Travelling through time

In a bumper Christmas issue of Golden Oldies, Brian Roberts delves into the CIABE heritage files and asks “How did Lindbergh spend a penny while on the first solo Atlantic crossing?”

How did the Viking warriors keep warm on their longships in icy Northern waters? What was the lighting system on the first Orient Express?

No, I don’t know the answers, and like most building services engineers I know very little about the heating, plumbing, air conditioning and lighting of things, other than buildings.

Consequently, one topic being investigated by the CIABE Heritage Group is the history of these services in transportaton. What follows is just a few revelations.

Railway passenger carriages

Richard Trevithick’s Penydarren Tranroad, from Merthyr Tydfil to Abercynon, opened in February 1804. A painting of the event depicts Trevithick, spanner in hand, marching briskly alongside, just in case running repairs were called for. The picture also shows the first passengers, uncomfortably but enthusiastically crammed into open waggons, braving both the elements and the smoke and cinders belching from the locomotive chimney.

Early passenger carriages were flanged-wheel adaptations of the stage coach, often four or more coach bodies combined on a single railway frame to provide compartments with side doors.

In 1830 first class travel became more comfortable, particularly on the broad gauge Great Western Railway. GWR

“... whose standard first class compartments could seat eight assorted sir and fat women — John and Joan Bull — with room to spacious on the best hair-stuffed Morocco leather.

But there was no winter heating for them, no applied sanitation, while the vegetable oil lamps dropped through holes in the roof at night were of the dampest sort.

In America, the conveyance of passengers across vast distances demanded something superior and carriages were based on the design of the canal boats which had preceded them. Europe stuck to the stage coach idea, with increasing variations. The first worthwhile improvements came in America. The long open coach called a “shabby omnibus” by Charles Dickens and termed an “elaborated spittoon” by someone less charitable, became gradually refined.

(Around 1810) Steam-heated radiator for shipboard use: a Cast-iron type with top steam inlet and bottom condense outlet, a Cast-iron type for bulkhead fitting, used on a one-pipe system. A Bulb heater or deck-supported type with inclosed gifts and combined pattern steam-exhaust valve.

...It had many good points. Its little two-by-two seats with reversible backs (uncomfortable but stylish according to Mark Twain) were adequate enough by day. A pot-bellied stove kept people warm in winter. Near this was a little annexe with abottomless can to serve natural calls. There were candle-holders at night.

In the middle (eighteen) sixties these were replaced by polythene kerosene (paraffin) lamps with Argument burners along clerestory decks.”

In 1856, George Pullman produced the “Pioneer”, the first proper sleeping car. It was an instant success and reasonably comfortable on a transcontinental journey of several days and nights. In Europe the compartment arrangement was generally used. A Russian sleeper of 1857 had five four-birth compartments, a small middle saloon, and an overhead observation deck. It was entered by open platforms at the ends, each with some form of water closet.

An Austrian sleeping car of 1873 was provided with underfloor stoves for heating through gratings, while another of the same period was furnished with chasse-langues instead of sleeping berth.

England had a touching affection for the portable metal foot-warmers. America used the Baker Heater, a stove-fired, closed circuit, hot-pipe system using either water or a saline solution which would not freeze when out of use. In Belgium (1875), Belcredo introduced an advanced hot-water circulation system throughout the train, using tender water from the engine, heated by a special injector.

“Contact with the passengers was through copper floor-plates called ‘chauffe-fetesés’ which cooked one’s boots’.

In the Netherlands, warm water heating was in general use. Low pressure steam heating of trains from a reducing valve on the locomotive was introduced in France in 1874 and ultimately superseded hot water systems. In England in the 1890s there appeared Laycock’s system with steam piped to storage heaters under the carriage seats:

...though in old English local trains the wretched travellers continued for some time to sit and shiver in winter.

Lighting also improved. In 1883, England pioneered the gas lighting of trains while America used incandescent lamps.
Candle lamps were favoured in Russia. A solitary Pullman car on the London-Brighton line was electrically lit in 1931, but the necessary batteries were clumsy. In Britain, right at the end of the 19th century, Stone perfected self-generating and self-regulating electric lighting equipment.

Air conditioning of passenger carriages had been tried from the early days. In America, George Foote introduced a system of ventilation incorporating air cooling by water jets. In India, R. D. Sanders made a large number of first class carriages ventilated through water-drenched cloth by means of air scoops, the cloth being kept wet from an overhead tank. Mechanical air conditioning was first successfully introduced by the Baltimore and Ohio Railroad in the dining car 'Martha Washington' and first applied to two complete trains on the New York-Washington service in 1931.

Steamships
At the turn of the century the warming of steamships, (steamers, warships and private yachts) was classified as follows:
- By the injection of heat from stoves and open fires.
- By the distribution of steam through pipes, radiators etc.
- By the circulation of hot-water through pipes, radiators etc.
- By the distribution of warm air.
- By electrically heated radiators and convectors.

"On HM warships, until recently, stoves and open fires were universally employed for warming the Admiral's and Captain's apartments, wardrooms, gunrooms and crew spaces."

While in the private sector:
"The old Royal Yacht, 'Victoria & Albert' was warmed by stoves and open fires for many years in the old days."

In large passenger vessels, steam heating systems were employed for warming the cabins and living spaces in cold weather, usually by leading copper steam pipes along the passenger ways. In the saloons and other public rooms the heating pipes were frequently fitted around two or more sides of the rooms and under the dining tables, located just above deck level and protected by ornamental gratings of cast iron or brass.

But warm air systems were taking over:
"The air heaters or thermal tanks (hence 'thermostatic') as they are generally called, consists of a battery of steam heated tubes or coils enclosed in an iron casing. The fresh air is drawn from shafts, which raise only a few feet above the upper deck and is forced by steam or electrically driven fans through the casings, heated tubes, trunks and shafts, into the compartments to be ventilated and warmed, the air being delivered about the ceiling level. A central installation for the whole ship is not favoured. . . ."

Passenger aircraft
A US technical paper on comfort in flying records that in 1933, in the days of the corrugated metal tri-motor airplanes, heating and ventilating was considered of more or less secondary importance.

Ventilation was achieved as follows:
"The supply of cold air was taken in through small 'horns' located at each seat, these horns extending through the floor to the outside. They were designed so they could be turned to take in the desired amount of air or turned up or back to stop the flow of air."

Naturally, considerable noise, vibration and quite often fumes from the engine were brought into the cabin, but at that time it was considered by most people as just part of air travel".

It may be noted that no extract air or ventilation valve was provided to help control the amount of foul or used air escaping from the cabin. This problem was solved by leaks around doors and windows, which were plentiful in those days. Heating was provided by a completely separate system:
"(It) usually consisted of a metal shroud covering the exhaust tail pipe. This told pipe was ordinarily on the underside of the plane and quite often extended almost the full length of the cabin in order to obtain sufficient heat. The air entered the duct thus formed at the forward end between the exhaust pipe and the shroud and after passing along the hot exhaust pipe, was admitted to the cabin through adjustable sliding valves in the side between the seat, or through tubular ducts along each wall near the floor."

The features of this system were poor circulation, often inadequate heat and the risk of engine exhaust gases and carbon monoxide entering the cabin.

In 1933, when the Douglas DC-1 was built for Trans World Airlines (TWA), a cabin steam heating system was installed, operating under "only a few pounds pressure". A boiler was located in the exhaust manifold in one engine nacelle.

Water entered the boiler at the bottom by gravity feed and went out the top as steam to a steam radiator located in the fuselage below the cabin floor. Cold air picked up at the nose of the airplane was directed by an electrically operated automatic temperature control either through the steam radiator or around it, depending upon the cabin heat demand. The DC-2 and later, more famous DC-3 (Dakota) were provided with similar systems.

By 1941 the Boeing Stratoliners incorporated all the latest thinking which comprised five separate systems of heating and ventilation, fresh air, spent air, warm air, steam heating, ground air conditioning.

In addition, the cabin was pressurised (or supercharged), as it was termed in those days, allowing flights of an altitude around 6000 m with the external temperature down to —50°C.

During World War II, air cycle refrigeration was developed and applied to aircraft air conditioning systems. That subsequently developed for the Lockheed Constellation airliner had a cooling capacity of about 35 kW, the weight of the refrigeration unit being only just over 100 kg. A similar system, which was used in the Douglas Commercial Transport DC-6B, had an airflow rating of 36 kg/min.
SS ņVictoriaÁ air conditioning plant and Dining Saloon (Carrier UK 1930)
Heater for Model A Ford 1929

Possibly the first air conditioned car (Kelvinator) Texas 1930
Air conditioning for the General Motor Oldsmobile 1956

Air conditioning for the Chevrolet (Frigidaire) 1950s
Passenger Cabin Ford Tri-motor Airliner 1930s USA

Imperial Airways Armstrong Whitworth Argosy 1920s
Note the pilot's open cockpit
Airliner Passenger Cabin 1930s USA

Imperial Airways Empire double-deck Flying Boat 1930s
Air conditioned Lockheed Constellation 1950s
Air conditioned Boeing Stratocruiser 1950s