Attached to the ground floor office was a fairly large strong room with thick walls and heavy doors, and also, fortunately, two small but heavy cast iron air gratings. The room was regularly locked at night and the key was retained by the Secretary, the assistant Secretary then being Jim Russell.

One evening Jim was missing at home and somehow Wheeler, the wharf caretaker, was contacted to see if Jim was on the premises. Wheeler took some time to go round, but towards the end he heard Jim shouting and traced the voice as coming from a strong room grating. Greenwood then had to be contacted at his home, which was some distance away, in order to obtain the key. By the time all this had been done many hours had elapsed before poor Jim was released. Who accidentally locked him in? It must have been Greenwood. Later Jim's remarks were on these lines.

> "Thank heaven for those air gratings which allowed me to get a bit of fresh air instead of the full musty smell".

Nelson asked:

> "Who holds the duplicate key?"

Jim's reply was:

> "I do and I had it on me but the door is only openable from the outside, and the key was too large to pass through the mesh of an air grating".

Following Queens Wharf I spent a short period in the London Duke Street office, and then went up to Leeds for six months.

LEEDS OFFICE:

This was situated near the centre of Leeds at 21 ~~Clive~~ Aire Street which is now demolished. It was a small and somewhat dingy but better than the basement at Charing Cross. The occupants were:

H. C. Hayes, Manager and Director.
K. Plowright.
C. Barraclough.
- Sayes.
Gargett (draughtsman) and one or two office staff.

At that time Denis Hayes was too young to enter the firm.

There was also a small store at Hull, which at one time was run by Victor Hole, a relative of Mrs. Hayes. Bert Hayes was a strict but fair taskmaster and did not hesitate to show his disapproval if any of us did wrong. An example of this is when one of us could not make a domestic hot water installation work. This was served by a horizontal type water to water calorifier with copper tubes and the primary water would not circulate through the tubes. Some of us had a look at it but Bert was finally told about the trouble and went to see it. It was discovered that the vessel was fixed sufficiently out of the horizontal so that the tubes were air-locked.

He expressed disapproval to the group of us in no uncertain terms. He took me in his car to see jobs which were being done in York and other places outside Leeds. I do not remember much about the work I did for him, except the following.

I was told to prepare a scheme and estimate for a church situated well outside York.

I took the estimate to him for approval but when he was looking at it I suddenly noticed a bad mathematical error in the costing, and waited for Bert to see it. It would have been an ideal opportunity for him to register disapproval.

He did not see it and so I corrected the error, which added to the cost of the estimate and then sent it to the client. Later we received the order and supervised the work for which I travelled from Leeds to York and then hired a bicycle to reach the site.

I did some work at the Montague Burton Clothing Factory in Leeds which was heated by overhead steam pipes. The factory housed hundreds of girls and I especially remember the job due to the combination of cheap scent and human odours with steam heating and poor ventilation. At the end of my six months in Leeds I returned to London to finish off my apprenticeship.

LONDON OFFICE:

By now this office had been moved from Charing Cross to 37 Duke Street, and close to Selfridges. The building has since been demolished and a new one stands on the site.

It was an improvement on Charing Cross, had a lift to reach the office on the upper floors, together with two small "Wright" gas fired boilers which bubbled and groaned when pushed too hard. When I arrived Ernest Naylor and Duncan Wallace were working there, the former under the tuition of Frank, and the latter under that of my father. I had expected to have been put under Alf on the basis that it would be best for fathers not to teach sons. For some reason or other I was not taught by Alf. Possibly this was because he was an individualist and did not wish to be worried.

I was therefore chivied between Frank and my father, and I have never decided whether this was to my advantage or otherwise. The after effects of World War I were still being felt and the work then being done (1923) was of a small type and mainly consisted of low pressure hot water gravity heating installations for private houses, branch banks etc.

Calculations and estimates were crude, but the following examples may be of interest to show how these matters were then dealt with and to compare them with more modern methods.

1. My father evolved a quick method for calculating the hot water heating surface required to warm a room. It was based on B.Th.Us with 180°F flow temperature of the water and a 30°F temperature drop. It proved to be reasonably reliable. The following is an example for a room 15' x 10' x 8' high.

Air:	15' x 10' x 8' x 2 airchanges:	2400	÷ 300	=	8
Exposed Wall:	25' x 8':	200	÷ 25	=	8
Glass:	10' x 5':	50	÷ 8	=	7
Sealed Ceiling:	15' x 10'	150	÷ 20	=	7
					30

Heating surface required for 60°F/32°
For 55° 30 HS x .8 = 24
For 65° 30 HS x 1.25 = 37

Glass surface was not deducted from wall surface and the divisors were arrived at by allowing for the average amount of glass generally to be found in a room. It did not matter whether the walls were 9" or 13½" thick, but for walls above 13½" another divisor was used. Plain corrugated iron had a divisor of 1.

2. Calculations for gravity pipe sizing were a bit more hazardous and I have an old chart as follows.

180°F flow. 30°F difference between flow and return.
Horizontal piping: 3" - 6" per second.
Vertical piping: 9" - 12" per second.

Pipe size	Heating Surface served Velocity 12"	9"	6"	3" per second
½"	46	33	22	
¾"	102	76	51	25
1"	182	136	91	45
1¼"	285	214	142	71
etc.				

Common sense and experience were required when using the chart. In the end the saving grace was that the temperature difference was either a bit more or less than 30°. There were only a few failures.

3. Labour rates were:

½"	pipe:	2½ old pence per foot run
¾"	"	3 " " " " "
1"	"	3½ " " " " "
1¼"	"	4 " " " " "
1½"	"	5 " " " " "
2"	"	6 " " " " "
2½"	"	8 " " " " "
3"	"	10 " " " " "

These figures covered cutting, screwing and bending of pipework and the fixing of pipe and fittings.

The rate for fixing a cast iron radiator and its valves and supports varied between ten and seventeen and a half shillings depending on the radiator size. When wages increased a percentage was added to the final labour figure. A labour figure used to be given to the fitter in charge and if he saved on it he received 50% of the saving. If he exceeded it the firm bore the brunt.

4. The amount added to prime cost was between 20% and 25% for overheads and profit. This could vary downwards when work was short and upwards when it was more abundant. The prime cost was the actual cost of materials, labour and workmen's lodging and travelling allowances.

A 2½% cash discount had to be given to a main building contractor when the work was done as a sub-contract and this was often included in the 20% - 25%.

Estimating, however, was on liberal lines so that the final percentage on completed work was often more than 25%.

I remember two amusing stories about this period as follows:

a) My father did work in a large private house, and the client asked for heat to be provided under and around W.C. seats and this was done by a coil of heating pipes. He was then asked to provide a similar installation for a friend of his client. On completion of this job he was told that it was not entirely a similar job which non-plussed him. It turned out that no W.C. coils had been fitted. He had forgotten to do so.

b) On another occasion Frank became angry with me about a heating job which I had helped to design. The conversation was on the following lines:

Q. "Edgar, do you understand what causes the circulation of water in a system?"

A. "Yes, sir".

Q. "Well, what?"

A. "Because hot water rises".

Q. "Do you not know that your answer is wrong. It is because cold water falls".

This rather confused me at the time, because basically there was no difference, but my answer was:

A. "But cold water does not always fall and under some conditions it rises. What about ice which floats?".

Q. "Do you realise that I was referring to a heating installation?"

A. "Yes, sir".

Many years after this the first atomic bomb was dropped. By then, due to my hobby, my knowledge of electrons etc., was a bit more than that of the general public and during a discussion in the office a conversation between Frank and myself was on the following lines.

My question to Frank:

"Do you know basically how the bomb works?"

His answer to me:

"Frankly NO".

I then gave my answer and said that if a bomb was exploded under the sea, cold water would rise and hot water would fall. Equally well, hot water would rise and cold water would fall. Frank remembered the previous argument and fortunately we both had a sense of humour.

The question remains:

"Who was right and who was wrong?"

My reply is:

"We were both right, but equally well we were both wrong".

My apprenticeship was now complete but I remember two installations which I dealt with as follows and which give an illustration of the type of work then being dealt with.

1. <u>The Greyhound Hotel, Richmond, Surrey</u>.

This was a small heating job for a wine bar etc., for Messrs. Shotts. The innovation was a copper heating coil at the base of the bar on which the visitors could place their feet so as to keep both feet and heads warm. Later I received an order for extra work which was probably due to the results of the "foot heating coil".

2. <u>The Eton College Boathouse</u>.

This again was a small installation which helped to preserve the boats. A tragedy, however, occurred at one time in that the Thames found its way into the boiler room, but this was not recognised as being my fault. I wonder if this small job helped the firm to obtain the order for heating Eton College in later years?

On completion of my apprenticeship I began to wonder whether this sort of work was going to be the best for me. Electricity was still and continued to be my hobby and although I enjoyed my serving days in the workshops of Queens Wharf, heating and ventilating work at that time did not really interest me. I continued with this work, however, and due to later developments it did become more interesting. In those days a son was expected to follow his father in a family business and that was probably one of the reasons why I continued as a heating and ventilating engineer. Although some years later I was made a director or the firm, I never had any ambition to be made a managing director.

1924 - 1948

This is a long period to cover and I am therefore dividing it up although this division may not be fully in genealogical order. The division is:

The Boat Race
London Office 1924 - 1939
Air Conditioning
Panel Heating
World War II 1939 - 1944
London Office 1944 - 1948
Finally

THE OXFORD AND CAMBRIDGE BOAT RACE

The first thoughts of future persons reading these notes will be "Why write about this? How did it have any connection with the firm? My reply is:

"Queens Wharf was an ideal location from which to view the race, which in that era was a very popular event. It was therefore an important means of entertaining architects and clients which led to orders for work being given".

Since then interest in the race has declined, but I feel that its influence should be recorded as described below.

Before 1924 viewing space was very limited (see my previous sketch plan) as these roofs were mainly pitched ones except for one small portion (G2) which was flat, and was not suitable to carry much weight. Pamela Russell (Frank's daughter) has an illustration of this flat roof.

The "Round House" was not used due to its dirty and derelict state, and because it contained only a few windows and a pitched roof. In 1910 or thereabouts, and up to 1924, the Russell, Wallace and Naylor families with only a few guests were able to view the race and sandwiches, sausage rolls etc., were provided by my mother and aunts. In 1924 flood damage, due to high tides in the Thames, necessitated the re-building of a part of the workshops, which were then provided with a flat roof (G1), the flat roof was due to the foresight of my father and Frank and Alf in order to provide more space for guests.

A pre-1924 description may be of interest. The race was popular and Hammersmith Broadway was crowded with people who arrived there by bus, tram and District and Metropolitan Railways. It would have been almost impossible to get there by private car. The crowds then went on to Hammersmith Bridge and dispersed along the river banks until the bridge was closed. The hawkers did good business by selling light and dark blue rosettes, and everybody wore one or the other. The journey to reach the Wharf from the Broadway was slow, due to the crowds, but when St. Paul's Church and Queen Street (now Queen Caroline Street) were reached, the rest became easier. The walk down Queen Street was very different from now.

After St. Paul's Church there were flats on that side and a convent on the other side, and I think that these buildings still exist. To

continue on, the buildings were old and the houses "tumbledown". There was Tingey's wireless shop and a smelly fish shop opposite to the entrance to the Wharf, and Queen Street ended with flood gates to the river. On entering the wharf one walked through the workshops and reached the viewing spot.

There was no broadcast radio and the first news of the race result was shown by the raising of a light or dark blue flat on Harrods Depository across the river. Later a launch with the winner's flag travelled from Mortlake to Putney and an aeroplane flew overhead with a coloured streamer. After 1924 and when extra viewing space was available more and more invitations were given to guests, and Edwards did a good job in delivering such invitations.

At first the aunts continued to deal with refreshments but this soon became too much for them and caterers were called in. Joints of cold ham, beef and chicken with salad and other good things were provided, not forgetting whisky. With these refreshments as a back-ground, the race was then viewed. The first scene, looking across the river was of crowds on the south bank towpath, and on looking to the right these crowds were passing over Hammersmith Bridge to reach the towpath. On looking down onto the river, barges were seen, for which the owners made a charge for viewing. These barges were inter-connected by means of wooden planks which were precarious, and only the younger ones used them. Even they sometimes lost their balance and fell into the water.

On one occasion somebody shouted "there is a boy in the water". It turned out to be a "buoy"!

After the race had started, eyes were turned to the Putney direction and gradually the two boats came into view, followed by the umpires and B.B.C. launches and then several pleasure steamers with viewers. The wash from the latter vessels caused the barges to heave up and down which was dangerous for the viewers on them. The shouts were "OXFORD" or "CAMBRIDGE" and these reached a crescendo at Hammersmith Bridge and died down after the bridge had been passed.

The evening was called "Boat Race Night" and this was quite an event in London when the victors treated the vanquished to a night in town.

I have often wondered what some of the architect guests thought of Rosser and Russell, after approaching the wharf by way of Queen Street and then through the old workshops. Their thoughts could not have been too bad, because the results were new contacts and increased orders, so that the race was a money-maker to the firm.

LONDON OFFICES 1924-1939

During this period the office moved from Duke Street to Romney House, Marsham Street and then to 30 Conduit Street. At Duke Street Frank was in touch with Oscar Faber who had moved into one of the floors. His main reason for leaving Duke Street was to allow Frank to keep in touch with Faber, especially about the Bank of England job, because Faber had moved into Romney House. The move from Romney House to Conduit Street was due to the outbreak of war when the building was requisitioned by the War Department.

This move was done when other firms were leaving London and the rent for the first year was one peppercorn. In 1924 there were very few Consulting Engineers who understood heating, so that schemes, specifications and estimates were prepared by firms such as Rosser and Russell and Hadens, for Architects. Few of these Architects understood such work, with the result that it was often given to the firm who put forward the lowest figure. This meant that a lot of abortive time was involved. From 1924 - 1939 the firm's staff increased considerably, as well as the numbers of Consulting Engineers, who were capable of dealing with such work.

At this point it may be of interest to record some of the older installations which came to my notice as follows.

1. The Perkins system of high temperature hot water heating which used to be installed in churches etc. I will not describe this in detail, because the older text books deal with it. In brief, the system worked at 300°F or more and consisted of a brick enclosed coil which comprised the furnace. From this a continuous coil of heating pipe was fixed in the rooms to be warmed. The circulation was by gravity and the piping consisted of ⅛" internal diameter steel, heavy gauge tubing jointed by means of right and left handed sockets. Air bottles were fitted at the top of the installation and the system had to be "pumped through" once per season, and re-filled with water.

   I remember arranging with the foreman, V. Bunn on maintenance for such systems but I never designed one myself. My last recollection is of replacing a furnace coil for Messrs. Maples in about 1942. Was this system the forerunner of the later large high pressure hot water systems?

2. I only came across the "Reck" system on one occasion and my memory of it is very dim. It was a Danish idea and not very many systems were installed in this country. Some years ago, I handed a diagram of such a system to the firm which I found amongst my papers. All that I remember is that steam bubbles were used so as to accelerate the flow of water and that deposits accumulated in the pipework, causing trouble. Such systems would have been installed before accelerating pumps were in use.

3. At the Royal Albert Hall I saw a few remnants of the original system, installed by, I think, Messrs. Ashwell and Nesbit, when it was built over 100 years ago. There were, and still are, constructional air ducts around the basement which served various vertical ducts which reached up towards the top of the hall, and which contained cast iron air inlet gratings on their run. There were indications that some recirculation of the air was used, and the two original fresh air constructional inlet ducts to the plant still exist. These two fresh air ducts were much smaller than the air delivery ducts to the hall, and this strengthens my opinion that recirculation was used. Air was delivered to the basement air ducts by two steam driven wooden fans, each one serving one side of the hall. I say that these fans were wooden but I only saw signs of wood casings to them.

   The fan blades were not seen, but I suspect that they would have been of a kind of paddle blade type. The air was warmed by masses of cast iron piping in the basement air ducts and some of this had been especially cast to work in with the elliptical form