PROTECTING PIPE LINES AGAINST ALKALI.

The matter of the proper method of protection for pipe-lines when alkali is present is a very important one to the engineer. Many of the water supplies for our Western towns and cities must be conveyed through many miles of pipe, and adequate protection is a necessity. Mr. C. P. Bowie makes the following comment on the subject in the May issue of Western Engineering.

Most of the larger oil pools so far developed in the state of California lie in the arid districts. In the construction of pipe-lines through these districts, and leading from them to the sea-coast, one of the most serious problems the engineer has to solve is the question of an adequate protection for the pipe against alkaline soils. In the San Joaquin valley, through which the majority of these lines pass, the total alkali salts in the soils range from 0.05 up to 5 per cent., and the average composition of these salts in the soils is about as follows.

	Per cent.
Potassium sulphate	11.28
Sodium sulphate	19.48
Magnesium sulphate	2.89
Sodium chloride	23.03
Sodium carbonate	40.96
Sodium phosphate	2.08
Sodium nitrate	0.28
	100.00

In many places the percentages of chlorides and sulphates are much higher than shown. In such soils, steel pipes 5/16-inch in thickness, altho gh originally protected with three coats of asphaltum paint, have corroded so badly that pit-holes have developed, extending entirely through the pipe in three years' time. If the life of a pumping system be taken as 20 years, and the cost of the pipe installed in the system as 40 per cent. of the total first cost, it is obvious that a protective coating which will triple or even double the life of the pipe through bad territory, becomes an important factor.

Working along these lines, a number of coverings have been brought forward. Various kinds of asphaltum paint have been used, but, so far at least, without any marked degree of success. Crude oil has also been applied by covering the pipe after it has been lowered into the ditch to a depth of six inches or more with the oil, and then immediately filing in the ditch with earth. This method is only partly successful for the reason that if the soil is at all sandy the oil soaks into it, and in time almost entirely disappears from the vicinity of the pipe, leaving the metal quite as badly exposed to the alkali as before the application. Quick-setting bituminous enamels, which can be put on in a layer ⅛ to ¼-inch thick, bid fair to give results. However, up to the present, these have one serious drawback, in that they cannot be successfully applied to a moist pipe or to a pipe having a lower temperature than 60°F., because the enamel, although it is put on at a temperature of approximately 200°F., is chilled so rapidly that it hardens before it can be spread. The action of the mop with which it is applied is merely to roll it into a myriad of balls or globules which do not stick to the pipe at all but fall to the ground. This not only causes a great waste of material, but is apt to leave many small portions of the pipe, especially on the under side, wholly unprotected even though several coats of enamel are put on. This difficulty can be largely overcome by applying the enamel in warm dry weather only, or to pipes through which warm oil is being pumped. There are no lines in this state which have been covered by this process and allowed to remain in the ground for any great length of time. One line passing through slightly alkaline territory, which was covered in this manner about two years ago, was found to be in excellent condition upon a recent examination.

The method of covering most extensively used, and perhaps the most successful one, is that employing especially prepared roofing papers. The papers commonly used are those made from ordinary deadening felt run through a mill in which the felt is plunged into a number of successive baths of hot asphaltum and rolled hot and under pressure after each successive bath until the fibres of the paper are thoroughly impregnated with the asphaltum. Just before entering the last set of rolls the paper is sprinkled with either mica or soapstone, which mineral, while it no doubt adds somewhat to resistance against the attack of chemicals, has for its principal function the quality of affording a means of keeping the paper from sticking in the roll in hot weather. Asbestos papers, prepared somewhat in a similar manner to the felt papers, have also been used in a number of places.

These papers are applied to the pipe by two methods, known locally as the "spiral warp" and "longitudinal lap." The spiral warp, which is in most cases the most efficient method, consists of applying the paper to the joints between collars by wrapping it around the pipe spirally. For this purpose, the paper is cut in the mill into rolls of the desired size, varying from 3 to 12 inches in width, and containing from 50 to 100 ft. in length as best suits the diameter of pipe to be covered. The pipe is covered immediately after being screwed together by the tong gang, and while still on skids over the ditch. It is coated with hot asphaltum and the wider strips wound on spirally before the asphaltum has had time to set. The crack which is left between each wrap of the wide strip is then coated with the hot asphaltum, and a batten, or 3-in. strip, wound on to cover it. The asphaltum used is a thin grade of the ordinary refined product, and is applied to the pipe at a temperature of about 200° F., and is of such a consistence that it will not set for about five minutes after application. If, due to climatic conditions or variance in the different shipments, the asphaltum sets too quickly, a so-called flux, which is simply a very thin grade of asphaltum, is added. It is usually the practice to ship one barrel of "flux" to the field for every 60 barrels of asphaltum. At the joints 3-in. strips stuck together with asphaltum are wound around the pipe on either side of the collar until a shoulder is built up flush with the outer circumference of the collar. The sleeve and shoulder thus built up are then coated with hot asphaltum, and the whole covered with a 12-in. strip of paper. Besides being stuck to the pipe with asphaltum, this last strip is bound on with wire, as are also the ends of the paper where it is wrapped spirally. If this is not done, the ends will curl up and allow dirt to get between the paper and the pipe after the pipe has been lowered into the ditch, and before the back-filling has been done.

The longitudinal lap system, which to the present time has been much more extensively used than the system just described, consists (as the name implies) of wrapping the paper longitudinally around the pipe. The paper is delivered in the field rolls, about 6 in. wider than the circumference of the pipe to be covered, each roll containing approximately 72 lineal feet. Two men go ahead of the paper gang and measure up each joint of pipe between collars and cut the paper into the desired lengths.

In applying the paper to the pipe, undoubtedly the best method is first to coat the pipe with hot asphaltum as previously described; then to wrap the sheet of paper around the pipe and stick down the lap with hot asphaltum. This, however, is not often done when covering lines where the oil passing through is to be heated, the supposition being that