PAINTING STRUCTURAL STEEL.

A PAPER to be presented to the American Society of Civil Engineers on January 7th next by A. H. Sabin, A. M. Am. Soc. C.E., outlines the situation as it obtains at present in the painting of structural steel. The corrosion of structural metal by atmospheric and other natural causes is a subject which has long been of importance to the engineer. A few years ago, the greatly increased use of concrete structures aroused the hope that danger from such corrosion would be much reduced; but unarmored steel seems to be used as much as ever. Concrete has not taken its place, but has made an entirely distinct place for itself. Much has been written, and much has been done, relative to the protection of steel; but improvement has been slow, progress being made step by step.

Some years ago, Mr. G. W. Thompson attempted to classify pigments, as to their relation with iron, by suspending them in water and immersing pieces of iron or steel in these mixtures. The results were somewhat surprising; some of the pigments which common experience approved, seemed to increase corrosion in this condition, and others, known to be useless in protective paints, seemed to be much better for preventing it. Lampblack, for instance, was the worst in provoking corrosion, and white zinc or pulverized chalk prevented it. This was probably due to the fact that lampblack contains, condensed on the surface of its particles, considerable carbonic acid, which is the most generally active agent in the corrosion of iron, and white zinc and chalk are basic substances by which iron is not rusted; however, the carbonic acid in lampblack is displaced by grinding in oil, and the well-known lack of durability in paints made of white zinc and chalk prevents their good qualities from coming into action.

So great is the need of more knowledge as to the value of pigments in paints, and their mode of action, that nothing promising new information is neglected. A committee of five chemists from different parts of the United States, with the approval of the Society for Testing Materials, made a series of tests of the principal pigments, and of some other substances, on steel immersed in water; and, as was to be expected, arrived at substantially concordant results. These results, as has been stated, were of no value from the standpoint of the paint-maker, being inconsistent with the known value of the pigments when ground in oil or varnish. When the report was published, however, the pigments were classified, according to their water value, into three groups, namely, inhibitors, indeterminates, and stimulators. This was the origin of the use of these now well-known words in paint terminology. It was expressly stated in the report that this was a classification as regards water only; but the names were so convenient and so tempting that those not familiar with the subject and also many who saw their value for advertising purposes (two quite distinct classes), put them into common use to classify pigments in oil. It is obvious that any classification of pigments in oil should be based on their behavior in oil, and if, as must be conceded, this is radically different from water tests, the latter should not be regarded. All this investigation began some years ago; meanwhile numerous young men, mostly students working under the supervision of their teachers, have made brief and generally inconclusive studies of paints, and almost without exception have used these indefinite terms, inhibitors and stimulators. Patents have even been taken out—which, in the writer's opinion, are not only worthless but invalid—covering the use of old and well-known pigments. What is worse, every maker of a paint nostrum assures his hearers or readers that his particular paint absolutely inhibits rust, and that everything else stimulates it. This is the whole history of this jargon about inhibition and stimulation; it never had any particular value to the consumer, and it is generally used to mislead him.

It is obvious that in a good paint the pigment particles are enveloped in a film of oil; they do not come in contact with the iron; if they did, the paint would peel off, for no dry pigment adheres well to metal. It is as true to-day as it has been in the past that steel rusts because air and moisture act on it; and paints are used to keep air and moisture from it. They do not inhibit rusting, except as they inhibit the cause of it.

The important practical question is whether paints have been or can be improved as to being non-porous and durable. This is essentially dependent on the relation between the pigment and the oil. As to the true nature of this relation, very little is known; but something is known about its visible manifestations. It is known, for instance, that 1 lb. of dry red lead mixed with 1/4 lb. of oil makes a paint of ordinary consistency, and 1 lb. of dry lampblack requires at least 6 or 8 lbs. of oil, say, thirty times as much, or making allowance for difference in density, six times as much, as the red lead. Similarly, 1 lb. of white zinc takes twice as much oil to make a paint as 1 lb. of white lead; and white lead takes nearly twice as much as red lead. These are things we know; but we have no idea why they are so. Again, red lead, which is an oxide of lead, makes an excellent paint for iron; oxide of iron is neither very good nor very bad; oxide of manganese is bad. Our knowledge of paints is as yet largely empirical; chemists dislike to admit this, for like everybody else, they hate to confess that there is anything they do not know, and thus when a new theory is offered some of them make a great rejoicing over it without first finding out whether or not it agrees with the facts. Where we are gaining is in more general appreciation of the value of the proper application of paint, better preparation of surface, more confidence in good paint rightly used, and in the better preparation of paint materials. For instance, in the older books, and until about twenty years ago, we find analyses of red lead showing as low as 55 per cent. of true red lead, with 45 per cent. of litharge. Red lead is made from litharge, and the presence of the latter is not a sign of adulteration, but of incomplete conversion. At the same time other samples showed as high as 80 per cent. of true red lead. As is well known, there was much difference of opinion in those days as to the value of red lead as a paint for iron; though most users liked it, some thought it poor stuff. It is now known that its value depends on the quantity of red lead it contains. Coarse red lead always contains litharge, because the litharge in the middle of a large particle is never oxidized. It was observed that the finer the red lead, the better it was, and so a demand arose which forced the manufacturers to make higher grades; now they are grinding their litharge to an impalpable powder before roasting it, with the result that 94 per cent. of true red lead has been on the market for some years. Then an unexpected fact was developed. The old red lead when mixed with oil would set in a day or so—often in a few hours—into a cement; just like plaster of Paris and water; this tendency made it work with difficulty and unevenly in application and its coarseness gave it a tendency to run; but the new, or high-grade, article is inactive to oil, and brushes out smoothly like a house-paint. This enables the painter to cover 50 per cent. more surface with the