

Bowling and Low Moor iron. Copper is, of course, the universal practice for stay bolts when a copper fire-box is used. A copper stay bolt screwed into a copper plate with its head carefully riveted over is more likely to stand the wear and tear, since the coefficient of expansion is the same. Leakage at the joints is reduced to a minimum; the action of the fire on the riveted head is far less severe, thus ensuring a far longer life than if the stay was made of a bronze, which naturally wastes with the fire action, the head vanishing, and later on the shank of the stay bolt in the copper plate for the same reason unless replaced in time. Fig. 44 is a good illustration of this wear and tear, although it is probably intended to illustrate a badly worn copper stay many years old.

Given a wider water space, and a pitch of stay bolts less than the usual practice, then with the high pressures now in use no trouble need be anticipated from broken stays, and copper is evidently the proper material to use, since it has to be fitted into a copper plate and both exposed to intense heat.

On the general design of boilers we find much useful information, and reference is made to Mr. Drummond's water-tube fire-box; surely the late Mr. W. M. Smith, of the North-Eastern Railway, had a good deal to do with the arrangement of the water tube, it being originally fitted into the fire-box of North-Eastern Railway engine No. 1619 in a somewhat similar fashion. This engine is not mentioned, by the way, in chapter xxxiii., dealing with compound locomotives, although it is the progenitor of the Smith type of three-cylinder compounds on the Midland and Great Central Railways; that is to say, the engine is fitted with one high-pressure and two low-pressure cylinders, the latter being used as high-pressure cylinders and the former being in equilibrium when starting a heavy train automatically. It is, of course, well known that the three-cylinder Smith compounds on the Midland have been fitted with a special regulator valve, which does away with the Smith automatic valve.

The question of compound working of locomotives has been a prominent one for a long time, and we cannot congratulate the author on the way in which he has dealt with it; surely four pages in a book of 300 pages is a ridiculous proportion to give us in a work on the railway locomotive. All engineers are fully aware that Mr. T. W. Worsdell was the inventor of the two-cylinder compound locomotive; why Mr. James Worsdell should get the credit is a mystery. This is a careless mistake for which there is no excuse.

On the question of valve gear, expansion and link motion, we find much information, but why "James Stirling's" steam reversing gear is described as "Wainwright's" might be explained; besides this, the latest type of the Smith piston valve is not illustrated in Fig. 81. It is of the segmented type, and is intended to free the cylinder of water when necessary, being collapsible. The vacuum-destroying valve referred to has also been re-designed so far as to constitute a lubricator as well, thus lubricating the moving parts when running down hill with steam off, a much desired improvement.

NO. 2046, VOL. 79]

We have much pleasure in noticing these two books; they have been written from such different points of view that one forms the corollary of the other. Locomotive engineers will do well to find a place for both in their libraries.

OUR BOOK SHELF.

Feste Lösungen und Isomorphismus. By Dr. Giuseppe Bruni. Pp. vi+130. (Leipzig: Akademische Verlagsgesellschaft, 1908.) Price 4 marks.

As an authority on the subject of solid solutions Dr. Bruni has an international reputation, and it must be considered a fortunate circumstance that the Chemical Society of Breslau should have invited the author to give a special lecture to its members, for it is to that incident that the book before us owes its origin.

The theory of solid solutions put forward by van 't Hoff in 1890 represents an extension of his well-known theory of liquid solutions to the solid state of aggregation. As a means of interpreting the vast number of experimental observations which have been accumulated since the date of its conception, van 't Hoff's theory has been invaluable. The author is one of its staunchest adherents, and has himself done much to uphold the theory in the face of adverse criticism.

Dr. Bruni has retained the original form of the address in the published text. The subject-matter of the lecture, which occupies eighty pages, is divided into two sections; the first deals with the mode of formation and the nature of solid solutions, the second with the connection between the crystalline form and the constitution of pairs of substances which give rise to solid solutions. Explanatory notes, experimental data relating to the observations referred to in the first part of the text, and references to original papers which are in many cases accompanied by critical abstracts, occupy the remaining fifty pages. The arrangement is a most satisfactory one, and the many references afford an excellent bibliography of the subject.

Not more than ten years ago a solid solution was regarded as somewhat in the nature of a *rara avis*. The investigations of Roozeboom, Tammann, Kurnakow, Bruni, Carelli and others have, however, necessitated a complete change in the attitude of the chemist towards the conception. As showing the general character of the phenomenon, the fact may be cited that of one hundred and forty pairs of elements examined by Tammann and his pupils, no less than seventy-seven give rise to solid solutions, and in twenty-three cases mixed crystals are formed which contain the constituent elements in all possible proportions.

Most interesting is the author's account of the application of the observed facts relating to the formation of solid solutions to the determination of the configuration of organic compounds. That much valuable information may be obtained from observations on syn-morphism (ability to form mixed crystals) in connection with the solution of certain stereochemical problems is clearly indicated. It is, however, not only on account of its applications, but of the intrinsic interest which attaches to the phenomenon that Prof. Bruni's lucid exposition of the subject of solid solutions and isomorphism may be expected to meet with a favourable reception by a wide circle of readers. Not merely the chemist, but the physicist, mineralogist, and geologist will find much that bears on his particular subject in this little volume.

H. M. D.