

## DOWNWARD-DRAUGHT FURNACES.

The JOURNAL OF THE FRANKLIN INSTITUTE for February, 1888, contains an article by Mr. Francis E. Galloupe, purporting to be a supplement to the investigation of Lozano and Erben upon downward-draught furnaces published in the JOURNAL for November and December, 1887.

The article is mainly an attempt to discredit the record of the experiments made at 94 Liberty Street, New York, by trying to show from our account of the experiments that some points necessary to the carrying out of the details of the tests in a proper manner seem to have been overlooked; and of a report of a ten-hour boiler test in East Somerville, Mass., totally irrelevant to the investigation it assumes to supplement.

Mr. Galloupe finds fault on the following points :

- (1) Large percentages of refuse from the coal.
- (2) Percentages of unburned coal, which must have parted with some of its calorific power if put in the furnace at all, different in the two trials.
- (3) Variations of water level.
- (4) Absence of correction for one-half inch too high water-level in the boiler at the end of the second test.

I shall briefly take up those points in their order.

(1) The total weight of refuse per pound of coal put into the furnace was in the first test '271,066 pound, and in the second test '269,230 pound. As long as this was practically the same, it does not make a particle of difference in the conclusions to be derived from the comparison of the results of those competitive tests, whether the percentage was large or small.

(2) The way to get the approximate weight of that part of the coal, other than ashes, which escaped unburned, is to subtract from the total weight of the refuse the weight of real ashes in the coal as determined by analysis. Thus, the total weight of unburned carbon per pound of coal put into the furnace is seen to have been '172,566 pounds in the first test, and '170,730 in the second, the discrimination complained of being well nigh infinitesimal, and certainly within the limits of the unavoidable errors of observation. Mr. Galloupe used the wrong figures, taking for unburned coal only that which was picked from the ashes.

- (3) The height of the water in the glass gauge was, as reported :

	<i>Test with Ordinary Grate. Inches.</i>	<i>Test with Downward- Draught Attachment, Inches.</i>
Lowest, . . . . .	1	1'5
Highest, . . . . .	4	4'5
Mean during the tests, . . . . .	2'84	3'23

a difference of '39 inch in the mean height.

(4) One-half inch of water in a boiler 14 feet long, 5 feet in diameter, amounts to less than 182 pounds; 182 pounds of water heated from the temperature of the feed to the steam temperature at which the trial was ended, means 31,122 British thermal units, to impart which at the efficiency found, would require only 3'74 pounds of the coal; or, in other words, the correction desired would be only about one per 1,000 of the coal used in the test. On the other hand, whereas the first test was begun and ended with steam of

precisely sixty pounds pressure, the second test was begun at sixty pounds and ended at forty-eight pounds, a drop of temperature on the total weight of the contents of the boiler, etc., of about  $13^{\circ}$  F., correction for which unavoidable fact would be in the opposite way, and somewhat greater. We were not censured for having likewise deliberately omitted this correction against the device.

Mr. Galloupe says, also, that "the admission that the water-level was left one-half inch higher at the end of the second test 'through inadvertency,' makes the feed-water record inaccurate." Singular, indeed! Nevertheless, anyone can see that the accuracy of the weight of the feed water has nothing to do with the inadvertency of the man in charge of the feed pump, or with the admission.

The superiority of the water-tube grate in regard to burning the coal up cleaner than the ordinary grate, was represented by 6.78 pounds in 3,692 pounds of coal used. We made no mention of it, because it was too small a quantity of its kind to be mentioned at all.

Really, if Mr. Galloupe can obtain from all his points, any quantity the commercial value of which is appreciable, he should compute and exhibit it.

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NEW YORK, *March*, 1888.

#### THE LIMITING DIAMETERS OF DESCRIBING CIRCLES FOR THE TEETH OF ANNULAR WHEELS.

In a note relating to "the Limiting Diameters of Describing Circles for Teeth of Annular Wheels," in your issue of April, 1888, Mr. Albert K. Mansfield states that in my "Treatise on Kinematics," (1883,) I "practically claim to be the original discoverer of the law of kinematics bearing on that point"—immediately adding that he had published a demonstration of that law in your issue of January, 1877.

Mr. Mansfield apparently uses the words "original discoverer" as synonymous with "first discoverer;" whence some of your readers may have received an erroneous impression, as reference to my preface will show that I did not positively claim the credit of priority, which, in mathematical matters, it is always unsafe to do, because identical results are very often, as in this instance, independently reached by different persons.

Mr. Mansfield further says: "It would seem, in the absence of evidence to the contrary, that he was not aware of your previous publication of the matter."

Allow me to assure your readers, since he does not, that this supposition is correct—the absence of evidence is accounted for by its non-existence.

I am perfectly willing to admit that Mr. Mansfield preceded me in point of time; but I did not know of his investigation until more than four years after the publication of my treatise.

Of all which Mr. Mansfield was informed, some time previously to the appearance of his note.

C. W. MACCORD.

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