# PROCEEDINGS OF THE HOUSE OF COMMONS ON THE LIVERPOOL AND MANCHESTER RAILROAD BILL. SESSION 1825.

## MINUTES OF EVIDENCE 12th. DAY
## JOVIS 21 DIE APRILIS 1825

**GENERAL GASCOINE IN THE CHAIR.**

**Mr., John Urpeth Rastrick examined by Mr. Wm. Brougham**

I believe you are a civil engineer?
*Yes*.

Where do you reside?
*At Stourbridge.*

Near Birmingham?
*Within 12 miles.*

Are you also concerned in the business of an iron foundry?
*Yes.*

Do you also make steam engines?
*We do.*

How long have you been employed in that capacity - as a maker of steam engines?
*As a partner in the manufacture of steam engines, about 18 years.*

In the course of that time have you been very extensively engaged in the manufacture of that article?
*I have.*

You are well acquainted with the principles on which an engine is made; and also the working of it?
*Certainly.*

On what principles have the engines been, chiefly, that you have made - high pressure or condensing engines?
*Both.*

Do you conceive that during the eighteen years you have been in the business, that you have made as many high pressure engines as the condensing engine?
*I believe fully as many high pressure as of condensing engines.*

Have the high pressure engines which you have made been fixed engines or moving engines?
*All of them have been fixed engines.*

Can you give the committee a notion how many of the high pressure engines you have made during the time you have spoken of?

*Above fifty.*

That you could enumerate?

*I could enumerate about fifty, but if I had been called upon to give a statement, I might have mustered a hundred from our books.*

But can you enumerate fifty?

*Yes; I can.*

Of the high pressure engines you have made, have any of them been sent abroad?

*Yes; a considerable number.*

But a great part of them have remained in this country?

*A great part.*

And of that number you can speak better as to their history, so to call it?

*Yes.*

Have you ever known, with respect to those engines, any accident happen to any of them?

*Not more than might happen to any other engines. Such, for instance, as the breaking of any particular wheel, or shaft, or any other part of the engine, to which others would be liable.*

An accident to which all machinery is liable?

*Certainly.*

Do you know of any instance (I am talking of your own engines) of accidents having happened to any persons attending those engines, from any bursting or breaking, or other accident happening to those engines?

*None what so ever, to my knowledge.*

On what principle do you construct your engines now?

*We are making them to act without condensation - to act by the expansive force of steam alone.*

Without using condensation?

*Yes.*

Strictly speaking, then, that is a high pressure engine.

*Undoubtedly.*

Can you state to the committee your reasons for preferring that principle to the condensing principle.

*Because of their application in many situations, were a condensing engine could not be made use of. For instance, in Dudley there is an engine that has been at work fifteen or sixteen years, were they have no water to work it, except that which falls from the clouds, and which is collected in the streets.*

So that in all situations, were there is a scarcity of water, such an engine is preferable too a condensing engine?

*Certainly.*

Have you the smallest reason to doubt the safety of those engines?

*In all engines we have made, I know of no accident to have happened which may be called a dangerous accident.*

What do you mean by dangerous accident? My learned friend supposes that you mean an accident of life and limb - what do you mean by that?

*Supposing the engine was at work, and it was to twist off the crankshaft, that would be an accident; or the piston rod; that would be likewise be an accident.*

From any experience you have had, or from any observations you have made, can you speak as to the application of that principle to moving engines?

*About ten or twelve years ago I made one for Mr. Trevithick, the person who had the original patent for making it; this was exhibited in London; I did not see that myself. A circular railroad was laid down, and it was stated that this engine was to run against a horse, and that which went a sufficient number of miles was to win.*

But from all your observations of the application of this engine, do you conceive it is a principle that can be well applied to other purposes?

*It is not only capable of being applied, but it is well applied.*

On a railroad, for instance?

*Yes; I have seen three different situations where they have been applied.*

Have you lately made any personal observations upon the working of any locomotive engines upon any railroad?

*Yes; I went down to Newcastle-upon-Tyne last January, in which place there were a number of engines assembled to make some experiments.*

And there you made some experiments?

*Yes.*

At what colliery?

*First at Killingworth.*

Any other?

*Likewise at Hetton.*

Did you afterwards see the working of the engine at Middleton Colliery near Leeds?

*I saw that two years before, and upon our return we called and saw it again.*

Upon the first observation which you made can you speak as to the safety of this machine?

*Certainly.*

Will you describe to the committee the what you conceive the construction of a locomotive engine should be in order to be safe?

*The boiler must be made of wrought iron; it must be cylindrical, and have spherical ends; a tube must be put in the inside, in which the fire must be made.*

Now suppose you where making a condensing engine, and supposing the pressure of the steam in the boiler to five pound upon a square inch over and above the atmospheric pressure, I wish you to state of what strength you would make a high pressure engine which is to work by the expansive force of steam to bear that proportion of force?

*That would depend upon the relative size of the boilers.*

What would you take the strength of a low pressure engine at?

*That depends upon the size of the boiler.*

How much upon the square inch?

*Generally five pound on the square inch.*

Now take a high pressure engine, and state to the committee what pressure you would require it to bear upon a square inch?

*More properly speaking, I suppose you would enquire what would be the pressure of the steam upon the boiler?*

Yes.

*Fifty pounds upon the square inch.*

Then the one engine would have a pressure of five pound on a square inch beyond the pressure of the atmosphere, and the other fifty?

*Certainly; but each boiler would be made proportionately strong according to the pressure it was to bear.*

What do you find the best form to resist that pressure?

*Cylindrical boilers with spherical ends.*

You have said that a tube is made to pass through these boilers having a fire at one end?

*Yes, and we sometime make it for the tube to return through the same end. You may suppose the boiler to be four feet in diameter, and the tube two feet in diameter, which is put down the lowest part of the circular case on the outside, and the water rises up to about four inches above the top of the tube.*

The space above the top of the water and top of the boiler is for receiving of the steam?

*Certainly.*

What precautions are used to prevent an accident from the over expansion of the steam so as to burst the boiler?

*Safety valves.*

Where are they placed?

*At the top of the boiler.*

How are those safety valves regulated?

*By a lever with a weight upon it which presses the valve down.*

When the force of the steam is greater than the pressure upon the valve, it will raise it up and suffer the steam to escape?

*Certainly.*

Is there any other safety valve?

*I always put a lock up safety valve to all the boilers that I have made.*

Is the use of those lock up safety valves to put the loading of the valves out of the power of the engineer?

*It puts it out of the power of the engineman to load the lock up safety valves - that if he hangs a weight upon the valve to which he has access, he can never increase the power beyond the lock up safety valves, because if he has no control over it, he cannot get at it.*

Do you consider the two valves you have described, the one under the control of the engineman, and the other locked up and placed beyond his reach, sufficient to ensure the safety of the boiler from bursting?

*In the number of engines which we have made, we have never had a boiler burst.*

Do you ever regulate the safety valves by a spring, instead of a weight?

*Sometimes.*

Which do you conceive to be the best?

*The weight.*

Why do you think the weight is the best?

*Because the spring may vary.*

It is not so easy to estimate the pressure as by weight?

*Certainly not.*

Suppose by any remiss of the engineman, if the water which aught to be kept above the level of the tube where the fire is contained was allowed to evaporate, would not the consequence be, that the tube would have a tendency to get red hot?

*Certainly it would.*

Now suppose this were to happen that tube got red hot, what would be the effect of it?

*The effect would be, the tube being heated red hot would not be so strong as when the iron was cold, so that the force of the steam might force it down.*

Is there any other danger to be apprehended from the tube being red hot?

*It cannot happen if the precautions we have always made use of are applied.*

That is not an answer to my question is there any other danger to be apprehended from the tube getting red hot from the water coming in contact with the red hot iron?

*The danger would be, that the tube would be force down and put the fire out.*

What is the heat of the tube when covered with water?

*It can never exceed the steam in the boiler about 230 or 240 degrees.*

If the tube is heated red hot, it is heated above 1200 degrees?

*Yes.*

What would be the effect of water coming upon that heated surface?

*It would partly decompose probably.*

It would be turned to gas?

*By the decomposition of the water a certain quantity of Hydrogen might be liberated.*

Or turned into steam of a very high elasticity?

*Probably it might.*

If that effect were to take place, would that endanger the bursting of the boiler?

*That would be the only danger to be apprehended: but it must be always understood that the boiler was constructed properly to bear the pressure which it is intended to bear; if the water were to be decomposed it would be an increase of danger.*

If the water was to be decomposed there would be a great deal of highly elastic power generated?

*Yes: quicker perhaps than the safety valves would allow to escape.*

As is you were to stop up the muzzle of a gun and fire the charge?

*Yes.*

Now then what precautions do you adopt to prevent this effect?

*A very easy one.*

Suppose the water is to have got below the top of the tube?

*The fire has a tendency to heat the top of the tube but in this tube there are holes drilled of about one inch in diameter. Into these holes I put a rivet made with lead; lead will melt at about 600 degrees; iron does not become red hot, even in a dark fire, until it is heated to about 1000 degrees; consequently, at 600 degrees when the iron has obtained that temperature, the lead would melt, and the steam would issue out of these holes, and of course blow the fire out.*

Would that be the only mischief?

*Yes, the only mischief: it is a circumstance that frequently happens from the negligence of the engineman.*

Have you known it yourself?

*I have an engine at my own works at Stourbridge were it has happened, and that is what we should consider as a safety against explosion.*

The putting out of the fire is the only inconvenience that results?

*There is the stopping of the work for a time.*

But with respect to the danger?

*Yes.*

And that would not take place but for the negligence of the engineman?

*Undoubtedly it would not.*

At all events, do you consider this precaution perfectly adequate to guard against such an accident happening of the water getting below the upper surface of the tube?

*Yes. We also make use of this precaution were we have tubes in boilers that work with a low pressure, that is, with steam at five pounds upon the square inch. I should state that I do not consider the lead plug to be a precaution to prevent the water getting below the upper surface of the tube.*

But as a precaution against the accident to which I have referred?

*Yes.*

In the condensing engine, I apprehend that you use the precaution for the same reason?

*Yes, for if the water got below the upper surface of the engines, it would cause them to burst; and it has happened that we have had boilers in our own works were we have used a lead plugs.*

But have you had any instances of boilers bursting?

*We have had them burst: perhaps the man has turned the steam improperly into the boiler and when worn down perhaps the steam would burst the tube. That happens occasionally to our engines; they are wearing out perpetually; and, unless they are continually attended to, the iron will oxidate; but the the thing happens very seldom, it is but a small extent; it is only in that part which becomes thin through wear.*

Not the cylinder of the boiler, but the tube were the fire is?

*It maybe the outside of the boiler, but it is not so in the locomotive engine for there is no fire upon it.*

There is nothing but water or steam against it?

*No the fire is against the tube.*

So that in a high pressure locomotive engine there is no danger of the cylinder of the boiler bursting from that cause?

*None.*

The cause is the wear and tear upon the tube were the fire is?

*Certainly.*

And could not affect the cylinder of the boiler, in as much as the fire does not touch it?

*Certainly not.*

Do you make use of any other precaution, except the safety valve and lead plug?

*We did, originally, but we do not now. We used to put into the boiler a plate of copper which is made thinner, or, rather, I should say weaker, than the iron; and, of course, as the weakest part would burst first, that would give way, and the steam escape.*

May less than one half of the strength calculated be sustained by the boiler?

*Perhaps one third of the strength. - I am speaking of a wrought iron boiler with a copper plate put upon it.*

Last January did you go to Newcastle-upon-Tyne to take a view of the coal works there and the engines?

*To take a view of the locomotive engines, not of the coal works.*

Did any other civil engineer and scientific persons accompany you upon the visit?
*They did.*

Where did you go to?
*To Newcastle-upon-Tyne, where I met Mr. George Stephenson, Mr. Silvester, Mr. Brunton, Mr. Philip Taylor.*

Do you mean Mr. Taylor of the house of Taylor and Martineau?
*Yes. Mr. Cubit, and afterwards Mr. James Walker; but he was not there the first day.*

Did you also meet Mr. Wood?
*Mr. Wood of Killingworth Colliery, of course would be there, he being the superintendent of the works, I believe.*

Did you apply to the proprietors of that colliery for leave to make experiments with their engines?
*When I went down I understood that an engine was to be prepared for us to try the experiment with; but when we got to Newcastle-upon-Tyne we found no such preparation was made; so that, in fact, before we could take the liberty of making use of any engine, a deputation of gentlemen waited upon Mr. Lambert, the proprietor, to propose to try the experiment with some of the engines at Killingworth; he gave us permission, so far as it could be done without stopping the working of the colliery, or affecting the business. We went to Killingworth, and there upon the railroad, we found an engine going down the road with a train of waggons after it.*

Was this an engine prepared for your experiment?
*This was the first engine we met.*

Was it then doing its ordinary work?
*It had been at work, I believe from five o'clock in the morning, till the time we met it.*

Did you take the engine exactly as you found it?
*Exactly as we found it; it was in its working condition, going on with its waggon.*

I believe you stated this was on the eighteenth of January?
*On the eighteenth of January.*

On first getting to the ground, what did you proceed to do?
*This train was a considerable way down the road, and we took it back again.*

Did you measure the distance of the road first?
*We went down with the engine first of all, and then we commenced to measure the distance.*

Very well, what sort of ground was it; was it level, or how?
*The ground undulated; the total rise in one direction was about five or six feet, to the best of my recollection.*

Have you any copy of the memorandum you made then, or the one itself?
*I have a copy of the levels that were taken.*

Those memoranda where made on the spot?
*On the spot.*

Have you any more detailed observations to make?
*It was about six feet.*

The total rise?
*Six feet or six feet six inches.*

What is the whole distance?
*Two thousand two hundred yards.*

That is about a mile and a quarter?
*About a mile and a quarter.*

Did you examine the rails which were laid down on the road?
*Yes.*

Were they of the cast iron or wrought iron?
*Some were of the cast iron some of wrought iron.*

Was the road, generally speaking in good order?
*It was not.*

Was it in bad order?
*The rails, in some places had not been put down originally for locomotive engines.*

For horses?
*For horses, I believe.*

Was it in a straight line, or were there turns in it?
*There was a very sudden turn in one particular part of it; it might be about mid way, there was a quick turn, and there the rails were very bad.*

Were those turns disadvantageous to your experiment?
*Undoubtedly, all turns must be disadvantageous on a railroad.*

The wheels, in consequence must slide on one side?
*Certainly, the body being fast on the axletree, which moves with the wheels it must have that tendency.*

What state was the engine in at the time of your first experiment?
*It was not in that state in which a person going down to try an experiment would wish it to be.*

It was not in a very good working order?
*Just about the same as you might expect to find an engine about a colliery.*

How long had the engine been working - how old was it?
*I can't state anything of my knowledge, I was informed.*

I take it, you know whether it was a new one or an old one?
*It was not a new one.*

What was the diameter of the wheels of that engine?
*About four feet diameter.*

Was that the diameter of the wheels of all of the engines?
*No; that was the only one the diameter of whose wheels was four feet.*

State what were the sizes of the different of the engine?
*Of that one I can tell you, the boiler was four feet diameter and eight feet long.*

Without going into dimensions of all the particular parts, what was the weight of the engine and the carriage of it?
*The weight of the engine, and the water in the boiler, was 7 tons, 10 cwt., 0 qts., 26 lbs.; the weight of the water carriage and water cask, and 20 pecks of coals and the water, made 2 tons, 3 cwt., 3 qts., 2 lbs., making a total weight of the engine and the attendant carriage of 9 tons, 14 cwt.*

9 tons 14 cwt. was the total weight of the engine and attendant carriage, with the water and coals?
*Certainly.*

How many waggons were there in the team?
*The number of waggons was twelve - twelve Newcastle Chaldron waggons.*

Each contained a chaldron of coals?
*Yes, it is 53 cwt. of Newcastle chaldron; the weight of each empty waggon was 24 cwt., and the twelve chaldron waggons contained 31 tons, 16 cwt., of coals, and the weight of the twelve waggons themselves was 14 tons 8 cwt., making a total weight of the waggons and coals of 46 tons, 4 cwt.*

That was the total weight which the engine had to move?
*No, it had to move itself as well; this is the total weight the engine had to drag after it, independently of water, coals, and attendant carriage. The first thing we did was to measure a certain quantity of coals and put it into the attendant carriage; the distance had been previously measured; the water cask was filled with water; we then started with this engine and the 12 chaldron waggons behind it, the distance being a mile and a quarter; we were twenty four minutes in going up the road, and returning down the road again with the same weight, same number of carriages, 18 minutes; upon our return we measured the coals that remained, and we then found we had consumed five and a half Newcastle pecks of coals, each of which weights 31 lb., consequently, the quantity of coals that we consumed was one hundred and seventy and a half pounds weight: that was our first experiment.*

Did you observe the number of strokes the piston made?
*To ascertain whether the wheels slipped much in the progress, we counted the absolute number of strokes the piston made in ascending and descending.*

You could estimate from that, the rate per hour at which the engine had gone?
*We did so by taking the time by a stop watch, both going and returning.*

How can you estimate the rate of the engine by the strokes of the piston, and the circumference of the wheels?

*By comparing the circumference of the wheels with the number of the strokes, we found the wheels had slipped some little, but not more than you might reasonably expected in passing round the curve.*

Were all your experiments there made in a similar way?

*Yes, we tried four experiments; we made three with that engine.*

With the first engine, what was the total weight that was carried including engine, coal, waggons, and everything, how many tons?

*46 tons 4 cwt., was the weight, and 9 tons, 14 cwt., the weight of the engine and attendant carriage.*

55 tons 18 cwt., in the whole?

*Yes, 55 tons, 18 cwt.*

And you have stated before, that 31 tons 16 cwt. was the useful weight?

*The weight of the goods.*

What was the average speed per hour ascending, going up the hill?

*In the first experiment we tried with that engine the total amount of weight was 55 tons 18 cwt., and the speed per hour, taking the average speed over the distance, was 3.6 miles, and the quantity of coals consumed to take a ton of goods one mile was 2.1 lbs.*

What was the speed ascending?

*3.125 miles.*

And the speed descending 4.166?

*Yes.*

You made two other experiments with that engine?

*Yes.*

Where they made precisely in the same way as the first was?

*Exactly.*

What was the useful weight - the weight of coals or goods?

*21 tons 4 cwt.; the total weight of 40 tons 10 cwt.*

What was the speed ascending?

*4.445, nearly four and a half miles.*

What was the speed descending?

*4.285; and the average speed was 4.37 miles.*

How did it happen that the speed descending was less than in the other?

*On account of the number of gentlemen present we were asking the engineer questions, and the consequence was he let the steam valve down.*

Was the man impeded in his operation?
*Yes.*

Could he have gone quicker if he had not been impeded?
*Certainly: we did not come down so quick as we went up: he let the steam off through is own negligence.*

Was the steam let down?
*Yes.*

Now, in your third experiment what was the useful weight of goods?
*15 tons 18 cwt.; the total 32 tons 16 cwt.*

What was the actual speed ascending?
*4.205 miles.*

What was the rate descending?
*5.172 miles, nearly five miles two tenths.*

Making an average rate of what?
*4.688 miles.*

Did you make any further experiments on that engine?
*We were not satisfied with the past experiment, because it did not meet our expectations so fully as we had reason to expect.*

Did you take another engine up?
*We did; one that happened to be by just at the time we were terminating our experiment.*

What was the diameter of the wheels of that engine?
*3 feet.*

Was that experiment made in the same way as the other?
*Yes.*

What was the useful weight carried?
*39 tons 15 cwt.*

What was the total weight?
*67 tons 19 cwt.*

What was the speed ascending?
*3.947 miles.*

The rate descending?
*4.838 miles: the average was 4.397 miles.*

The last engine had 3 feet wheels?
*It had.*

And the first had four feet wheels?
*Yes.*

Supposing the last had four feet wheels would the speed have been increased?
*We took the four feet wheels on the Saturday, and put the four feet wheels upon that engine.*

Perhaps you can state the whole of the experiment you made on the eighteenth?
*We did nothing more, except when it became dark, we detached the engine from the other carriages, and got into it just to see how fast it would go, and it went at the rate of ten miles an hour.*

Along the same line of road?
*Yes.*

Upon the twenty second day of the month - will you state what experiments you made?
*On the twentieth of January we went down to Hetton.*

Go to the twenty second, to your return to Killingworth; what engine did you make use of on that day?
*The engine made use of in the last experiment on the eighteenth, with the exception that we had taken off the three feet wheels, and put on the four feet wheels that were upon the first engine.*

What was the weight of the coals which were put into the waggon - the coals only?
*We weighed the empty waggon to ascertain what was its absolute weight, we then weighed the loaded waggon, and each waggon was twenty five hundredweights when empty, and the coals were fifty three and three quarter hundredweights though only marked to contain fifty three hundredweights.*

What was the total of the coals?
*The total weight was 53 tons 15 cwt.*

And the total weight of the coals, with the carriage and the engine?
*59 tons 5 cwt.*

What distance did you take it?
*About 1.075 miles.*

Was that upon the same ground?
*Upon the very same as we tried the experiment on the eighteenth.*

How often did you go up and down this road?
*Five times.*

With respect to the water and coals used, and the other particulars of the experiment, was it done in precisely the same way as the experiment of the eighteenth?
*Yes.*

State the result, if you please?

*The total distance we went during the whole five experiments, was ten miles and three quarters.*

What was the average weight that you carried?

*The weight was the same in all experiments; there were the same waggons and the same coals that we took up and down the road, that being on the Saturday. Upon the eighteenth we were interrupted by the waggons going up and down the road, and we went on the Saturday to have use of the road without being impeded by the passing and repassing of the waggons, the colliery not being then working.*

What was the average speed per hour?

*The average speed up and down 6.66 miles, but the average of all three last experiments was 7 miles and hour.*

Weights are all the same; what was the average rate of the first experiment?

*We went up at the average rate of 4.86 miles, and descended at the rate of 6.24 miles, the average of these two being 5.55; the second experiment ascending was 6.06, and the descending 7.00, the average of those two was 6.53; the third experiment ascending was 6.85, descending 7.36, the average of these two was 7.08 miles; the fourth experiment, the speed of ascending was 6.85, and descending 7.36, the average of these two 7.10 miles; the fifth experiment was at the rate of 6.92 ascending, and 7.19 descending, and the average of these was 7.05 miles. The total of the average together is 33.31; this being divided by five is 6.66, or 6 miles and two thirds per hour.*

State the quantity of coals per mile that was consumed?

*From those experiments we found that 1.6 lbs. of coal would take one ton of goods one mile; and that we consumed 55/100 of a gallon of water to take one ton of goods one mile, that is both the water and the coal; these are ale gallons.*

In your opinion, were the engines that you made the experiment with well constructed; were they of the best construction?

*They were as well constructed as any engines of that sort usually have been; but it does not follow that improvements may not take place upon them.*

Do you think they might be constructed better?

*I have no doubt that engines might be constructed by which 1 lb. of coal would take a ton.*

Do you conceive an engine could be constructed that would take forty tons of goods six miles an hour with perfect safety?

*I do. In those experiments you find that we took 33 tons 15 cwt. or nearly 34 tons, seven miles an hour.*

At what rate would such an engine carry 30 tons?

*The speed will be in proportion to the power of the engine, if the engine was durable; the power of that which took forty tons six miles an hour, an engine of double that power would take it twelve miles an hour.*

**MR. ALDERSON:-**

That - you mean to say?
*Yes I do.*

**MR. WILLIAM BROUGHAM resumed:-**

Would it take it with perfect ease and safety?
*With perfect ease.*

But with safety?
*Not so safe as if you went down.*

But with respect to any accident that might happen to the bursting of the steamer?
*I went afterwards and saw an engine that started with waggons 10 miles an hour at Fordham Colliery, Mr. B. Thompson. They are fixed engines, and a rope goes from one engine to another: the distance was about a mile and three quarters, and that they went over in ten minutes, which is nearly ten miles an hour.*

Where these low pressure engines?
*They were stationary.*

Low pressure engines?
*Yes, Boulton and Watts. I believe that one was made by Murry and Company of Leeds, and the other by some person in the country.*

Do you conceive that an engine calculated to carry forty tons an hour is an under or an over estimate of its power?
*We have not stated any power I was asked whether an engine could be made to carry forty tons an hour.*

Could such an engine be made perfectly safe?
*Yes.*

How large would it be, compared with the one you made your experiments with, take it in horse power, to take forty tons at the rate of 6 miles an hour?
*Those engines we are speaking of are stated to be 8 horse power; but the power of the engine must have a reference to the velocity with which the piston works. If you consume double the quantity of steam, you would produce, perhaps, double the effect, if the power of the engine were but increased in proportion to the quantity of steam produced. I find, from my calculation, that, taking the velocity with which these engines worked, that is, the velocity of the pistons, that the engine, on the twenty second, worked up to a ten horse power.*

**The witness withdrew. Adjourned till tomorrow 1 o'clock.**

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Sorry I've not been able to get back to this document to get the rest of his testimony.