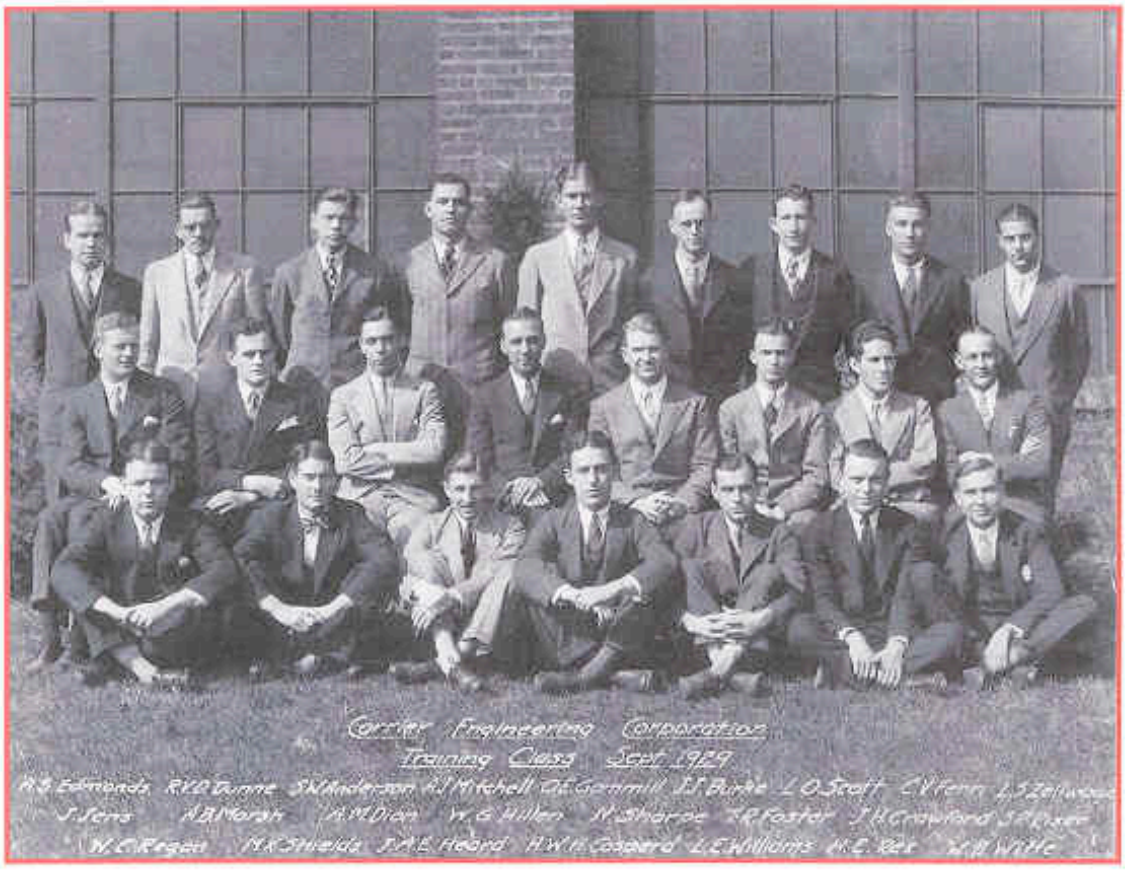
Willis Haviland Carrier

Father of Air Conditioning

VOLUME-1
Willis H Carrier: The Man and His Message



1.3 The Educationalist and His Training Classes, 1922-1930

J.A.E. HEARD

CARRIER THE MAN & HIS MESSAGE

CHAPTER THREE

(Carrier the Educationalist with his training classes)

The writer's first initiation into the Carrier team was ~~forty~~ fifty ~~seven~~ year's ago in 1929. In that year, learning that Carrier Engineering Company of Buckingham Gate, London SW1 required a young engineer to go over to the States to learn about "AIR CONDITIONING" I was interviewed by C. L. Sainty, then Chief Engineer at Carrier, London. He asked me what I knew about thermo-dynamics. My reply " we called it Heat Engines at King's" reveals only too clearly the position of this science in universities at that time. In due course I joined about thirty other young graduate engineers who were to form a Carrier Engineering Corporation training class. My companions were graduates from many universities in America with a group from Europe.

My first meeting with Willis H. Carrier was when he got our training class started. As the boss he revealed himself in those first few minutes as a man of ideas as well as a man of humanity. We stood around him in that rather dingy factory at 850 Freylingheusen Avenue, Newark, New Jersey (Carrier Engineering Corporation first headquarters). He told us that each had a part to play - from the man who swept the floor to himself - any part not covered adequately put burden on others - each playing an independent role must achieve harmony with all others in the full function of the Company. He went on to speak of the part air conditioning would be able to play in the world; how climates would no longer inhibit the energy of peoples; colder climates had produced dynamism; air condi - tioning would enable people in any climate to work and sleep in "Manufactured Weather".

This training course and the many that followed were to form the pattern of the Chief's decision that the technique of air conditioning would be promoted only by carefully chosen young engineers with detailed instruction under top supervision.

Many years later in 1944 Carrier gave lectures on Engineering Education and these extracts illustrate the basic thinking

that established those training courses fifteen years before.

"The generally accepted idea is that the engineer gets his education in high school and college. If this accepted idea were correct, the quality of our engineering would be extremely poor. I have known men of excellent natural ability in our own organisation who required ten years of experience in the field to discover the truth. Generally the engineering graduate discovers this fact for himself in the first two or three years. If he is a conscientious and thorough-going person of a type that will ultimately succeed, he sets about either consciously or unconsciously to further his education. I did not say "complete his education" because if he is a person who will continue to advance in his profession contrasted with one who "goes to seed" and becomes a casualty; he will realize that his education never will be completed...

"with few exceptions, the quality of teaching, from grammar school all the way through college, is not only poor but in the majority of cases has the wrong objective as well as the wrong approach. From my own viewpoint, the principal purpose of elementary engineering education should not be that of amassing knowledge, but to learn the proper approach to the acquisition of knowledge. There is no way the engineer or technical man can advance his particular art except by going beyond the boundaries of existing knowledge .... The fundamental technical knowledge needed by the engineer is arithmetic and the physical laws and the correct application of arithmetic to physical laws so that engineering projects may be envisioned and correctly developed to a successful accomplishment.

"The engineer must always strive to develop his imagination for it is only through this that great progress is made .... he should not be too greatly hampered by the consideration of detail ... he must learn not to allow the so called theoretical studies out his practical or even his imaginative viewpoint. Physics and mathematics must be servants and not masters.

".. the most successful engineers are those who somehow have acquired the "simplified fundamental approach" to all problems .. Such engineers are not afraid to use approximations if they are

able to determine the possible magnitude of the error of such approximations. ... If your mathematics do not agree with your acquired common sense or sense of proportion, the probabilities are that your mathematics are wrong ".

"One of the greatest faults .. is that they are satisfied to take too many for granted. The engineer must understand what he is doing at every turn if he is to be successful and if he is to advance .... Don't even accept $V^2 = 2gh$ without thoroughly understanding and seeing the reason why, and when you have the formula set up, don't merely substitute values to get an answer. Keep in mind what the relationship of the variables mean in the overall solution of the problem.

"In a little country school, I was taking fractions in elementary arithmetic . To me a fraction was one number over another with a line between. There were certain rules which were given us for addition, subtraction and multiplication of fractions, with the use of these rules, we were able to get the answer. This satisfied the teacher, as it does in most schools. My mother, who had been a teacher herself, questioned me one day and discovered that I was doing my little sums in fractions without the faintest understanding of the significance of the process or of what a fraction really was. She sent me down to the cellar of the farmhouse and had me bring up a pan of apples. With these apples, she proceeded to teach me objectively what fractions were and how to perform the simple operation of addition, subtraction and multiplication without any rules whatsoever. In this instruction she told me nothing but developed the idea by making me answer all of her questions. The reasoning was mine and was made very simple. It was all mental arithmetic and objective teaching. This gave me a great idea which I have carried through my whole life and was probably responsible to a considerable extent for any success that I may have had. In this lesson I learned far more than the immediate subject of fractions. I learned that there was probably a reason for everything, and that I was capable of thinking through a problem for myself if anyone else had ever done so ... if I took the necessary time and went at it the right way. What she really taught me was the "method of approach".

".. Great accomplishments are not attained by unusual mental gifts, as a rule, but by learning to breakdown the problem in hand to its very simplest elements and applying the most simple, most obvious type of reasoning".

That was the Chief in his lecture in 1944 and the Chief's life was a complete confirmation of his basic principle.

The question has been asked "Was Willis Carrier a good teacher ?" A close colleague for many years says "he was not" but goes on to say "his associates learned much from him. He taught that no problem or job is too difficult to be solved by concentration, careful reasoning and application of simple basic information." Sometimes his extraordinary concentration could be mistaken for absentmindedness.

From my memory one incident that follows his basic principle is very clear. It was at a time in the early 1930's when he had been advised to ease up, so he took his wife on a world trip. They arrived in Calcutta and having welcomed them, I dined with them at the Great Eastern Hotel. His wife implored me to keep his mind off business so I tried to keep the conversation to local matters. Suddenly he asked whether he was right in thinking that we had had trouble with the Carrier Centrifual Refrigeration machine serving the air conditioning plant in the hotel. I murmured "Yes". Immediately he wanted to go down to see it. I secured a delay by questioning him on his recent visit to South Africa. Again he was full of enthusiasm. Yes, he had seen the Robinson Deep Mine which was the first deep mine to be air conditioned with Carrier Centrifugals. Over the remainder of the meal, he was in full flood on how it would be possible to work out the rate at which the coolth from the air conditioning penetrated the rock formations surrounding the mine headings; how with calculations from the right formulae, it would be possible to compute how far you could drive into the rock and find the rock still cool - so many yards for each year of air conditioning. After dinner and during coffee, he was till expostulating on the method to be used for these calculations. In spite of his wife's resigned expression, he was thoroughly enjoying himself as he scribbled lengthy equations on any handy piece of paper. However finally we

arrived at a point when I suggested the need for advanced calculus reference books and reluctantly the Chief agreed to let me search Calcutta for any suitable books. He and his wife were off to Darjeeling to spend the week-end up among the Himlalayas. On Monday morning when the train was due to bring them back to Calcutta, I was waitong on the platform. I had not solved the problem. I had not found any reference books to assist in the solution. I was no further forward than when we parted. As his train drew alongside the station platform, I saw him leaning out through the window of his carriage looking for me. I hurried towards him. He jumped down from the train while it was still slowly moving, leaving his wife and their cases in the compartment. He rushed towards me, gesticulating with his hands, and said "I've got it ! I've got it". What he had got was a formula from which charts could be prepared showing how the develop - ment of air conditioning in the deep mines would provide cool rock for calculable periods of time ahead. It was this boy - ish enthusiasm that showed through even at that stage of life when most men are retiring. His envelopment of me within the scope of the solution to the problem was the essence of his leadership. Just to complete the story, I collected his wife and their baggage and her remark to me was "It was a lovely week-end, I enjoyed it immensely, and thanks to your problem so did Willis ! "

Make sure of the fundamental rightness of your idea; use simple basic engineering data to establish the problems; dedicate yourself to the solution of the problems that arise from it; allow nothing to deviate your thinking from the problem and the right solution will be yours. This was what the Chief taught as an education. This was how the Training Classes were endoctrinated. These training classes that were to go on over many years; were to provide the international businesses with their trained engineers; were to form a close-knit band of men who were inspired by their Chief and gavie him their unstinted byalty. So if Willis H. Carrier was not an educator in the sense of a college lecturer, he was a leader whose example was the finest education anyone could receive.

The period leading up to 1929 had provided the Chief with many of his most prestigious problems that were to set the pattern for the world wide expansion. Carrier had developed and put into operation by 1928, the air conditioning system for the House of Representatives and the Chamber of the Senante in the U.S. Capital. Away in New Delhi, India, the Secretariats and Legislative Buildings were being provided with air conditioning to Carrier's design.

From 1924 to 1929 he was working on the scheme for Morris Velho Gold Mine in Brazil with air conditioning apparatus and the refrigerating machine at working depth. At the same time, the design was being applied to the Robinson Deep Mine in South Africa.

As expertise was being developed from direct experience of applications in U.S.A. the opportunities were being created for similar applications in Europe and the rest of the industrial world.

The manufacturing expansion necessitated the purchase in 1928 of a second building in Newark. The first was named the Carrier Plant and the second was named the Lyle Plant.