Notes on the foregoing Synopsis.

a. Superheating the steam and its effects.

These quotations are the best approximations attainable. The thermometers could not be put exactly into either the water or the steam of the boiler, and an allowance is therefore made to bring the temperature up to correspond with the pressure.

If this steam was not pure, where are we to obtain it? Surely not from the *test* boilers, either American or English, which I have described, unless indeed we are prepared to back the *gross* insinuation, that the tables used to show the relative volumes of steam and water may possibly be wrong to the extent of even "*one-half.*"*

The increased amount of superheat in the steam on the last day, may be accounted for by the fact, that the smoke tubes and passages were thoroughly swept out the day before, whereas, on the first day's trial they had not been swept for two weeks.

Superheating the steam is one of the main objects of the boiler arrangement, at the same time it is believed to be the lightest, strongest, and most effective steam (real steam) generator ever produced. This is the boiler referred to in this *Journal*,† and with which I challenged any boiler in the United States to compete. It has now been more than two years in constant use; it is not in the least impaired, and is fully adequate to the bursting of any other boiler in existence that I know of.

Nearly all tubular boilers are known to prime badly. That is their greatest fault, and yet, we find the evaporative effect of boilers tested in such a manner as to induce the belief that priming was a desirable qualification, and those boilers which primed the most are usually extolled as evaporating the most.

The water being measured from a tank and pumped into the boiler, the sooner it was got out again through the cylinder, the better for the character of the boiler.

The remedy for priming is undoubtedly superheating the steam. There is no priming when that is properly effected.

b. It is not so much the water that goes into the boiler which is of any importance, but *the steam which can be caught uncondensed after it has left the cylinder* that we want to know about, for that is the steam, and that only, which has done the work. Of course, it is not possible with a jet condenser to ascertain this, and the only alternative is to measure it by the indicator.

The system which I here recommend is entirely trustworthy, for, between the cylinder and the condenser, with the means of separating the steam from the water, from whatever source the latter may be derived, there can be no possible source of error unless it be against the boiler, because, even if the condenser is leaky, the pressure on the inside of it being greater than on the outside, the condensed steam will be blown out rather than the condensing water drawn in.

To this test for evaporation my boiler has been subjected, and it is not too much to say, that there are many boilers of fair repute which will not furnish steam of equal efficacy with double the amount of fuel.

This water is from pure steam beyond all cavil. It is the first time to my knowledge, that the test of collecting the steam alone and condensing it, has ever been applied to the verification of the tank system of measuring the water before entering the boiler. I think it much more accurate than the indicator method.

The experiments were undertaken to test the boiler and condenser, and not the steam engine; the latter was merely made use of as a medium to pass the steam from the boiler, but was not indispensable or even necessary, except as furnishing the power necessary to pump back the water of condensation into the boiler.

To submit to the arbitration of the indicator, is to add all its faults and deficiencies to those of the engine, boiler, and condenser, whatever they may be, which the boys would call "going it blind."

It may be as fair for one as another of the same breed of boiler and condenser, but who puts his full-blooded courser to pull against a cart horse? My boiler produces undeniably pure and superheated steam; use it and let me have it back to condense and return to the boiler again as pure as the mountain dew. But what have I to do with the want of skill in the user of it, or with any fanciful mode which may be adopted of testing its power?

Even if the steam engine and the indicator were both perfect, there can be no benefit derived from their use, as mere measures of the weight of steam passed, for we obtain the absolute *steam* condensed into water to weigh and to measure as we please; all the loss is against the boiler, there can be no other error. No other system admits of this

*Indicator and Dynamometer by Main & Brown, page 32.

†Vol. xxxiv, (3d Series,) pages 201 and 202.

absolute certainty, nor, indeed, of any approach towards it, and hence the imperfect instruments which are indispensable to the testing of their power, only insures error in this case where truth is much more easily obtained by other means.

For, where a pound of steam has any fixed value, and we are sure that we get it, we are in possession of a *fixed standard*, with which no other can compare for accuracy.

c. This shows, that the superheat of 17° F. to steam of 145 lbs. total pressure, is nearly sufficient to prevent the appearance of water in the "*dirt trap*," and therefore for all practical purposes we may consider that 10 lbs. of steam may be calculated upon from 1 lb. of coal, of a quality usable, with as much certainty as a permanently elastic fluid, for it is quite obvious that there need be no condensation in the cylinder.

Now let it be insisted upon, that the question of the pressure of the steam is comparatively an important one; it is the weight that we want to be sure about, and having got that, a considerable difference of opinion about the pressure will not materially affect results; only allow that it is steam of the quality represented, and then, whether its elasticity is represented by 95 or 100 lbs. to the square inch, will make comparatively but little difference in the result of a calculation of its power, for within any reasonable limits the product of the pressure multiplied by the volume will show little variation, for what is gained in pressure will be nearly lost in volume.

d. The difference in these quantities is doubtless owing to the increased tension of the steam causing more steam leakage somewhere, and if within the boiler, then to the improvement of the draft, and much cheaper than by the blast-pipe. But the leakage is a mystery nevertheless, for if a boiler like this one leaks almost imperceptibly from 7·8 to 8·6 per cent., what must ordinary boilers leak? There is a well-grounded suspicion that *steam boilers leak far more than is generally imagined*, even when not a drop of water is visible. This alone seems to account for the large quantity of recuperative supply, which every boiler connected with a surface condenser is reported to require, and may also relieve the boiler of the "*Bee*" of a portion of the obloquy attached to it.

e. Even this amount exceeds any well authenticated *real* evaporative effect ever produced by any boiler, in ordinary working and without priming, and yet we have to add several items to it, before it is fairly placed for comparison with the two boilers before mentioned, to wit: the deficient temperature of the feed water, the increase of heat (superheat) in the steam beyond its normal amount, and also the additional total heat in the high pressure steam which was produced. These two last items effectually prevent condensation in the cylinder, and therefore supersede the necessity of superheating the steam by a separate apparatus, or of surrounding the cylinder with a steam jacket, for it accomplishes their work in a far more economical manner, with entire safety, efficiency, and convenience.

f. It has already been explained, that these temperatures were kept down, for the purpose of conveniently withdrawing the water of condensation. ,This occasioned considerable reduction in the temperature of the feed water, which in the ordinary way of working is actually 200° F., and although it may be increased, the conviction now is, that a higher temperature is not desirable at present, for when working thus, the exhaust steam has sufficient tension to go over into the still and produce distilled water of twice the weight of fuel consumed, which is deemed sufficient for any emergency.

(To be Continued.)

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*Lubricating Railway Brakes.**

According to an invention patented for a correspondent by Mr. Johnson, it is proposed to use, in connexion with any suitable lubricating apparatus, a capillary pad or cushion composed of wool, cotton, or other suitable material, and combined with a metallic conducting spout, which is pressed against the underside of the enlargement or shoulder of the journal of the axle or shaft. This pad sucks up the excess of oil which always collects at that point, and causes it to return either to the elevator or reservoir, so that there will be no waste of oil beyond a few drops occasionally. The pad should always be placed above the level of the oil, so that it will remain in a comparatively dry state.

*From the London Mining Journal No. 1236.