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PROCESS OF CONDITIONING, AND RE-USE OF MINE BLEED WATER IN MINING SULPHUR

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This invention relates to the treatment of water, variously described as "bleed water" and "formation water" and which has been used in the mining of sulphur, in such a manner as to reduce its corrosive and otherwise undesirable properties. The general object of the invention is to provide a suitable treating process affording protection of pipes, valves, well casing, pumps and other equipment from the corrosive action of such water so as to enable the re-use of such water and recovery of its heat content and of valuable constituents which are present.

In the process of mining sulphur by the underground fusion method, a hole is drilled into the sulphur formation and the well equipped with a system of concentric pipes within the well casing. Super-heated water is pumped into the well and discharged into the formations through perforations in the outer pipe. The melted sulphur enters one of the inner pipes and is raised to the surface by a suitable means such as an air-lift. The water (hereinafter designated as mine water) required for melting the sulphur is relatively large in volume in proportion to the sulphur removed, and this volume increases as the sulphur in the deposit is reduced by mining. In this manner, the quantity of mine water required becomes so great after a certain time that it is not profitable to extract the remaining sulphur from the formation.

To prevent the accumulation of excessive pressure the greater portion of the mine water pumped into the deposit must be withdrawn by means of bleed wells, during and/or subsequent to the removal of the sulphur. Water, thus returned to the earth's surface (hereinafter designated as bleed water) is still at an elevated temperature, and in addition to the usual constituents of ground waters such as chlorides, sulphates and bicarbonates of sodium, calcium and magnesium, contains hydrogen sulphide, thiosulphates, hydrosulphides and polysulphides, and other sulphur compounds of various basic elements (which will be designated hereinafter simply as sulphides) and various other dissolved substances. The bleed water is acidic having a hydrogen ion concentration greater than that of neutral water, and these constituents in the bleed water render it highly corrosive and extremely destructive to the usual materials encountered in commercial operation of a sulphur mine, making its re-use entirely uneconomical.

It has long been recognized by the sulphur industry that to recover the heat in bleed water by re-use would be very advantageous and some un-

successful attempts at recovery have been made. The re-use, without treatment, of the bleed water would require all conduits and equipment with which it came in contact to be made of special noncorrosive material, which is costly and economically impractical. Commercial recovery of the heat in bleed water has heretofore been confined solely to a closed type of heat exchanger in which the bleed water flows over conduits carrying colder fresh water, the heat transfer being from the bleed water through the conduit material and into the fresh water. Only a small part of the heat can be commercially recovered in this manner and the heat exchangers must be constructed of costly non-corrosive materials. It has, therefore, been customary to attempt to locate the bleed wells so as to return to the surface as cold a bleed water as possible and to discharge this water to waste. This practice has accounted for great losses by the sulphur mining industry in the past because of the non-recovery of the heat and other valuable constituents from the bleed water by the inability to re-use the bleed water and by loss of heat due to the flow of the hot mine water to the upper formations of the deposit where it is no longer available for melting sulphur in situ. The disposal of the bleed water thus produced is subject to the further disadvantage in that the suspended matter, hydrogen sulphide, and sulphides contaminates surface water into which the bleed water may be permitted to flow. In order to prevent objectionable pollution, it is necessary to purify the bleed water before its discharge, and such purification is now required for the protection of marine life by governmental agencies. The apparatus and process of purification before disposal have imposed a heavy expense upon the sulphur mining industry.

One of the objects of this invention is to effectively and economically reduce the corrosiveness of the bleed water by repressing the formation of hydrosulphides and still further to alkaline sulphides and to lower the hydrogen ion concentration thereby diminishing the corrosive action of the bleed water.

Another object of this invention is to deposit upon the surface of pipes, valves, pumps, and all auxiliary equipment which may come in contact with any water used in sulphur mining, a coating of scale which will protect the equipment from corrosion.

A further object of this invention is the control of such scale deposition by varying the com-