

U S Naval Academy
Annapolis Md.
February 7th 1854

Sir,

In obedience to your order of the 24th ult. the undersigned respectfully report:

First. As to the success of the plan of heating the public buildings of the Academy by steam, they find that it has not been perfectly successful.

Secondly. As to the defects in construction and arrangement, and their remedies: it is found that some of the most exposed rooms, at the greatest distance from the boiler have been well heated; but, while a superabundance of steam has been generated in the boiler, and allowed frequently to escape by the safety valve. While the Lyceum and most of the rooms in the recitation hall. even in the 3rd story, have been warm enough in the coldest weather, rooms nearer the boiler, have not been sufficiently heated -

The inequalities, and irregularities in the performance of the apparatus appear to result from the following causes. The main steam pipe, from the boiler, passes through the spongy ground near the laboratory, from which ground, water oozes freely into the box containing the pipe; this, leakage was small during the good weather, and easily kept down by an inch pipe leading to the engine - The heavy

raints since winter set in, have proved this pipe utterly insufficient for the work, even with the addition of hand pumps, which had to be often resorted to - The consequence is, that the main steam pipe is often flooded with water. This partially condenses the steam: the condensed water is driven by the steam into the service pipe, and thus by hydrostatic pressure in some parts, keeps back the steam -

The remedy for this is a blind drain from the reservoir, (into which the water from the pipe box is now discharged) to the engine -

Again; some of the pipes for returning the condensed water are too small, and the pipes underground for conducting the condensed water to the boiler are much too small. Hence, in very severe weather, the condensed water not being carried off with sufficient rapidity, has remained in some of the pipes and been congealed during the night -

The substitution of $\frac{3}{4}$ inch or 1. inch pipe for the half inch return pipes within the buildings, and of two inch pipe for the present return pipe underground, will remedy this difficulty.

Another difficulty has been found in the necessity of using in the boiler, water from the river: which besides being partially salt, holds much earthy matter, mechanically suspended - The blowing off, we understand has been frequent enough to keep the strength of the saline solution, one third that of the sea water - The earthy deposit burned on the flues, prevented them from transmitting heat from the furnace, and finally destroyed one of them -

The fresh water cisterns were so much too small, and when finished, leaked so badly, that no attempt was made to obtain a supply of water from them -

It is recommended to lay down pipe from the cisterns to the boiler in order to use whatever fresh water they can supply; and in the Spring to build larger and better cisterns.

The burning of the flue already mentioned has caused a temporary suspension in the use of the whole apparatus, and it has been found necessary to resort to stoves in the several apartments - It appears to some of the undersigned that interruptions of this kind are of too serious a character not to be efficiently guarded against, which can only be done by adding another boiler of a cheap construction, to be used while cleaning or repairing the main boiler - It would also be of advantage to have the pumping engine independent of the main boiler, especially as it is required in the Summer for supplying the gas-works with water and may be applied to other useful purposes -

It has been suggested that the main pipe should be removed from its present position (in front of the buildings) and carried under the buildings - In this case air chambers could be constructed in ~~some~~ of the basements of some of the buildings; in which air introduced from without could be heated and thence conveyed by flues to the several stories and rooms above - Thus, much of the loss from radiation and condensation might be avoided, and the unsightly and

inconvenient pipes and coils in the several rooms be dispensed with - This method of applying heated air is recommended, by its simplicity and economy. But the undersigned are not prepared to say that it would be advisable to substitute it at present in buildings some only of which are provided with the requisite flues and none with the proper means of ventilation.

Thirdly - as to the economy of the system, they report that they have not very accurate data for determining this. The coal furnished has been of a very poor quality, being largely mixed with slate and dust; of this at least $1\frac{3}{4}$ tons have been used per day under the boiler. The exact ^{quantity} we are unable to ascertain, as no separate account has been kept of the coal consumed in other ways - but the present consumption of fuel does not afford a fair comparison between this and other methods. Doubtless much of the heat has been lost by the incrustations on the flues; much also from the unnecessary condensation of the steam from causes already stated. Moreover, the system is not applied to all the purposes for which it was originally designed: as the laundry, baths, and machine shop: nor have the steam pipes been yet extended to the Battery, laboratory, library, chapel and observatory.

It is supposed that the boiler as now arranged is sufficient, when the defects above specified have been remedied. To heat all of these, in addition to the buildings already provided for, with, even, a

a less expenditure of fuel: Until the system is extended to them, it may be expedient and advantageous to contract the grate surface under the boiler -

Fourthly, Among the advantages of the system, may be mentioned as of great importance, the security against fire - With gas for light and steam for heat, a fire can scarce occur by accident in the public buildings - besides, if a sufficient hose be provided, it is believed that the engine attached to the boiler would suffice to bring under any fire which may break out in the officers quarters - if taken in time -

It must not be forgotten that some of the buildings do not safely, or conveniently admit of any other mode of heating than by steam - In the armory and battery, where powder is kept, any other method is either impracticable or dangerous - In the chapel, heat is required only for a few minutes each day of the week, or for a few hours on Sunday; the recitation rooms, armory and battery are not all in use at the same time - and few of the recitation rooms throughout the day - Full heat is not required in the mess^{hall}, except during mess hours - nor in the library and observatory at all times. In all these cases, by simply turning a cock the supply of heat when not required, is stopped - an accumulation of steam occurs at the boiler, which the attendant becomes aware of, & lets

fuel becomes necessary, and proportionate economy results -

In conclusion, the undersigned would respectfully suggest, in order to give the system a fair trial, that the steam works, until they are thoroughly completed, be placed in charge of some person, experienced in such matters, who can devote his whole undivided time to the work. Unless this is done the scheme may ultimately fail merely in consequence of defects in execution - and we might be induced to try another - at a great sacrifice of course, without having any just reason, either for rejecting the present, or expecting the new one to succeed -

Very Respectfully
Your Obedient Servants
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Commander

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