Portsmouth New Hampr April 21, 1797

sir
(Trench Coxe Esqr )

I transmit you herewith my accounts of the expenditures for the Light house in this state for the quarter ending the 31st March past

I have not felt to give attention to the subject of your letter of the 24th January last relative to the quantity of Cotton used or provided for the Lighthouse. After your former communications on this businefs I had questioned the keeper Mr. Duncan on it and I directed him to forbear drawing out the Wick as had before been his practice of 2 to 4 inches at a time several times in the night - since the rect of your letter I have renewed my examination of this management - he informs me that after my former direction he had tryal of the mode advised of drawing out only one inch of the wick at a time - that he found the light was weak & some complaints were made & he was obliged to have recourse to his former practice. - In order to be fully satisfied of the different effects of the light variously conducted I directed one of the lamps to be brought to me, also some of the wick and oil - The lamps having three pipes I had one of them fixed with a wick projecting or advanced from the end of the pipe one inch, another of 2 & the other of 4 inches - these were lighted - it had been my opinion that the wick of 4 inches would make a blast for a moment & expire as soon as that of one inch - but on the exposement I found it otherwise - they exhibitted a light proportionate to the quantity of wick - that of 2 inches double to that of one & the one of 4 inches in like proportion. The wick of one inch expiring in about 10 hours gradually burning weaker - and that of 2 inches was nearly extinct at 12 hours & that of 4 inches at this hour gave more light than that of one inch when first lighted & burnt 12 hours, none of the wicks being moved during this tryal. - It appeared to me that the wick of 4 inches affording a great heat attracted the oil by it,- and dropping by its weight from the end of the pipe was supplied with the oil growing weaker power as the oil fell in the lamp - & the incrustation of the wick increased - had it been opened once or oftener during this time as is practised by the keeper of the Light house it must have increased the brilliancy of the light - would have been sooner consumed & have required drawing out to furnish support to the oil - From this tryal I am induced to think the consumptuon of so large a proportion of Cotton does not arise from a dishonest application of it, but that the most juditious management & the right proportions in the size of the wick to the pipe has not been discovered - that the best construction of Lamps are not introduced or that the best management is yet to be learnt. - It appeared to me that the size of the wick - which is from 7 to 9 10ths of an inch diameter was too large for the pipe of the lamp & that the wick when swelled with oil would fill the pipe so as to obstruct the pafsage of it - I found that about 7¾ ounces of wick made from half a pound of Cotton measured in length 205 inches, or 410 inches to a pound - from which I was enabled to make calculations of the quantity consumed. - Of the 5 lamps which we have, 3 are suspended in the lantern.

these are placed in a triangular position & 8 of the wicks are lighted - Under these 3 in the winter is placed on the floor a 4th lamp with a lighted wick under each of the suspended lamps - which is thus placed as a substitute for a stove that is found to be necefsary, ll wicks are therefore lighted in the winter & 8 in the summer. The Keepers ans. is that he draws out the wick 2 - 4 inches at a time & sometimes 4 in a night in the winter - taking the average of 3 inches of wick at each drawing out twice a night (after the first fixing) from ll pipes, amount of cotton consumed in half the year would be 44 pounds - admitting the other half year in shorter nights under the same management would require half the quantity our lighthouse would consume 66th per year - & The Deleware Lighthouse with 32 wicks of the size we have used, at one inch only to each pipe per night would consume 28ts per annum whence I concluded that the wicks used here are large - that a fulnefs of the pipe thus stuffed with the wick prevents the approach of the Oil - not only by stopping its pafsage, but rendering the attraction of the fire lefs powerful - I therefore made a second tryal in which I found a wick divided kneeded burning nearly as long as the the wick of the same length - the blaze rather brighter in its appearance though not quite so large - at the second tryal the whole or half sized wicks of one inch in length continued burning without drawing out or snuffing 12 hours - & the wick which was burned out 4 inches continued burning 19 hours, yielding more than double the quantity of light than either of the others.

Notwithstanding improvements have been made, I conceive that the construction of lamps the size and manner of spiring or preparing the wick and the management of the whole is susceptible of further improvements - & that among the several keepers of Lighthouses whose attention is almost wholly given to this subject, there may be some whose ingenuity is adapted to these inquiries and whose different experiments concentrating at the department having the general direction of the business and being thus communicated with might produce some useful alterations - I have heard of mirrors or reflectors being applied to Lanterns & the fountain lamp I think would be an improvement -

I will endeavor to reform the management of our keeper & to excite in him the utmost attention to his employment. I cannot doubt his integrity & I rather think it is his zeal to excel that has led him into an erroneous profufsings in the use of Cotton.