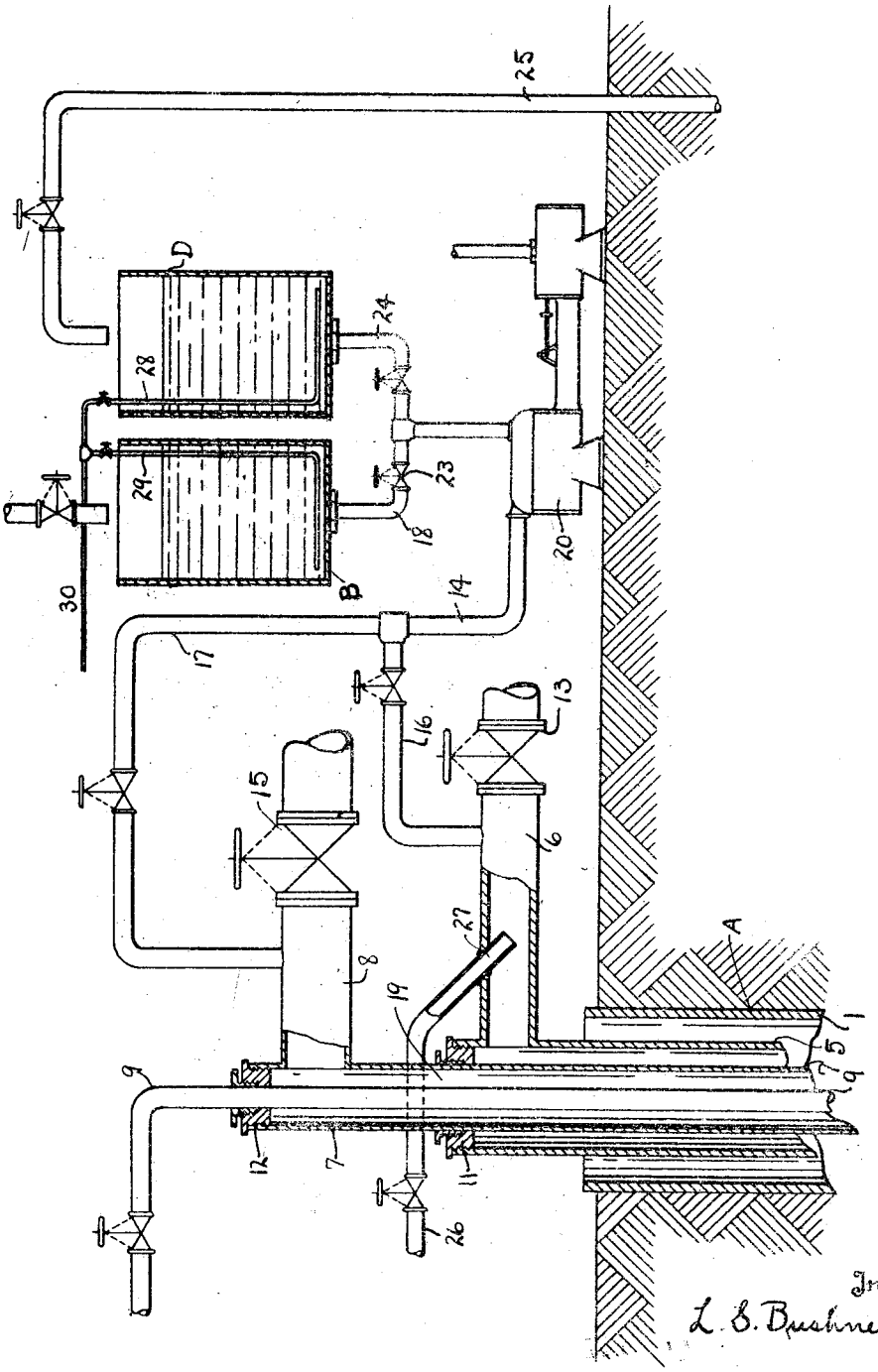
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L. S. BUSHNELL

PROCESS OF APPLYING A PROTECTIVE COATING TO PIPE

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Inventor

L. S. Bushnell

By Jesse R. Stone

Attorney

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LYMAN SELDON BUSHNELL, OF FREEPORT, TEXAS, ASSIGNOR TO FREEPORT SULPHUR COMPANY, OF FREEPORT, TEXAS.

PROCESS OF APPLYING A PROTECTIVE COATING TO PIPE.

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My invention relates to a method of applying scale to pipe and is particularly adapted for use in sulfur mining.

It is an object of the invention to place a corrosion resisting scale upon the pipe used in sulfur mining after the pipe has been placed in position in the well.

The invention contemplates the applying of a scale of sulphates and bi-carbonates of calcium and magnesium and similar salts upon the surface of the pipe, the said scale having the effect of preventing the action of corrosive liquids upon the pipe, and also to insulate the pipe so as to prevent electrolytic action of the fluid upon the pipe.

In the mining of sulfur by the so-called "Frasch" method, the mine is drilled down to the sulfur stratum and a concentric system of pipes is introduced into the well for the purpose of forcing the water down to the vicinity of the sulfur. This water is called mine water and is heated to such a temperature as to melt the sulfur with which it comes in contact and cause it to flow toward the bottom of the well to the lower end of the eduction pipe where it may be raised to the surface through the pressure of the liquid upon the sulfur and the assistance of an air lift which aerates the sulfur and tends to lift it upwardly to the surface. In this system of mining, the subterranean strata in which the sulfur occurs is ordinarily charged with cold water, usually salt laden, having other elements in solution, such as sulfur, which tend to corrode the pipe. Furthermore, the water which occurs in the vicinity of sulfur mines and which must be employed as mine water in the melting of the sulfur is usually impure water having therein various corrosive elements which cannot be economically eliminated and which tend to corrode the apparatus.

My invention has as its broad object the protecting of the pipes employed in the sulfur mining apparatus by scaling thereon a coating covering the surface of the pipe and serving to protect the same from contact with the water and other fluids which tend to corrode the pipe.

Referring to the drawing herewith, I have illustrated the apparatus as it is connected up at the surface of the ground. The pipes extending into the well are indicated in central vertical section, and the apparatus is somewhat diagrammatically shown.

Referring to the drawing, the well which is to be operated is shown at A. It has an outer surface pipe 1 which usually is extended downwardly to retain the walls of the well in position. The mining apparatus includes a heat discharge pipe 5, spaced from the walls of the well, and having a laterally connecting pipe 6 at its upper end, said pipe having a valve 13 therein to control the flow of liquid into the well. The upper end of the pipe 5 has therein a stuffing box 11 which is adapted to make a closure between the pipe 5 and the sulfur discharge pipe 7.

The pipe 7 extends from the surface to the lower end of the well where it is adapted to project into the molten sulfur and to allow the discharge therefrom of the sulfur in this molten state. The upper end of the pipe 7 has a discharge pipe 8 having a valve 15 therein to control the passage of the sulfur. The upper end of the pipe 7 has a stuffing box 12 therein, closing the pipe 7 about the inner pipe 9, which is intended to convey air under pressure downwardly to a point spaced somewhat from the lower end of the sulfur discharge pipe 7. The air from the air line bubbles up through the molten sulfur, aerating it and tending to lift it upwardly to the surface where it is discharged through the branch line 8.

When the apparatus is thus installed, the invention consists in my approved method of depositing scale upon the pipes to protect them in the manner previously noted. This is done by pumping into contact with the pipe surfaces liquid containing salts in solution which are adapted to precipitate out as scale upon the pipes. Sulphates and bi-carbonates of calcium and magnesium are preferably employed for this purpose, although other similar elements may be employed. Iron, silica, or other similar ingredients, either in solution or in suspension, may be employed, as desired. Ordinary sea water has a number of salts including sulphates and carbonates of calcium and magnesium, and it is intended to employ sea water as a vehicle for conveying the salts into contact with the pipe. The proper content of salts is obtained by mixing with the sea water such further ingredients as are necessary.

The ingredients are preferably mixed within a tank or container B and agitated therein by means of air delivered at the bottom of the container through an air line 29 connecting

with the pipe 30, leading to a source of air under pressure.

A pump 20 is employed to force the treated liquid into contact with the pipe and said pump is connected with the mixing tank B by means of a pipe 18 having therein a valve 23 to regulate the flow of liquid from the tank to the pump. The discharge end of the pump connects with a pipe 14 having branch lines 16 and 17 with valves therein to control the flow of the salt-laden liquid through either of said branch lines. The line 17 is connected to the pipe 8, previously noted, and the pipe 16 is connected with the pipe 6, as will be seen in the drawing.

The usual steps in the scaling of the pipes consist in first applying the scale to the outside of the air line 9 and the inside of the pipe 7. This is accomplished by forcing hot water or steam at the proper temperature downwardly through the pipes 9 and 5. This hot water will serve to heat liquid within the space 19 between the two heated surfaces, the pipes 9 and 7. With the hot water thus circulating, a salt-laden liquid is pumped through the pipe 17 and into the line 8, leading to the space 19, and liquid thus flowing into the heated space will become heated in contact with the pipe. It is planned to pump the cold fortified sea water through the pipe 7 at a rapid and gradually decreasing velocity. The salt-laden liquid will become heated to a temperature at which the salts contained in the liquid will be deposited upon the outer side of the pipe 9 and the inner side of the pipe 7, the water being pumped rapidly down will carry the same to a point near the bottom of the well before the salt is precipitated out. This velocity will be gradually decreased so that the scale will be gradually deposited at points farther up until finally the whole interior of the pipe 7 and the exterior of the pipe 9 will be covered with scale of the proper thickness.

The heating liquid in the pipe 6 may be raised to any desired temperature by means of a steam line 26 which is adapted to discharge steam through a nipple 27 into the pipe 6, said nipple 27 being welded within the side of the pipe, as indicated in the drawing.

When the pipes 9 and 7 have been scaled within the chamber 19, the circulation will be stopped and hot water will be circulated into the space 19 within the pipe 7, and the cold salt-laden sea water will be pumped inwardly through the pipes 6 and 16, the valve in the pipe 17 being closed. This water will be partially heated through steam from pipe 27 and partly from contact with the heated pipe 7. The pipe 5 may be thus scaled on its inside and the outer side of pipe 7 will similarly be scaled. It is desired in this scaling process to pump the sea water at a slow rate at first and gradually increase the velocity of the salt-laden liquid, so that the upper part of these two pipes will be scaled first and the point of deposit of the scale be gradually extended downwardly toward the bottom. This method is for the purpose of preventing the deposit of a large amount of scale at the lower end of the pipe 5, so as not to stop up the openings in the screen or perforated pipe which allow the inlet of sulfur to the well.

When the pipes have been thus scaled so as to protect them from corrosive liquids employed in the mining of the sulfur, the usual impure liquid obtained and used for sulfur mining will have no effect upon the pipes through which the water is circulated, the said pipe being thus thoroughly protected against the attacks of acids or other corrosive elements upon the pipe.

In the usual process of sulfur mining, bleed wells are usually drilled to allow the outlet of water from the sulfur stratum so that the hot water being pumped into the well may circulate into the stratum to maintain it at the proper temperature. The water discharged from these bleed wells is usually hot and but for the corrosive action of the chemical elements contained in the water, this water could be re-used in mining. I have shown a pipe 25 leading from a bleed well through which the formation water may be discharged into a vat D and there agitated through an air line 28 for treatment, as desired. It may then be pumped into the well for transferring the heat to the sulfur stratum and as it is passed through the pipe 6 it may be further heated through the use of the steam line 26, as previously noted, and it will be obvious that economy in the heating of this water will be accomplished in this manner.

By employing the formation water from the line 25, several important advantages are obtained. It is possible to use water which would otherwise be wasted, thus avoiding the necessity of drawing on the supply of cold water, and furthermore, the water thus retained is already heated to a fairly high temperature and a limited amount of heat is necessary to raise this liquid to the proper temperature for fusing the sulfur.

It is to be understood, of course, that the advantage of scaling the pipe is not entirely in the fact that the operator is enabled to use the hot water from the mine. Much of the water obtained in the vicinity of sulphur mines is more or less contaminated with corrosive elements which cause a rapid deterioration in the pipes. When the pipe has been thus scaled, it is not attacked by these corrosive liquids. Also the scale forms an electrical insulating coating which prevents electrolysis, which ordinarily tends to cause the rapid disintegration of the metal pipes.

This process whereby the scaling liquid may be heated in direct contact with the pipe where it may be precipitated from solution and deposit directly upon the pipe enables the opera-

tor to deposit upon the pipe a uniform scale of desired thickness without difficulty.

Having thus described my invention, what I claim as new is:

1. A method of scaling pipes including installing said pipes in concentric relation spaced apart to form fluid conducting passages between adjacent pipes, discharging heated liquid into the pipes on each side of one of said passages, then circulating a salt-laden liquid into the passage to be scaled and allowing said salts to deposit upon the adjacent pipes as the temperature of said salt-laden liquid is raised.

2. A method of forming a layer of scale upon a series of concentric pipes in wells, having fluid passages between them, comprising heating the walls of the passage to be scaled, and then forcing through said passage a liquid laden with salts, and allowing said salts to precipitate upon the walls of said passage as the temperature of said liquid is raised.

3. A method of forming a layer of scale upon a series of concentric pipes in wells, having fluid passages between them, comprising heating the walls of the passage to be scaled, and then forcing through said passage a liquid laden with salts, and allowing said salts to precipitate upon the walls of said passage as the temperature of said liquid is raised, and varying the rate of flow of said liquid to allow the deposit of scale at different levels in said passage.

4. A method of forming a layer of scale upon a series of concentric pipes in wells, having fluid passages between them, comprising heating the walls of the passage to be scaled, and then forcing through said passage a cold liquid laden with sulphates and carbonates of calcium and magnesium, and allowing said sulphates and carbonates to precipitate upon the walls of said passage as the temperature of the liquid is raised.

5. A method of forming a layer of scale upon concentric pipes in wells having fluid passages between them comprising heating the walls of the passage to be scaled by pumping heated fluid through a passage adjacent thereto, forcing into the passage to be scaled a cold liquid laden with salts to be precipitated, and varying the rate of flow of said liquid to deposit the scale at various levels.

6. A method of depositing scale upon pipes in sulphur mining comprising heating the walls of the pipe to be scaled, circulating into contact with the heated pipe a cold fortified salt water, and gradually heating said water in contact with said pipe to cause said salt to precipitate upon said pipe.

In testimony whereof I hereunto affix my signature this 24th day of April A. D. 1928.

LYMAN SELDON BUSHNELL.