TRIPLE-EXPANSION ENGINES AND ENGINE-TRIALS

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ENGINE-TRIALS.

BY

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With an Abstract of the Discussion upon the Paper.

EDITED BY

F. E. IDELL, M. E.

NEW YORK:
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1890.

PREFACE.

The expansion of steam in three or more cylinders is now claiming the attention of engineers and manufacturers, and experimental data upon the action of steam in the cylinders and jackets of a triple-expansion engine will be studied with great care, especially when the engine was designed and built with reference to the facility of measuring each important part while it is performing work.

The Committee, consisting of Prof. Reynolds and Messrs. Ramsbottom and Robinson, having in charge the designing of the engines for the Whitworth Engineering Laboratory, worked with this end in view, and the manufacturer gave them every facility for obtaining an engine which, while representing, as far as possible, the most approved existing practice of steam engine construction, should be thoroughly available for experiment on the use of steam throughout, and if possible beyond the range hitherto attained in practice.

Prof. Reynolds made some preliminary tests and then commenced a series of trials of triple-expansion at 200 lbs. per square inch boiler

pressure with and without steam in the jackets. This series of thirty-two trials was commenced in October, 1888, and finished in April, 1889. Several trials were made at each speed, and the results obtained agreed so closely that three trials with steam in the jackets and three without were taken as illustrating the results obtained; these results are given in detail in the paper.

The Editor has endeavored to retain the full substance of Prof. Reynolds' paper, omitting only such portions as are of no interest to the American readers.

F. E. IDELL.

New York, May, 1890.

TRIPLE-EXPANSION ENGINES AND ENGINE TRIALS.

In designing steam-engines to take their place amongst the appliances of an engineering laboratory, at the present stage of the development of these institutions, many considerations present themselves.

The primary purpose of the engines is to afford the students opportunities of practice in making the various measurements involved in steam-engine trials, and to afford them an insight into the action of steam in the engine, as well as of the mechanical actions; also to render them familiar with good examples in steam-engine design.

Another purpose, however, which it is very desirable such engines should serve, is that of supplying a means of research

by which knowledge of the steam-engine may be extended. A systematic and experimental investigation of the steam-engine involves two sets of conditions, which, unless it be in a laboratory, can hardly exist together, namely, the time and attention of the scientific investigator, and the assistance of a considerable number of trained observers. In the engineering laboratory these conditions should exist; the first being supplied by the permanent staff, and the second by the students as their training advances.

Having regard to these two purposes, the Committee, appointed by the Council of Owens College to select, amongst other appliances, the steam-engines best adapted for the special purposes of the laboratory, decided that the engines, while as far as possible representing in their principal members the most approved existing practice in steam-engine construction, should be specially designed to afford the utmost facilities for experiments on the use of steam throughout the entire range, and, if pos-

sible, beyond the limits hitherto accomplished in practice.

As best meeting this demand it was decided to have three engines working on separate brakes. All engines to be of the inverted-cylinder type, with the walls and covers separately jacketed, with steam at boiler-pressure, and so arranged that they could be worked with or without steam in any or all of the jackets. Each engine to work with steam at any pressure up to 200 pounds per square inch, to run at any piston speeds up to 1,000 feet per minute, and to have expansion-gear to cut off from zero up to two-thirds of the stroke. One engine to be supplied with air-pump and surface-condenser, the other two engines to be furnished with alternative exhausts, either into the atmosphere, or into steam-jacketed receivers supplying steam to the next engine, each of the receivers also having an alternative supply of steam direct from the boiler. The boiler to be of the locomotive type, having five square feet of grate, to be set in a hot

chamber with an economizer and alternative chimney and forced draught, on the closed stoke-hold system. The condenser to have 200 square feet of cooling surface. The dimensions of the engines to be somewhat as follow:

Engine.	Diameter of Cylinder.	Stroke.	Diameter of Crank-Shaft.
	Inches.	Inches.	Inches.
No. I (high-pressure)	5	10	2⅜
No. II (intermediate)	8	10	2⅜
No. III (low-pressure)	12	15	4
Air-pump on No. III	9	4½	
Feed-pump "	1¼	2	

In addition to the brake, each engine was to be furnished with a fly-wheel, to act as a belt or rope-pulley, weighing about 1,200 pounds, carried on a separate shaft with a coupling to the crank-shaft.

The design of the engines contains many novelties. These were not adopted without what appeared to the Committee to be sufficient reason, as it was