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There is at present no practical and definite Code in Great Britain for boiler plant testing, and, consequently, such tests are largely carried out according to the fancy of the particular engineers engaged. I am decidedly of the opinion that the time has arrived for the adoption of a standard up-to-date Code devised on thoroughly practical lines, especially in view of the urgent necessity of fuel economy, and the fact that nearly 50 per cent. of the coal consumption of Great Britain is used for the one operation of steam generation.

What is supposed to be the Standard Code in Great Britain is that of the Institution of Civil Engineers ("Report of the Committee on Tabulating the Results of Steam Engine and Boiler Trials". Revised 1913. Published by Messrs. William Clowes & Sons Ltd., 94 Jermyn Street, London, S.W. 1. Price 3/- net).

The original Committee of the Institution of Civil Engineers for this purpose was appointed on the 29th June, 1897, and they made an Interim Report on the 25th April, 1901, followed by a final Report on the 14th April, 1902. The Committee was then reappointed on the 19th October, 1909, to revise the original Code of 1902, and the Report of this latter Committee is embodied in the present (1913) Code. In practice, however, this Code is ignored because it is too complicated and unpractical.

I am of the opinion also that the Code is entirely out-of-
date, and, with all due respect to the Institution of Civil Engineers, the devising of an Improved Code is essentially the business of two branches of engineering, chemical and mechanical.

The Standard Code in America for Boiler Plant Testing is the "Rules for Conducting Performance Tests of Power Plant Apparatus, Code 1915," of the American Society of Mechanical Engineers, 29 West Thirty-ninth Street, New York, U.S.A., being the Report of the Power Test Committee, which resulted from the Council's resolution of 13th April, 1909. As is of course well known, this Code is at present under revision by the "Power Individual Committee, No. 4" (Messrs. E. R. Fish (Chairman), D. D. Pratt (Secretary), A. D. Bailey, W. N. Best, A. A. Carey, and E. B. Ricketts), and by the courtesy of the Secretary I have been able to study the preliminary draft of the Report of this Committee, so that any criticisms and remarks of mine in this book apply to the Final Revised Code. I think that this American Code, even as revised by the "Power Individual Committee, No. 4," is still open to criticism, although much superior to the British Civil Engineers' Code.

I suggest, therefore, that the time is ripe for the devising of a Standard International Boiler Testing Code by the American, British and French Engineering and Scientific Societies working in collaboration.

In Great Britain the premier societies concerned are the Institution of Mechanical Engineers and the Institution of Chemical Engineers, with various other societies like the Civil Engineers, Electrical Engineers, Mining Engineers, and the Society of Chemical Industry, holding a watching brief. In America the lead would presumably be taken by the American Society of Mechanical Engineers, and in France by the Ingénieurs Civils de France.
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The present book is a contribution towards the work of devising such an improved International Code, and I have divided it into the following parts:

Part I.—"The Results at present being obtained on Boiler Plants in General," to show the necessity of adopting modern scientific methods in steam generation, and of devising a practical international test Code to encourage such work.

Part II.—"Criticisms of Existing Codes and Suggestions for Improvement." This part is divided under the following heads:

1. The necessity of a separate Code for boiler plant testing.
2. The object of boiler plant testing.
3. Duration of test.
4. Sampling and analysis of the fuel.
5. Flue gas analysis.
6. The method of measuring the boiler feed-water.
7. Moisture in the steam.
8. Specific heat of superheated steam.
9. Steam or power used auxiliary to the production of steam.
10. Lbs. of water from and at 212° F. per 1,000,000 B.Th.U.
11. Various minor points.
12. The method of calculating the results.

All these points are matters that could be settled immediately by American, British and French Committees appointed to devise the International Code, and would include the provision of a list of "recommended" instruments, calorimeters, water meters, combustion recorders, pyrometers, etc.

Part III.—"Suggestions for New Features that may be added in the future to an International Code as the result of further discussion and investigation." This chapter includes
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the following heads, and consists of various matters which may, or may not, be added to an International Code:—

1. The question of the use of a special factor depending on the quality of the fuel.
2. Labour, attendance, repairs, upkeep, interest, and depreciation.
3. Dust and grit in the chimney gases.
4. Steam meters.

Part IV.—"Design of a New and Improved Code as a suggested basis for the International Code," giving, as an example, the results of an actual boiler test according to the suggested Code.

For convenience and simplicity, throughout this book, the fuel under discussion is coal; but the same reasoning and principles will apply to all fuels, solid, liquid, and gaseous.

The general grounds for criticism of the Institution of Civil Engineers' Code, in particular, I consider to be as follows:—

1. The Code is far too academic and not adapted to practical requirements, and it appears to be drawn up with the idea that boiler tests are a luxury only to be carried out on rare occasions. Thus it takes up pages arguing about heat balance sheets, specific heat of flue gases, and the full chemical analysis of the fuel, and almost ignores matters of vital practical importance, such as the amount of auxiliary steam or power used on the plant, the price of the fuel, and the cost of evaporation of a unit of water.

2. The Code is completely out-of-date in the methods given for carrying out the test. For example, it insists on weighing or measuring the water in tanks, even at sea, and practically omits to mention the twenty different water meters available, and also does not discuss steam meters. Although it insists
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rightly on a bomb calorimeter for fuel analysis, it recommends an instrument no one in this country, except the "Civils" Committee, has ever heard of, and as regards flue gas analysis, hand methods of the most antiquated and unpractical types are insisted upon. Automatic CO₂ Recorders, a commonplace of modern boiler plant work, are disparaged, but if used, an instrument is recommended which is many years out-of-date.

3. The Code is expressed in such a confused and complicated manner that it rivals the Income Tax and can only be understood with great difficulty, whilst the methods of calculating the results are so intricate as to be largely unintelligible without a great effort, even to specialists on the subject. Thus it is not drawn up in any logical sequence. The first sheet deals with "General Description of the Boiler," and then the second sheet follows with data from the test. We then come to "General Description of the Economiser and Superheater," and in this way general descriptive matter, data, and calculations are all mixed up together in the most extraordinary manner. The attempt also to regard the boiler, economiser and superheater as entirely separate is most confusing.

I have to confess that, if only because of the continual cross references, I have been compelled to buy a number of copies of the Code and cut them up with scissors, so that all the references to each point could be stuck on one large sheet of paper, and in this way to dissect the Code into a large number of separate sheets, so as to read it easily. For example, the question of auxiliary steam or power has five different references, and the particulars relating to the calculations based on the full chemical analyses of the fuel and the flue-gases are hopelessly involved. The American Mechanicals Code is infinitely superior in this respect, and is provided with an admirable index.

In studying the Civils Code at great length, one is com-
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..eled to come to the conclusion first, that it applies only, more or less, to the years 1897-1901, the time of its original formation—and little alteration seems to have been made in 1913, so that it is about twenty years out-of-date—and secondly, that the Committee apparently have had in mind only academic tests on small boiler plants of one boiler or so. The attempts to apply the Code to moderate sized boiler plants, and especially to very large plants, like twenty "Lancashire" boilers or equivalent, prove it to be ludicrously unpractical, as I hope to show.

D. BROWNIE

2 Austin Friars,
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