The draft paper “The Development of Heating & Ventilation Systems for British Cars,” is by J Michael (Mike) Barber, Secretary CIBSE Heritage Group
The Development of Heating and Ventilation Systems for British Cars

J. N. Barber
As initially the open car was the norm, car drivers and passengers would expect to have to wear heavy winter clothing and use blankets (hence the 'car rug') when making car journeys in cold weather. This expectation would be habit forming and would be carried over to journeys made in saloon cars, there being no expectations of greater warmth, the shelter provided from the wind and rain being seen as an adequate bonus. Indeed the bulkhead between the engine and the saloon of a pre-war car was so unsubstantial and badly sealed that engine heat could fortuitously find its way into the saloon. In some cases there was evidently too much engine heat conveyed into the saloon by this route; as evidenced by a comment in a 1935 edition of the 'Autocar' about the Wolseley 14 saloon - "the interior of the car is quite free from fumes and heat even with the windows closed and the engine pulling hard".

Thus there was little demand for heating for comfort in early saloon cars. In 1935 The Daimler Co. presented King George V with a new Daimler saloon to commemorate the Silver Jubilee of his reign. Contemporary descriptions of the car make no mention of any form of heating and it is therefore fairly safe to assume that even Royal saloons were unheated at this time.

1.2 De-mist and Defrost

A by-product of car heating and ventilating is the de-misting and defrosting of the windscreen. As soon as windscreens were fitted to cars, problems arose of impaired through-vision in inclement weather. The most pressing problem occurred during rain, and was initially solved by arranging for the windscreen to fold down flat during such occurrences. The windscreen wiper was soon introduced, first manually operated, then electric or vacuum operated, but provisions for folding the screen flat remained.

The enclosed saloon introduced a new windscreen visibility problem.
which the windscreen wiper could not solve, namely condensation misting up the inside of the screen in cold weather. In extremes this mist would freeze to form ice. From perusal of motoring journals of the mid 1930’s it appears several solutions were available, such as small electric strip heaters, or transparent stick-on panels. (Fig. 2 shows a device which combined the two) Mr. H. C. Lafone. was asking in an 1935 article entitled ‘That perfect car’, "will someone please tell me why we are not given an internal as well as an external blade? If it is difficult to drive with the front of the screen wet and muddy, is it any more easy with the back of the glass covered with condensed moisture" (2). Fig 3 shows what his proposal would look like. Mr. Lafone, no doubt like the majority of motorists of the period, seemed to have been completely unaware that a perfect solution to the problem was not a second wiper blade, but jets of warm dry air, directed onto the inner face of the windscreen, heated by the engine’s cooling system.

Thus, half a century after the invention of the motor car, the consumer demand for car heating was very little in evidence.

1.3 Technology

As well as lack of consumer demand, the technology of the motor car also would not allow the widespread introduction of practical car heating before the mid 1930’s. Up to this time most water cooled engines relied on the thermosyphon effect to cause the hot cooling water from the engine to circulate through the radiator. In order for this to work satisfactorily it required the engine block to be much lower than the top of the radiator (Fig 4) which gave the cars up to this period their distinctive appearance of a large bonnet and high radiator. Much of this bonnet was however empty because of this height requirement. This thermosyphon circulating effect generated a minute pressure, completely inadequate to carry the hot water into the saloon to circulate round any practical form of saloon heater.
Waste Heat: 33 kW

Mechanical Power: 14 kW

Fig. 1: Waste Heat from typical Car Engine.

The Berkshire DEFROSTER and DEMISTER

Complete freedom from inside misting on defroster WITHOUT CURRENT

CLEAR VISION essential to Safe Driving is assured all the year with the BERKSHIRE DEFROSTER & DEMISTER (6 or 14 YGLT) PRICE 48.3

Fig. 2: Windscreen De-mister.

Fig. 4: (a) Gravity Circulation. (b) Pumped Circulation.
In order to improve engine cooling (and as a secondary benefit, to do away with the need for a higher radiator), mechanically driven (from the fan belt) water pumps were to become increasingly common as the 1930's progressed (Fig 4). The higher circulating pressure now available, was more than sufficient to pump water into the saloon, for use in a heater. Thus this advance in car engine cooling technology was necessary before any form of heater using engine hot water could be introduced.

It is interesting to note that in-car entertainment has a somewhat longer history than car heating. Fig 5 shows a car radio which was available for a 1935 Ford 8. No heater could have been fitted to this car as it still relied on thermosyphon engine cooling.

2. Development of Car Heating and Ventilating

Obviously heat can be put into a space by a number of different mechanisms. The two most practical methods for the saloon car would seem to be direct input by having a hot surface or 'radiator' in the saloon which provided heating directly by radiation, conduction or natural convection (an example of this would be a hot water bottle!) or in-directly by providing heated air to the saloon. It was this latter method which proved most practical, and as an enclosed saloon needs fresh air for ventilation purposes it is not surprising in retrospect that eventually these two functions, warm air heating and controlled ventilation, evolved simultaneously and that they were eventually provided by one system, fully integrated within the structure and fabric of the motor car.

As explained below this evolution has taken place in three distinct stages, and these are described in turn.

2.1 STAGE 1 The 'Open' Saloon - Pre 1939

The first weather protection provided for occupants of the motor car
Radio While One Drives
Compact Set Available at Modest Price on 8 h.p. and 10 h.p. Model Ford Cars.

Fig. 5: In-Car Entertainment.

Fig. 6: Opening Front Screen

Fig. 7: Top Scuttle

Fig. 8: ½ Light.
after the windscreen was a hood which could be pulled up in inclement conditions. This evolved into a fixed roof with wind-up side windows, and ventilation was provided by opening windows, folding front windscreen, and side scuttle vents. (Fig 6) The latter were necessary to provide cool air to the feet of the driver and his passenger, to offset the heat coming through the poorly sealed engine bulkhead. Seals round the doors and windows and between the floorboards making up the floor would also be very poor, and therefore although the occupants were sheltered from the worst of the weather, as far as ventilation was concerned they were more-or-less 'open' to the outside. Hence the name for this stage of development, the 'open' saloon, having fortuitous and largely uncontrolled ventilation.

2.1.1. Top Scuttle Vent

The first modification to this standard ventilation arrangement was the introduction of the top scuttle vent, replacing the two side scuttle vents. The first car to have this feature was perhaps the 1935 Morris Series 2. Air was thus introduced for the first time from under the dashboard, and gave opportunity to direct some of it onto the inside face of the windscreen via slots, for demist purposes. This top scuttle inlet vent position has, of course, now become the standard for all of today's cars, utilising a natural high pressure point caused by the aerodynamic movement of the car, which maximises the rate of air supply, as well as supplying cleaner air than that from inlets closer to the road surface. (Fig 7).

2.1.2. 1/2 Light Ventilation

1935 seems also to have been the year when another feature was first introduced to on British cars, which was to become a standard feature of post-war cars. This was the 1/2 light ventilator in the front door
windows. The half light appears to be an invention of the American General Motors Co. in 1932, and was seemingly first used in the U.K. on some 1935 models which included the Wolseley 14, Vauxhall 14, and Lanchester.

The half light had the advantage of acting as a draught free air extractor when slightly opened, but when swivelled right round would act as an air inlet scoop for hot weather use. This latter function reduced the need for the fully opening windscreen. (Fig 8).

Car heating was also evolving at this period. The 1923 Brown Brothers catalogue of motor accessories lists a air heater utilising the heat from the car exhaust, the heat apparently being emitted from a grating in the floor of the rear part of the saloon. This heater was no doubt of primary interest to the chauffeur driven car owner! (Fig 9).

This principle was developed in the 1930's for European cars with air cooled engines, with engine and exhaust pipe cooling air being ducted into the saloon by an electric fan. Examples are to be found on the 1933 Mercedes-Benz 130H and the 1935 Czechoslovakian 'Tatra' car. The VW 'Beetle' introduced in 1937 was well known for its air heater, during its long post war production period.

2.1.3. The Drum Heater

Most British cars of this period were water cooled, and apparently some were provided with ducted warm air from the main cooling radiator. Ducted air from the engine compartment carried the risk of bringing with it engine fumes, and it was soon realised that a better solution would be a second 'radiator' in the saloon over which saloon air could be circulated. These were first introduced into the U.S.A. in 1926. (3) and in 1931 Clayton-Dewandre of Lincoln started to manufacture them in the U.K., the first of them being fitted to long distance motor coaches. Other manufacturers such as Smiths & A. C. soon introduced their own
which were to become standard in all cars in the two decades after the
Second World War, were readily available. These were:

1. The top scuttle air inlet giving a clean and aerodynamically
efficient air supply to the saloon.
2. The fresh air, water coil, heater with screen demist.
3. The \( \frac{1}{2} \) light giving draught free extract, or a boosted fresh
air supply in hot weather.

The first car to incorporate all of these components would seem to be
the 1940 model Jaguar saloons. (launched in Summer 1939) (Fig 12). The
1940 Jaguar consequently set the standard of environmental comfort for
all post war cars. This standard was however only slowly achieved in
some cases. For example, many post war cars, such as the Austins of the
early 1950's, incorporated fresh air heaters virtually as standard, but
still took their fresh air from the front grille, and the early Minis,
introduced in 1959 were only fitted with re-circulatory 'drum' type
heaters and lacked the now obligatory \( \frac{1}{2} \) lights.

2.2.1. Face and Bypass Control

Although the basic saloon car heating and ventilation system was now
established. Improvements continued. The method of heat output control
on the drum heaters had been by varying the speed of the circulating
fan. With the fresh air heater this was no longer practical and
control was therefore exercised by a control valve in the water circuit.
This was not altogether satisfactory, because there was a significant
time lag due to the thermal mass of the air coil before any effect was
noticed, and as the pressure across the control valve varied with engine
revs. control was erratic. Thus the face and bypass control \( \frac{1}{2} \) for
air valve system was introduced (Fig 13) which worked by by-passing the
fresh air round the heater coil when cooler air was required. This gave
much more responsive control at the cost of bulkier heater unit. The
BROWN BROTHERS, LIMITED
WITH WHICH IS ASSOCIATED THOMSON & BROWN BROTHERS LIMITED.

Fig. 9: 1922/23 Catalogue

Buchan's cold spells?...spells what?

THE CLAYTON HEATER
of course!

The Clayton Heater is the most complete, all-inclusive, all-thermostatic heater. It can be used in any position, even in the most inaccessible places. It is simple to install, easy to operate, and assures the maximum output of hot air, even in extreme weather conditions. The Clayton Heater is suitable for all types of vehicles, from light cars to large buses.

Available for all cars having water pump circulation.

CLAYTON DEWANDRECO LTD. LINCOLN

Fig. 10: Drum Heater.

A New Air Conditioner
A compact unit, by S. Smith and Sons, for supplying clean and warm air to the interior and to the screen to keep it clear.

Fig. 11: Smith's "Air Conditioner"
Fig. 12: Simplified schematic diagrams of the alternative control methods.

Fig. 13: 1930 Model Jaguar Saloon.
Ford Anglia introduced in 1957 and the Farina styled Austin Cambridge of 1959 both incorporated this feature.

2.2.2. Facia Vents

Since the first days of the motor car the driver had been able to direct a stream of fresh air onto his face when required. Initially this was provided by the opening windscreen and then later provided by the \( \frac{1}{4} \) light in its 'scoop' mode. In 1961 the design of the Triumph TR4 sports car did away with the then universal \( \frac{1}{4} \) light and substituted instead what may be called dashboard or facia vents (Fig 14), fed from the fresh air heater system, the volume and direction of these air outlets being controlled directly by those occupying the front seats of the car.

2.2.3. Extract Points

During the 1950's motor car construction had abandoned the chassis and moved to monocoque or unitary construction, which incorporated much better sealing between the engine and the saloon, around doors and windows etc. The sealing becomes so good that in some cars it was difficult to shut the car door unless a window was open to release the air pressure build-up when the door was slammed shut. This meant that unless the quarter lights were open the car's fresh air heater did not work as the fan could not deliver any air against the build up of pressure inside the saloon. Consequently Humber in 1960 provided a pressure relief extract vent at the base of the rear window, to allow out the air pumped into the car by the fresh air heater.

As quarter lights were not now required for their scoop function when facia vents were provided, they could be eliminated completely if purpose designed extract points were built into the saloon.
Fig. 14: Facia Vents - Triumph TR4 1961

Fig. 15: 1964 Ford "Aeroflow" Cortina

Fig. 16: "Aeroflow" Heater.
2.3. Stage 3 - The 'Hermetic' Saloon

Thus by 1964, as in 1939, new and proven components were available for the introduction of a radically changed saloon car heating and ventilating system. To summarise, these were:

1. Facia vents to give fresh air jets completely under control of the front seat occupants.

2. Extract points to allow out the air pumped into the car, without the need for open windows.

3. Face and bypass control of the fresh air heater.

It is commonly accepted that the first car to incorporate all these was the 1964 model of the Ford Cortina (Figs 15 and 16). Ford called it the 'Aeroflow' system. For the first time it was possible to drive in all but the hottest weather with all the windows tightly closed. The extract vents in the rear 'C' posts incorporated non-return flaps, which required a positive pressure in the saloon to open them. This positive pressure in theory would help to keep out road dust and dirt, but without air filtration, which, unlike the 1939 Jaguar, was not provided, would be of little practical value. What the closed windows did undoubtedly provide was lower noise levels, particularly when travelling at speed. So the 1964 Cortina was the first what may be called the 'Hermetic' saloon, and has set the standard for European car heating and ventilating to the present time.

The 'Hermetic' saloon has all but eliminated the + light and has given scope for creative design of the extract vents. On most cars they are now hidden from the casual observer, for example on the Ford Sierra, (the direct descendent of the 'Aeroflow' Cortina.) one is incorporated in each of the doors. the outer 'crack' round the doors servicing as the final outlet point.
The facia vent has also developed from the two provided on the dashboard of the 1961 TR4 to perhaps half a dozen or more, with controls which can make some give cold air and some hot simultaneously.

Thus the heating and ventilating system fitted on today's 'Hermetic' saloon represents the culmination of some sixty years of development of heating and ventilation systems for motor cars in Britain. It is interesting to note how standard it now is, being an integral part of all but the most basic of mini-cars up to all but the most expensive 'executive' models, this degree of standardisation being greater than at any time in the past. Nearly all European cars now contain the components listed above, differing only cosmetically.

Table 1 summarises this evolution, chronologically.

4.0. The Future

It would be foolish to believe the standard H & V system of today's mass produced motor car is not capable of improvement. Factors incorporated in more expensive cars are often pre-cursors of those later fitted to more popular models (as with the 1940 Jaguar), so it is interesting to briefly consider some of these features.

4.1. Thermostatic temperature control

Electronic control systems exist to provide a pre-set temperature in the saloon. Some would argue, however, that manual controls are quite satisfactory for two reasons:-

1. The requirements of the passengers and particularly the driver vary during a journey and consequently the automatic control will need frequent re-setting. Given this need for re-setting, what advantage has a thermostatic control over a direct acting manual control?
2. Unlike occupants of a building, front seat car passengers sit directly in front of the controls of their heating and ventilation system, with little else to do but to set and re-set them to give the changing requirements for temperature and air flow pattern. Re-setting of manual controls is therefore no inconvenience and has the advantage of an immediately detectable response.

4.2. Air Filtration

The 1940 model Jaguars were provided with fresh air filter. This is the only feature of this car's H & V sytem which failed to generally 'catch on' and become a standard fitment for all European cars. However, without air filtration, the full benefits of the 'hermetic' saloon, namely cleanliness, are not realised. Some present 'top of the range' cars do incorporate air filtration as standard, and it may well be that feature will somewhat belatedly become more popular, although the extra maintenance, cost and inherent reduction of air flows mitigate against this.

4.3. Air Conditioning

Jaguar, in 1939 claimed their cars were 'air conditioned'. However today the term 'air conditioning' is reserved for systems providing mechanical cooling which was not provided by the 1940 Jaguar. Air conditioning systems are available optional extras for most 'top-of-the-range' large cars on the UK market. However unlike the energy for car heating which otherwise goes to waste, air-conditioning requires a mechanically driven compressor, driven from the car engine, at the cost of extra fuel consumption, and a possibly larger engine. Air conditioning also has significant costs in terms of capital cost and extra space requirements of the hardware. It can therefore be argued that
these disadvantages more than outweigh the gains in passenger comfort offered by air conditioning when fitted to most cars for use in the U.K.’s temperate climate. If this is so, air conditioning will continue to remain as an optional extra, and will never become the standard feature of all cars in the way that the ‘hermetic’ heating and ventilation system has.

If however, a new energy efficient method of propulsion, such as the electric motor ever becomes a viable proposition for the motor car a complete re-think will be necessary, as such prime movers give little of the surplus of waste heat essential for satisfactory operation of the heating and ventilation systems in use today.

Conclusions and Summary

Heating and ventilation for the British saloon car has evolved over the last sixty years in three distinct phases:-

1. Pre 1939 - The ‘open’ saloon era, where ventilation was excessive and largely uncontrolled, and any heating was completely separate from the ventilation of the car.

2. 1939-1964 - The ‘½ light’ era - Introduced by the 1940 model Jaguar, in which the fresh air supply ventilation system was integrated with the car heating, and extract was effected via the opened ½ lights.

3. 1964 - to date - the ‘hermetic’ era. Introduced by the Ford ‘Aeroflow’ Cortina. The car’s saloon (Fig 16) became sealed from outside. fresh, heated if required, air being available through numerous outlets incorporated above, within and below the car’s facia (or dashboard) with the extract air being taken to often hidden extract points, pressuring the saloon slightly.
Looking towards the future, features such as air filtration, thermostatic controls, and mechanical air conditioning are now available on some UK cars, and although the first two may become standard on all cars of the future, it is felt that the third, air conditioning, will remain an optional 'luxury' indefinitely.

The present 'hermetic' heating and ventilating system is recognised by all as an indispensible integral feature of today's motor car. How indispensible is possibly illustrated by the tale of a shirt-sleeved motorist driving alone in his car, on a freezing winter's day, basking in the all-embracing warmth of his car's ultra efficient heating and ventilation system. He appeared the sole user of the road traversing an uninhabited landscape. He suddenly felt the need to relieve himself, so stopped the car, got out, still in his shirt sleeves, and did what he had to do. On returning to the car he found he had inadvertently locked himself out and hence he was suddenly faced with two pressing options:— either to die of exposure or break into his car to regain the life-sustaining warmth it offered. There is no need to record which option he took!
| Stage 1 | 1931 - Recirc. Hot Water Heaters  
1935 - '½' light - Wolseley 14  
Vauxhall 14  
Lancaster ++?  
The 'open'  
Saloon |
|---------|---------------------------------------------------------------------|
|         | 1935 - Top scuttle vent - Morris series '2' ++?  
1938 - Some cars being supplied with recirc. heaters  
as standard  
1939 - Smiths introduce Fresh air heater with demist |

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<td>Fresh Air Heating &amp; Demist</td>
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| Stage 2 | 1961 | Replacement of ½ lights with facia vents  
Triumph - TR4 |
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|         |      | 1961 - Replacement of ½ lights with facia vents  
Triumph - TR4 |

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<td>Air extract points</td>
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| Stage 3 | 1964 | Increased number of facia vents to give more flexibility and demist of side windows  
Extract points become concealed. |
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| The 'hermetic'  
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Table 1