

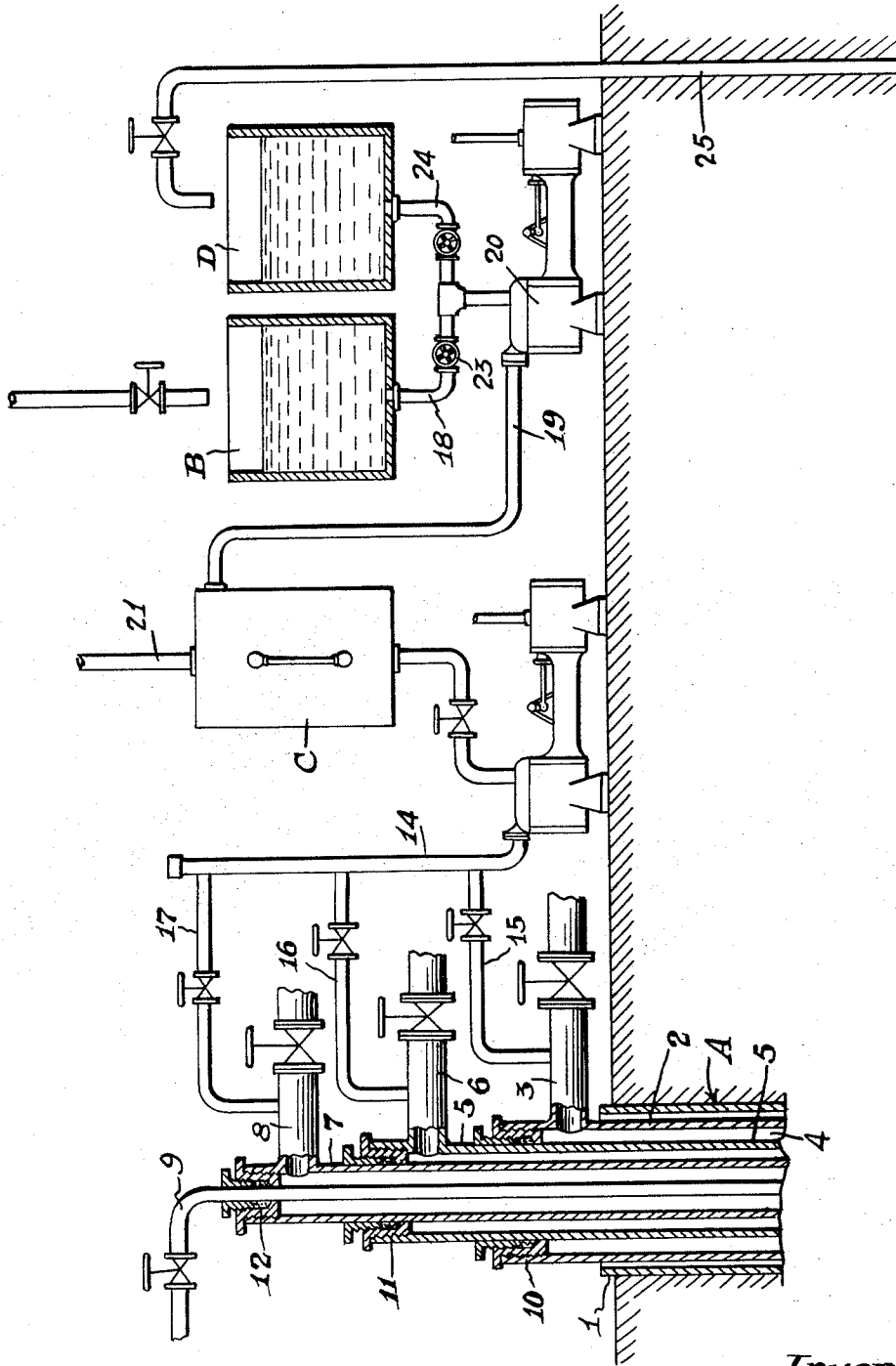
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PROCESS OF PROTECTING PIPE FROM CORROSION

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PROCESS OF PROTECTING PIPE FROM CORROSION.

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Our invention relates to a process of treating pipe and other fluid conducting apparatus from the attack of corrosive liquids or gases. It has particular application to sulphur mining and contemplates the forming of a protective coating on the conducting pipes.

In subterranean sulphur mining the producing formation is usually found in so-called sulphur "domes." Hot water, steam or other fusing agent raised to a temperature above that of the fusion of sulphur is pumped through pipes into the mine, where it comes into contact with and loses a part of its heat in fusing the sulphur, which may then be raised to the surface in its liquid state. The sulphur occurs in an area originally flooded with cold water and when the sulphur fusion fluid is introduced, a large amount of the heat contained therein is used up in overcoming the effects of the cold water. This adjacent cold water gradually becomes warmed but it is colder than the fusion liquid, and deflects the hot water away from the sulphur, so that the effectiveness of the agent is greatly decreased. It is, therefore, customary to provide mine openings from the surface leading to points adjacent the producing mine, which allow the escape to the surface of water of a temperature below the fusion temperature of the sulphur. These wells are called "bleed" wells and the water escaping at the surface is called "bleed water" or "formation" water. This water is usually hot, but not hot enough to fuse the sulphur. A large amount of heat is wasted by present methods which allow this formation water to flow to waste.

The said waste formation water contains large amounts of corrosive constituents in solution, such as the sulphides and chlorides of sodium, calcium and magnesium, and the sulphates of calcium and magnesium. The sulphides and chlorides are particularly injurious to ordinary iron or steel pipes such as are employed in mining the sulphur. The bleed water cannot therefore be saved and again further heated, because its corrosive action upon the pipes and other surface equipment soon destroys them.

It is an object of our invention to provide a process of treating the fluid conducting pipes employed in sulphur mining, so that

the corrosive agents found in the bleed water cannot reach and act upon the metal of the said pipes.

We contemplate the forming of a scale of corrosion-resisting compounds on the surface of the pipes, preferably after the said pipes have been placed in position within the well, although it will be obvious that said pipe can be treated when in any position by our process.

The drawing is a diagrammatic view partly in section illustrating an installation for mining sulphur and with which our process may be carried out.

The drawing illustrates at A the upper end of the pipes employed in conducting fluid into and from the sulphur mine. The outer pipe 1 is a surface casing which is ordinarily extended down into the mine to the upper surface of the cap rock. Within this is set a concentric pipe or casing 2 which has, at its upper end, a branch connection 3, through which any fusion liquid may be pumped into the well for the purpose of communicating heat to the upper sulphur stratum. The fusion liquid pumped in through this pipe passes downwardly through the channel 4 between the said pipe 2 and an inner concentric pipe 5.

The pipe 5 is the pipe for the hot fusion fluid for discharge into the lower sulphur formation and commonly known as bottom water. This water is pumped into said pipe through the branch pipe 6 leading to a source of supply of the heated liquid. Within the pipe 5 is a smaller concentric pipe 7 which also has a connecting pipe 8 at its upper end, and this pipe is the sulphur outlet pipe through which the melted sulphur is discharged at the surface.

A still smaller pipe 9 which comprises an air line extends downwardly through the pipe 7 and serves to discharge air under pressure into the lower end of the sulphur conveying pipe, thus forming an air lift to assist in the raising and discharging of the melted sulphur. Stuffing boxes are employed at the upper ends of the pipes 2, 5 and 7 to form a fluid-tight connection between the adjacent pipes, the stuffing box 10 shutting off the upper end of the pipe 2 and fitting tightly about the next inner concentric pipe 5. A stuffing box 11 packs the space between

the upper end of pipe 5 and the sulphur pipe 7, while the stuffing box 12 closes the upper end of the pipe 7 about the air line 9.

When these pipes are thus arranged in the well ready for mining sulphur, we contemplate covering the surfaces of the pipes with a scale resistant to the action of corrosive liquids, such as have been described. We, therefore, provide a scaling liquid for the purpose of forming a coating of scale upon the surfaces of the pipe with which it comes in contact. Sulphates and bicarbonates of calcium and magnesium when in solution in water may be heated and discharged into the well, and if the said solution is forced at a comparatively slow rate of speed through the pipe and at the proper temperature, the sulphates and the carbonates will precipitate out and form a scale upon the pipe.

We contemplate that this may be done most economically through the use of sea water which has in it a number of salts, including sulphates and carbonates of calcium and magnesium. The sulphates occur in much greater quantities than the carbonates in the sea water and will commonly make a harder scale than do the carbonates under most conditions. If, therefore, sea water is heated up to the proper temperature and forced into the pipe, the carbonates and sulphates of calcium and magnesium will precipitate and scale over the surfaces of the pipes.

We do not wish to be confined, of course, to the use of sea water as a vehicle for the deposit of scale upon the pipes. Another embodiment of the invention for scaling equipment would be to dissolve scale forming salts in sea water or other water and, if this is done, such salts as the sulphates and carbonates of calcium and magnesium are made up in solution and employed in the same manner as the sea water. It is to be understood, therefore, that any solution, either naturally or artificially formed, or a combination of both, may be employed in carrying out our process.

It is to be understood also that other elements than bicarbonates and sulphates of calcium and magnesium may be employed to scale the apparatus. Iron, silica, or other substances either in solution or in suspension, may be employed. Furthermore, these substances may be precipitated upon the pipe by the addition to the liquid of any suitable chemical reagents, such as lime, soda ash or sodium silicate. In such case heat will not be necessary.

In the drawing, the equipment previously described would be connected to a pump 13 through the discharge pipe 14 from said pump. Branch pipes 15 connecting with the pipe 3, pipe 16 connecting with the pipe 6 and 17 connecting with the pipe 8, would serve to allow the passage from the pump into the spaces between the various pipes of

the scaling liquid. Said liquid may be prepared for use in a container B and an outlet pipe 18 leading from said container would allow the pumping of the prepared liquid through the pipe 19 by means of a pump 20. Said pipe 19 will conduct the prepared liquid to a heater, indicated generally at C. Within this heater the liquid would come in contact with steam which would be discharged into said heater through the pipe 21 and would be heated to the temperature desired so that the salts would be most readily precipitated out. This temperature for precipitation of the salts varies with the kind of salt employed and can be readily determined by test in each case.

The process of scaling a pipe could be thus carried out by forcing the prepared solution, through means of the pump 20, into the heater and then pumping it by means of the pump 13 into the spaces between the various concentric pipes. This might be done simultaneously through all of the three pipes 2, 5 and 7, or one pipe at a time might be acted upon and scaled before the next adjacent pipe is treated. When a scale of the proper thickness has been deposited in this manner upon the pipes into contact with which the formation water would come, the scaling operation would then be stopped, and the valve 23 in the pipe 18 could be closed to shut off communication with the container B.

An adjacent container D could be connected through a pipe 24 with the pump 20 for then using the heated formation water from an adjacent bleed well 25. It is contemplated that the warm water being discharged from the bleed well 25 may be conducted to the container D, and after the pipes have been properly treated and scaled, the formation water from the container D will be pumped in the same manner as was the scaling water into the well, but in the use of the formation water as a fusion liquid, the valve in pipe 17 would of course be closed, thus discharging the fusion liquid through pipes 15 and 16 directly into pipes 3 and 6 and thence downwardly through the pipes 5 and 2 to the sulphur formation. The formation water will be heated to the proper temperature in the heater C so that it will perform the function of fusing the sulphur in the same manner as would fresh water.

By employing the formation water from the mine 25 several advantages of marked importance result. We are enabled to use water which would otherwise be wasted, thus avoiding the necessity of obtaining a large supply of fresh water and, furthermore, the water thus obtained is already heated to a fairly high temperature and the amount of heat necessary for raising it to the proper temperature for fusing the sulphur will be much less and a large economy in heating will thus result. We are enabled to carry out this

process without injury to the pipes through our process of first scaling the surface of the pipes with which the formation water comes in contact. Pipe thus scaled will resist the
5 action of the corrosive constituents in the formation water, so that the passage of the said formation water therethrough will have no deleterious effect upon the equipment.

It is understood of course that the vessels
10 or the pipes and containers which are not and cannot readily be coated with scale for carrying out this process may be made of a material resistant to the action of the corrosive constituents of the formation water. While
15 it would be too costly to equip the well with pipes of this nature, it will be possible and even economical to equip the small portion of the apparatus which is not scaled so that the process may be carried out.

20 Having thus described our invention, what we claim as new and desire to protect by Letters Patent is:

1. A process of treating pipe for resistance to corrosion, including forming a solution of
25 salts of calcium and magnesium which will precipitate out of solution at suitable temperatures heating said solution, forcing said solution into contact with the surfaces of said pipe, and allowing the deposit on said pipe
30 of a scale by the precipitate thus formed.

2. A process of treating pipe for resistance to corrosion, including forming a solution of salts including calcium sulphates and magnesium sulphates which will precipitate out
35 of solution at suitable temperatures, forcing said solution into contact with the surfaces of said pipe, regulating the temperature of said solution and allowing the deposit on said pipe of a scale by the precipitate thus formed.

40 3. A process of treating pipe for resistance to corrosion including heating a solution having therein salts adapted to precipitate out

under heat, pumping said solution into contact with the pipe surface, and allowing the precipitation of scale on said pipe.

4. A process of treating pipe for resistance to corrosion including heating a solution having therein salts adapted to precipitate out under heat, pumping said solution into contact with the pipe surface, regulating the
50 speed of flow of said solution, and allowing the precipitation of scale on said pipe.

5. The process of mining sulphur by the underground fusion system including first pumping through the fluid-conducting pipes
55 a treated solution of salts adapted to precipitate out at a suitable temperature, allowing a deposit of scale upon said pipes by said solution, and then heating the corrosive formation water from the mine, and using
60 said formation water as a fusion liquid.

6. The process of mining sulphur by the underground fusion system including first pumping through the fluid-conducting pipes a heated solution of salts adapted to precipi-
65 tate out at a suitable temperature, allowing a deposit of scale upon said pipes by said solution, and then heating the corrosive formation water from the mine, and forcing said heated formation water through said
70 pipes to the sulphur formation as a fusion liquid.

7. The process of treating pipes for resistance to corrosion including first forcing through the fluid-conducting apparatus a
75 liquid containing salts therein adapted to precipitate out, acting upon said liquid to cause precipitation of said salts, and allowing a deposit of scale upon said pipes by said salts.

80 In testimony whereof we hereunto affix our signatures this 8th day of July, A. D. 1926.

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