METHOD OF COMPLETING WELLS

James H. Adkison, Tulsa, Okla., assignor to The Dow Chemical Company, Midland, Mich., a corporation of Michigan

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The invention relates to a method of casing a well. It more particularly concerns a method of temporarily sealing off the overlying formations penetrated by a well bore so as to allow the productivity of a stratum penetrated by the bore to be tested.

It is usually desirable as the drilling of a well proceeds to test a particular formation, as regards its productivity of the desired mineral fluid, before completing the well as by cementing the conventional well casing in place. It is the conventional practice to lower the well casing or metal pipe used to line the well bore to a point just above the stratum to be tested and seat it on a shoulder provided for the purpose while making the production test. While this method is satisfactory, if a stratum or strata producing undesirable fluids, such as water when drilling for oil, have not been encountered, it usually happens that one or more of such strata are drilled through before a productive stratum is penetrated. If a satisfactory test is to be made in this case, it is usually necessary to cement the well casing in place to seal off the offending fluid prior to making the test. In the event that the test then indicates that production of a commercial nature can not be expected, it is practically impossible to remove and thus salvage the casing preparatory to abandoning the well or to loosen it so that it can be later used if the well is to be drilled deeper to another stratum of a productive nature.

It is, therefore, the principal object of the invention to provide a method whereby a well casing may be sealed in the well bore in such a manner as to positively exclude the encroachment of undesired fluids during a production test and thereafter be readily removable from the well bore.

I have found that by attaching to the lower end of the conventional iron or steel well casing, a section of metal pipe that is more readily removable by chemical means than iron or steel, and thereafter cementing the casing in place with an amount of cement calculated to seal off at least a portion of the space behind the readily removable section, the intrusion of undesirable fluids can be effectively prevented while a production test is being made and thereafter disintegration of the readily removable section can be readily brought about by chemical means so as to free the iron or steel casing, allowing it to be readily withdrawn from the well bore.

The invention then consists in the method hereinafter more fully described and particularly pointed out in the claims, the accompanying drawing and following description setting forth in detail a mode of carrying out the invention such mode illustrating, however, but one of the various ways in which the principle of the invention may be used.

In said drawing:

The single figure is a diagrammatic view in vertical section of a well bore drilled into a productive stratum showing the well bore lined with a conventional iron or steel casing having attached to its lower end a readily soluble section of metal pipe.

As shown the upper portion of the well bore 1 is cased with a conventional iron or steel pipe 2 down to a point 3. Attached to the lower end of the metal casing 2 at point 3 by means of a coupling 4 is a section of readily removable metal pipe 5 which extends into the well bore to a point 6 adjacent the upper level of productive stratum 7. The readily removable metal section is shown cemented in place by a quantity of cement 8 which fills the annular space between the well bore and the readily removable section 5 up to point 9 a short distance below the upper level of the removable section.

In the operation of the method in a well, wherein it is desired to ascertain the productivity of a stratum, such as is indicated by numeral 7 in the drawing, a conventional iron or steel casing is made up having attached to its lower end a section more readily removable by chemical means than iron or steel. Te casing string assembled as described is lowered into the well bore to a point adjacent the upper level of the productive stratum. A quantity of cement is then introduced in the conventional manner so as to place a seal about the readily removable portion of the casing string. Thereafter, the well is allowed to produce and, since other interfering fluids are excluded from the well bore, the productive nature of the stratum can be readily and accurately ascertained. As the chemical means of disintegrating the removable portion of the casing, a quantity of a chemical solution capable of disintegrating the readily removable portion of pipe is then introduced to bring about disintegration or solution of the removable or soluble section and, if the productive nature of the stratum tested is such that it is desired to produce from this stratum, the steel casing may be permanently cemented in place in the conventional manner. Also, it is to be understood that the well may be drilled deeper into another productive stratum or the metal well casing may

be withdrawn from the well bore readily and used in another well. In the event that the well is to be deepened, the bore may be made the same diameter and additional sections may be added to the same casing without the necessity of introducing a casing of smaller diameter as is the case if conventional practice is carried out. In any case, if desired, the casing may be readily withdrawn from the well bore.

Among the metals suited for the purpose at hand and which are more readily removable by various chemical means than iron or steel while having the necessary strength characteristics are magnesium, aluminum and zinc. Alloys of these metals in which one of the metals is a predominant constituent are also suitable.

The chemical means employed to bring about disintegration of the readily removable metal section may suitably take the form of a chemical solution selected according to the particular metal employed. When the readily removable metal pipe is made of magnesium or alloys thereof in which magnesium is a predominant constituent, hydrochloric acid, sulfuric acid or the like may be employed to bring about disintegration of the removable or soluble section. The disintegration of a section made from aluminum or an alloy thereof is best brought about by employing a solution of an alkali metal hydroxide, such as for example, sodium hydroxide although acids may be used. On the other hand, if zinc or alloys thereof are employed either an acid or an alkali metal hydroxide may be suitably used to bring about its solution. The concentration of the chemical solution to employ to bring about disintegration of the readily removable sections may vary quite widely. For example, when employing an acid, such as hydrochloric acid, a concentration of between about 5–30 per cent and preferably about 20 per cent may be suitably used. It is desirable, when employing an acid solution, such as hydrochloric acid, that it be inhibited against corrosive attack on iron or steel by the use of a suitable inhibiting agent in the way now old in the art. The concentration of alkali metal hydroxide to employ to bring about disintegration of the removable section may be from between about 0.5 to 50 per cent and preferably between about 10–20 per cent. Other chemical means may be suitably employed to bring about the disintegration of the readily removable section. For example, a charge of explosive may be set off opposite the removable section to cause its disintegration without substantially any danger to the iron or steel casing. Also a charge of "thermit" which is a proprietary mixture of metallic aluminum and iron oxide capable of reacting to produce intense heat may be suitably employed to disintegrate the readily removable section.

In those instances where chemical solutions, such as those above mentioned, are employed they may be allowed to remain in contact with the removable or soluble section for from 2 to 6 hours or more and, in some instances, it may be desirable to renew the solution from time to time as the solution first placed in the well bore becomes exhausted by reaction with the soluble or removable section. Instead of merely introducing a quantity of the selected chemical solution, in case such is used, into the well bore and allowing it to remain in contact with the soluble or removable section until it is used up, it may be preferable, in some instances, to circulate the chemical solution past the readily removable section as by pumping it down a conduit, such as a conventional well tubing, and forcing it up through the annular space between the casing and tubing. In this manner, excessive heating of the chemical solution can be controlled.

In the foregoing manner, a production test on a well can be readily made while excluding undesirable fluids from the well bore and thereafter the conventional iron or steel casing may be released so that it may be readily withdrawn from the well bore or thereafter employed as the well is deepened without the necessity of introducing a new casing string of smaller diameter.

I claim:

1. In a method of casing a well drilled into a stratum to be tested for production, the steps which consist in locating in the well bore a metal pipe comprised essentially of iron and having attached to its lower end a section of pipe which is more readily removable by chemical means than the iron pipe, introducing a quantity of a sealing material into the well bore so as to seal only the readily removable section in the well bore at a point above the stratum to be tested for production, ascertaining the productivity of said stratum, bringing about the disintegration of the readily removable section of metal pipe by chemical means, and thereafter withdrawing the metal pipe comprised essentially of iron from the well bore.

2. The method of claim 1, wherein the section readily removable by chemical means is subsequently disintegrated by introducing into the well bore a quantity of chemical solution capable of dissolving the readily removable section without substantially attacking the section comprised essentially of iron.

3. The method of claim 1, wherein the well bore is deepened to another productive stratum while maintaining the bore of at least the same diameter after the metal pipe comprised essentially of iron is withdrawn from the well.

4. In a method of completing a well drilled into a stratum which is to be tested for production, the steps which consist in locating in the well bore a metal pipe comprised essentially of iron and having attached to its lower end a section of pipe which is more readily soluble in a chemical solution than the iron pipe, introducing a quantity of a sealing material into the well bore so as to seal only the readily soluble section in the well bore at a point above the stratum to be tested for production, ascertaining the productivity of said stratum, introducing into the well bore a quantity of a chemical solution so as to bring it into contact with the readily soluble section of metal pipe, said chemical solution being capable of dissolving the soluble metal section without substantial attack upon the section comprised essentially of iron, and thereafter deepening the well to another productive stratum.

5. In a method of casing a well drilled into a stratum to be tested for production, the steps which consist in locating in the well bore a casing string at a point just above the stratum to be tested, said casing string being composed of ferrous metal pipe except for the lower portion which is composed of a metal more readily removable by chemical means than the ferrous metal, cementing only said readily removable portion of said casing string in place, and thereafter ascertaining the productivity of the well.

6. In a method of casing a well drilled into a stratum to be tested for production, the steps which consist in locating a casing string in the

well bore at a point just above the stratum to be tested, said casing string being composed of ferrous metal pipe except for the lower portion which is composed of a metal more readily removable by chemical means than the ferrous metal, cementing only said readily removable section of the casing string in place, ascertaining the productivity of said stratum and then removing said readily removable section by chemical means without substantially attacking the ferrous metal sections of the casing string.

7. The method according to claim 6 wherein the well is deepened to another productive stratum while the well bore is maintained of substantially the same diameter after the productivity of the well has been ascertained.

8. The method according to claim 6 wherein the readily removable section of the casing string is comprised essentially of magnesium.

9. The method according to claim 6 wherein the readily removable section of the casing string is comprised essentially of magnesium and the chemical means employed to remove the same is hydrochloric acid inhibited against corrosive attack on iron or steel.

10. The method according to claim 6 wherein the readily removable section of the casing string is comprised essentially of aluminum and the chemical means employed to remove the same is a solution of an alkali metal hydroxide.

11. The method according to claim 6 wherein the chemical means employed to remove the readily removable section is an explosive.

JAMES H. ADKISON.