The Sources and Images of Streamlining

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THE SOURCES AND IMAGES OF STREAMLINING

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THE SOURCES AND IMAGES OF STREAMLINING

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CHAPTER 1

THE SOURCES AND IMAGES OF STREAMLINING

1.1 Introduction:

Since man crawled from his primitive cave he has survived in one of three states of progress. Negative, or backward, neutral and forward. Since the middle ages we have been living in an era of forward progress. There are several promiment points such as the Renaissance, the Industrial revolution and the newer Information revolution. The word of each of these times has been 'progress' and can be summed up by the common comment,"Thats modern."
At each stage of advancement there has been a problem, a problem solver and the subsequent solution. Then there have been the scientists, those people who just look, rather than solve specific problems. They give us the raw material of progress that the problem solver bends to his current needs.

In each stage of advancement there is a sutuation or function. If the function is grinding corn, then the technology may be an understanding of the winds and aerodynamics and the solution the windmill. Assuming that its anticedent was the stone and morter method, the windmill has cut down on the amount of time people need to spend grinding corn to survive. This is called progress. If we step forward to the mid 19th century we are surrounded by such solutions to the problems of living, yet still our desire is for more progress. A machine must always work faster and cost less and so on. This modern progress has given rise to another famous saying. "The increasing pace of life." Look at the car since its inception in the late 1800's. It just got faster and better and more efficient and, and so on again. The word we are looking for is streamlined. The car has become more streamlined. Not just in the aerodynamic sense, but in all its other possible applications, even those used by an executive describing his company.

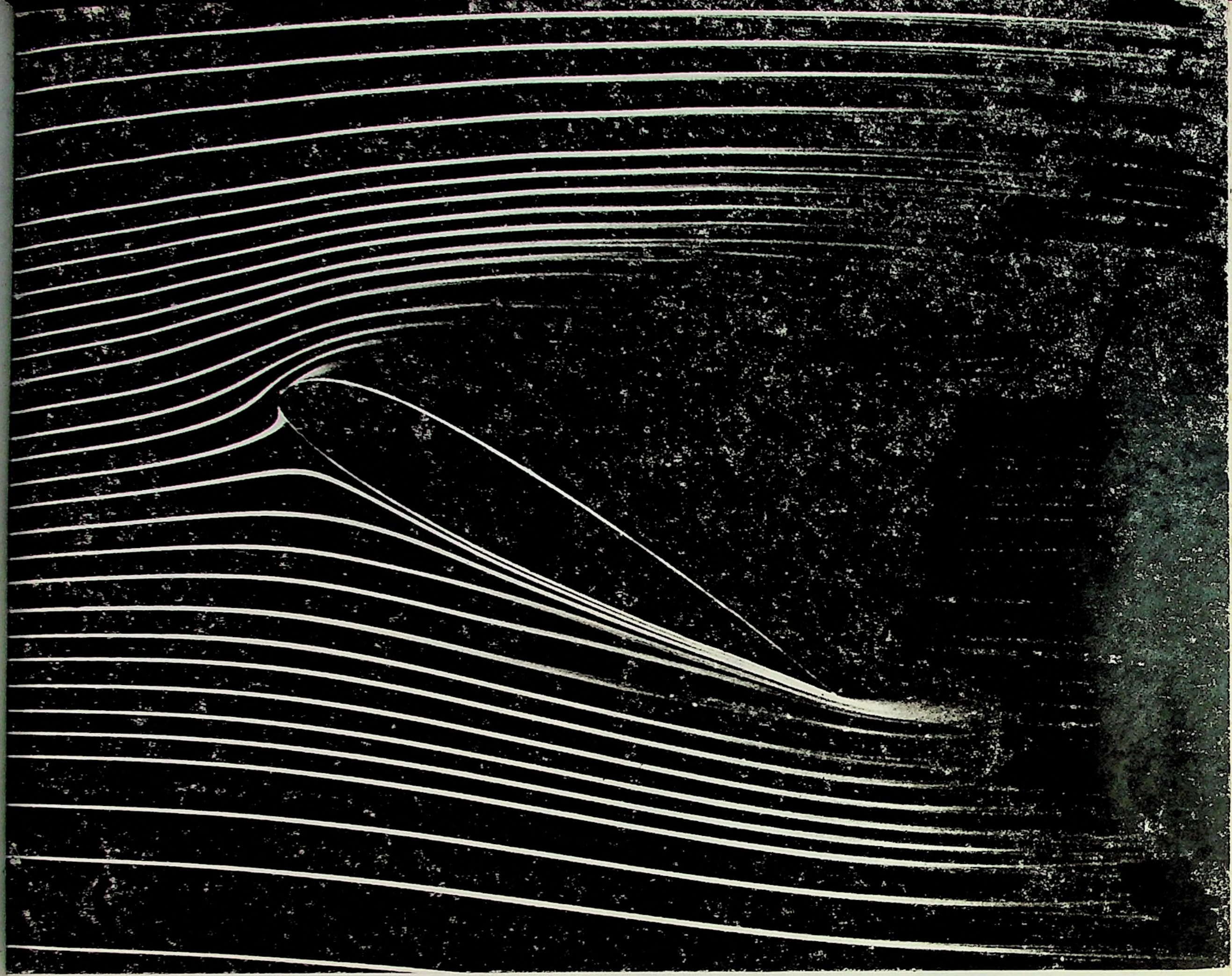
This is what concerns this essay. Streamlining. The subject area will be confined as much as possible to its application to things that move. It will also look at the images created by its application. A more precise definition of the subject matter is the area of science that looks,or lies within the interface between an object that moves and the medium through which it is moving. This interface, when considered by the designer, I am calling streamlining.

The bulk of the essay will look at the history of objects that benifit from being streamlined,since the Renaissance,up to the 1930's. This, the 30's, was the ultimate era of streamlining. Its images were applied to everything that was designed by man. It became a way of life that was to last up till the second world war. After that the streamlined image lost some of its glamour and had to take a back seat to other sources of imagery. The essay also looks at applications of streamlining in nature.

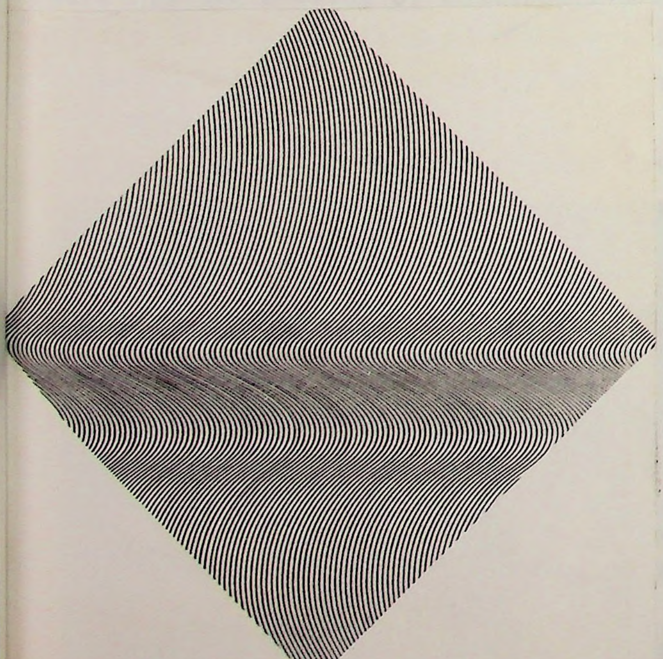
Before I start on the history,I want to introduce the subject by looking at some of the more varied sources of streamlined images. These have been selected both from nature and technology.

Picture Essay

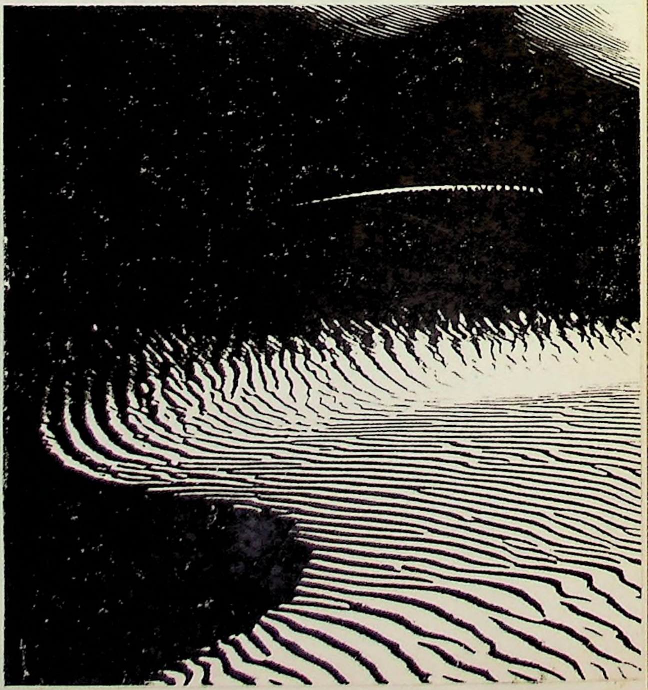
THE STREAMLINED WORLD

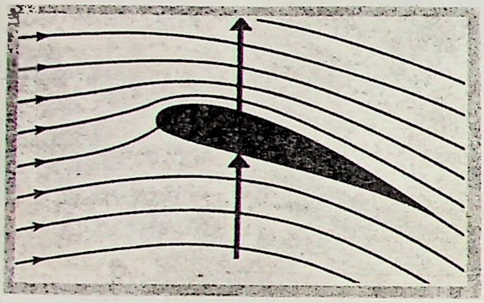


Above: Streamlines or air flow patterns around an aerofoil wing. These have been made visible with the aid of smoke streams. Their patterns can be seen reflected in desert sand flow patterns (below right) and in the art of Bridget Riley. (below left)



142 BRIDGET RILEY *Crest* 1964

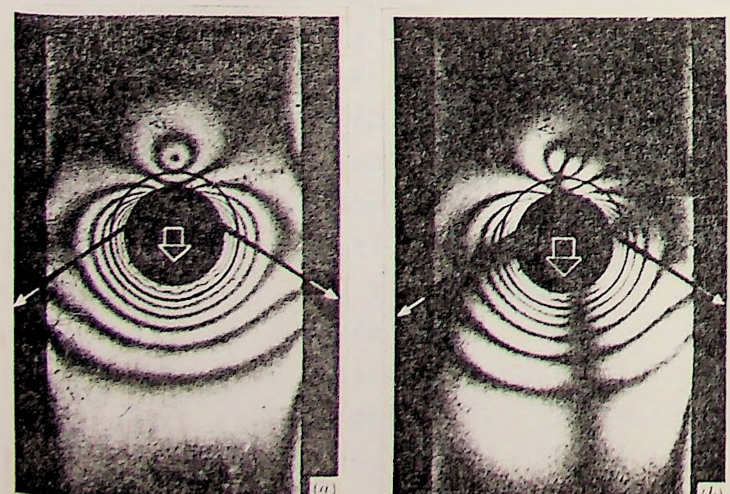


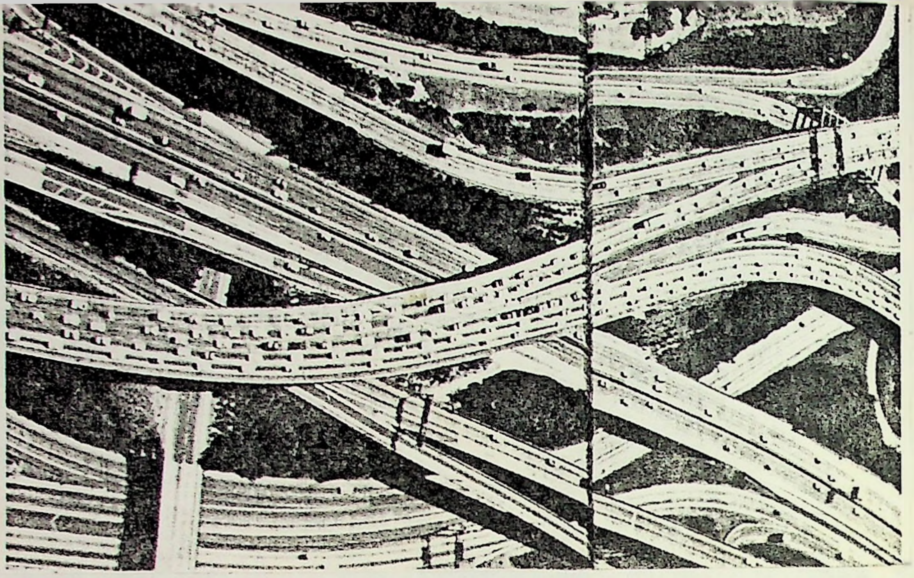


The flow patterns. overleaf, can be seen in the civil transport planes, top. The wing section (above) shows the direction of lift provided by the aerofoil pattern.

All these curves can be seen at work in the drawing of contemporary high society (above left) of the 1930's. This reinforces the concept that, the people of that era, saw streamlining as a way of life, and not just a suitable image for things that move.

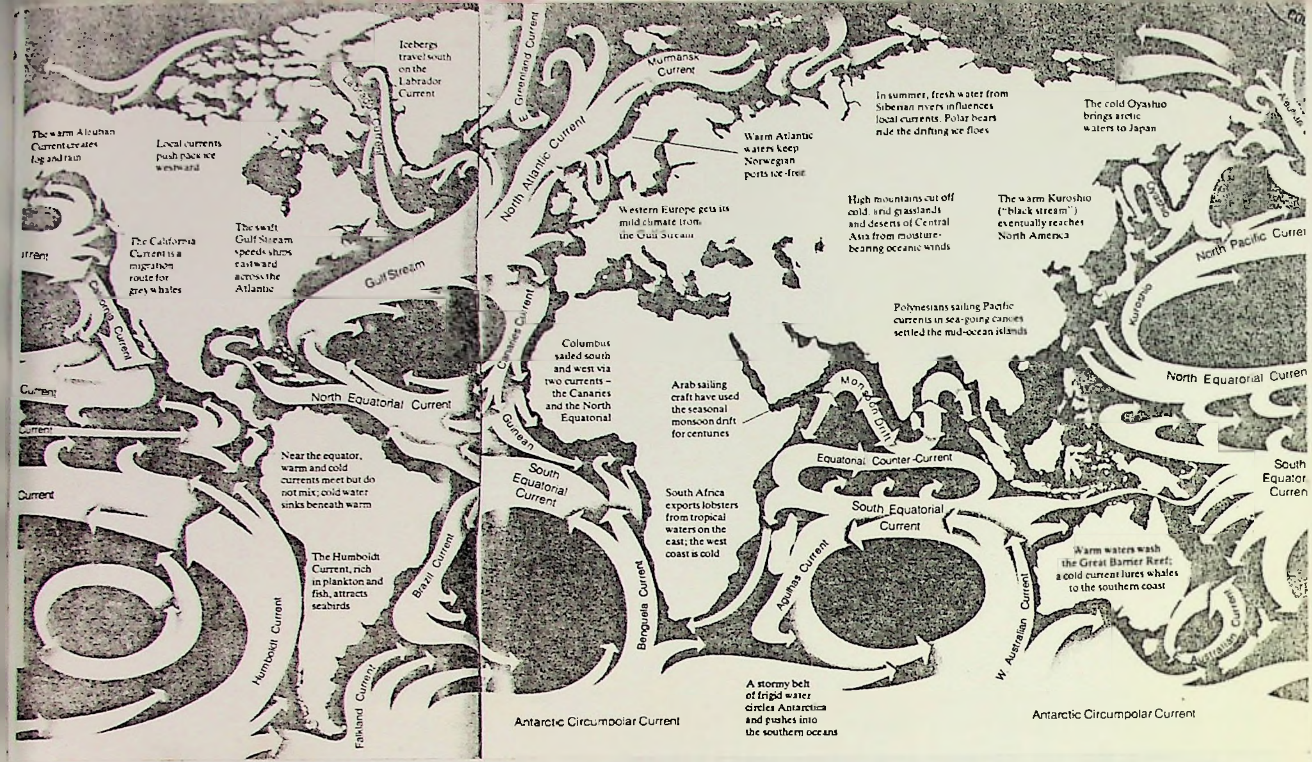
The two figures below show another source of stream lines. They are stress patterns in a length of steel which has a hole cut in it, and a bar through it at this point, that is loading in the direction of the arrow. The flow lines show how the metal takes up the stress.





Multitudes of migrating wildebeest, up to 50,000 in a single herd, roam the East African plains seeking new pastures. These bulky antelope thrive on the sparse grasslands. As a large herd of wildebeest grazes, the grass is kept short, green and succulent; with a small herd it becomes too tall and dry to serve as food. This may be the reason that wildebeest move across the plains in such vast numbers.

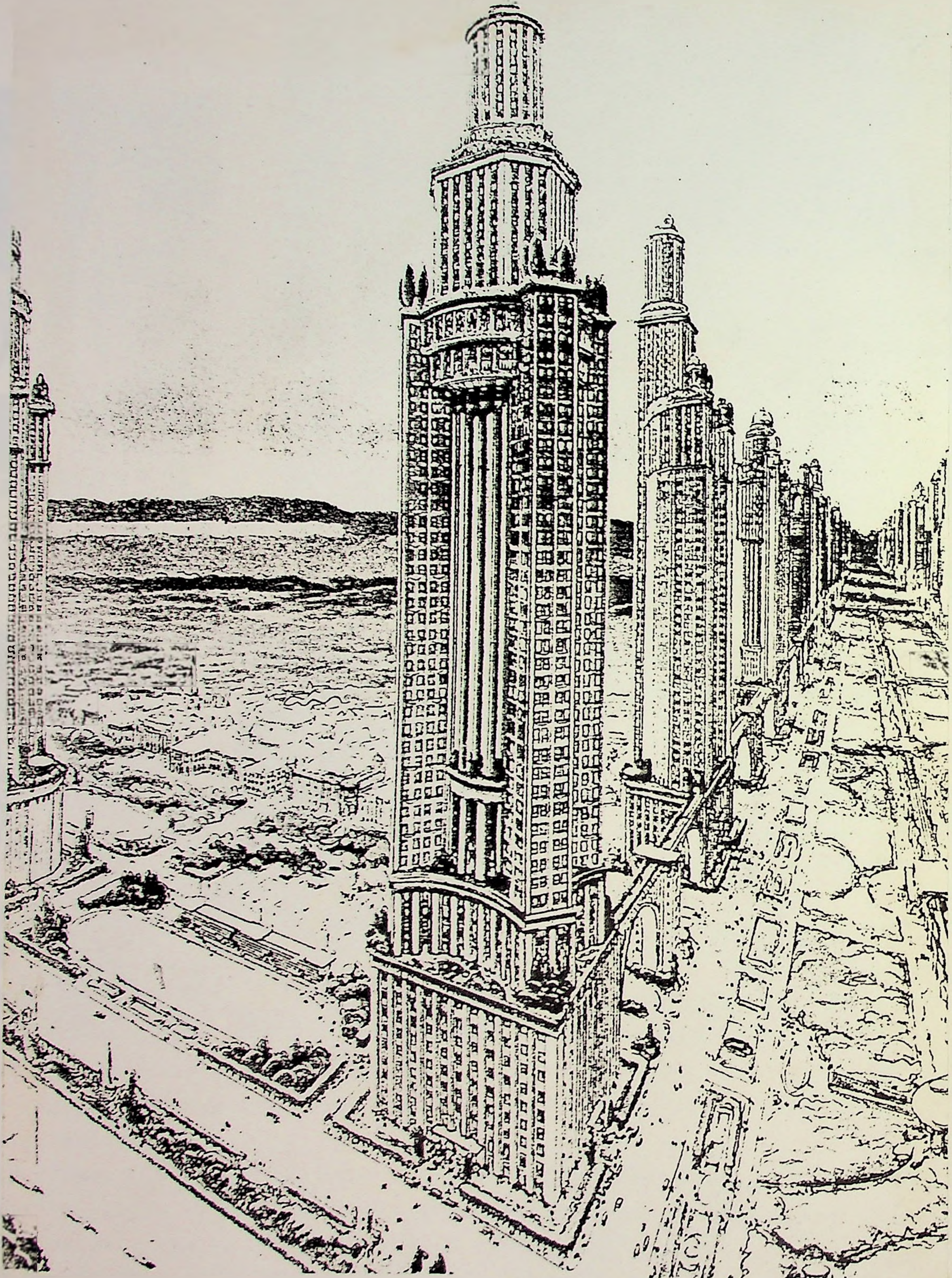
With the increased use of personel transport this century, interesting flow patterns began to appear from our more complex roadway intersections. (Top) From the ground these "spaghetti junctions" appear as a blot on the landscape, but from the air they have a graceful beauty. The same flow patterns are found in the migration of the East African Wildebeest (aboye left) and in the ocean currents. (overleaf) In both cases a flow line is straight until a tree, rock, hill, thermal current or land mass gets in the way. As the flow lines deviate around the obstruction their speed increases to keep up with the average flow speed of the medium. With any flowing medium this causes a compression point. The opposite causes a vacuum. It is the generation of this compression below an aircraft wing,



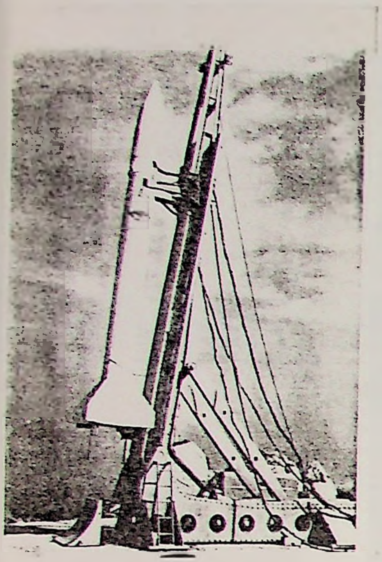
and vacuum above it, that yields its aerodynamic lift.

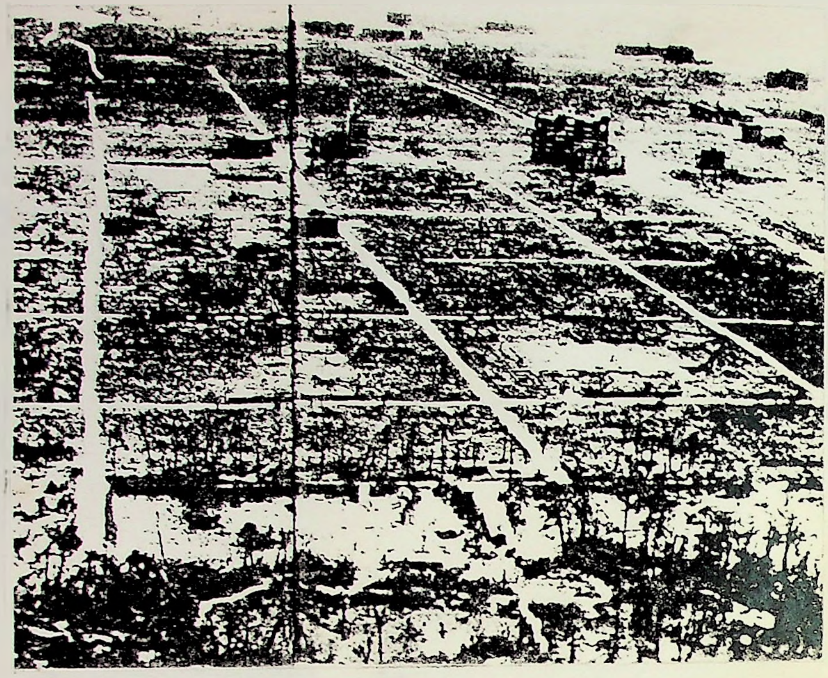
(below) The streamlined images here have been imposed by the town planners. It many look good from the air and hence their plans, but it can offer the inhabitants no sense of community or a natural town center. This has been the major criticism of modern town planning. Architects like Auguste and

Gustave Perret saw this type of planning as being the ultimate way to house people Their tower blocks designed in 1922 that were to replace Paris (overleaf) made a big impact in the 1960's. It took twenty years of misary and isolation, for millions of people, before town planners began to rethink this concept of very streamlined town planning.



24 Auguste and Gustave Perret *Study for Tower Blocks for Paris* 1922
Akademie der Künste, Berlin





Below An official photograph of the victims of Belsen Such image were to remain in the European consciousness for many years

Henry Dreyfuss reffered to the streamlining he imposed on his products as "cleaning". Removing the clutter and confusion and replacing it with highly functional, high speed, no waste, ultimate product.

The two pictures (top right and left) show a more drastic form of the first stage of this 'cleaning'. The two top pictures show the remains of Hiroshima town center and some of the streamlined hardware that can make this sort of wholescale 'cleaning'possible .

Many of our cities suffer from a similar 'cleaning' that is carried out on a smaller scale. Huge derelict areas are created so that a hopless mass of humanity can be replaced by new modern architecture.

Durning world war 11 Hitler started a streamlining design project on the human race. He sought to produce an ultimate people, worthy of ruling the world. The photograph (left) shows some of the 'waste' from his cleaning operations.

The pictures (top and left)show the more aggressive shape of fast cars of the 1970's. The Jaguar (left) XJ 1 is the ultimate sports car ever designe to date. Its 5 litre engine could manage speeds of over 150 mph with ease.

Below shows the results of wind tunnel testing on popular car forms.

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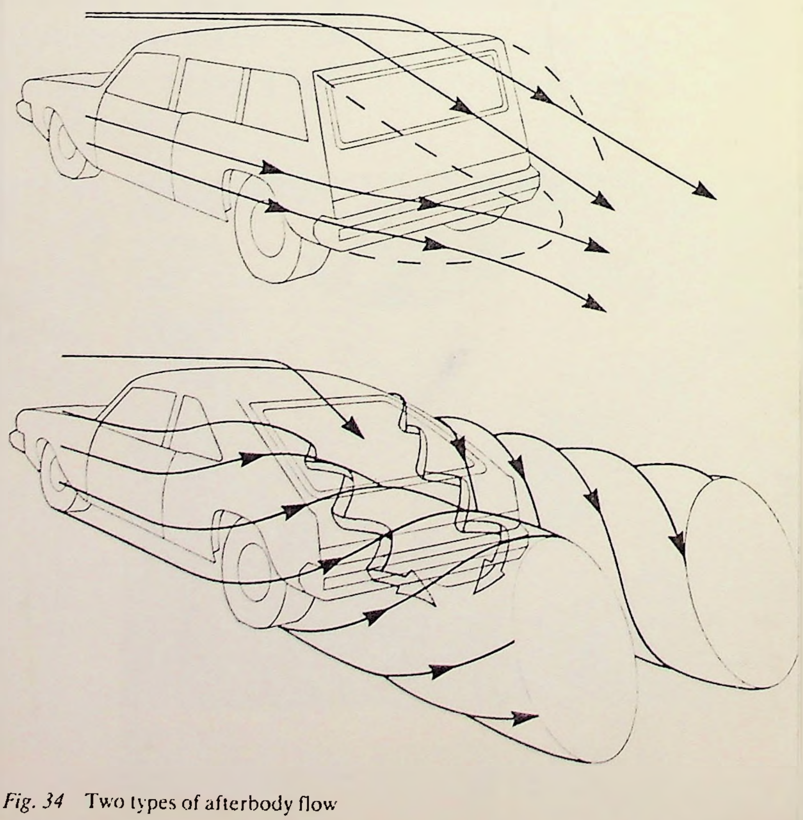
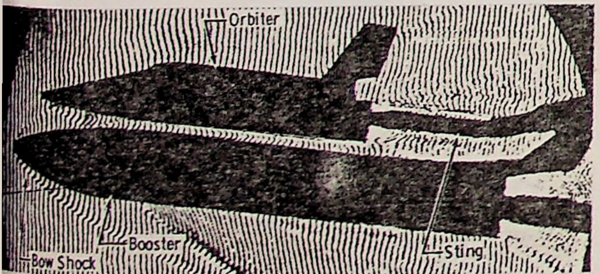
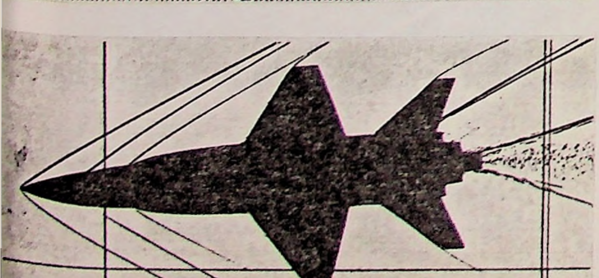


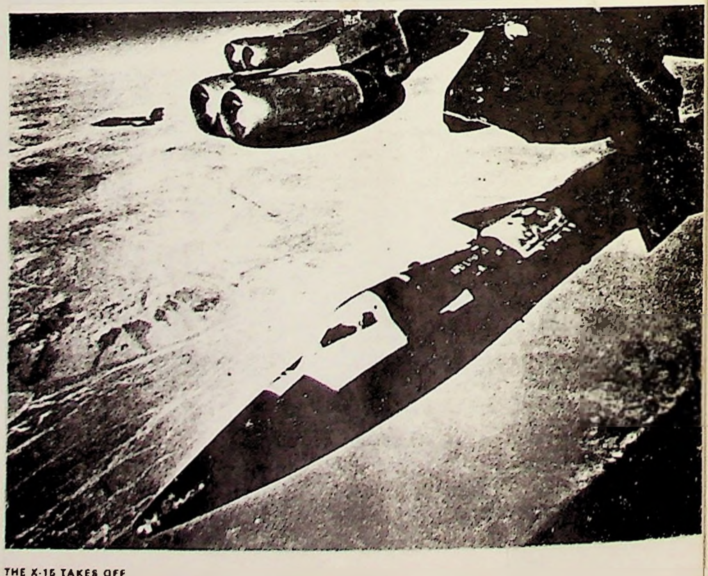
Fig. 34 Two types of afterbody flow

(above) The high speed, jet and rocket age as mirrored in the Pop Art movement of the 1960's.

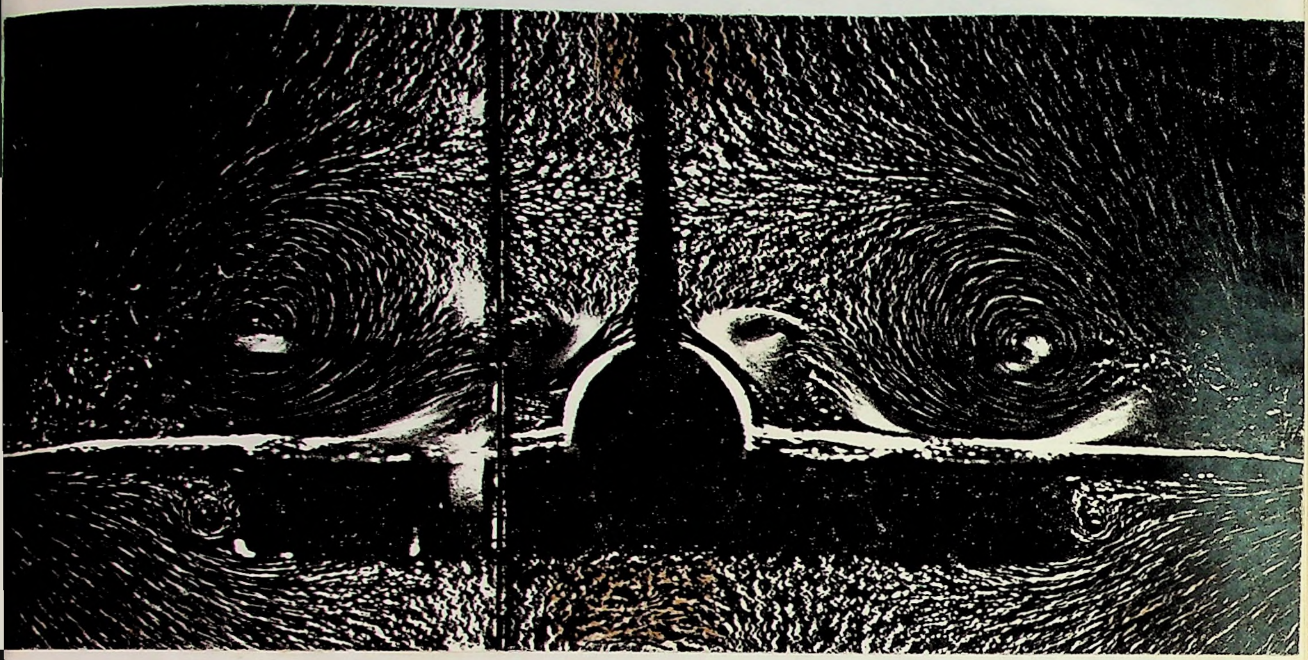
With the 1970's we were designing objects that were to go beyond supersonic speeds to the hypersonic region. Wind tunnel tests at this speed reveal none of the curvilinear forms that triggered the streamlining of the 1930's. The rocket powered plane (lower right) is designed to fly at speeds of over 3500 miles an hour.



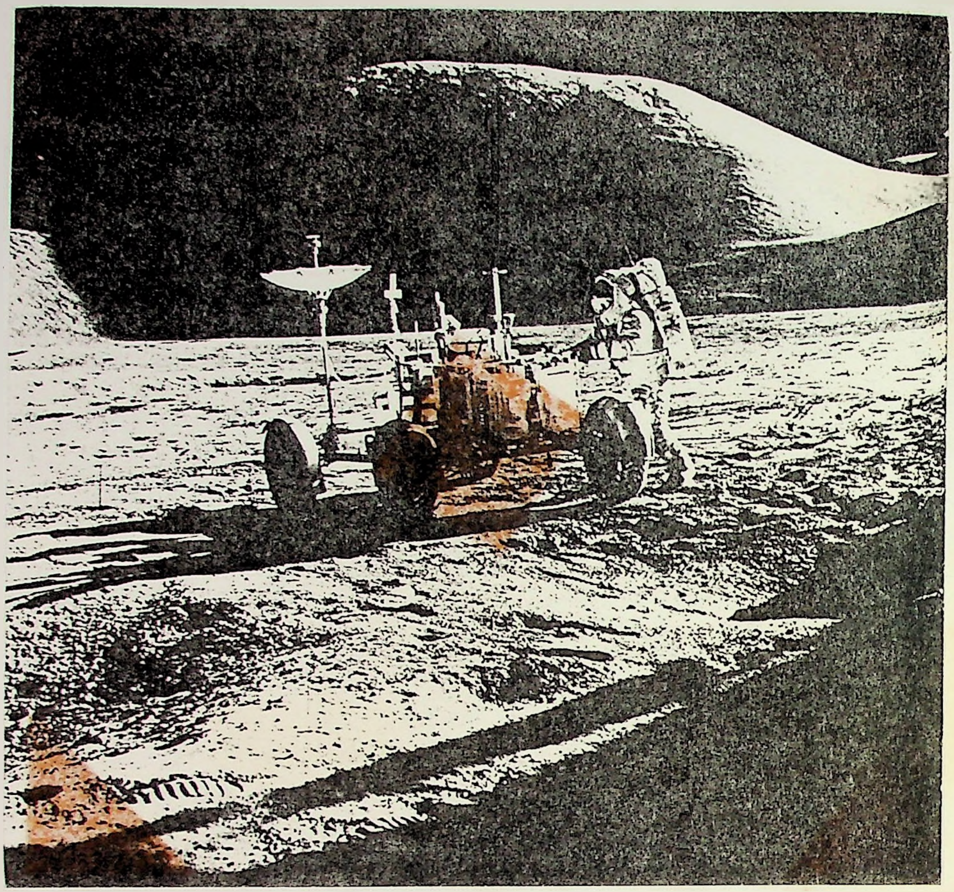




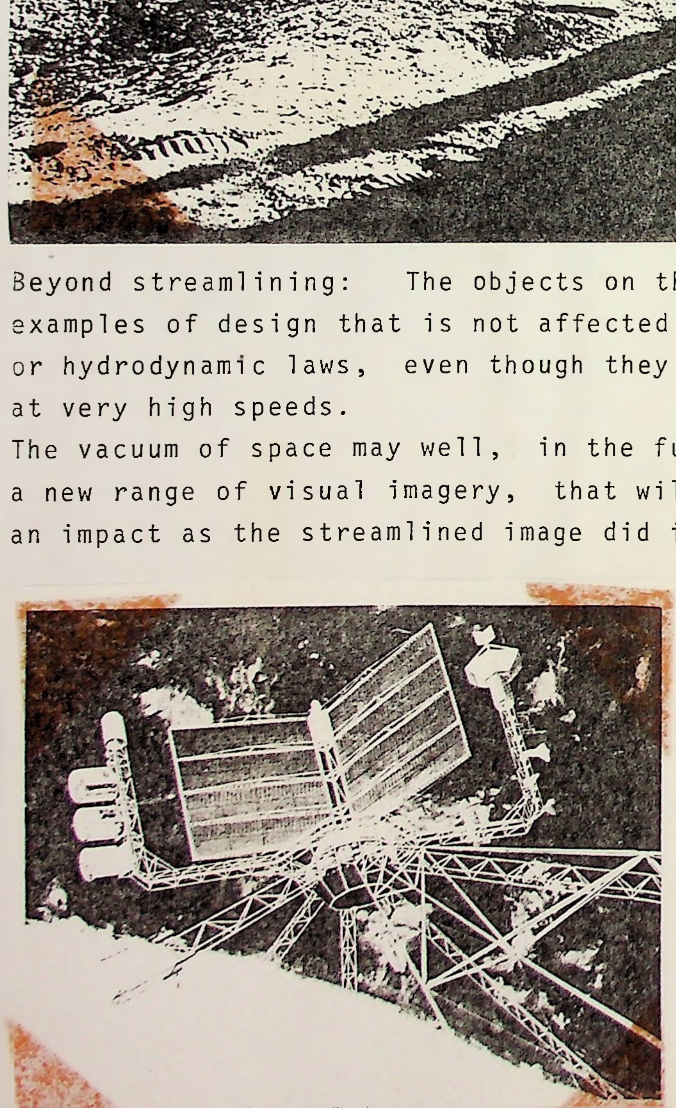
THE X-15 TAKES OFF
Dropping from its carriage under a B-52 that has carried it to 35,000 feet, the X-15 blasts off on a flight that will reach Mach 5 or better. Though rocket powered, the X-15 differs from a missile or space vehicle in that it is designed for aerodynamic flight: it still has wings. When its engine burns out, the craft will glide down to earth and a smooth landing at around 200 mph.



Concorde; a shape that has changed our visual image of the comerical jet airliner. As with most high speed craft, she is very graceful, and could without doubt be mounted in a museum as a bit of sculpture. The two photographs on this page show wind tunnel tests on her.



Beyond streamlining: The objects on this page are examples of design that is not affected by aerodynamic or hydrodynamic laws, even though they may be moving at very high speeds.
The vacuum of space may well, in the future, produce a new range of visual imagery, that will have as great an impact as the streamlined image did in the 1930's.



Assembly in orbit of elements of the power satellite shown on page [illegible]. The central cavity structure is supported by lightweight trusses, extending downward to the two-mile-wide mirror. The U-shaped [illegible] is a temporary framework for construction of the radiators, which are the large panels above the central cavity. On the right arm of the U, a 100-foot-long space ship indicates scale. (Courtesy Boeing Aerospace Co.)

CHAPTER 2

2.1 Nature and the background to Streamlining.

Streamlining is defined in the dictionary as being that, "having boundaries following streamlines so as to offer minimum resistance: a term of commendation with a variety of meanings, as efficient, without waste of effort, up-to-the-minute, superior type, graceful.

In nature there are many animals and plants that depend upon streamlining for their survival. If we consider a tree in a very windy hostile environment, we can see streamlining at work. There will be the rounded branch section, the sparse leaves, and quite often the branches will be aligned to the wind direction. In the same manner we can see the effect of wind erosion of certain rock formations. In fig. 2.1 the rock formations are due to limestone being weathered away revealing the hard granite shapes below. Subsequent wind and sand erosion has worn them into smooth round shapes not unlike a tree section. This may be why man has always preferred round pillars for structures, even though they are harder to produce for the stone workers. The builders of the Gothic and Romanesque Cathedrals have left us with some fine examples of the intricies of form found in nature in their stone.

Fig. 2.2 shows how shapes or arches are streamlined to allow the stress and force lines to flow down to the base. Without their streamlined shapes, the Gothic and Romanesque builders could never have built what they did. Our modern knowledge of mechanics allows us to build far more slender shapes in high strength materials such as the Golden Gate Bridge in San Francisco.

See Fig. 2.3 Here the weight of the bridge deck is suspended from the two towers. Stress lines such as those in a fluid have to follow the path of the material which contains them. If you decrease the section thickness at any point, you increase the flow rate at that point. They will pass round objects in their way easily if there are no sharp points where stress

FIG. 105. Forms due to sculpting of hard granite, Devil's Marbles, Northern Territory, Australia.

Fig 2.1

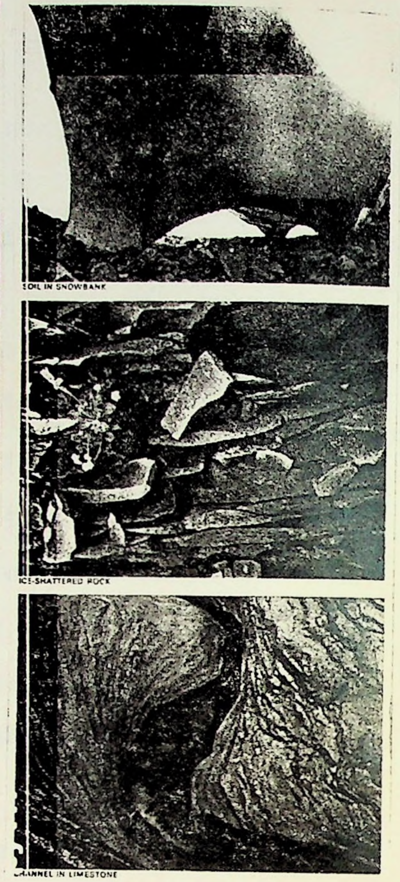
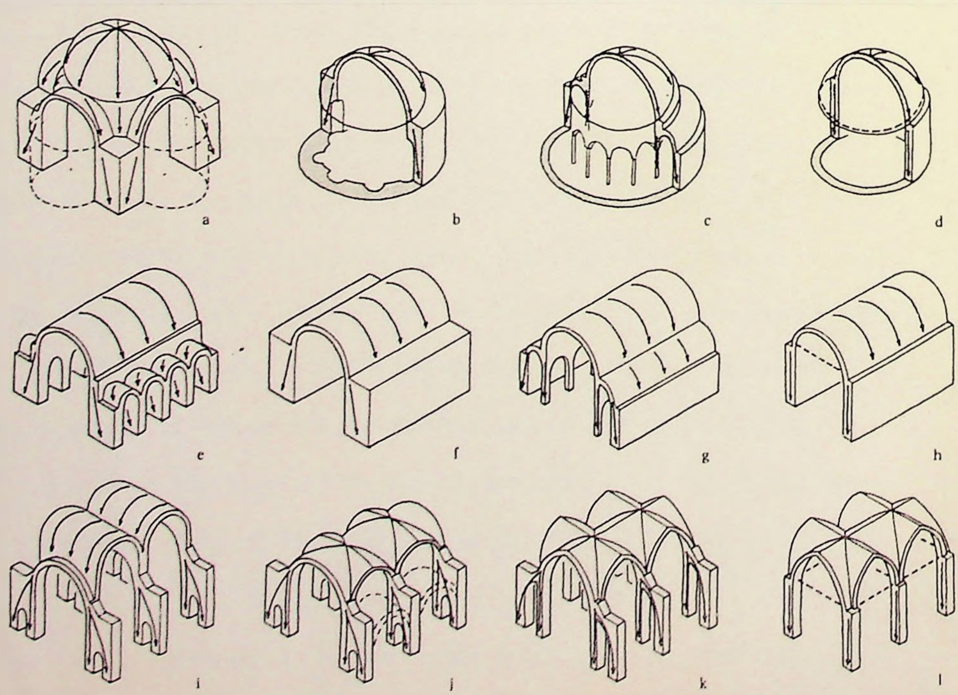


Fig 2.2

Fig 2.3



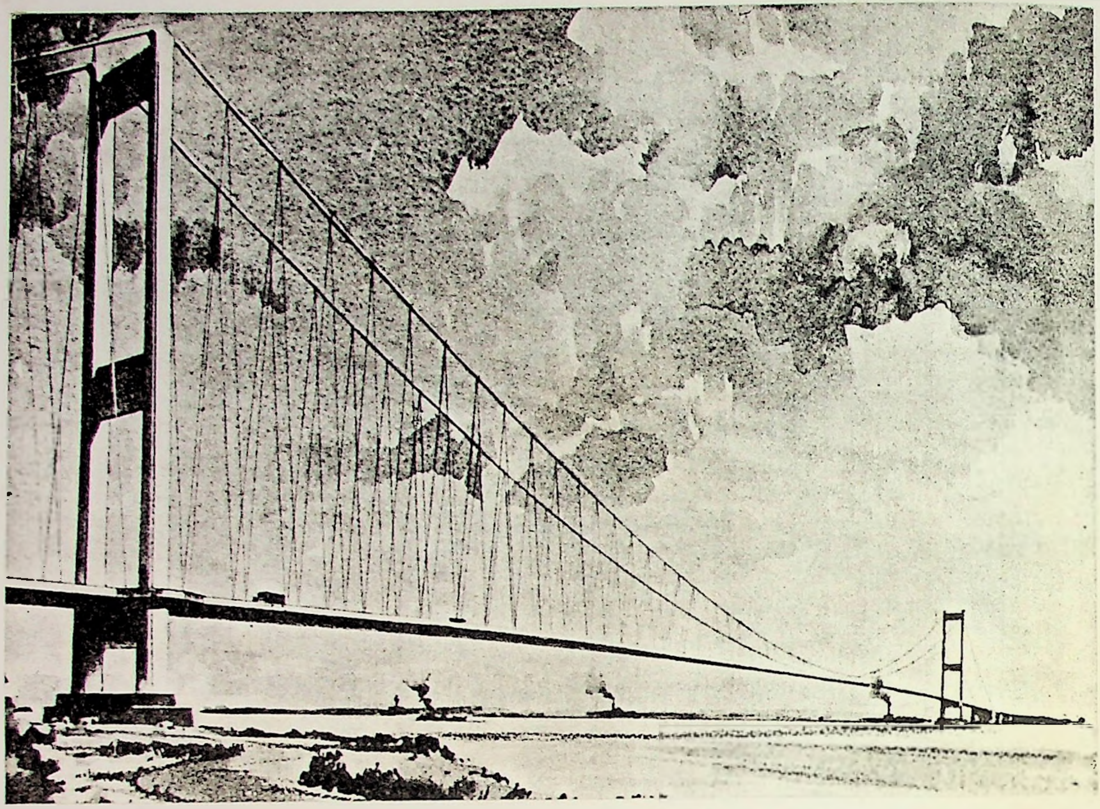
can be concentrated to beyond what the material can withstand.. Here the material will fail. With fluid,turbulance is generated at the back of the shape which pulls it along in the direction of the fluid.

2.2 The science of penetration:

What we are looking at here is how an object fares as it passes through a fluid such as air or water. The first studies in this field concentrated on hydrodynamics,as it was to be the late 1800's before man had objects moving fast enough through air to merit streamlining. One of the first was Daniel Bernoulle who in 1738 published data on hull design. However, hull design was still a matter of trial and error. Over thousands of years man had developed a few forms that seemed to work better than others.

In 1869 the British decided to fund experiments by Frederick Reech. He towed a variety of model hulls through water and discovered - as had others before him - that some worked better than others. It wasn't until the 19th century that any hydrodynamic theories were formed. These were the concepts of turbulent and laminar flow. It was discovered that turbulent flow generated a partial vacuum behind a moving object which retards its progress. This can be seen in fig 2.4. Fig 2.5 shows the results of work carried out by a French Physiologist, Etienne Marey who in 1899 constructed a vertical wind tunnel. It was fitted with tubes that released threads of smoke into the airstream. With these he was able to see and photograph the behavior of air-flow around various shapes placed in its path. Fig 2.4 shows typical aerodynamic flow patterns. The laminar airflow is where the streamlines remain parallel with either themselves or the surface they are travelling over. Turbulent flow is where an airstream has broken away and changed direction, This is usually found at the rear of an object and acts as a retarding force against forward motion. This is because of the partial vacuum generated by the turbulence.

W.J MacQuorn Rankine is credited with the first drawings of streamlines, ie those lines representing parallel layers of a fluid. The first wind tunnels



The Golden Gate suspension bridge San Francisco.

Fig 2.5

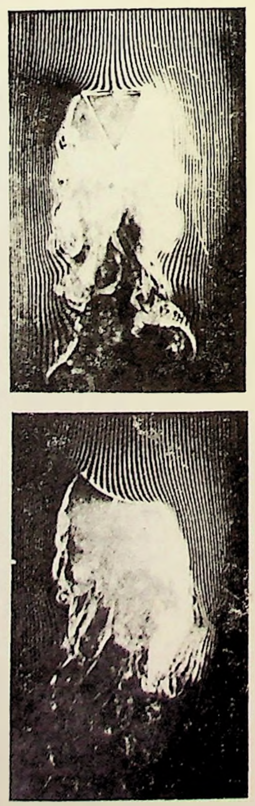


Fig 2.4

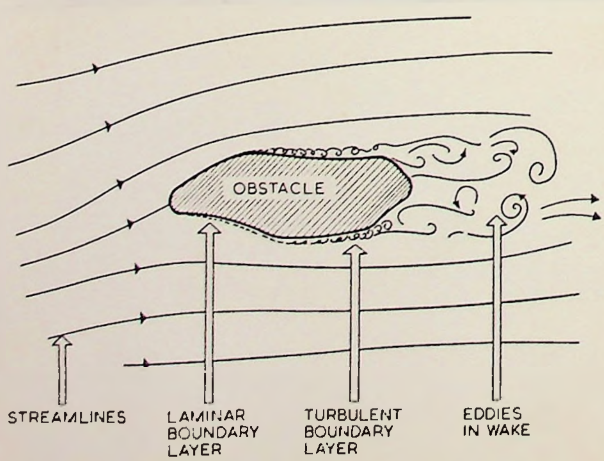
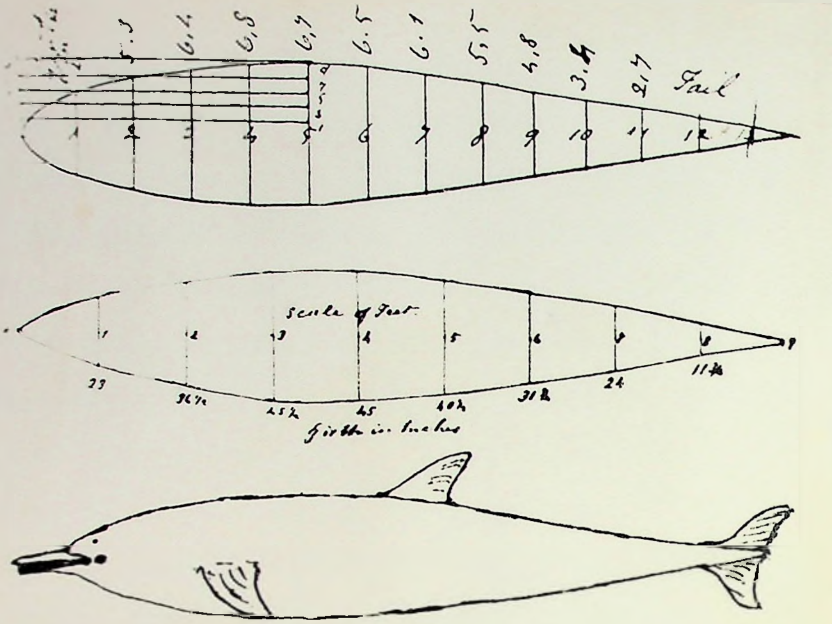


Fig. 3 Typical aerodynamic flow patterns



2. Sir George Cayley. True Forms of Least Resistance. 1809 and later. (*Courtesy Charles H. Gibbs-Smith.*)

Fig 2.6

A 'landsmans' image of the dangers of whaling in the 1800's before the invention of the explosive harpoon.

used a combination of smoke and ribbons attached to the model to help visualise the streamlines. Sir George Cayley in his design for a 'Dirigible' proposed that the most perfect shape be "that of a very oblong spheroid". He connected the field of hydrodynamics with that of aerodynamics saying "that the general form would serve either in the sea or in the sky, for both are fluid forms". He went on to look at forms used for swimming and flying in nature,made many wooden block spindles whose longitudinal section copied that of such animals as trout, dolphins and woodcock. He also saw that the trailing end of a body seemed to be as important as the front end. He went on to use these spindles split in half as hulls. Fig 2.6 shows his drawings of a dolphin which he proposed as an efficient hull design for a boat.

Thefirst wind tunnel appeared in 1871 at Greenwich and soon data on many profiles was gathered including data on stuffed fish and birds. Photography was used to track the progress of silkthreads and smoke and particles of hot iron.

Towards the end of the century the whaling industry was given a giant boost with the invention of the explosive harpoon. There was a great expansion of the whaling fleets,and the image of the whales streamlined bodies became much better known to the public at large. When the balloon was first converted into an airship the logical shape for it at the time was that of the whales being fished at the time. Fig 2.7 shows one of these early airships.

The Victoreans were very curious about these huge animals from the deep. They understood that it was the streamlined shape that allowed them to move swiftley through the water. Unfortunately it was not until the 1940's and world war two that much serious research was done into the science of streamlining. As a result we now know that to get a body to travel through air or water with a minimun expenditure of enegry the body has to be so shaped that it causes laminar flow over its surfaces. The lack of turbulance in this condition means that only a minimum amount of energy need be used in parting the fluid. The body of a whale does this as it passes through the water. It is however a lot more sophisticated than the Victorians realised. If an area of

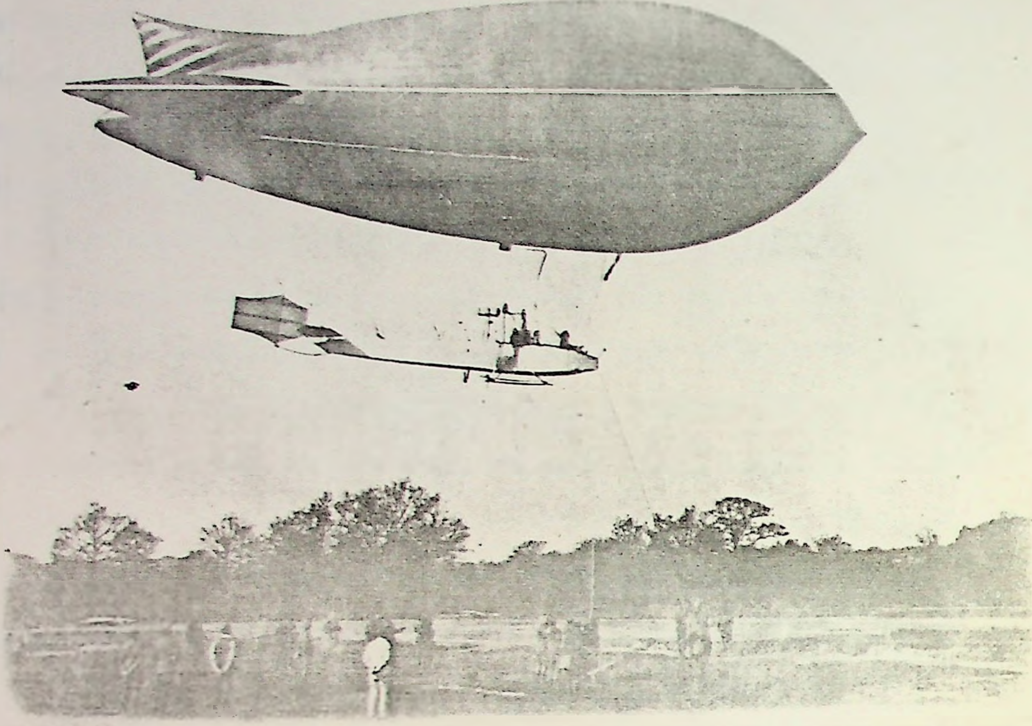
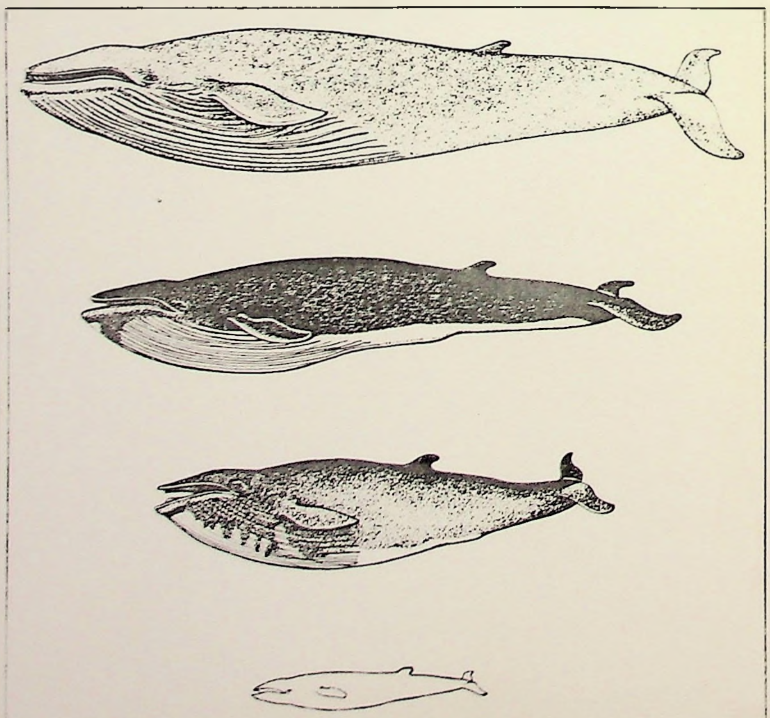


Fig 2.7

Fig 16. The Irish rorquals. *From the top*: blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*) and (outline only) minke whale (*Balaenoptera acutorostrata*).



s,one of the few strea-
d images the Victoreans
of.

turbulance occurs against the skin, ie an area of low pressure. the skin bulges out increasing the pressure at that point. This was one of the many finer points of streamlining that designers up to the 1930's were unaware of. The result has often been objects aerodynamically restyled whose co-efficient of drag or drag factor was no lower than that of the former design.

In nature streamlining has in cases been used in the negative sense. The jelly fish is an example of this. By making its body surface area as large as possible for a given body volume, they move themselves with the water currents. At the other end of the spectrum there are those fish who rely on a low drag factor and high speed to survive. The sailing ship exemplifies this. The sail like the jelly fish or plankton gets in the way of as much wind as possible, forcing a streamlined hull through the water which generates in turn as little drag as possible.

Nature is well known for getting things right. Sir D'Arch Wentworth tried to explain how nature evolved her streamlined forms. " The contour of a snowdrift of a windswept sand dune, even of the flame of a lamp, show endless illustrations of streamlines or eddy curves which the stream itself imposes, and which are often times of great elegance and complexity. Always the stream tends to mould the bodies it streams over, facilitating its own flow; and the same principle must somehow come into play at least as a contributory factor inthe making of a fish or of a bird."

CHAPTER 3

3.1. The Renaissence,from the dark to the light:

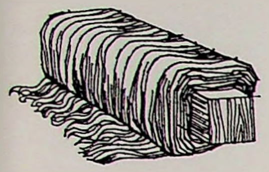
There are many who say that the Renaissance was the birth of modern man. It was considered by many as the change from what is often called the hell-fire damnation and absolute poverty of the Middle Ages. It is also going to be the beginning within the frame work of this essay. One can go much further back in time and find much relevant material on streamlining,but I feel that the roots of streamlining of today don't go back much further.

The beginning of the Renaissance was the late 1300's when such people as Gitto and Dante nearly had to reinvent the term "culture" with their writings and art. By the 1400's it was well on the way. The most fundemental aspect of change was peoples treatment of themselves and the world,as individual elements rather than make generalizations. The world changed from a place of poverty one must pass the years of life on, to a complex mass of facts to be discovered and admired. People became thinkers and were credited for their discoveries.

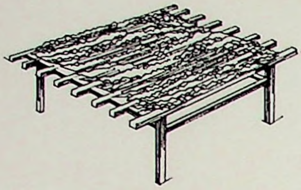
Time had to be found for this burst of intrest in what we now call 'leisure time activities.' Money also had to be made to support great artists. Minds such as Leonardo Da Vinci's invented new machines and systems that helped produce the essential consumables of life, and produce for export what could generate wealth. Progress was slow and the impact of new technologies was small. This was due in part to the lack of materials and also because of the huge pool of cheap labour. Fig 3.1 shows the machinery used in the processing of yarn into woven cloth. They were all made from wood and either held together with wooden pegs or tied with tough cord. Though the industry employed some 30,000 people it was owned by only a handfull of merchants. It was the dependants of these priviliged few who were only really able to pursue the arts and sciences.

3.2 Leonardo Da Vinci:

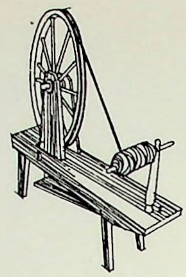
Leonardo Da Vinci was one of the first to study the field of fluid mechanics. He also saw that the laws that govern liquids are the same as those that govern a gas. His major contribution to the science was to understand what



COMBING *the wool separated the long strands from the short tufts of fuzz. Then the long strands, wound on wooden blocks, went directly to the spinners. The tufts were used too, but first had to be prepared by carders.*

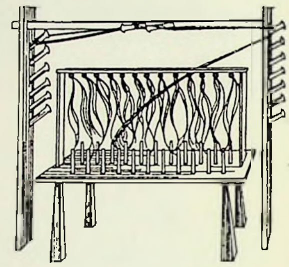


CARDING *was a scraping process applied to lower-grade wool. Spreading the wool on wicker frames, workers untangled it with wire scrapers—tools so efficient Florence forbade anyone to take them out of the city.*

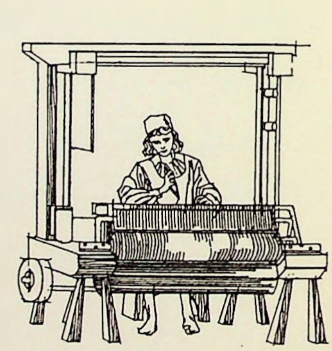


SPINNING *was usually done in the country, where peasant women worked in their own homes, converting wool into yarn. They were constantly busy, since at its height Florence produced some 80,000 bolts of wool a year.*

Fig 3.1



WARPING *was the process of looping strands of wool (centre) over the pegs of a frame, preparatory to weaving. Workers stretched the wool on this frame and stiffened it with a gum. It was now ready for the loom.*



WEAVING *was the last step, transforming yarn into cloth that Florentine merchants would sell to the world. A handful of wealthy merchants ran the whole industry, whose peak employment was some 30,000 workers.*

exactly happened when a body was forced through a fluid. He found that as it pushed through the fluid meduim it compressed the fluid in front and generated a partial vacuum behind it. As the fluid rushed in behind the object it forced the body forward compensating for the energy loss due to the fluid compression in front. If the shape at the rear of the body is flat and the fluid suddenly clamps back together without exerting any forward force on the body the energy is lost. If on the other hand the compressed fluid at the front comes together at the back after moving along a gently curved cone it is constantly forcing the projectile forward as it comes together and hence less enegry is lost. This loss is today called the drag factor and is derived by dividing the amount of energy used in moving a projectile forward by the amount of enegry rec aimed by the body at the rear.

Leonardo saw clearly that there was little difference between a body moving through air and water. He illstrated this by the following. "Describe underwater swimming and you will have described the flight of birds."

It was while observing large flying birds that he began to think that man powered flight might be possible. It was his conviction that natures answers to a problem were the most perfect,that led him to mimic birds in his designs for flying machines. He started designing these machines only after he had extensively studied and drawn birds in many stages of flight. Some of these can be seen in fig 3.2. Fig 3.3 shows the wing construction of his flying machine...In it he closely copied human and bird anatomy. His wings were composed of cane skeletons, leather tendons and muscular steel springs. It is almost certain that no successful models were built and flown. He was however the first person to think along practical lines as to how we might fly.A contemporary remarked "Lenardo Da Vinci also tried to fly, but he too failed." leading us to conclude that there was little success and quite a few rather terminal failures.

Leonardo also applied his streamlined thinking to other engineering problems. His clear far-sighted thinking managed to produce some amazingly streamlined

Fig 3.2

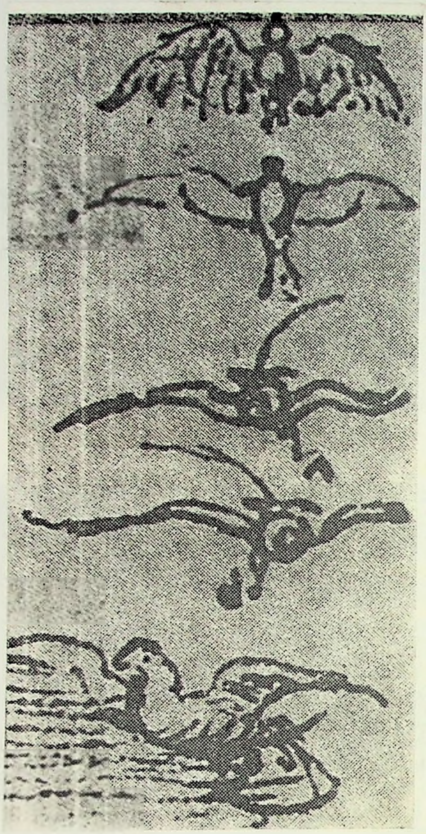


Fig 3.3

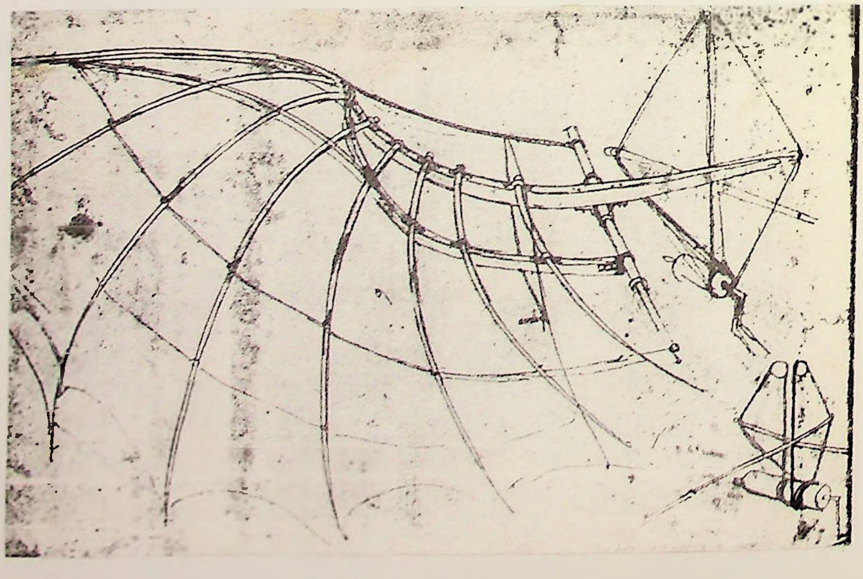
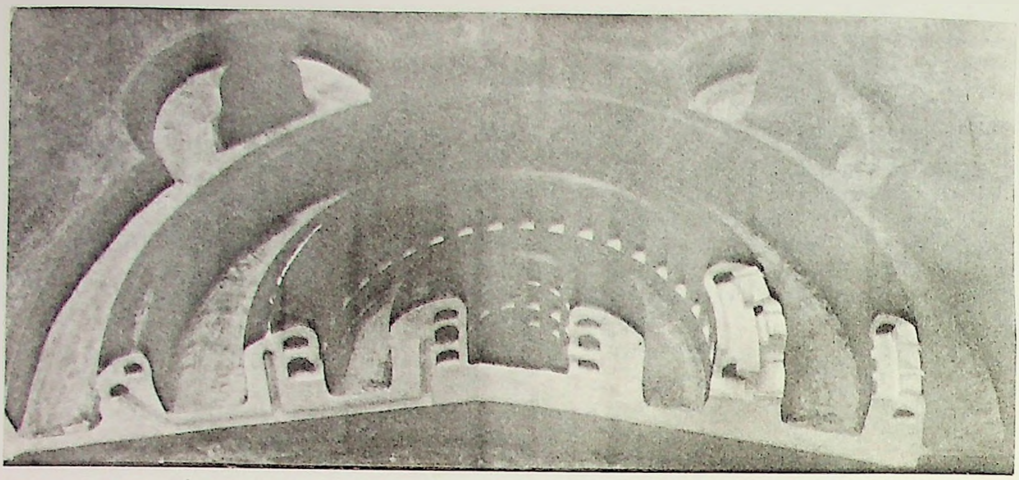
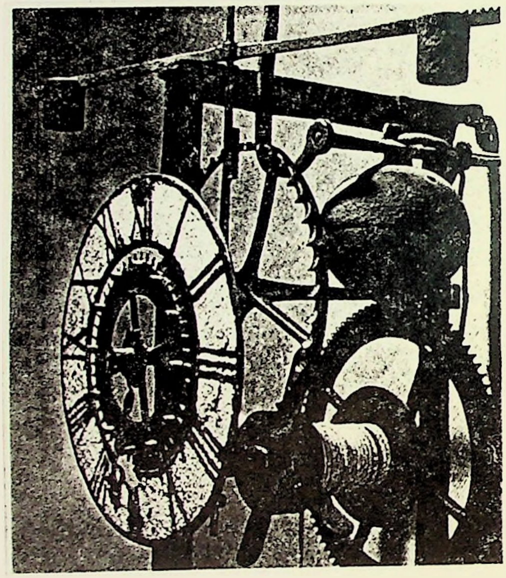


Fig 3.4





PROTOTYPE OF ALARM CLOCKS
A German wall clock of the 14th Century was a small version of the early mechanical clock. Regulated by a verge and foliot escapement *(weighted bar at top)*, it was driven by a weight that hung down below the clock. The wall clock was employed to toll the hours in monasteries.

An early clock. 1400's. The only feature that's been styled is the clock face.

CHAPTER 4

structures. His fortress design shown in fig 3.4 shows how streamlining can be applied to defensive forms. All the wall tops are smooth curves giving no grip for grapple hooks or projectiles to lodge in. In plan the buildings are round,producing no point weaker than any other. Then they are placed in three concentric circles, each of which can be defended independantly if an outer wall should fall. With no large entrance gate - tunnels beneath the moate were used for access - and four corner towers giving a 360^{0} field of fire coverage, the fortress, had it been built, would have been most formidible.

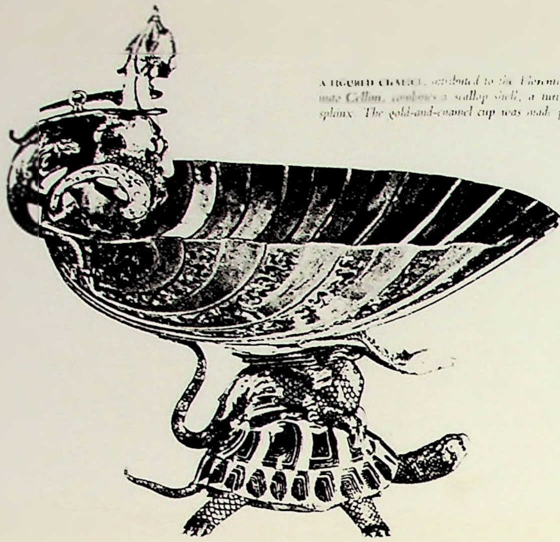
4.1 Applications of the streamlined image:

The images of swirling smoke, water, and steam that already existed and came out of the Renaissance through the drawings of patterns of flow from such people as Da Vinci can be seen reflected in many artifacts produced right up to the present day. They are very apparent in the later Rococo and Baroque styles. The silver chalice in fig. 4.1 not only shows curving spiralling lines, but through the scallop shell shows us where the imagery has originated from; the sea. The candle sticks of the early 1700's in fig. 4.2 show small figures caught up in swirling waves of water. This could be said to reflect the curling smoke trails of the candle it was intended for. It is curious to note that such similar images should come from two such opposing mediums, fire and water.

The Rococo coffee pot and vases in fig. 4.3 show the development of the swirling curve into a much lighter and more flippant line of the high Rococo period. Here the curves imposed on the plant forms are a contrast with the staid and unexciting overall form. The spiralling curve of the coffee pot spout allows the user greater control over the liquid stream when it is poured. This is, however, one of few examples of a functional application of streamlining, and is characteristic of much design of the time, and that of the later 18th and 19th centuries.

The decorative images used then all come from nature, and are applied for purely aesthetic reasons, rather than reflecting any inherent function of the object. These sources - smoke, water, steam and plant forms - were primary decorative motiffs right up to the beginning of the 20th century. After World War One, they tended to fade, being replaced by the more geometric images of the 20's. This could be due to the introduction of electric light around that time. Candles were gone and electric light introduced hard shadows because of its strength, that old light sources never gave. There were also the new artistic movements coming out of Germany making their impact. People were moving in a serious time of facts, and in that world, the quickest way of getting from 'a' to 'b' was in a straight line, not a curved one.

Fig 4.1

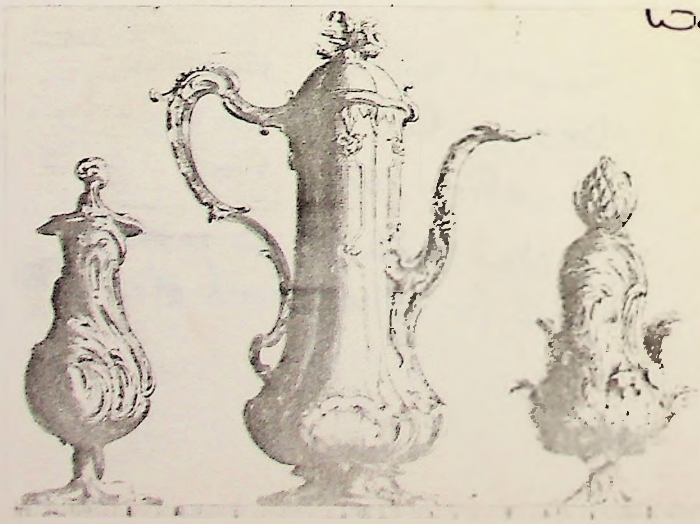


A FIGURED CHALICE, attributed to the Florentine goldsmith Benvenuto Cellini, combines a scallop shell, a turtle, a dragon and a sphinx. The gold-and-enamel cup was made purely for ornament.

Fig 4.2

Wo

Fig 4.3



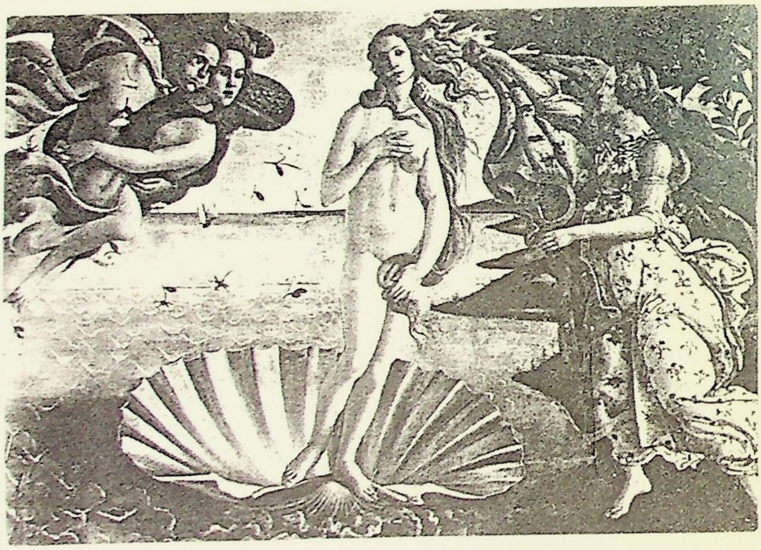
CHAPTER 5

5.1 The female form:

Another major source of the curving line, the female nude, has been looked upon as streamlined form by artists right back to the most primitive cultures that we have discovered. No matter how taboo the naked body may be at that time, it has always managed to pass the censors and appear in popular culture. There are many types of nude, for instance compare the Greek ideal with the more buxom, well built one of the Victorian times. Its all a question of fashion, and fashions are never static. The people of the Renaissence did not invent their favourite body format; they, as with many elements of their culture, copied their version from the Greek and Roman civilisations. This can be clearly seen in fig 5.1. Both pictures show three nudes in similar positions, with the same slim gracefull bodies. The group on the left represent the three graces out of Roman mythology and were found as part of a wall painting in a large villa in Pompei. The group on the right - nearly identical - are from Botticelli's painting, "The rites of spring." Botticelli has clothed his in a silky gauze like material that reflects and accentuates the curving lines of their bodies. In his "Birth of Venus" we have examples of many of the elements of streamlining. There is the cause, in this case the wind, and the effects. The sea is turned into waves and upon these sits a scallop shell, a shape designed to withstand the force of water rushing past it while channeling it between its two shells to sive food from it. The ribs give it strength and guide the food rich water into the center of the organism. Upon the shell stands a streamlined Venus Da Milo. The wind rushing past her sends her hair swirling past her head. The cloak she is being given reflects the curving lines of her body as it billows in the wind. Everything in the picture is in motion except those streamlined elements able to stand up to the winds.

Velaques's later nude in fig 5.3 shows the development of theidealised female form. The curving lines are less graceful and much stronger with sudden and even voilent changes of direction and flow. Her body is very like a teardrop in shape and one can even find teardrops within her body. The

Fig 5.1



The Birth of Venus.

Fig 5.2

Fig 5.3

most obvious one starts at the torso and sweeps down to her left foot. The sweeping curve of the sheet under her is almost a reflection of the upper side of her body and if we look at the form of both together there is almost a perfect teardrop starting at the head and sweeping down to the slim end at her feet.

If we move onto the 1800's we find a far more buxom form. This can be seen in Edgar Degas "Woman in a tub" in fig 5.4.. Her limbs are much fuller with lines being very rounded. The figures in fig 5.5 show the trend at the turn of this century. A much fuller very plump figure showing little of the classically graceful lines.

The next change in female form belongs to the 1920's. The fashion then was for almost flat chested wemon who wore clothing that transformed their bodies into that of an undeveloped girl. See fig 5.6 These women were referred to as the 'flappers' and were very much part of high society right up to the late thirties.

For an introduction to the nude of the seventies we can look at Philip Castle's, "Did any of you guys see that ?" Fig 5.7. Her figure is more like that of the classical nude. She is slim and very streamlined, she has to be to keep up with the jet fighter analogy. With what is now considered a more permissive society she is allowed to look very sensual and available. One can look on the picture as a dramatic reaction to the fast pace of modern life. It accepts that things are tough - the jet fighters - but it can take it, The question is, are you up there in the sky with the hero's of today or somewhere down below, trying to hide.

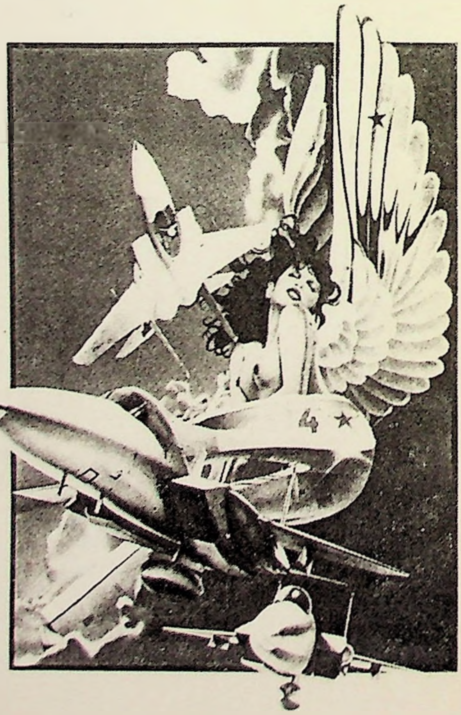
Fig 5.4

Fig 5.5

Fig 5.6

Below: Twenties elegance — an evening dress by Callot Soeurs, photographed by Beaton.

Fig 5.7



CHAPTER 6

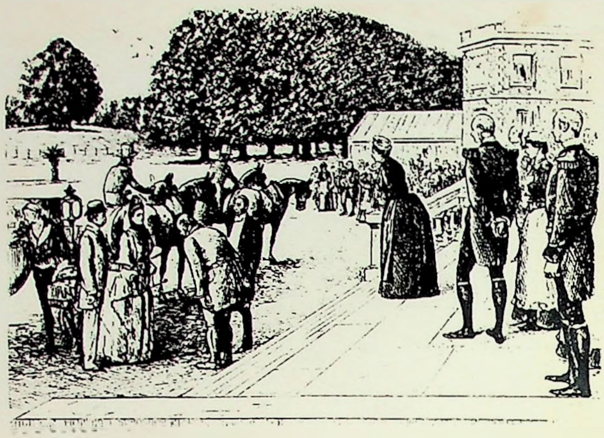
6.1 The industrial revolution:

At the turn of the 19th century Britian was changing from a agricultural land based economy ruled by the old aristocracy to an industrial ecomony with power slowily transferring to the new middle classes. With the begining of Queen Victoria's reign in 1837,the industrial revolution was in full swing.

The new middle classes were well educated and very curious about the world around them. They were constantly pushing the boundaries of knowledge forward. They were a great race of explorers and would be found climbing the last unconquered mountians, crossing the last great deserts or exploring the inner regions of Africa; all in a time when communication and transport were very limited. Their thirst for knowledge gave birth to many popular scientific journals and societies,and even later working mens educational institutions. One must recall that it was they who first introduced free compulsary education with the factory act of 1833. Learning was not locked up in the ivory towers of the universities as some people believe it is today. It was for everyone and as many important discoveries were made by the amateur as by the professional scientist.

As the industrial revolution evolved,the middle classes grew in numbers and wealth,and also in political power. It was they who had most control over the day to day state of society. The people were proud of what they were producing from their new factories,but it was considered in retrospect to be work of quite inferior quality.

The fault lay in the current delight in all that was new,and if a product was in some small, even trivial way,inovative;it became an instant success. The quality of visual design or applied decoration was either appalling or completely overlooked. This trend contunued with standards of taste dropping as production figures went up. As mentioned,the rising middle classes ran the factories, and they found that decorated objects sold better than plain ones. With the new methods of mass production it became very simple



ARRIVAL OF ARISTOCRATS AT COUNTRY SEAT
(George du Maurier in *The Graphic* 1888)

A landlords country home.

The Victoreans were very curious about the world and universe around them. Most of the well-to-do devoted a large amount of their time to the sciences.

to apply impressive looking decoration to products. These objects were not bought for their own sake, but used merely to assert the status of their middle class owners and the more gaudy, the better.

Decorative motifs were taken from every period, culture and country and the middle class manufacturers, lacking the cultural education of the aristocracy - or any aesthetic education for that matter - managed to plaster their misplaced excesses over everything. Fig 6.1 shows four different versions of essentially the same fireplace produced as a range. No specific style or period can really be identified from the jumbled mess. The Victorians managed to create a style of their own which was a confusing mixture of earlier styles. This can be seen in fig 6.2 which shows a candelabra whose function seems to be quite secondary to its potential as a carrier for add on decoration. We see a mixture of very flamboyant Rococo leaves beneath which lies a rather classical looking sculpted scene. The gas lamp in fig 6.3 almost manages to convey the impression that its growing.

This state of affairs became apparent in 1851 when the Great Exhibition was opened. Designed to show off the progress that Britian had made as an industrial society, it was their vision of the future. For many, Crystal Palace became a symbol for the future, but there were those who saw that many of the new ideas and products housed there, had little to do with progress. Such things as an "Alarm Bedstead" that could hurl one out of bed into a cold bath at any given hour, or a Prussian stove in the form of a knight dressed in full armour were looked upon by the proud Victorians as being the highest achievements of human ingenuity. In general it could be said that Englands great new industries were producing vast amounts of bric-a-brac.

6.2 The late 1800's:

This state of affairs continued on with the only redeeming exception being work produced by the craft movement. The popular Art Nouveau style appeared

Fig 6.1

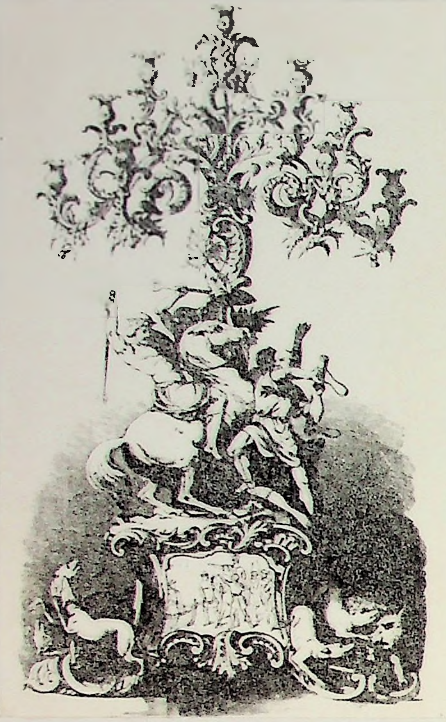


Fig 6.2

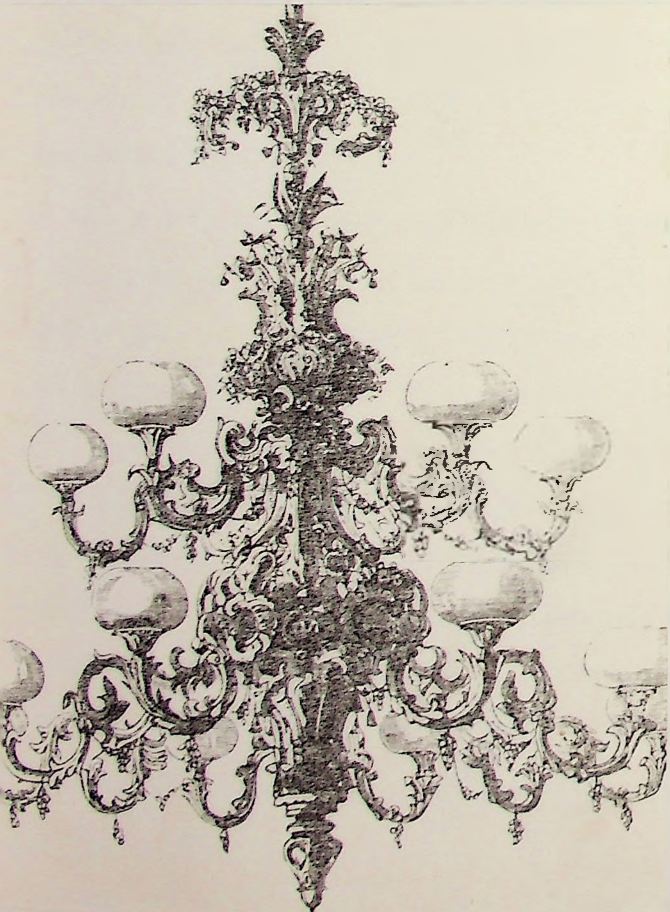
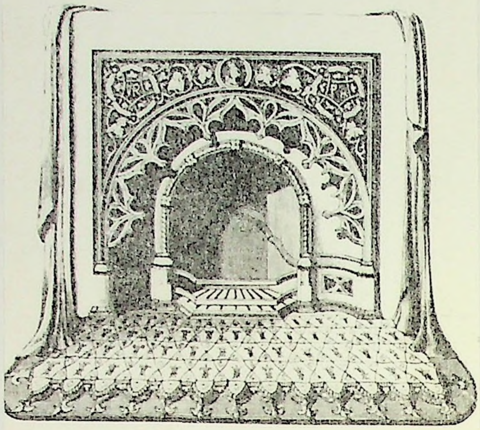
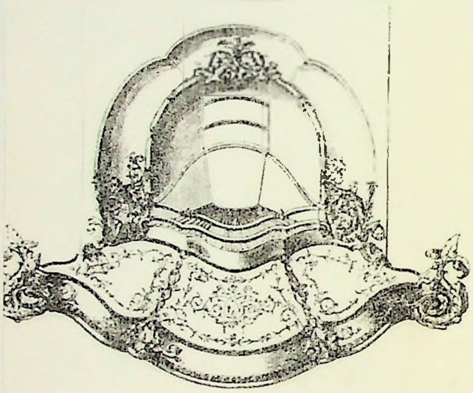


Fig 6.3





35, 36 Rococo and Gothic fire-grates by Stuart & Smith of Sheffield

37 Chaucer fireplace by John Thomas

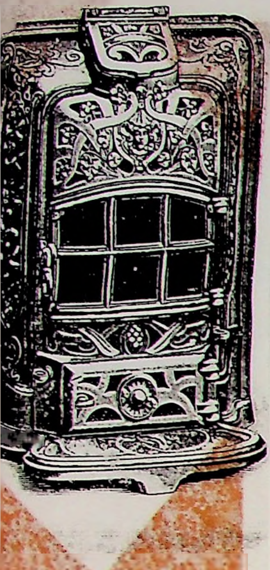
38 Fire-grate by Owen Jones

towards the end of the 19th century and employed many sources of streamlined images. Again as with the early Victorian era the images used for decoration reflected no function of the object they adorned. Fig 6.4 shows an Art Nouveau poster. With the exception of the background the whole picture is built up of a series of graceful curves. The stove in fig 6.5 is also covered in curving spirals but they represent plants and not a flickering flame.

One of a series of objects whose form tended to reflect a streamlined function were those containers designed to contain liquids. The average water jug of the time consisted of a basic upright tear drop shape with a handle and spout attached to it. This is the ideal shape in that it stops water spilling while in carriage and when tipped for pouring the handle moves over the center of gravity of the water mass thus putting little extra strain on one's hand. The spiral of the spout ensures accurate pouring which can be finely controlled. Fig 6.6 shows a Wedgewood soup tureen. Its elegant lines are very close to the spiral of the Golden Section ratio.

It was to this background that technology gave us the first objects in the last quarter of the 1800's, to which streamlining could be applied. Never before had there been objects designed by man that moved fast enough to necessitate streamlining. There is of course the one great exception, the sailing ship and later the steamer. But these were to provide only a weak source of imagery as the all important hull was below water and all that was to be seen above was the complex mass of rigging and superstructure. Another exception is those rare occurances of far sighted thought already refered to in earlier sections. To sum up, a quote concerning the mish-mash of architectural styles of the 19th century can be applied to most design of the time. "All is mere mask and the whole building an ill-concived lie."

You may ask "what has this to do with streamlining". Little and that is why I am mentioning it. Though Victorian design displays many streamlined



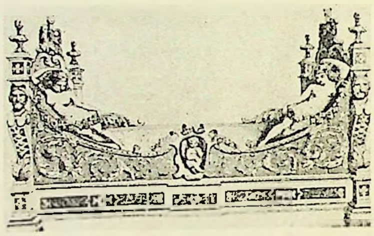
A LANGUID LADY admires "Job" cigarette papers in another Mucha poster

ig 6.5

Fig 6.4

103 Cream-coloured Queen's Ware tureen. Wedgwood, late eighteenth century

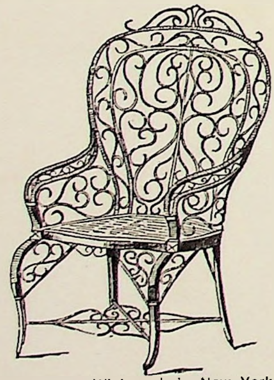
Fig 6.6



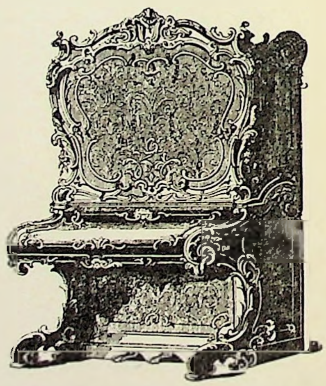
M. Roule. Bedstead in Italian style, London. 1851

Furniture designs from the 'Great Exhib-ition'of 1851.

H. Clay. Dressing table and chair, papier-mâché, England. 1851



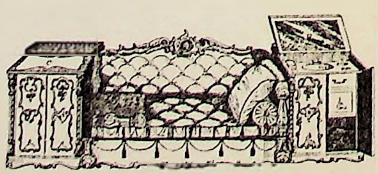
John Tuph. Wicker chair, New York. 1851



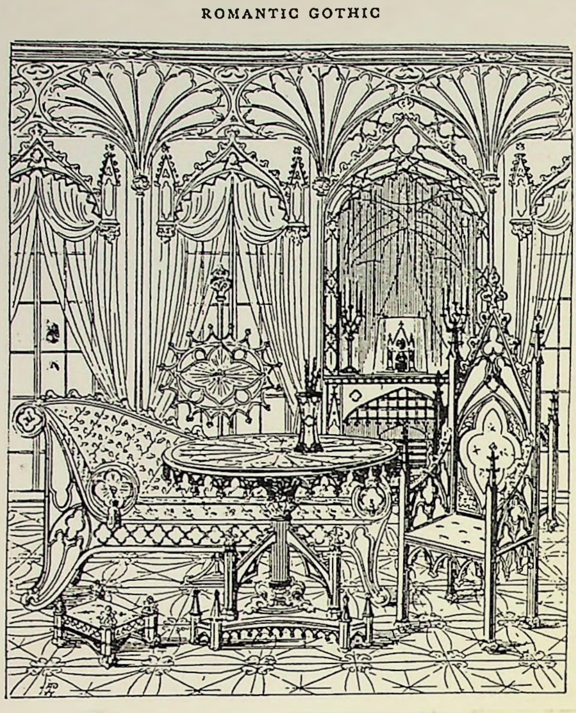
Collard & Collard. Upright piano. England. 1851

A. W. N. Pugin. Bookcase in Goth.c style. England. 1851

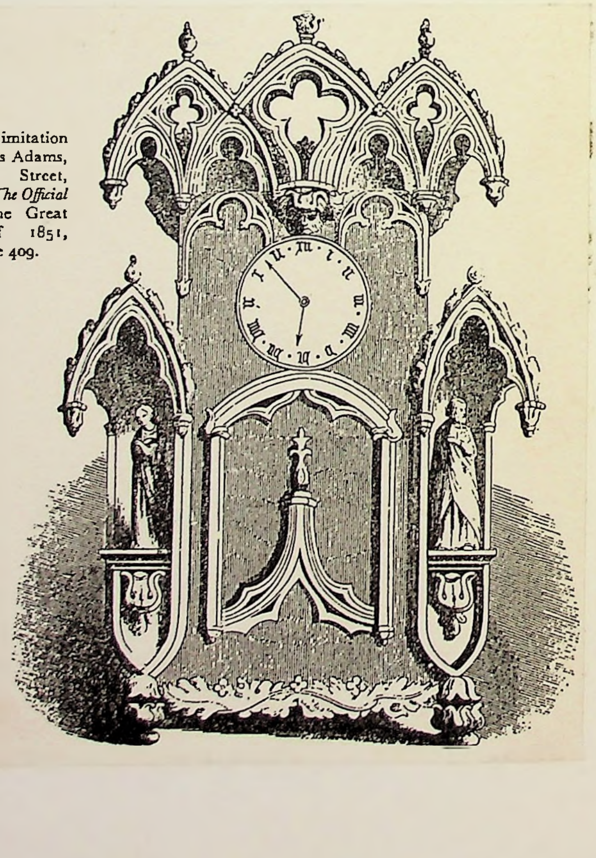
Michael Thonet.
Table with bentwood legs. 1851



Taylor & Sons. Steamship furniture convertible into life raft. England. 1851



Imitation Gothic furniture and interrior design from the 'Great Exhibition'of 1851.



Gothic clock in imitation oak, by Thomas Adams, 36, Lombard Street, London. From *The Official Catalogue* of the Great Exhibition of 1851, Vol. I, page 409.

motifs, they made small progress along the path of actually streamlining their products. In fact, it was not until the last quarter of that century, that streamlining began to emerge as a science.

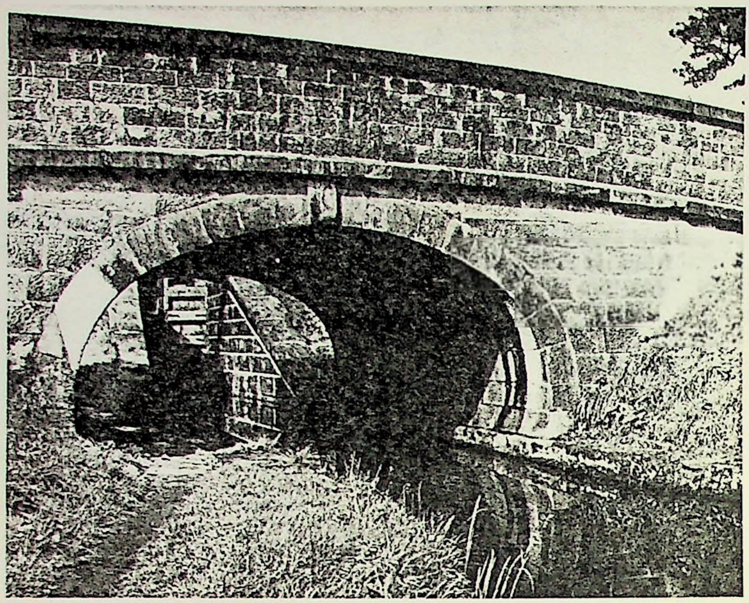
Before we move onto the objects of speed there are however, some examples of streamlining, still to be considered that date from the industrial revolution and earlier.

CHAPTER 7

7.1 Structures of the Industrial Revolution:

The need for better transport, produced some of the most functionally streamlined design, and today this still holds true. As the industrial revolution progressed it soon became clear that the road system could not handle the increased transport needs. The first answer was the canal.. As far as streamlining is concerned the canal is a utopian system, probably only matched by the rail systems. It worked on keeping water within its system to a certain operational level. This often involved cutting away huge banks and hills or bridging valleys with vast stone aquaducts and even tunnels plunging through mountians to connect cities with this silken thread of water. Any element of the landscape that got in the way was ruthlessly smashed out of the way or bridged over. The Dundas Aqueduct built in 1805 in England is a famous example of a cannal forgeing on its level way whatever. The cost of them was huge but once this narrow trench of water had been established between two places it was very economical to transport goods on barges between them.

Some of the architecture was external to the streamlined needs of the canal, but things like bridges, locks, tow paths, stone banks, warehouses and aqueducts all gave the impression that everything was going somewhere. Relative speeds may not have been fast but the whole system had to run to a tight schedule, much in the same manner as that of a railway system. Barges could not pile up at points as therewould be no space form them. and such obstacle's as locks and swing bridges and tunnels would always be ready waiting for the next oncoming barge. This streamlined efficency can be seen reflected in the almost Art Nouveau style of the decoration on the boats. Their colourful flowery patterns reflect the whorling eddies of bow waves and water pouring from sluice gates. The pictures of cottages and country life that also adorn the barges suggest a subconsicous desire for a more stable homebound lifestyle.



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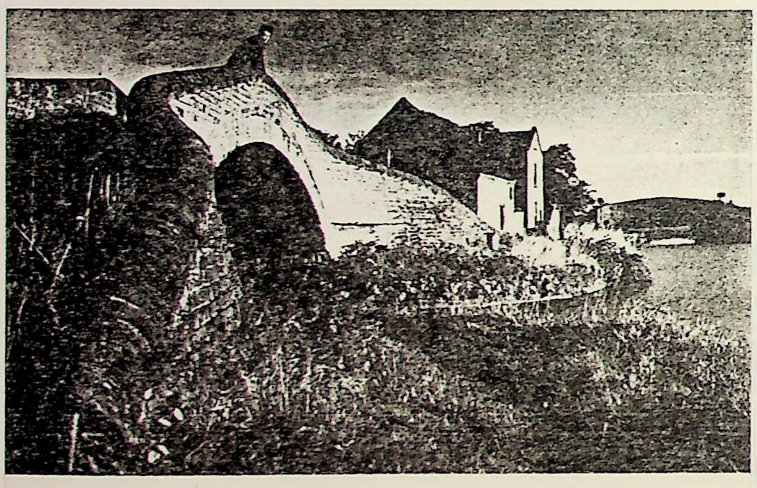

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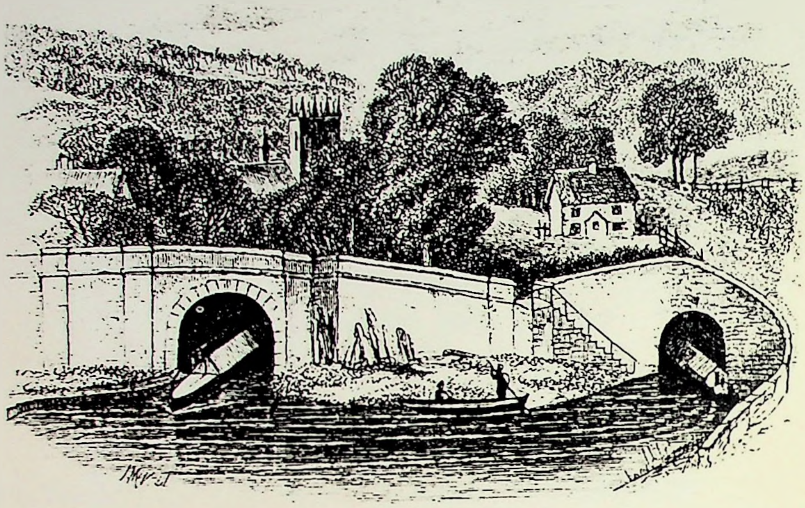
Examples of canal architecture.

Harecastle Tunnels, Brindley's on the right and Telford's on the left.



101 *The Etruria factory built for Josiah Wedgwood by Joseph Pickford 1768–9. Opened 13 June, 1769*

Canal architecture.

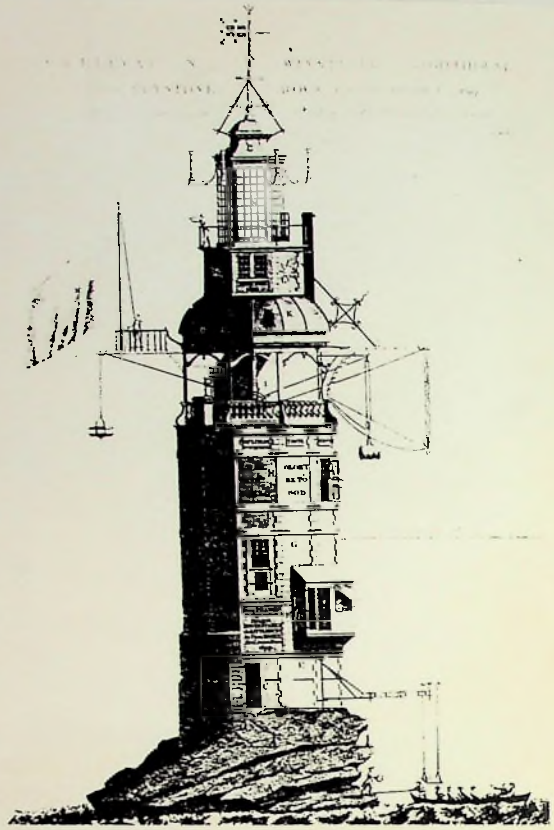
Modern cannals of today lack much of the romantic character but as streamlined systems they are even more efficient. Barges come in trains that may be over a quater of a mile long. Water transport is also by far the cheapest in terms of tractive effort required per unit load carried.

7.2 Windmills and light houses:

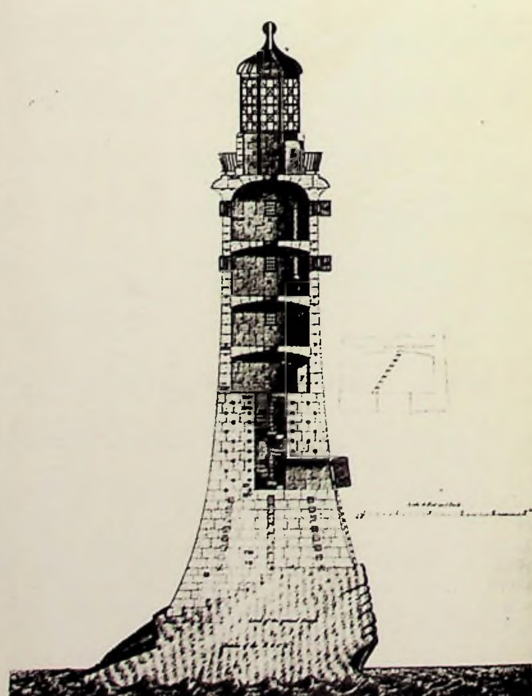
If were are considering the interaction of a fluid medium with a man made object there are two classes of buildings, both of which don't look all that streamlined, but have to be very streamlined.

The first windmills seem to date from around the tenth century. These were used to grind corn between two flat revolving stones. The apparatus that revolves the stone, works in the same way as a driving propeller, except that it works in reverse and collects power from the wind. The huge propellers or sails of windmills have to be able to turn into the wind as it changes direction. This is made possible by mounting the sail structure on a revolving cap that is placed on top of a conical building. In many cases this cap is like the hull of a boat upside down. Behind it is a vane that aligns itself with the wind and keeping the sails facing into the wind. The base of the building is always round so as to disturb the wind flow as little as possible.

This leads on to lighthouses, and also large chimny's. These buildings benifit greatly from a bit of streamlining as was proved by the builders of the Eddystone Lighthouse. This had to be rebuilt on several times as builders underestimated the power of the wind to grip their first very angular structures. Dungeness lighthouse in England is a good example of a streamlined structure, designed to withstand very high winds. It is only 13 feet wide but 135 feet high. Smoke stacks of the early industrial revolution produced similar problems for their designers. They sucked up rising warm air from burners by drawing up another current of air through natural convection. The thinner it was the greater the current of air in the chimney, but this put a great strain on the construction materials - stone - so they were tapered with a wide base and a narrow top. Today with



Winstanley's second lighthouse was built in 1699. He was killed when it was destroyed in a storm in 1703



Cross-section of John Smeaton's lighthouse at Eddystone. It was in use for 123 years before it was replaced by the present lighthouse.

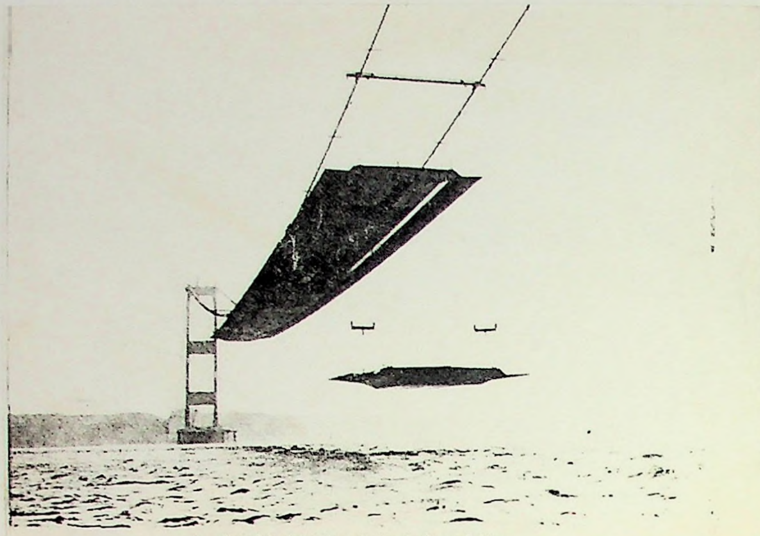
Eddystone Lighthouses. See 7.2

reinforced concrete we need only taper the tower very slightly. The reduced wind surface area then allows the tower to go much higher. Todays towers can have a height to width ratio of 40 to 1 or more. Those of the 1800's rarely exceed 10 to 1.

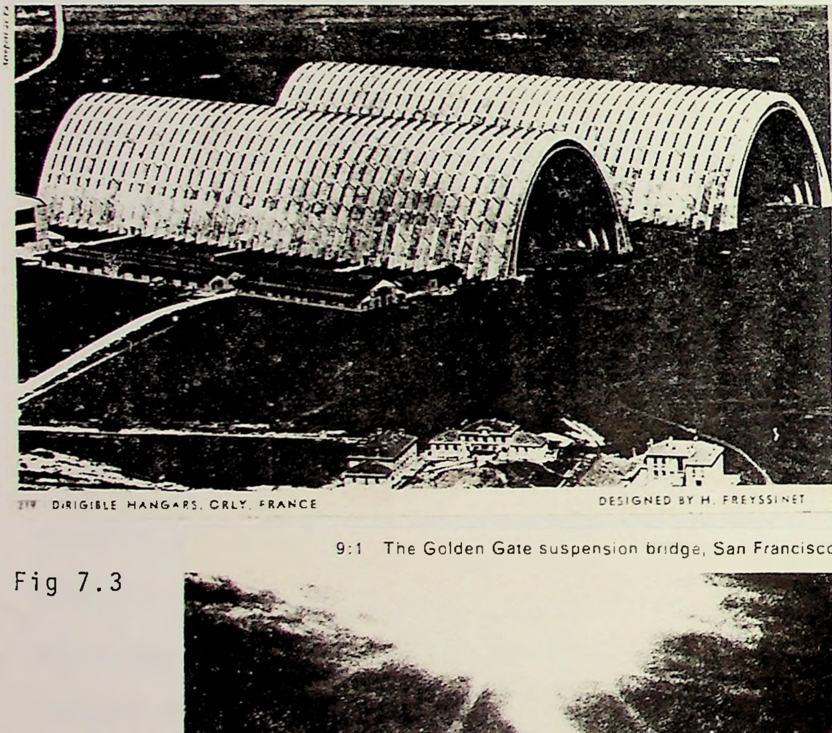
Its quite fair to say that streamlining had little to do with early bridge design. With more modern bridges however it is very important. When you have great spans, hundreds of feet up, wind suddenly becomes a problem. The bridge across the Puget Sound in Washington State was one of the longest in the world untel it blew down some months after it was opened. Wind tunnel tests showed that the deck of a suspension bridge can act like an aeroplane wing, having lift and drag in certain wind conditions. One can either make the deck stiffer and heavier, or one can stop the aerodynamic lift, using a system of flaps and fins that equalize the air pressure above and below the bridge. Fig 7.1 shows a section of the aerofoil deck of the Severn suspension bridge being raised into position. Many bridges are designed to sway in high winds, and can move in a rippling motion which can oscilate over a foot.

The other major reason for the streamlined shapes of most bridges has nothing to do with fluids or air flow but results from the ideal form required by the stress lines within the structure. Stress patterns flow in much the same way as air and water currents. They like long gracefull lines lacking sharp corners and confused forms. As materials technology progressed engineers were able to let thinner and smaller sections take the strain. Stone was taken to near its limits with the bridge arch at Plauen, Saxony in 1903. This spanned 295 feet. Bridge arches like this are often used in the building of large covered halls such as the dirigible hangars shown in fig 7.2 With spans larger than this, the usual answer is the suspension bridge. Fig 7.3 shows the Golden Gate suspension bridge, one of the largest in the world. These are prehaps one of the most functionally streamlined objects that man has ever produced. As the length of the span increases, so it seems does the gracefullness and beauty of the structure. It is

Fig 7.1



A section of the deck being raised on the Severn Bridge.

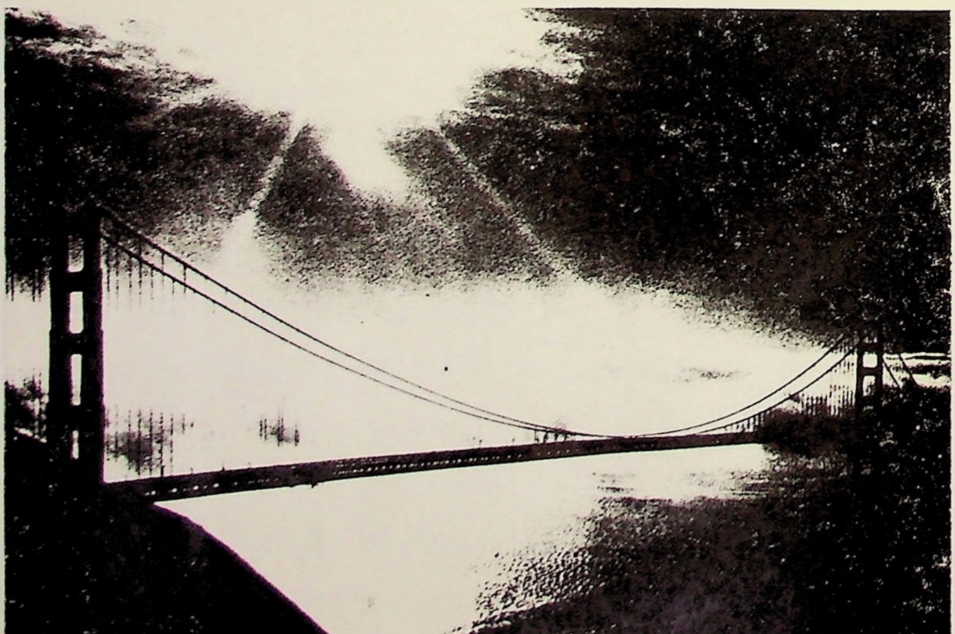


219 DIRIGIBLE HANGARS, ORLY, FRANCE DESIGNED BY H. FREYSSINET

Fig 7.2

9:1 The Golden Gate suspension bridge, San Francisco (U.S.A.).

Fig 7.3



important to note that any beauty inherant in these structures is not applied but results directly from their function. One might call it discovered rather than created beauty. " It is undeniable that the arch of a bridge is the most artistic - of structural forms - for its graceful lines are always pleasing." J.A. L. Waddell. 1916

7.3 Railways:

Though trains of the 1800's were not streamlined - they did move fast enough to have benifited from it - the support structures around them were. Dimensions of the train had to be set within critical limits and any architecture that had to interact with the train had to also follow these limits. Fig 7.4 shows the critical parameters needed for most elements of railway architecture.

In 1870 the first underground train in America opened in New York. This was a pneumatic system that blew a tubular passenger car along a tubular tunnel. This can be seen in fig's 7.5 to 7.7 The Evening Mail of the opening day described it thus. "The passenger car used in the tunnel is of circular form, richly upholstered and very comfortable, with seating for eighteen persons. The mode of propulsion is on of the most simple things imaginable. Air is forced into the tunnel by a gigantic blowing engine of 100 horsepower." The New York Herald,described as, "the most novel, if not the most successful enterprise that New York has seen for many a day." It however turned out to be impractical due to the high air pressure needed to push a heavy compartment along.

A more successful application of pneumatic transport was used by the U.S. city postal service in New York. Fig 7.8 shows one of the small air blown cars being filled at one of the sorting offices.

7.4 As I have said before,it was not until the last quater of the 1800's that streamlining began to emerge as a science. The applications of it cited here, have been the exception rather than the rule. What prompted the new streamlined images was the need for increased speed of personal transport. To be specific,three main products; the car, aeroplane, and later trains.

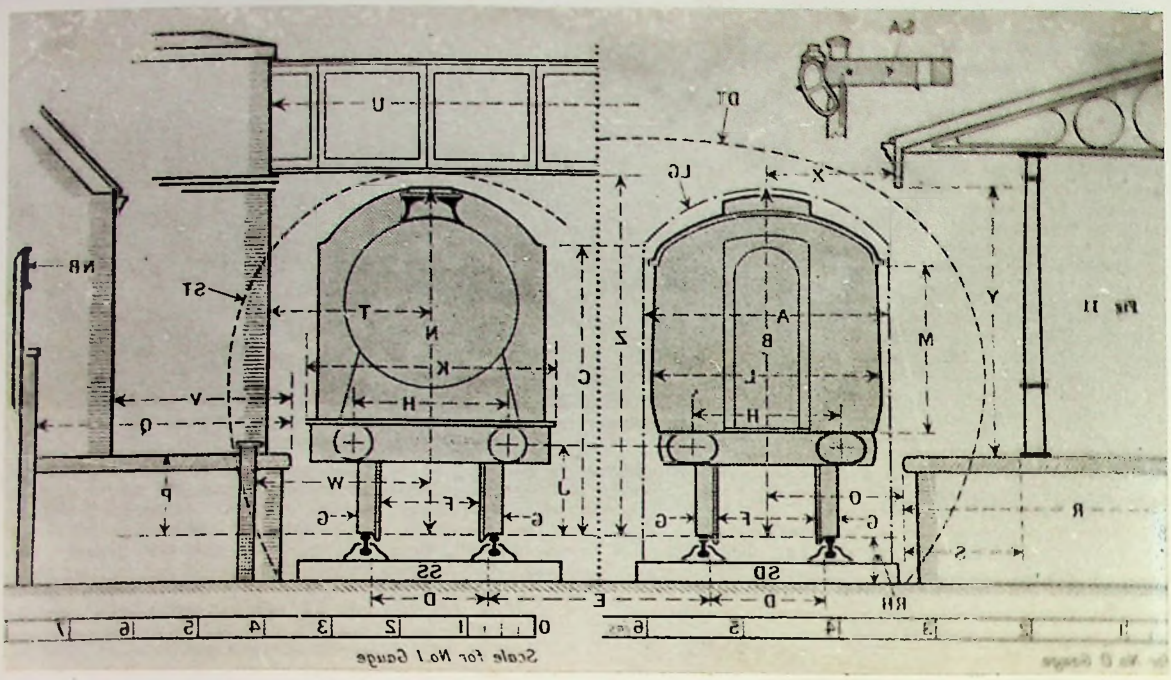


Fig 7.4

Fig 7.5

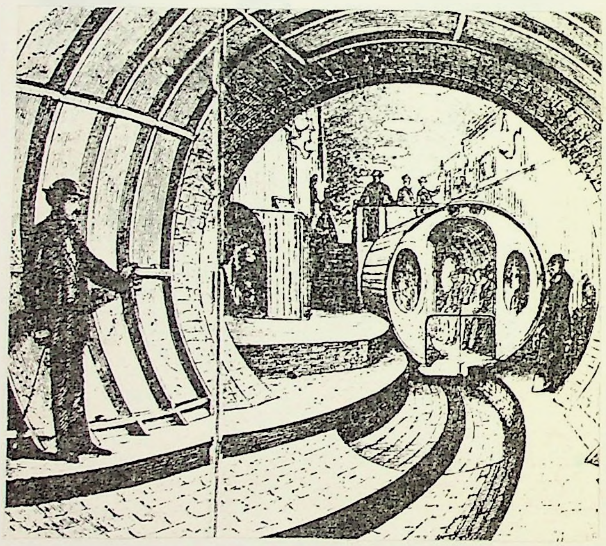
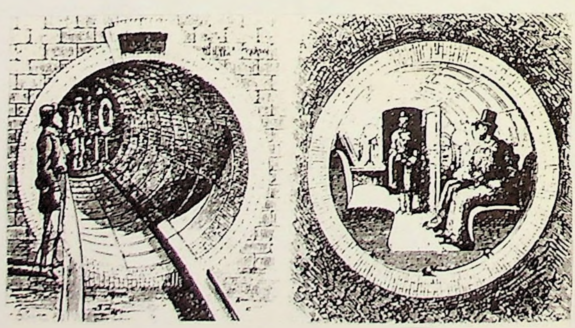


Fig 7.6



The pneumatic railway under Broadway (1870)

PNEUMATIC TRANSPORT

Fig 7.7

OPENING OF THE BROADWAY TUNNEL
IN NEW YORK

Fig 7.8

Application of the pneumatic dispatch to city postal service [1867]

CHAPTER 8

8.1 The Car:

The first true automobile was built by N.J. Cungot of Lorraine. This was a huge heavy steam powered tricycle which was said to have run for 20 minutes and $2\frac{1}{4}$ mph in 1796. See fig 8.1 The pistons used in the engine were made possible by the invention of a new drill that was used to accurately machine out cannon bores. Things were quiet after this development with just the usual sporadic ideas that led in real terms nowhere. It was not until the latter half of the 1800's that the predecessor of our modern car evolved.

Early cars were not the streamlined forms that we have today. In fact it was not until the turn of this century that they gained an identity of their own. Those early cars were basically motorised horse carriages, hence their first name, horseless carriages. Many were so confused looking that it was hard to put any label on them. See fig 8.2 A comment of the time described them thus, "The vehicle in motion does have something comical in its appearence and someone who did not know what it was might think it was a runaway chaise."

It was'nt until 1885, that a more successful car was to appear. This was the petrol driven Benz three wheeler. It was the engine that made the difference. The steam engine was too large and under powered for use in a car. Benz used a two cycle one cylinder gasolene engine. He was somewhat of a visionary and completely dedicated to the proposition that the internal combustion engine would supersededthe horse, and revolutionize the worlds transportation. Others even his financial backer, thought he was mad about this and saw no future for the horseless carriage. However by 1888 he was employing fifty people to build and sell his car, which could nowtravel at 15 km/hr.

As time went by speeds increased. One owner commented that " its possible to attain 20 kph but such great speeds require considerable attention on the part of the driver and are not always advisable. " In 1893 the Minister of the interior of the Grand Duchy of Barden regulated that "speed on the open road

Fig 8.1

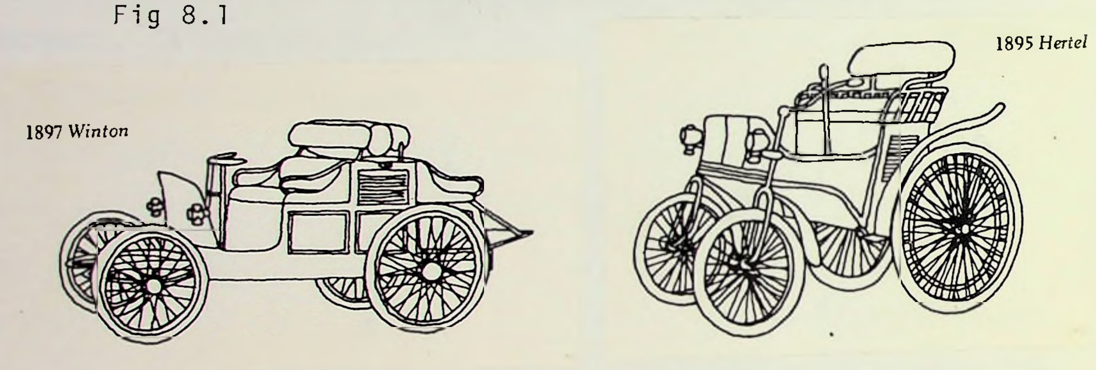


Fig 8.2

Fig 8.3

A PRIZE-WINNING RACING CAR, led by a wind-blown spirit of speed, was featured in this Parisian advertisement by Eugène Vernon shall not exceed 12 kph outside towns and withintown limits,6 kph. At the time,most engines were producing no more power than that of a domestic lawn mower, so few were bothered by these limits.

One of the first streamlining operations was carried out by a traveller while touring. "Progress was impeeded by the fringed canopy attached to the car which caught in the wind. This was abandoned the next morning." A further comment of his throws light on the cars lack of identity. "Dinner, 2 rooms. stabling for the car and breakfast cost us 10 francs."

Some designers took the 'horseless carriage' image to extremeswithsome designs . It seemsthat people of the 1890's really wanted a carriage with no indication on it that it was a self propelled vehicle. "Most designers struggle" remarked the'Horseless Age'of May 1899, "to make the self-propelled carriage as innocent of machinery and as short as though a horse were to be attached at any time."

This was the first period in the evolution of the car. As the century turned the power of the engines shot up. By 1903 the racing car had appeared. Fig 8.3, shows an Art Nouveau poster expressing the romantic image which the public had of the speeding hero in the racing car. It is to these cars that we have to look for the first signs of streamlining. Their design became an obsession, as for the first time ever, man could experience and control speed greater than that of a horse.

It was no easy job to ensure that a car reflected its ability to go fast, especally when the field of aerodynamics from which we get most of our images was not to be considered seriously until twenty years later. The only analogy that made any sence was to the field of hydrodynamics. The result of these borrowed and applied images, was a series of racing cars, that looked like the upturned hulls of the speed boats that had began to appear at the time. Fig 8.4 shows the rear of the model N Ford runabout of 1906 which had a distinctly hydrodynamic look about it. The speed boat version of this shape works well as a hull is smooth,ensuring laminar flow of water over its surface, but when you come to the four wheeled version its value becomes dubious.

There is nothing wrong with it in principle until you add four wheels, lights bumpers, drivers compartment and the many other obstructions thatcompletely destroy the laminar flow.

The first cars built purely as racing machines, appeared around the turn of the century. In the Mercedes racing car of 1902 in fig 8.5 we can see the distinctive high seating positions and the front mounted engine. The high seats were close imitations of something one would find in drawing-rooms of the time. These high backed seats helped the passanger stay with the car as it traveled over roads that had never been designed for such speeds. It also increased the feeling of speed as one had little protection from the effects of the wind. The 1903 Peerless in fig 8.6 and the 1908 Buck model 10 in fig 8.7 both show these high open seats.

The next shape to influence the form of the fast car was that of the submarine. The submarine had made a big impact, if not at that time on the worlds navies; on peoples imaginations. Combined with the then externally mounted torpedoes it gave the appearance of deadly speed, which the thrill seeking motorist of the time could not resist. The Allen-Kingston model of 1910 fig .8.8 and 8.9, shows many of the 'underwater' features, Mainly the smooth curving lines of the body work, and the torpedo body-cowl area of the passanger compartment. The 1917 Hudson racing car in fig 8.10 Continues on with this theme and can be considered as representitive of the time.

8.2 The first Aerodynamic cars:

The French were the first to investigate the possibility of streamlining cars with the Leon-Bollee. This looks more like an early submarine or airship than any cars of the time. It is interesting to note that the visual change from the horseless carriage is purely cosmetic. The wheels, steering, undercarriage and seat position remain unchanged. The aerodynamic efficiency also is no greater for all its high speed looks. For the next 15 years streamlining was to remain like this with great importance attached to such small things as removing outside door handles and hinges, none of which had any effect on the

Fig 8.4

1906 Ford Model N Runabout

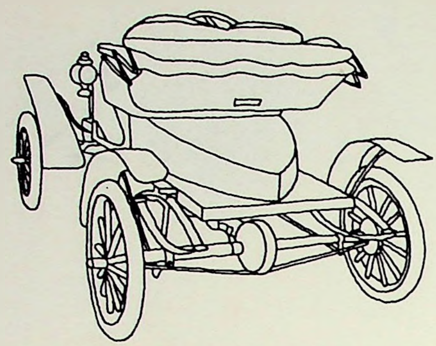


Fig 8.5

1902 Mercedes racing car

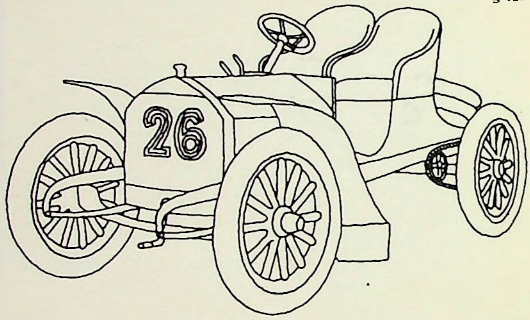


Fig 8.6

1903 Peerless

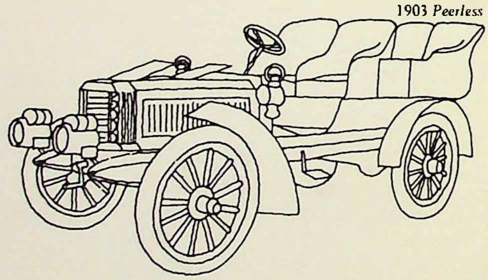
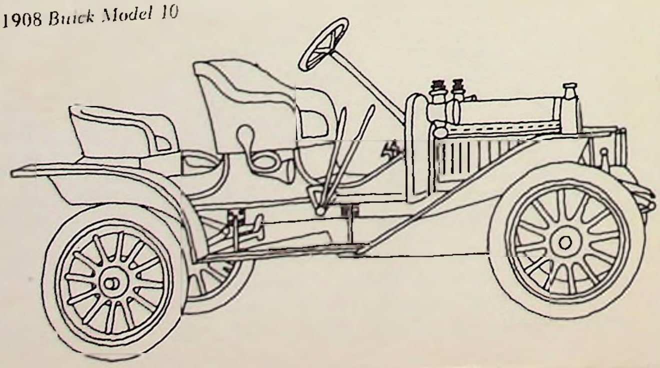


Fig 8.7

1908 Buick Model 10



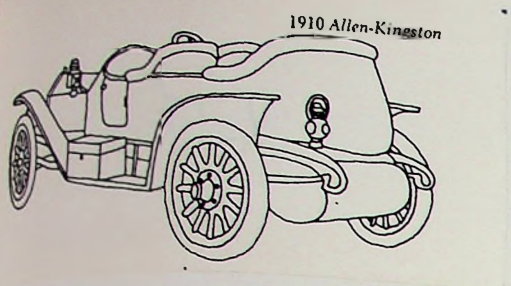


Fig 8.8

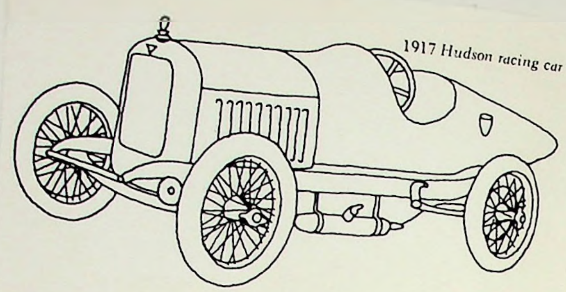


Fig 8.10

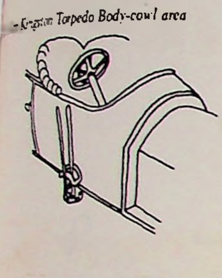
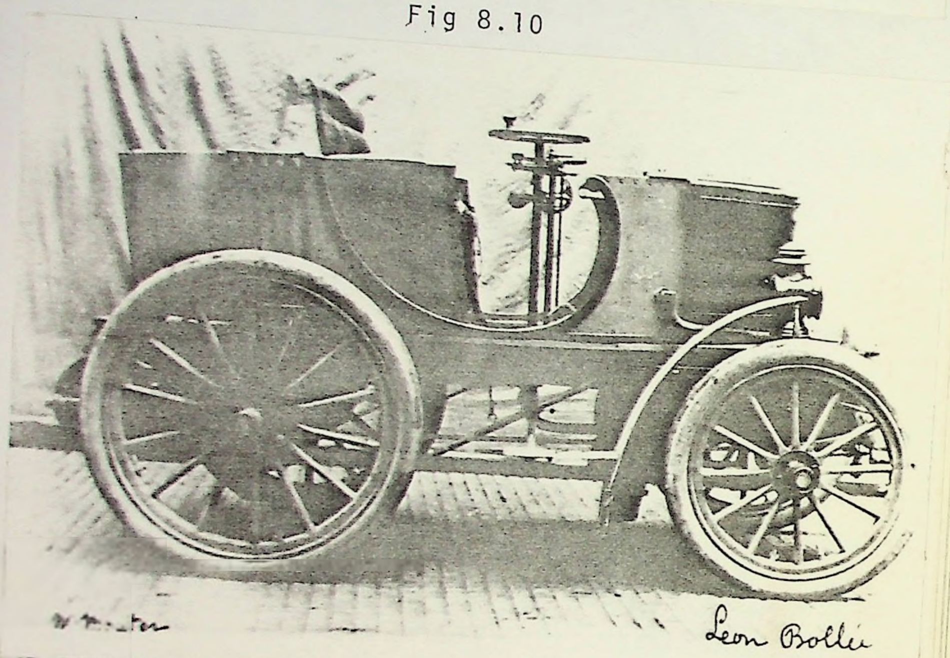
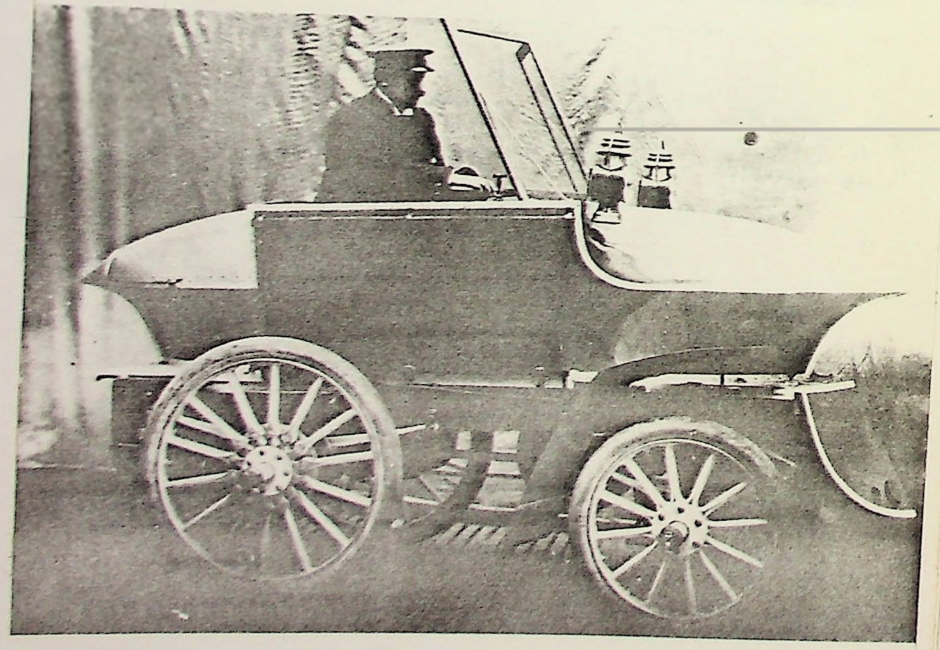


Fig 8.9



The first Aero-dynamic stream-lining was done by the French.



12 This Leon-Bollee may have been an earlier version of the car with pointed prow [14]. Its all-metal body is held together with rivets and its cooling system is unusually neat and unobtrusive — the radiator, for example, having an almost modern appearance. Note the sprag angled downwards and towards the rear below the frame amidships, to stop the car from running backwards, and the vertical steering column.

wind resistance of the car. The influences of marine design continued and commented on in the magazine,'The horseless Age.' "Observe these yacht like lines. Much has been said by car builders about yacht like lines. Well here they are - sweeping, graceful, unbroken from the bow of the bonnet through the midships to the slender pointed stern."

Up until the 1920's streamlining experiments were left to the Europeans. A noteable German project in 1921 produced the 'Rumpler'. This was designed by an aircraft firm,and its teardrop shape has much in comman with Raymond Loweys designs of the thirties. It retained the classic speedboat shape and added four fish like fins over the wheels. See fig 8.11 The first really effictive streamlining was done by the French firm Jaray in 1924. Fig 8.12 shows how they managed to widen the body over the wheels so as to partially enclose them. It was unlikely that at the time they knew that the spininngwheels caused so much turbulance but they did notice an improvement in the preformance of the car. The rest of the body smoothly carried air up the slopeing hood around the finlike superstructure and down to a carefully tapered tail.

The organic lines of Jaray's cars did not catch on. An American commented in "The Motor Age". "It does not seem that there is any neccessity for such measures in America." By this he ment that if Americans wanted to go faster they just bought a bigger engine,where as in Europe, the high cost of petrol ruled this option out for most.

For the ultimate in streamlining,the car had to wait till the 1930's.

Fig 8.12

1921 *Rumpler*

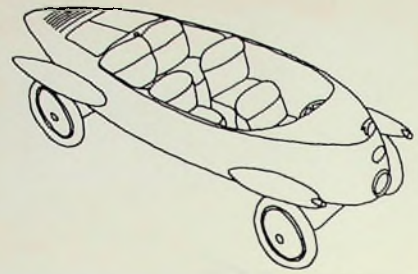
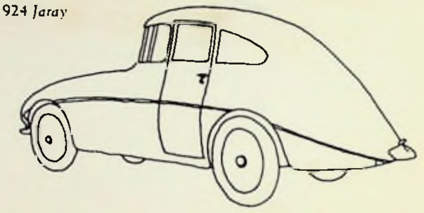


Fig 8.11

1924 *Jaray*



CHAPTER 9

9.1 Flight and the flying machines:

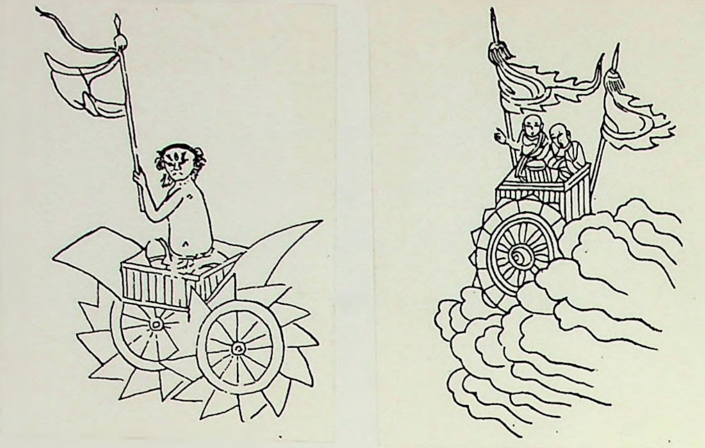
"How I yearn to throw myself into endless space and float above the aweful abyss." These are the words of the German poet Goethe. Other peoples dreams can be seen in fig 9.1 and 9.2 These drawings date from 1500 BC and show flight as some mythical gift from the gods. It was beyond their reach so they could only dreamabout it. The object of greatest concern seems to be the prominent display of their flag. Both do, however,show some sort of screw propeller device. Leonardo Da Vinci,as mentioned, earlier also looked at the possibilities of flight. His notes even show a device,that many have accredited to be the forerunner of the helicopter.

The aerodynamics of flight must be the most streamlined of all. Right from the Wright brothers first flight , to todays hypersonic jet propelled rockets, the forms their outer surfaces take is of fundamental importance. Streamlining is not just a question of increasing performance or cutting down of fuel consumption, its a case of will it or wont it fly. Of course there are other factors involved such as how fast you move through the air; but by-and-large aerodynamics is the first thing a designer thinks of when contemplating say the flight characteristics of an office desk.

The Victorians were fascinated by the possibilities of flight and every year there would be issued a fresh batch of patents for flying machines, followed some months later by another crop of,mostly,fatal accidents. Fig 9.1 shows one such design which fell to bits when its inventor was dropped 4000 feet up in it from a ballon. Figs 9.2 and 9.3 show flying machines that were never actually built

The Montgolfier sons were the first people to realise mans dream of flight. Noticeing that smoke rose, they filled a light silk bag with it and found that it too rose. On June 5th 1783 they invited the inhabitants of the town Annonay,France,where they lived,to witness the first major balloonflight. A

Fig 9.1



Leonardo Da Vinci's
Helicopter design.

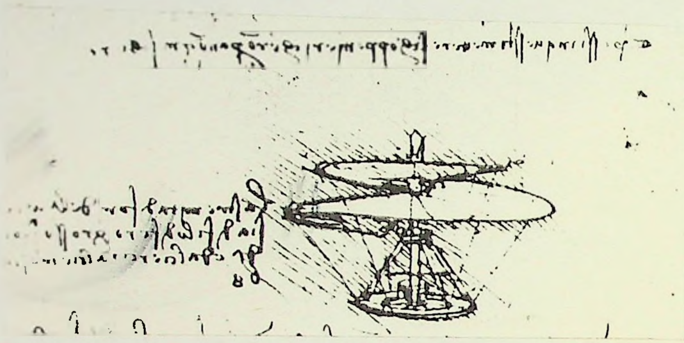
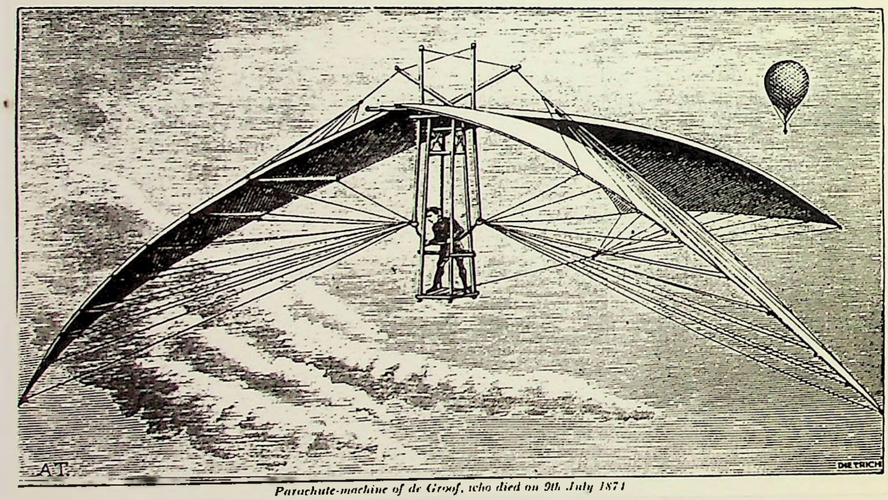
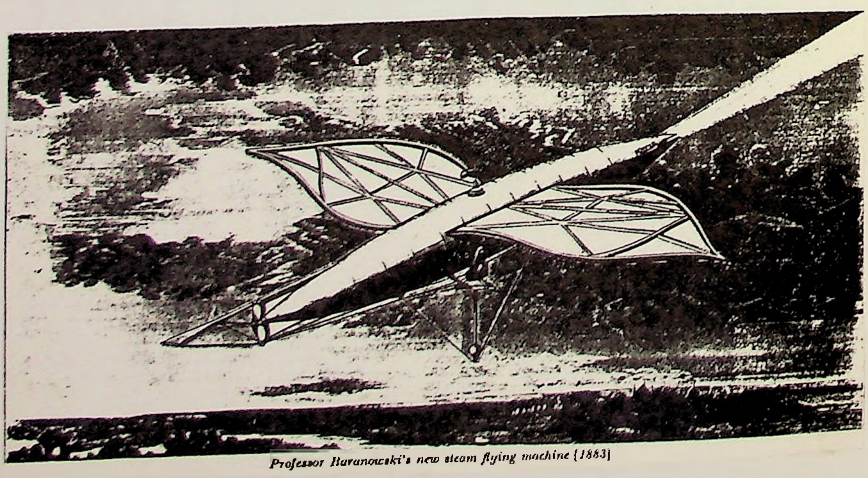


Fig 9.1



Parachute-machine of de Groof, who died on 9th July 1871

Fig 9.2



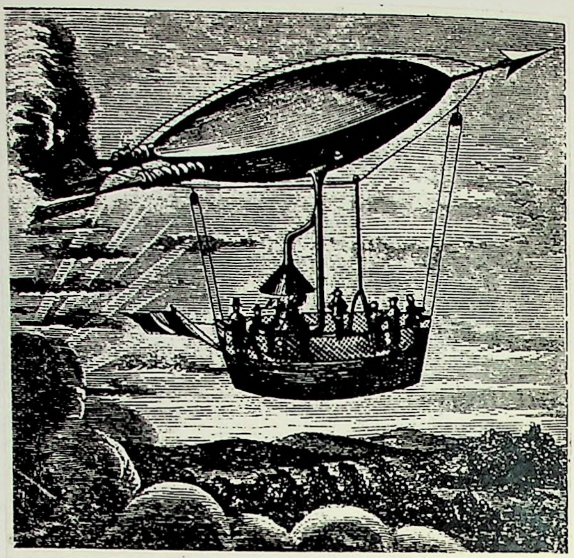
Professor Baranowski's new steam flying machine (1883)

30 foot diameter ballon filled with smoke and hence hot air rose nearly a mile. In November of that year they launched the first manned balloon from the Palace of Versilles. These flights generated world wide interest and over the next thirty years over 470 people including 50 women are recorded as having 'flown'.

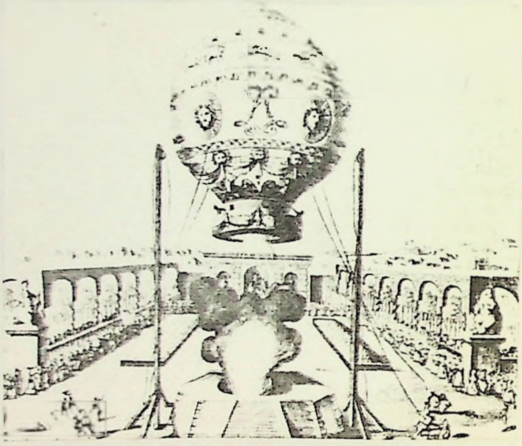
This was the only form of flight until the invention and demonstration of the airship in 1883. The balloonhad one major problem, it could only follow the winds. To solve this two things were needed, first a compact engine that could drive a propeller and, secondly, a longer and more streamlined shape that wouldn't spin round in circles when it was pushed in a direction. The first airships looked rather like large fish hanging in the sky. One can be seen in fig 9.4 The first airship 'La France' flew for 23 minutes under electric power. The day of mechanically controlled flight had arrived.

The most famous Airships, the Zepplins were the brainchild of Graf von Zepplin. These became the most advanced of all airships and were constructed of a ridged frame structure within which were the hydrogen gas cells, power plants and the crew accommodation. It was the advent of the light petrol engine that allowed von Zepplin to convert the military balloon he had seen in use to a totally directional craft. His first airship flew in 1900 and consisted of a huge 420 foot cigar shape filled with 16 gas cells made of a rubberized fabric. A similar airship can be seen in fig 9.5 Though its flight was encouraging von Zepplin saw that the development program would not last for long if some comerical application could not be found for the work. Hence in 1910 he founded a company called "Delage " which up to the first world war carried over 34,000 passengers without any accidents. It was this success that prompted the great German development program and by 1918 over 100 airships had been built, mainly to bomb London. However their part in the war was never great as they were two slow and unreliable.

Fig 9.3

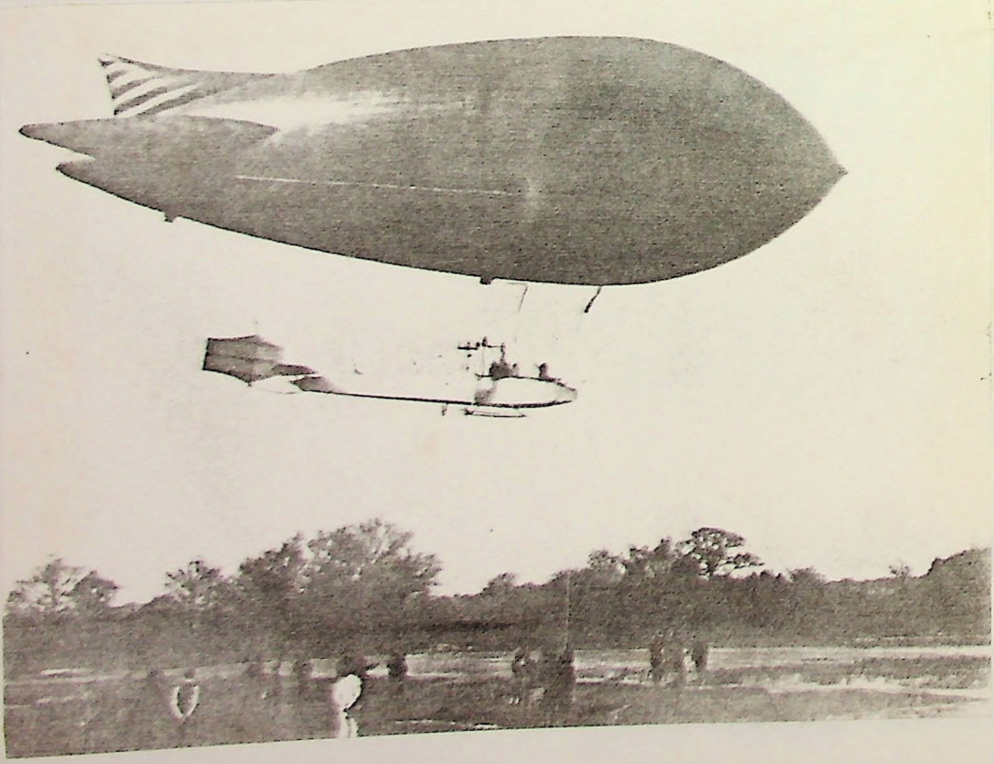


A steam flying-machine [1872]



The first balloon flight.

Fig 9.4



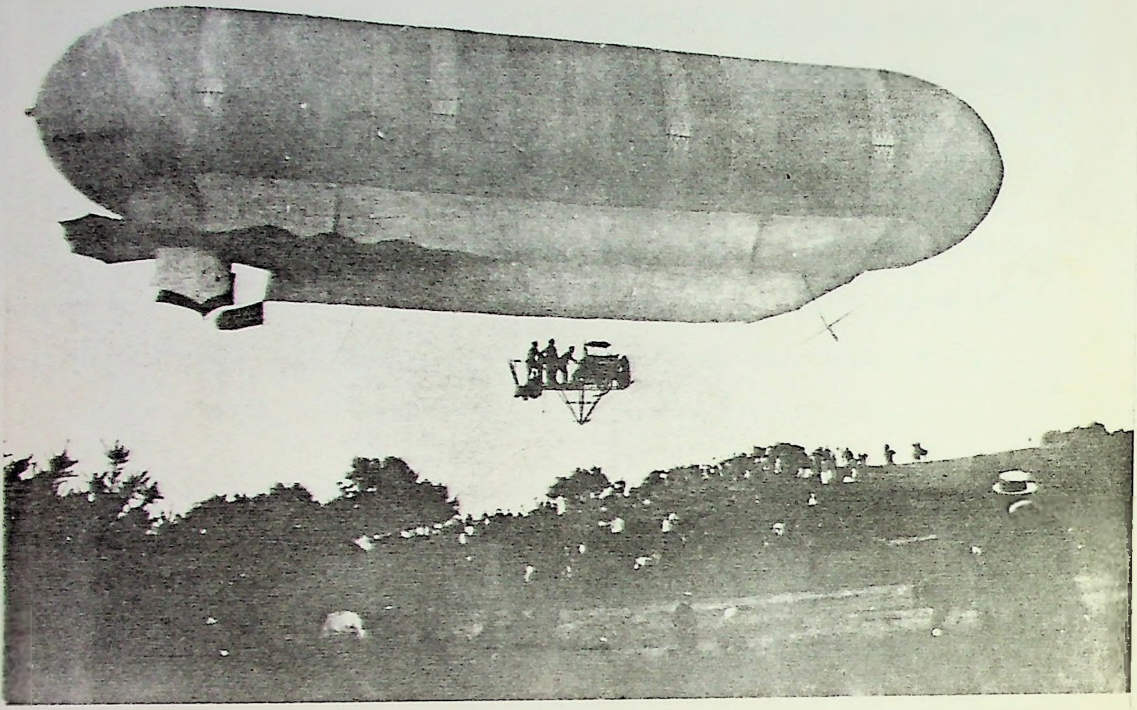
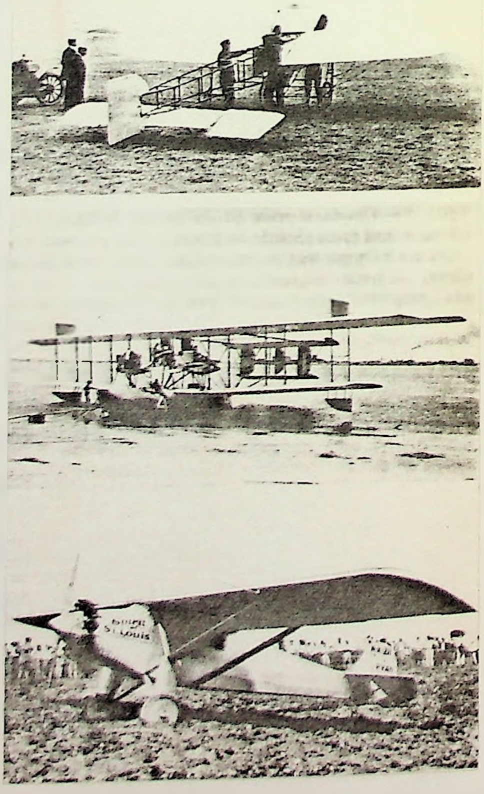


Fig 9.5



Early aircraft.

igure 4 *Historic flights*
Top) Louis Blériot's Blériot XI plane, which flew the English
hannel from Les Baraques, near Calais, to Dover, July 25,
909 (Centre) The Curtiss NC-4, which flew from the U.S. to
ngland via Newfoundland, the Azores, and Portugal, May
919 (Bottom) The Ryan "Spirit of St. Louis," flown by
harles A. Lindbergh nonstop from Long Island, New York, to
aris, May 20–21, 1927

9.2 The first heavier than air, powered craft.

Durning the second half of the 1800's there were many attempts at powered flight using the steam engine. The Russians were the most successful..They built a steam driven monoplane that was launched down a ski jump ramp and became airborne for a few seconds. This is the basis for their claim for the worlds first aeroplane flight. For several decades the steam engine tried its hardest but could not provide the high power to low weight ratio required by powered flight. It was to be the end of the 1800's before this power source became available. Due to its use in the horseless carriage large amounts of money had been spent on refining the petrol engine.

The first aerodynamic research was carried out by an American, Samual Pierpont Langley. The wind tunnel had not appeared in America so he used a whirling arm device capable of speeds of 70 miles / hr. Models of wings and other shapes including stuffed birds were mounted and measurments taken. He managed in his work to spend a huge amount of public money but was never successful at flying. His main problem was like most other people trying for powered flight too early in his research. This was not the case with the Wright brothers.

9.3 The Wright brothers:

Before they became interested in flight they were semi-literate bicycle mechanics. Their interested and professional methods turned them into research scientists who succeeded where everyone else failed. The reason for this was, as they put it, they did not attempt powered flight without first learning to fly. They first experimented on kite's and from there progressed through gliders to man-carrying powered aircraft. They decided that their research should concentrate on the balance and steering of the mechanics of flight. Unlike Langley they had only small quantities of privite funds. In testing wing profiles and propeller shapes they would first mount the test piece on the front of a moving bicycle. Only after first tests had been made there would they transfer it to a small home made wind tunnel.

Having solved the aerodynamic problems to their satisfaction they then looked for a suitable power plant. None were availible that had the right high power low weight ratio so, with their usual singlemindedness, they built one in their own bicycle workshop.

In December of 1903 they made the first man-carrying-powered flight in history. At the time no one believed that they had done it and it was to be five years before the world accepted that two bicycle repair mechanics had succeeded where huge fortunes and the worlds greatest scientists had failed. By 1909 they had sold the worlds first powered aeroplane. The model was designed for the U.S. Signal Corps and had to fly two men at at least forty miles per hour for a distance of 125 miles. That autumn Wilbur Wright had to set up the worlds first flying school.

While the Wrights were putting on spectular air shows in America, aviation in Europe was only slowly coming to life. The first major event was the crossing of the English Channel in 1909. The second was the first stageing of an aerial circus . At this tens of thousands of people could see aeroplanes and pilots from all over the world. Fig 9.6 shows a poster advert for one held in 1909. Huge amounts of prize money sponsored by newspapers and private individuals ensured that aircraft development did not sag. By 1912 altitudes had leaped tothousands of feet, speeds approached 100mph and endurance flights were measured in hours rather than minutes. Fig 9.7 shows a Etrich monoplane of 1912. At this early stage of development the aeroplane still has the very bird like form that people like Leonardo Da Vinci thought it would have. The only difference is that the wings do not flap.

9.4 World war one and beyond.

The early circus and carnival period of flight ended abruptly with the out-break of world war one. Aircraft design suddenly became big business with governments willing to pay out anything to get the right machine. In 1914 France mobilized 150 military planes, Germany 260 and Britian nearly 100.


G. N. R.
ENGLAND'S FIRST AVIATION RACES
AT
DONCASTER
OCTOBER 15TH TO 23RD
SEE SPECIAL PROGRAMMES FOR TRAIN SERVICE & EXCURSION
ARRANGEMENTS GRATIS AT ANY GREAT NORTHERN OFFICE

Fig 9.6

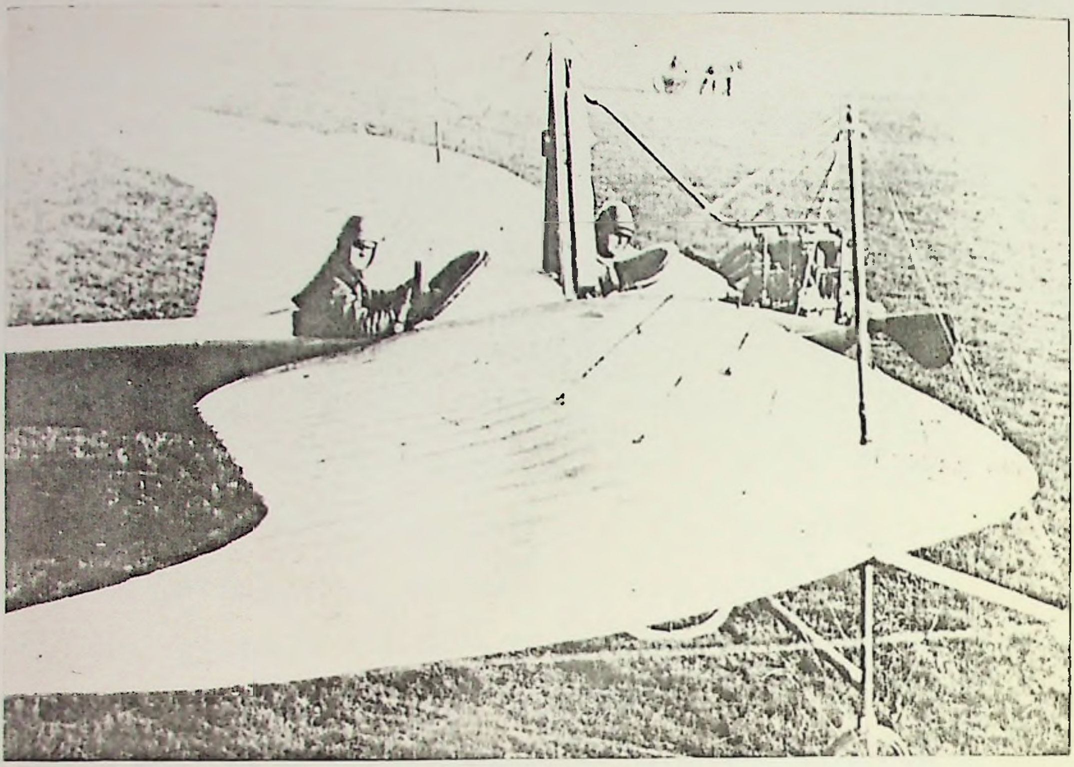


Fig 9.7

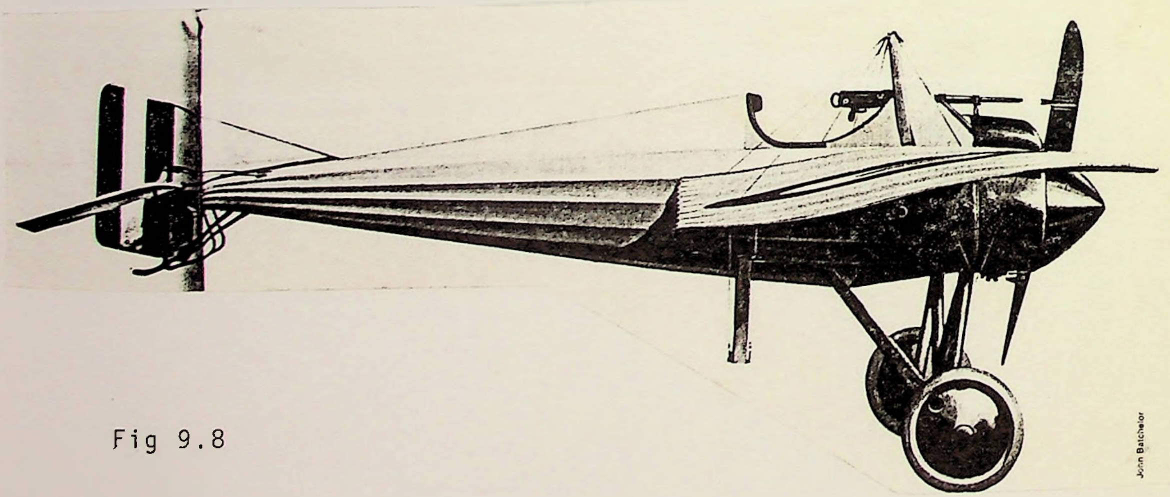


Fig 9.8

At best these planes could climb to 3000 feet, fly at 60 mph and, if the wind was with them, travel for 200miles. Four years later, 150 - 200 horse power single seat fighters, armed with pairs of synchronized machine guns were fighting each other at 15,000 feet and heavy bombers were penetrating deep into enemy territory by day and night. Fig 9.8 shows a early fighter the Morane-Sauinier N. This had a 80 horse power engine, one machine gun, top speed of 102 mph and a ceiling of 13,000 feet. It still retains the very organic, bird like lines mentioned earlier, however it is coming close to the 'ideal' teardrop shape.

After the war most of the machines, and thousands of people, found themselves unemployed. Some stayed on to rejuvinate the old airshow's and a few sold rides to the public. This was the begining of commercial aviation but it did not develop until the early 30's. The only other area of work for the aeroplane was in flying mail.

In 1926 the Guggenheim fund of $3,000,000 was set up to promote aeronautics and aeronautical research. In the following year Charles Lindbergh put the aeroplane firmly on its career by flying across the Alantic from New York to Paris in 33½ hours, the first non-stop transalantic flight.

CHAPTER 10

10.The Submarine:

For centuries man has attempted to descend into the depths of out sea's for scientific observation, salvage, and to try to gather animal and mineral riches from the oceans. The idea of a submarine has been around in thought if not in practice for many years. A 13th century French manuscript, 'La Vrai Histoire d'Alexandre' describes a fictitious underwater adventure by Alexander the Great,in a glass barrel. Leonardo da Vinci also turned his mind to a device for underwater exploration. The idea of being able to pass secretly underwater and suddenly appear - gererally leaving something explosive behind - has been the dream of man for many years.

The first successful submarine was built as early as 1620. Its Dutch inventor Cornelius Brebbel tested it in the river Thames to depths of 12 to 15 feet. The structure was of wood that was then covered in greased leather. It was said that King James the first went aboard for a short ride which shows great confidence of the designer in his craft. The submarine progressed little after this until the worlds navies started taking an intrest. Fig 10.1 show's a early submarine torpedo boat designed in 1776. Most of these craft mounted remarkably unsuccessful submarine attacks and quite a few sank taking all the crew with them.

It was not until the turn of this century that the submarine evolved into the streamlined propeller driven object we know of today. By world war one most of the major navies included submarines in their fleets but they were often of questionable value. The length was 200 feet on average and they were armed with torpedo tubes externally mounted and a 3 or 4 inch gun mounted on the upper deck.

It was clear right from the start that if you wanted speed you needed a smooth uncluttered hull form. The designer has to take into account the flow of water over the submarine form when it is in two positions. The first when submerged should be as streamlined as possible but this contradicts

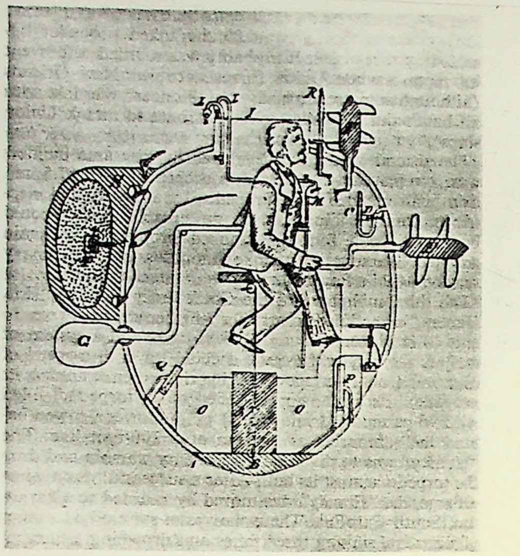


Figure 1: Bushnell's submarine torpedo boat, 1776. Drawing of a cutaway view made by Lieut. Comdr. F.M. Barber in 1885 from a description left by Bushnell.
By courtesy of the U.S. Navy

Fig 10.1

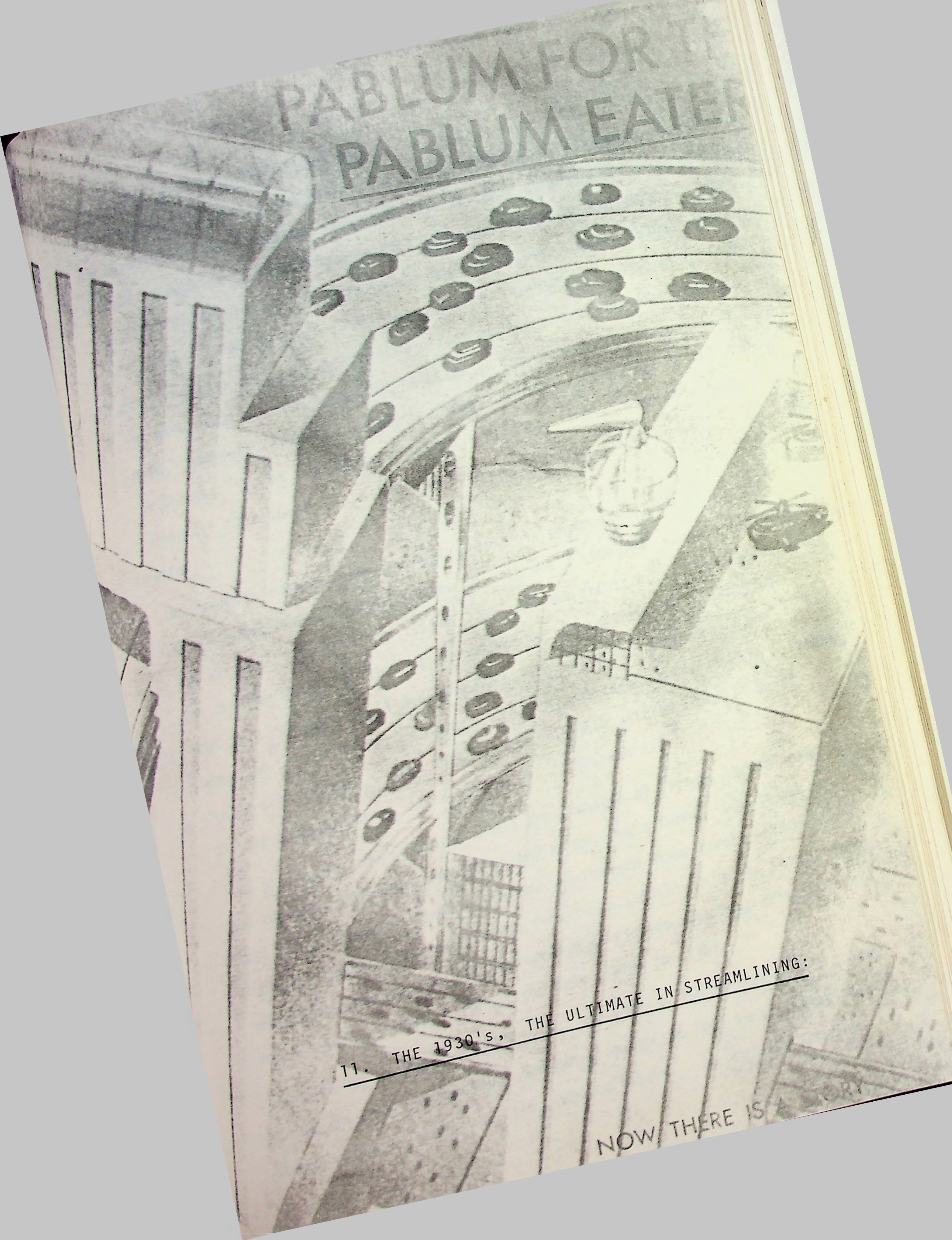
the needs of the second position. This is when surfaced. In this position a deck is required and a conning tower for access. The tower being the major obstruction often looks like an aerofoil wing in section. Such openings as are needed have to have tight fitting covers over them lying flush with the deck and any equipment that projects beyond the hull form needs to be retracted when not in use.

It is interesting to compare submarines of the turn of the century with the early airships of the same time. If a submarine tries to mimick a fish, an airship a bird one can ask if there is much difference between a bird and a fish. They both need to be slim with a smooth streamlined form and then they need control surfaces - the wing, fins and tails - for directional control.

The submarine proved to be popular with the public. It was like a knight in black armour who like a god could silently appear and render great distruction to those around and then slip away to the safety of the deep. There is much in popular fiction of private submarines batteling with monsters that appeared from the deep, and indeed these silent deadly machines took on the animal characteristics of such monsters.

Todays submarines still retain that image but now it is somewhat tarnished as they have become that monster and just swim the waters of the world waiting to be told to launch their warheads. These huge submarines are rarely ever seen by the public above water and have lost their romantic image of earlier times.

CHAPTER 11



11. THE 1930's, THE ULTIMATE IN STREAMLINING:

11.1 The ultimate streamlined era:

As we have said before one definition of streamlining is that which facilitates a current of flow, but for those who live in their streamlined Fuller dymaxion Dwelling machine filled with electrical labour saving domestic devices designed by people like Norman Bel Geddes and Walter Dorwin Teague and who drive to work in their streamlined Airflow Chrysler on networks of high-speed freeways to a job supervising a fast moving production line producing yet more beautiful labour saving machines in the never ending streamlined mode, toasters, fridges, electric fires, tables and chairs, cars, buses, buildings, trains, cinemas, cameras, clocks, lamps, posters, aeroplanes, spaceships...... Well to them streamlining was a way of life.

The feverish excitment of the 1930's can only be countered by the depths of the great depression which bore it. It was a time when man seemed to have the ultimate future within sight. On the new architecture Bel Geddes said, "It must be realised that at the moment we are only on the threshold of what in a few years will undoubtedly be the universal architecture of tomorrow" This he saw as being, "Modern, efficient city planning - breath-taking architecture - each city block a complete unit in itself. Broad, one-way thoroughfares, space, sunshine, light and air."

As a philosophy and solution to all the problems of living, streamlining had about as much going for it as any other idea offered, but it was to last for a decade and took world war two and the hippy revolt before people could see that putting a curve on everything, while it solved some problems helped with few others. At least today we can see that high rise flats and modern concrete cities are not the best places to live.

Streamlining was not invented by man and even in the thirties - its golden decade or worst depression, depending on how you look at it - there were those who would admit what they owed to nature. Ad for the Chrysler

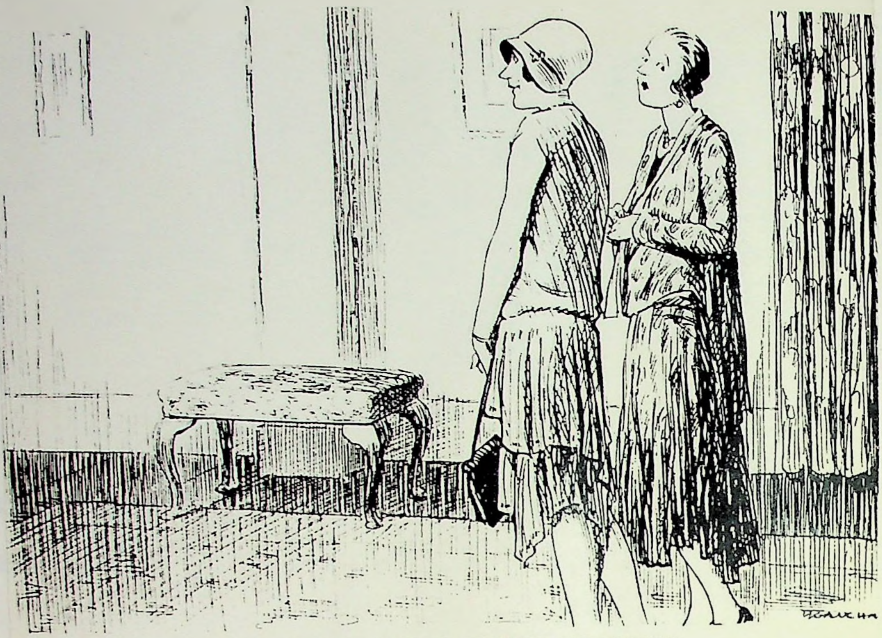
Airflow car. "Old mother nature has always designed her creatures for the function they are to perform. She has streamlined her fasted fish... her swiftest birds... her fleetest animals. You only have to look at a dolphin, a gull, or a greyhound to appreciate the rightness of the tapering, flowing contour of the new Airflow Chrysler."

11.2 The new era of product designers:

Around 1927 product manufacturers in America were begining to feel the effects of the great depression to come. Their products were not much to look at and tended to reflect a rather tangled evolution of function. That automobiles, telephones and refrigerators could become works of art had not occured to most Americans. So when manufacturers saw the need to stimulate sales they turned to the current wave of interest in modern styles and visual motifs to sell their products. It was the industrial designer who was to apply these styles to product forms.

Norman Bel Geddes was the first to set up an industrial design office that could tackle both the technical and asthetic aspects of product design. When not involved in consultancy work he set his staff of about 20 people to 'development work'. This comprised of imaginative exercises free from the limitations of cost but based on the needs of people, the laws of physics and feasible engineering practice. His first book'Horizons'(1932) was a record of this work and in it were designs for ships, cars, trains, huge aircraft and buildings. They were his dream of the future and employed as fully as possible the laws of streamlining. They were not only applied to the appearence but to the function of the product to . He sought simplicity in his design both in production and in the way that that product would be used.

Henry Dreyfuss became an industrial designer in 1929. His work had the same simple streamlined forms to it as Bel Geddes but his interest was in the immediate environment rather than the future. He used the expression



THE SIMPLE NOTE IN MODERN DECORATION.

Ecstatic Female. "MY DEAR, HOW *EXQUISITELY* UNFURNISHED!"

THE NEW TASTE FOR SIMPLICITY.

"My Dear how exquisitely unfurnished."

'cleaning' to describe his approach to redesigning existing products.

Walter Dorwin Teague was a full time industrial designer by 1930. He was one of the first to talk of a direct connection between the function of an object and its appearence.

Raymond Loewy also set up in 1930. His background was in engineering which led him to work for the Pennsylvania Railroad. There he worked on streamlining railroad engines and designing carriages and interriors.

Richard Buckminster Fuller, a designer, architect, engineer, managed to consider most design problems durning his career. These ranged from product design to the worlds energy problems. According to his Dymaxion concept, (quote) "rational action in a rational world demands the most efficient overall performance per unit of input in every social and industrial operation." For this to take effect every aspect of a system has to be looked at to see if it can in some way be more streamlined.

11.3 The Father of streamlining:

After the wall street crash manufacturers were clamouring for the services for the services of industrial designers. They now saw that to survive their products had to be suporior to everyone else's. To manage this they could not stop the design process but had to keep bringing out better and better models. Bel Geddes described this new attitude to design. "Never before in an ecomonic crisis has there been such aroused consicousness on the part of the community at large and within the industry itself. Complacency has vanished. A new horizon appears, a horizon that will inspire the next phase in the evolution of the age."

In his book 'Horizon's' he used recent advances in high speed railroads. race cars and aircraft to sketch a future where travel would be convenient, luxurious and cheap. In each case aerodynamic streamlining would be applied as the current form reflecting the products function. He also looked at domestic products. In this case streamlining consisted of providing efficient and cheap products for the house of the future. Again their visual design reflected not just their function but Bel Gedde's whole philosophy of a fast moving society. The result was a range of high speed toasters, frige's and of course the building to house the products. By the end of the decade he was not just looking at products in isolation but looking at the entire system of living. In the Futurama exhibition of 1939 he envisioned a total urban - rural environment interconnected by super highways.

He is considered the Father of streamlining for he was the first to popularise the new asthetics of dynamic functional forms and their smooth organic shells that were consistantwith known aerodynamic principles. The teardrop can be seen in all his work and was used by him as the ideal form. For him it became the symbol of progress towards the high speed future.

CHAPTER 12

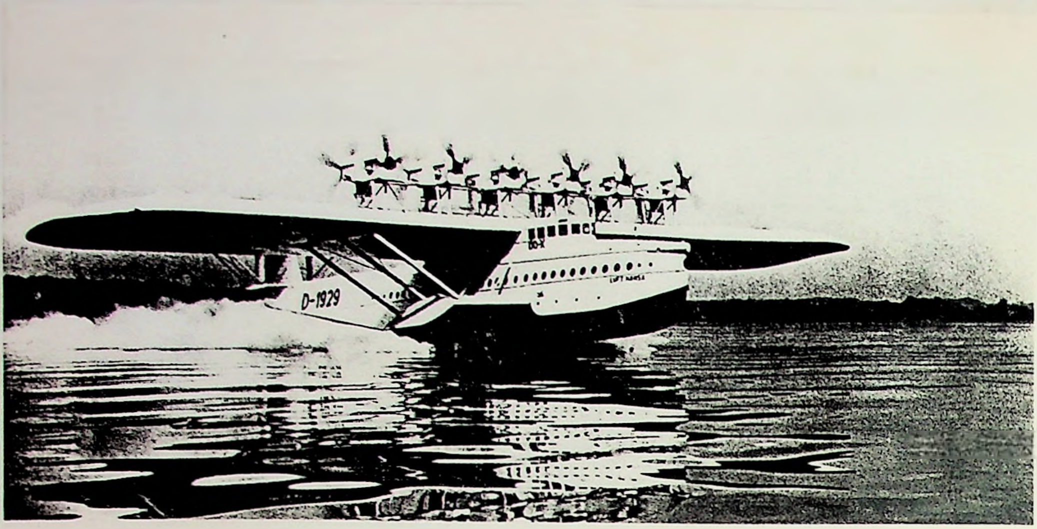
12.1 The new age of transport. The aeroplane:

It was undoubtedly the modern aeroplane that provided the source of images that were to replace the geometric designs of the Art Deco period. In the later 1920's materials and technology had allowed the aeroplane to free itself of the boxy open frames and struts with guy wires. People began looking for the ideal aerodynamic form and by the 1930's the aeroplane was composed of smooth curving streamlined shapes. The Claude Dornier of 1929 in fig 12.1 shows the first of these lines. The plane was also appearing as the fast transport vehicle of the future and for designers represented a new exciting way of life.

Bel Geddes Airliner Number 4 was perhaps his most adventerous design. It was basically a flying wing that could carry 451 passengers across the Alantic in ocean liner luxury. See figs 12.2 and 12.3. The design was not so fantastic as one would imagine. In the mid 1940's the U.S. Air force were experimenting with a jet fighter, see fig 12.4 built along the lines of Air liner No. 4. Some of the early world war two jet fighters also copy his flying wing. The German fighter in fig 12.5 shows a large wing with a tear drop fuselage set into it.

The flying boat was to make a big impact in the early 1930's. It was especially suited to inland flights. As it needed no expensive runway or airport complex, anywhere with a stretch of water could be serviced. For the designers it was one of the ultimate objects to streamline. Not only did it have to obey aerodynamic laws but it also had to have a hull that could travel through water at high speed. Fig 12.6 shows the B-314 taking off. This was a huge plane for its time but also one of the most gracefull.

It was racing planes that began the metamorphosis from the old boxy aircraft and soon ideal shapes were appearing. The logic of aerodynamics was now clearly stated in a form that revealed its function while summing up and symbolizing the concepts of flight, lift and speed combiened with low air resistance. Le Corbusier in 1935 described the aeroplane as a "symbol of



12. Claude Dornier. The *DO-X*. 1929. (*Courtesy Macdonald and Jane's Publishers, London.*)

Fig 12.1

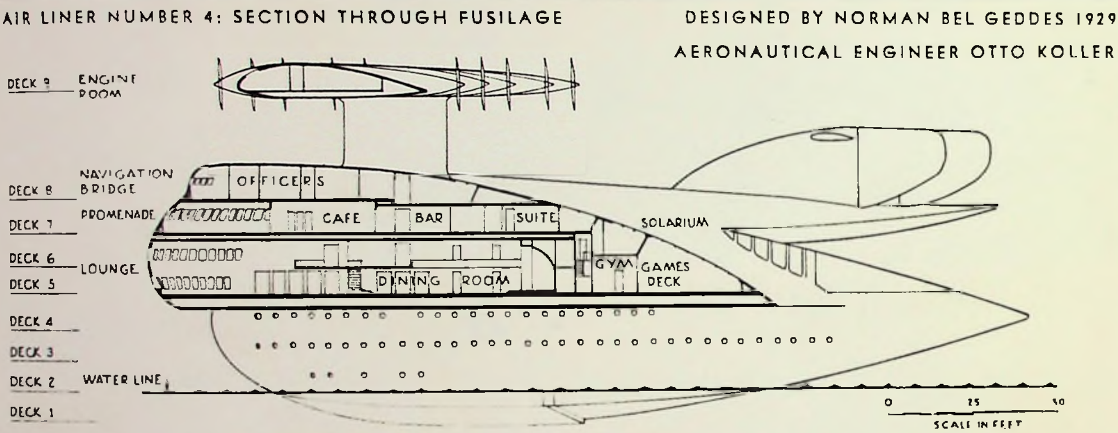
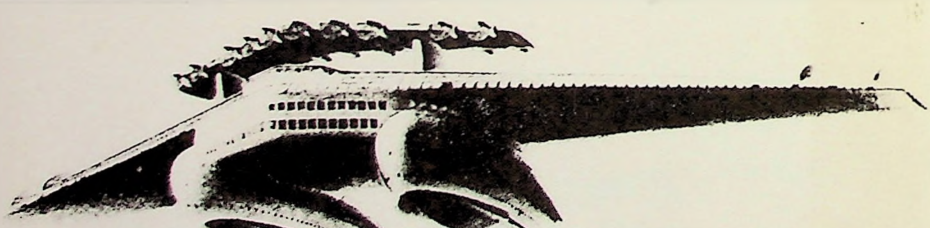


Fig 12.2



13. Norman Bel Geddes with Dr. Otto Koller. *Air Liner Number 4*. 1929. (*From the work of Norman Bel Geddes at the Hoblitzelle Theatre Arts Library, The Humanities Research Center, University of Texas, by permission of the executrix Edith Lutyens Bel Geddes.*)

Fig 12.3

16. The Northrup Company. The *YB-49*. Mid 1940s. (*Official U.S. Air Force photo.*)

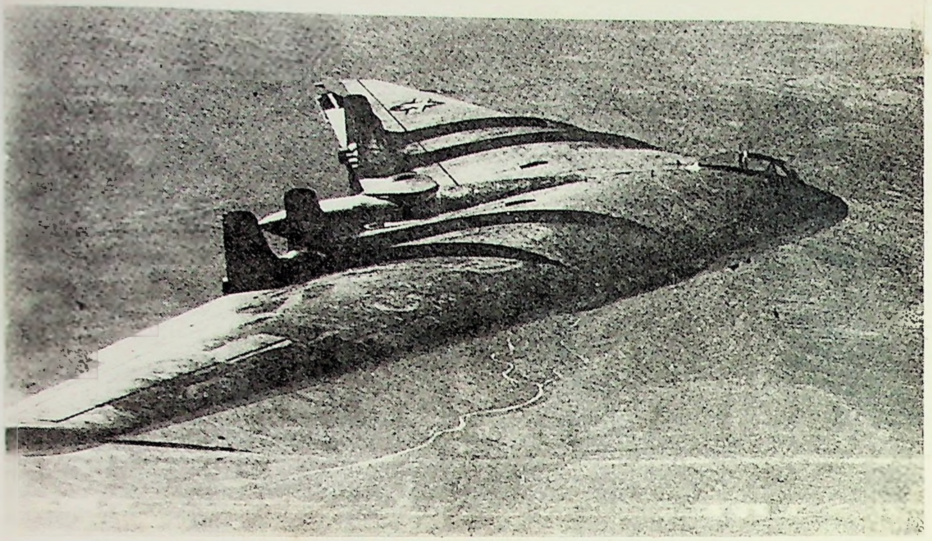


Fig 12.4

Horton Ho IX (Gotha Go 229)

The Horten Ho IX V2 was the only aircraft of this [illegible] to achieve powered flight. Its career ended abru[illegible] following an engine failure.

[illegible]

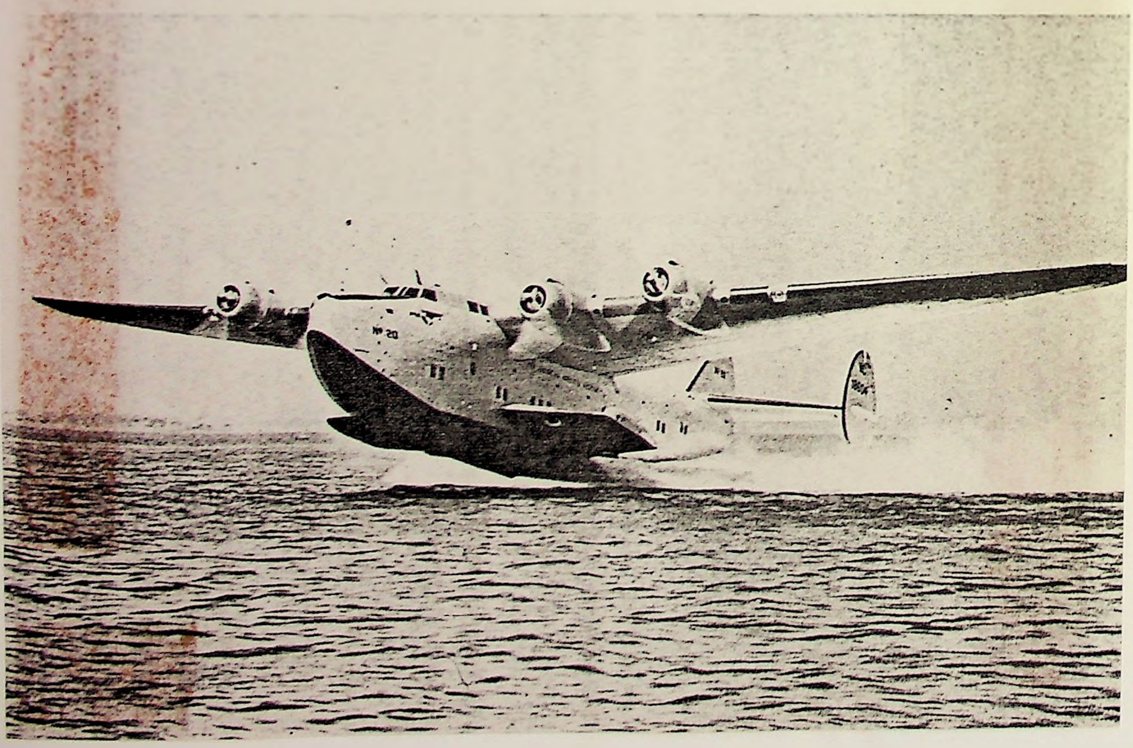
Specification
Go 229A-0

Powerplant: [illegible]
Performance: [illegible]
Weight: [illegible]
Dimensions: [illegible]

Fig 12.5

Fig 12.6

24. The *B-314* taking off. (*Pan American World Airways Photo.*)



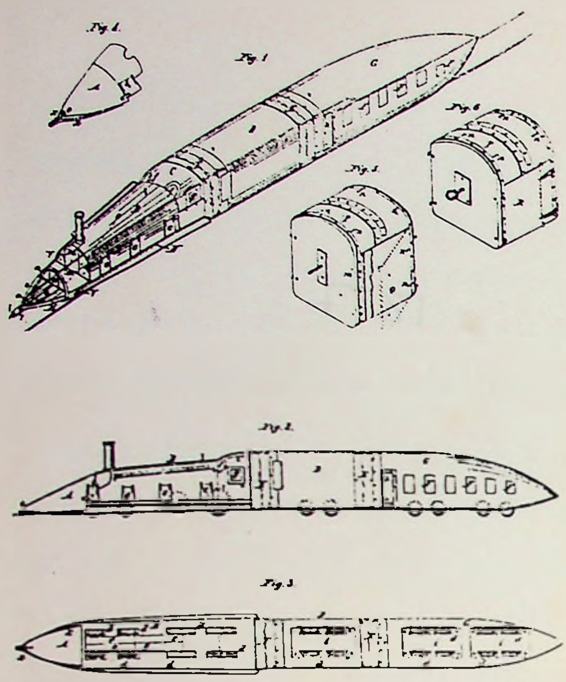
the new age." By 1933 the fully streamlined aeroplane had become the norm. Bel Geddes talked of the stirring beauty of aeroplanes and Teague wrote that there is "no more exciting form in modern design."

12.2 Revolution in Rail:

Next to the aeroplane the railway is perhaps the most streamlined object. The streamlined aspect does not just apply to the locomotive but stretches to the track, stations and even time tabling. To increase speed all these parts of the system have to be considered. It only needs one weak link such as track quality and the whole system is affected.

A Reverand Samuel R. Calthrop took out a patent durning the 1800's for what is very likely to be the first streamlined train. Shown in fig 12.7 it incorporated a steam engine, tender and passenger car in a single articulated tapered form. He wrote "regarding the whole train as an aeral ship and modeling its surface in accord with the principles so successfully applied to ship building, modified however by the consideration that the railway train is wholly immersed in the fluid through which it is passing." However the Reverand was a little forward in his thinking and it was not until the 1930's that the streamlined train became accepted. Again it was the industrial designers of the time who started the move towards a it. By 1933 the American Railway association was considering the practicability of streamlining its locomotives and rolling stock. Comfort and service were also to be improved. "For too long" Geddes said, "the comfort has been sacrificed for capicity."

The 'City of Salina', was the first high speed steamliner passenger service. It was called a 'monster aeroplane fuselage on wheels' by many but its owners the Union Pacific considered it to be 'Tomorrow's train, today.' In its design phase an extensive study was made of aircraft wind tunnel data. To determine the effects of the ground plane below the train block models were tested in wind tunnels. The result was a form that came right down to



41. Samuel R. Calthrop. Patent drawings for an "air-resisting train." 1865. (*Author's Collection.*)

Fig 12.7

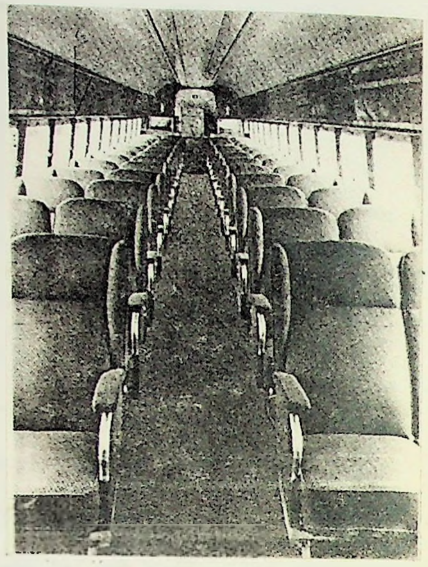


Fig 12.8

48. Interior of the *City of Salina*. (*Union Pacific Railroad Museum Collection.*)

47. Pullman Car and Manufacturing Company. The *City of Salina*. 1934. (*Union Pacific Railroad Museum Collection.*)

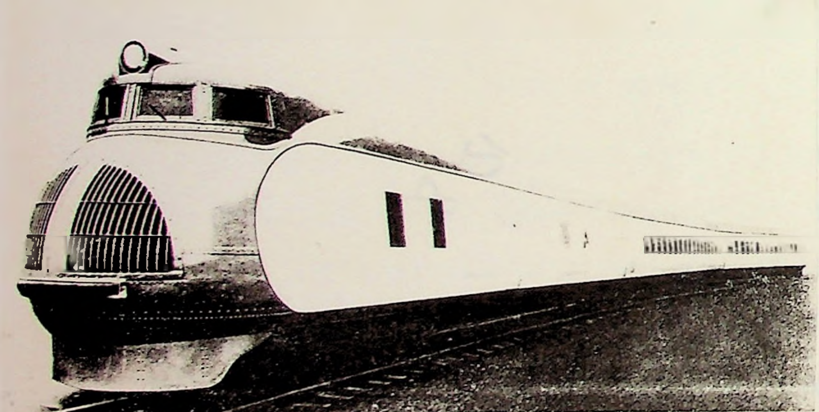
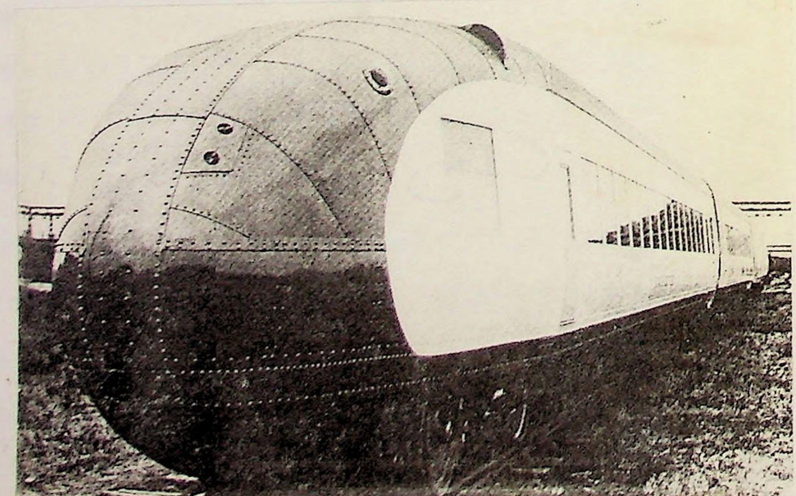


Fig 12.8

Fig 12.8



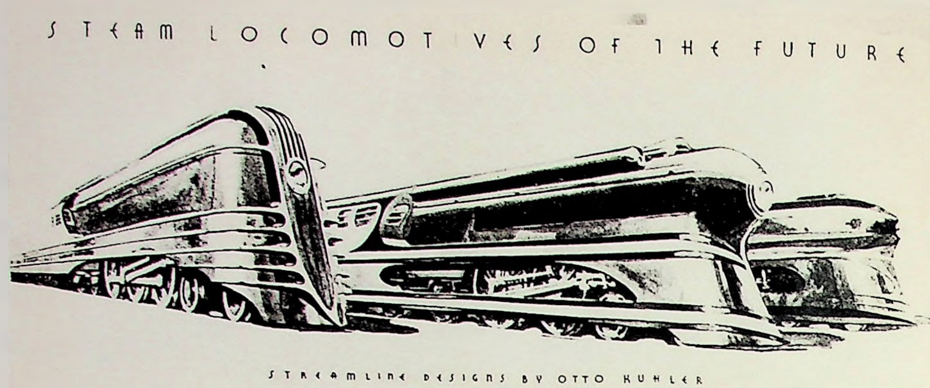
cover the wheel units. All fittings were set flush with the body and the carriage connections were shrouded in rubber sheeting. As a result of this work a direct connection between streamlining and cost reduction or speed increase - between 5 and 10% - could be seen. By the mid 30's the benefits of streamlining had left its mark on the public and it became the popular mode of design. The City of Salina can be seen in fig 12.8

Streamlining was not restricted to the outside. Geddes felt that every part of the train should express its overall function. Speed. The result was some of the first examples of streamlined interriors. To be found on the City of Salina were such comforts as air-conditioning, indirect lighting, safetyglass windows and rubber cushioned wheel bogies. There was seating for over 100 people in 4 position reclining chairs, wash rooms, baggage and mail compartments and a buffet kitchen in the tail. The interrior has much in comman with todays passanger jets and more modern trains. It was the high quality finishes and good service that rekindled interest in the rather flagging rail services of America.

The next streamlined engine and passenger unit, the Zephyr in fig 12.9 came two months later. It added an observation car within an elliptical tail. It was finished in gleaming stainless steel with corrugated sides emphasising the low horizontal lines and sense of forward movement.

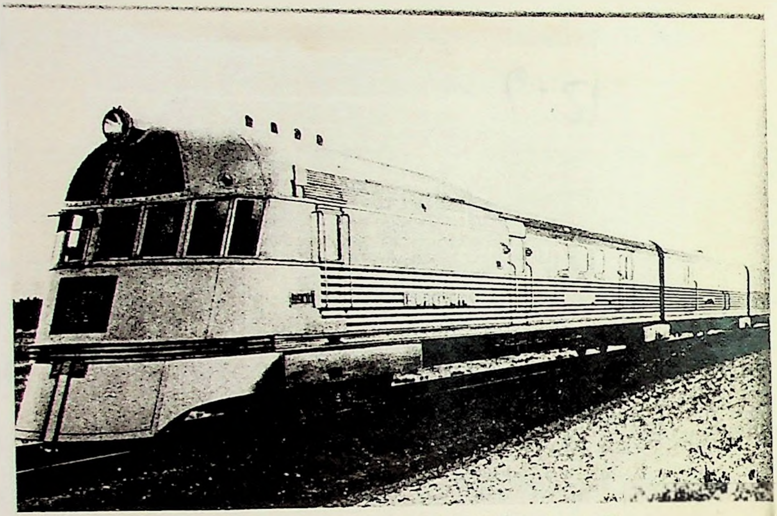
After the success and public interest generated by these two trains many followed. One impressive engine was the Commodore Vanderbilt in fig 12.10 The simple plain lines of this engine increased its pulling capacity by up to 12%. Many old steamengines were updated by simply giving them a new streamlined shroud.

Around the mid 1930's designers started breaking away from what had now become a constant stream of Zephyer type designs. An effort was made to express the function of the boiler, smoke stack, cab and tender and blend their forms together while still retaining their individuality. The result



46. Otto Kuhler. Proposal drawings for streamlined steam engines. 1933. *(Courtesy Otto Kuhler.)*

Steam engine designs by Otto Kuhler. 1933.



50. The E. G. Budd Manufacturing Co. The Burlington *Zephyr*. 1934. *(Burlington Northern Railroad Photo.)*

Fig 12.9

Fig 12.9

51. Observation lounge of the *Zephyr*. *(Burlington Northern Railroad Photo.)*

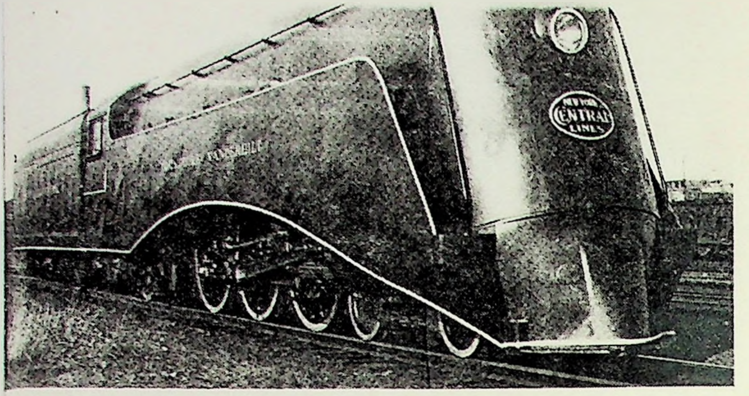
was something like a giant torpedo on wheels. Henry Dreyfuss's Engine 5450 in fig 12.11 is a classic example of this style, expressing the function of the steam engine without cuttting down on the aerodynamic efficiency, It was like a great machine straight out of a 'futurists' painting and infact made quite an impact in the later era of pop art. Charles Sheeler the precisionists painter/photographer used it as one of a series of subjects entitled "Power"

By the end of the decade railroads had won back the public by a progressive managment that considered the needs and comforts of the passenger. The main changes had been visual. The Railway Age of 1941 noted. "It is significent that all these improvements have been made partly or entirely in passenger service, and that they are all kinds that make a impression of one sort or another on the observer..... It was things that an overwhelming majority could see and feel that had influenced their new opinion of rail travel."

The last comment must go to Frank Norris, a quote from his book "The Octopus." "With a quivering of all the earth a locomotive, single, unattached, shot by with a roar, filling the air with the reek of hot oil, vomiting smoke and sparks, its enormous eye, cyclopean red, throwing a glare far in advance, shooting by in a sudden crash of confused thunder, filling the night with the terrific clamour of its iron hoofs."

12.3 The flight of ships:

Without doubt the finest, most highly developled sailing ship up to the thirties was the clipper ship. Bel Geddes paid homage to it in his book Horizons. What he did not like was the cluttered superstructures of the current ocean liners. He saw that as with any form of transport the ocean liner should be designed along aerodynamic principles. He described the flow of wind over a conventional ship, "It climbs on deck and swirls around ventilators, towing bitts, hoists, life-boats, davits and life belt boxes



58. The New York Central's *Commodore Vanderbilt*, 1934. (*Penn Central Transportation Company Photo.*)

Fig 12.10

57. The final version of Zapf's test model was made practical and attractive. (*Courtesy Mildred Zapf.*)

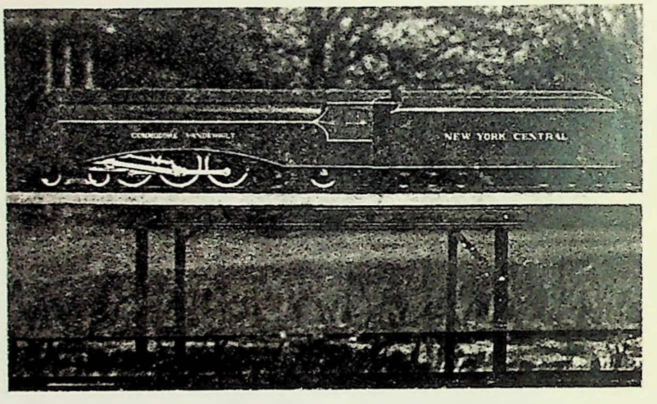
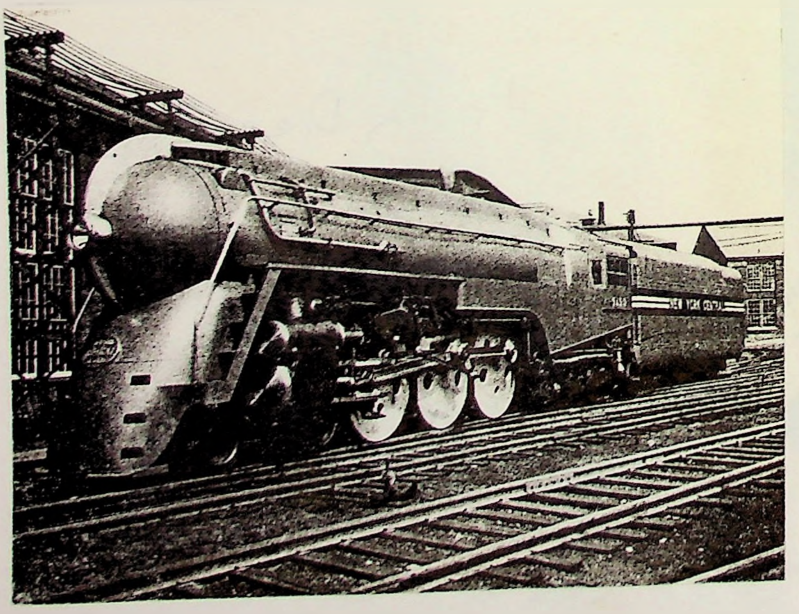


Fig 12.10

Fig 12.11



25 · OCEAN LINER: BOW

DESIGNED BY NORMAN BEL GEDDES 1932

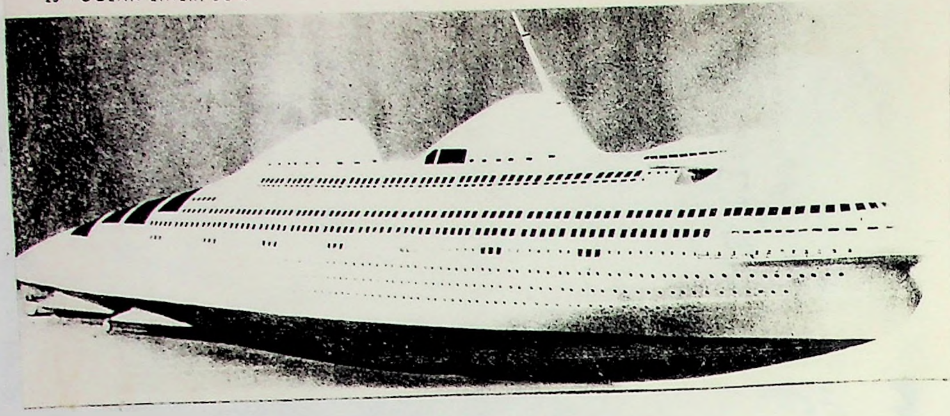


Fig 12.12

21 · OCEAN LINER STERN DECKS OPENED

DESIGNED BY NORMAN BEL GEDDES 1932

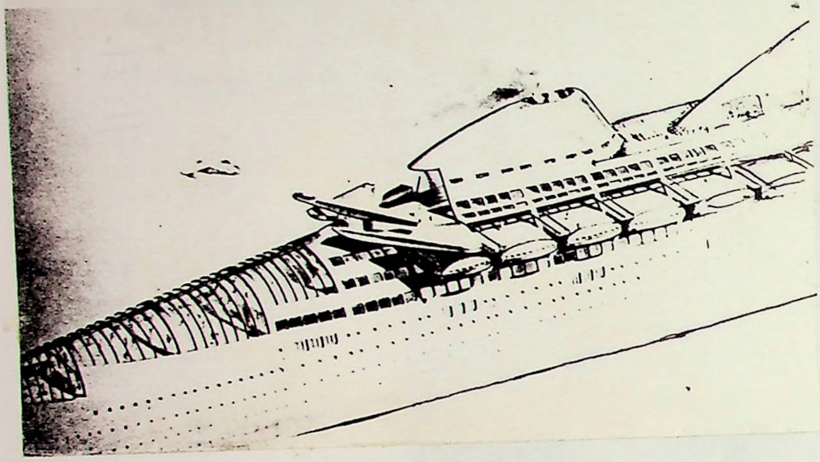
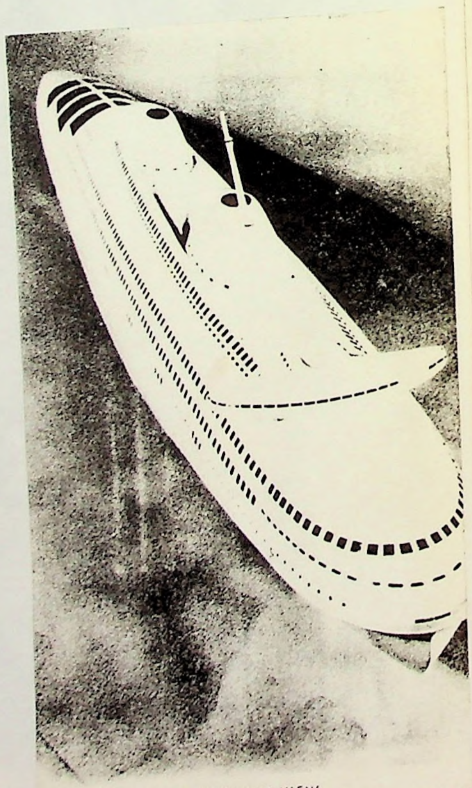


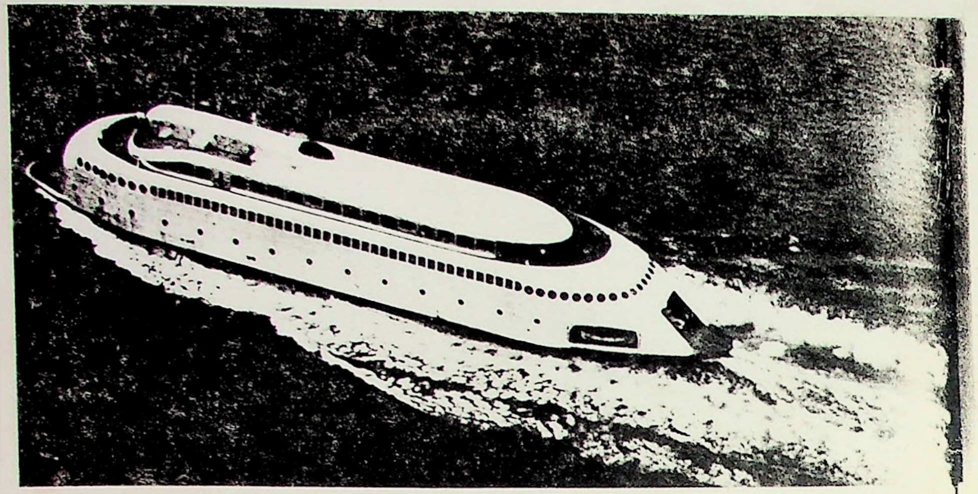
Fig 12.12

Fig 12.13



26 · OCEAN LINER: AIRPLANE VIEW

DESIGNED BY NORMAN BEL GED



39. The *MV Kalakala.* (*Joe Williamson Marine Photo.*)

One of the few streamlined ships built. See text.

Fig 12.14

It eddies around the wings of the bridge, the masts and the funnels." The logical thing to do was to enclose the whole superstructure in a streamlined shell as was done with the steamengine.

The result was his Ocean Liner. See figs 12.12 to 12.13 Its form was as close as he got to a teardrop with his transport designs. The only protrusions from the sleek whale like form are the bridge deck; aerofoil in section and the two smoke stacks. After that it was completely smooth. Geddes thought that it could cut 22 hours off the New York to Plymouth passage. He was never to find out as no ship was built on that scale with such extensive application of streamlining.

One of the few ships that were built in the streamlined mode was the Princess Ann, designed by Raymond Lowey in 1933. She was a 260 foot ferry boat and at the time the fastest ship of her kind. She had the same whale-like superstructure and uncluttered sculptural form of Bel Geddes's Ocean Liner. Rounded contours were further emphasized by the paint patterns. Another was the M.V. Kalakala also built in 1933.

Unlike the streamlined railway engine the streamlined ship never took on. However many ship interriors were restyled in the streamlined mode, but the exterriors remaind the same and have changed little right up to today. This could be because the romantic image of a ship is of something that sticks up from the water with great masts and an angular superstructure. The organic designs of Bel Geddes and Raymond Lowey completely strip the liner of this character, leaving it looking like a whale about to submerge. One must also accept that the savings to be gained from streamling a realitively slow moving form are small. Their designs did have some impact as can be seen in the "Normandie" advert in fig 12.14 This shows simplicity of form to be the over riding visual image.

If we look at some of todays high speed boats such as Hydrofoils, speed boats and hovercraft, we can see many elements that first appeared in the

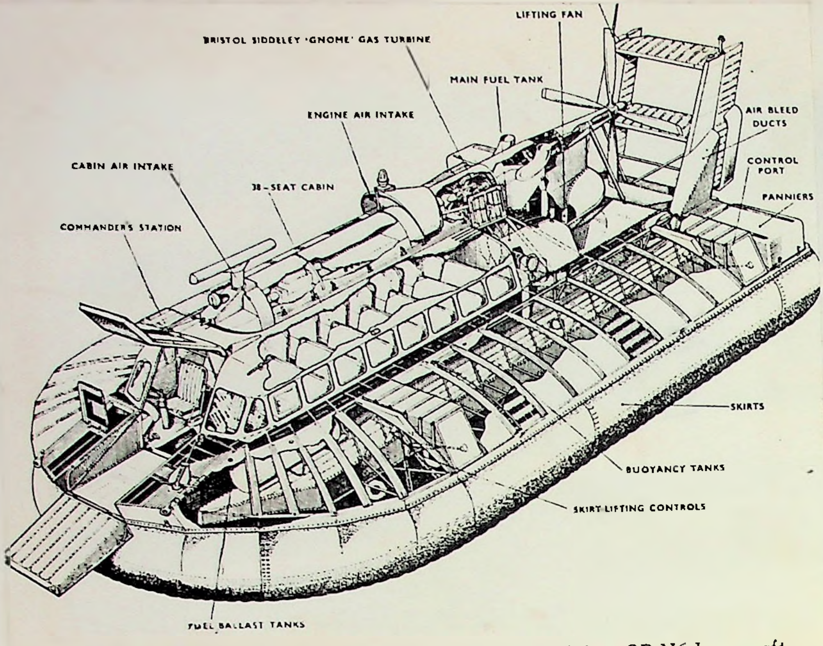


Figure 2.8a. A cut-away view of an air propeller amphibious SR.N6 hovercraft (Courtesy of British Hovercraft Corporation)

Fig 12.15

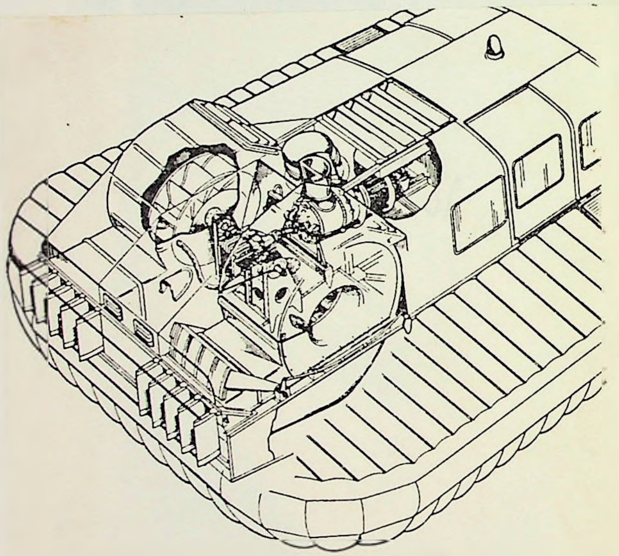
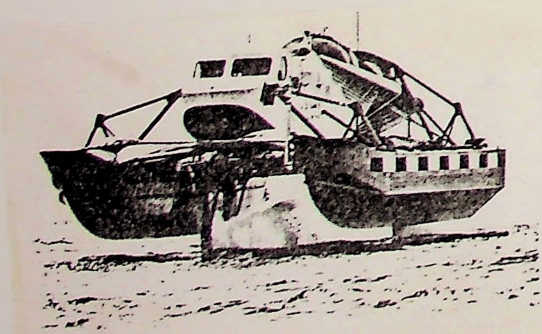
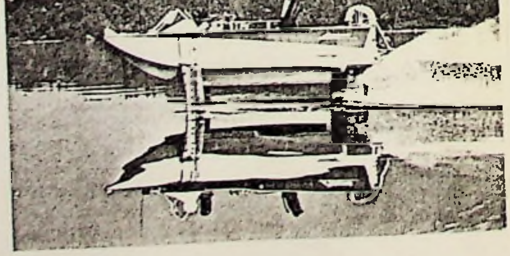


Figure 2.8b. A cut-away view of an air jet amphibious C((Courtesy of Cushioncraft Ltd)

Fig 12.16



The twin-hulled Boeing FRESH-1, the world's fastest hydrofoil, is designed to exceed 1[illegible] mph, and is used as a test bed for high-speed foil systems, which are suspended between the two hulls



Little Squirt, a Boeing research hydrofoil capable of speeds up to 50 mph, is propelled by a waterjet, water for which enters a scoop at base of the aft strut and is forced out at rear by a double-action centrifugal pump

Fig 12.17

Fig 12. 18

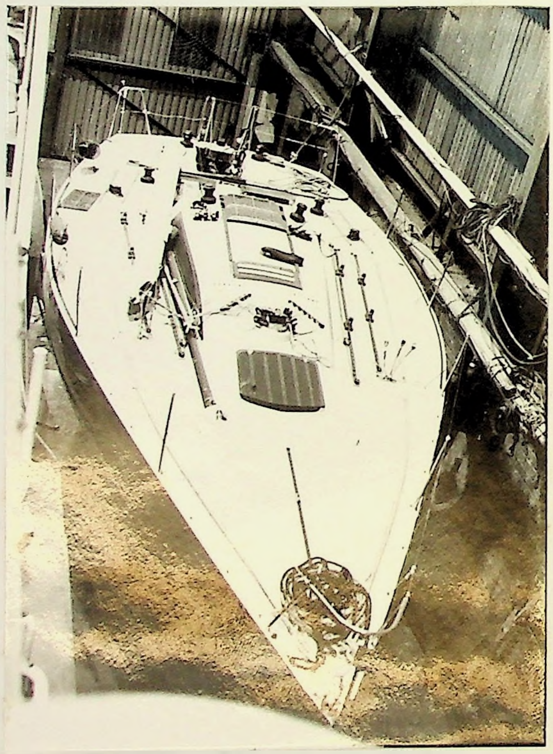


Fig 12. 19

designs of Bel Geddes, Raymond Lowey and others working durning the thirties. The hovercraft in figs 12.15 to 16 show many of the slow curves and smooth lines. The one difference is that today we have discovered that the tear drop shape is not always the best. This can be seen in the angular lines of the hydrofoil in figs 12.17 and 12.18 Within most of todays fast craft can be seen a box like geometry dictated by the function. Sharp corners have also been found acceptable at water borne speeds. However fig 12.19 shows a modern racing yacht which is very close to the teardrop shape.

12.4 The new era of personal transport:

"Today," Wrote Bel Geddes "Speed is the cry of our era, and greater speed one of the goals of tomorrow. One hears easy off-hand predictions that the motor car will attain five hundred and the airplane a thousand miles an hour." This was all going to come about with the application of aerodynamic laws to vehicle design.

The teardrop had been identified as the most streamlined form for the car back at the begining of the century. An early example is a special Alfa Romeo built in 1914 for the Count Ricotti in fig 12.20 It was not however until the late 1920's that designers started taking aerodynamic research seriously. Count Ricotti's Alfa Romeo was actually slower than the standard Alfa Romeo.

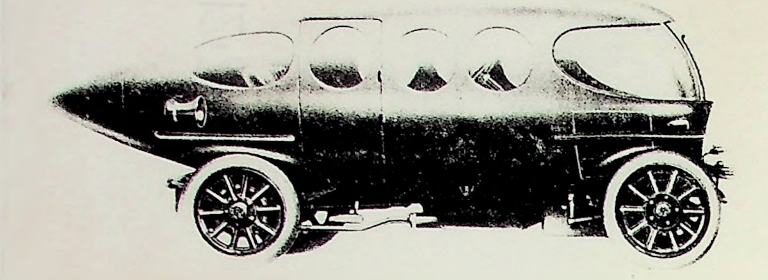
Paul Jarry's designs from the late 20's were the first streamlined cars to make an impact. Opel. Mercedes-Benz, Ley, Dixi, and Maybach all used Jarry's designs on their own chassis. He stated that his design was intended to reduce the resistance to air, "in the highest degreeattainable The spokes of the wheels have been enclosed- the whole car has recieved a low and slender shape, and quite espécally the whole body has been shaped somewhat like a torpedo or airship body."

In 1933 Buckminster Fuller set up a small consortium to design and build his Dymaxion range of cars as shown in fig 12.21 As a result of enclosing the chassis and some of the wheels within a smooth tapered envelope he reported being able to attain speeds of 120 mph with a 90 horse power engine. This speed he said would need a 300 horse power engine in a conventional sedan car. Fuel consumption would drop by 30% at 30 mph and 50% at 50 mph. Where ever it went the car attracted considerable attention. It represented the first reexamination of the automobile sense it first emerged as the motorized carriage. Fuller had scientifically justified the designers extensive use of the teardrop form durning the 1930's. Streamlining could now become the offical style of the future.

In 1935 a German, Dr. Wunibald Kamm proved that the ideal form did not have to extend back to a sharp point. The tear drop need only by tapered back as far as suited and then truncated. America's designers were begining to uncover what they thought would be the natural single form for the car. Raymond Lowey presented an evolutionary chart in 1933 showing the cars form ending up as this ideal sleek teardrop shape. This it was felt would be the logical conclusion to car style development with only minor modifications to the designer of the future.

What these designers could not have predicted was that the average car of the 30's was going to stay a square boxy geometric shape completely lacking any of the new streamlined looks. It was the time of the first family cars. These needed to be a reliable large box on wheels into which the whole family, the dog and the kitchen sink could be piled into. This lot could not be easily packed inside one of Raymond Loweys teardrops.

One of the first production cars styled in the streamlined mode was the Chrysler Airflow. This appeared in 1934 and is in fig 12.22 It had been extensively wind tunnel tested. A huge amount of work had been done on it



90. Il Carrozzeria Castagna. A special *Alfa Romeo* for Count Ricotti. 1914. (*Courtesy Alfa Romeo, Milan.*)

Fig 12.20

94. Richard Buckminster Fuller. *Dymaxion Cars One, Two* and *Three* (TOP TO BOTTOM). 1933, 1934. (*Courtesy R. Buckminster Fuller.*)

Fig 12.21

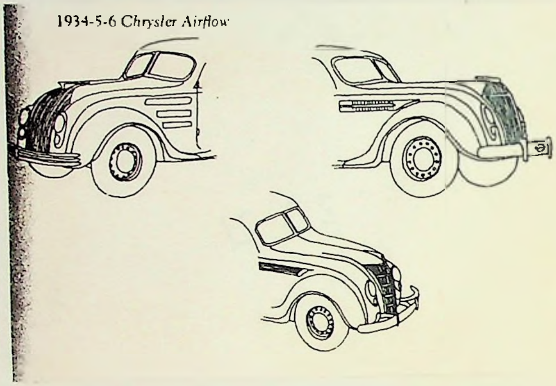


Fig 12.22

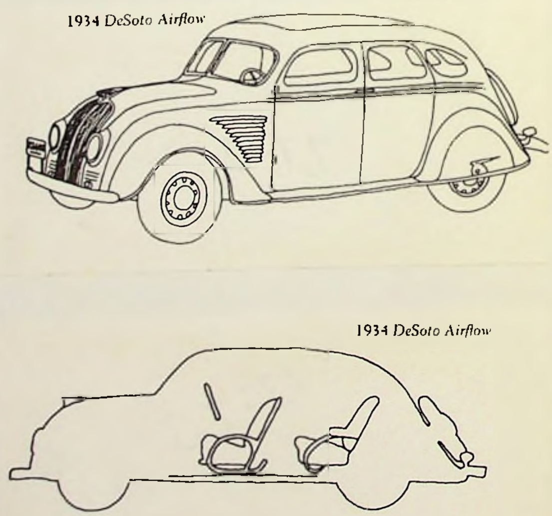


Fig 12.23

and the end result was an all round very high quality product. Advertisements claimed that the car was, "functionally correct for cleaving through the air.... and functionally correct for moving over the uneven surface of the ground" giving "the greatest travel comfort man has ever enjoyed." It did not sell well however. This was blamed on its streamlined styling which was said to be too advanced for public taste. They still wanted a big box on wheels. Henry Dreyfuss explained its demise with "a classic example of going too far too fast. " Another car similar in style was the Desoto Airflow of 12.23 of 1934. This experienced similar sale's problems. The Lincon Zephyr of 1936 was a further but less laid back version of this style. A later model the Lincon Continental was put into production in 1940 and attracted considerable attention. The public at this time were more used to the streamlined forms and if it had'nt been for world war 11 we might never have broken away from the teardrop forms.

The design of buses also followed this streamlined trend in the late 30's. Metallic finishes and gleaming chrome were all part of the image and these vehicles can still be seen in use in America today.

As with trains, streamlining left its mark on auto design. The clean uncluttered lines of todays cars all originate from the styling of the 30's. The teardrop car never did manage to get into production. It was that bit too radical looking and impractical. They did however generate an awarenes of the importance of streamlining in the public. By the end of the decade moderately streamlined cars were to be found in all price ranges.

CHAPTER 13

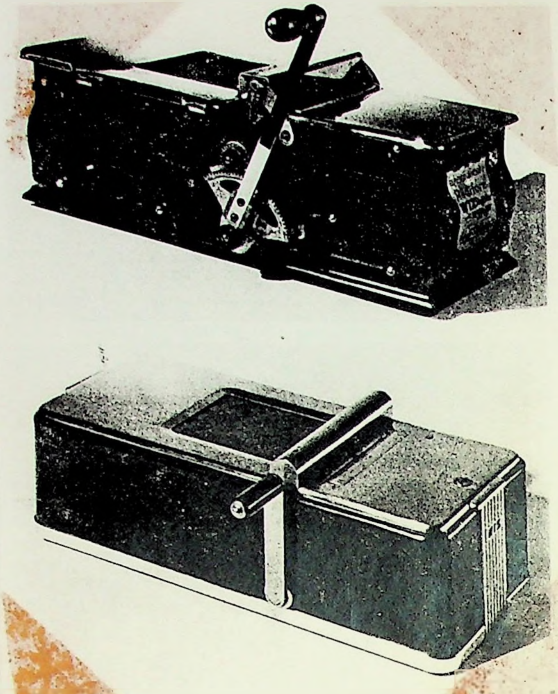
13.1 The new streamlined product:

The identification of streamlining with sensible design and efficiency proved to be popular in the days following the great Wall street crash. These new dynamic forms were economic to produce and seemed to be pointing the way forward

Small products were first to take on the new style. This was because re-tooling costs were nothing compared to those of producing a streamlined automobile, Before this time, products had been treated as machines. It was rare even for a casing to be provided concealing all the inner workings. They were now styled to match the new Moderne domestic environment. The result was some very dramatic redesigns. Look at Walter Dorwin Teagues "Wiz" sales book registar in fig 13.1 Not only did he manage to up date the appearence but by applying the curving forms of the streamlined mode designed something much easier to produce. With Raymond Lowey's cream seperator the smooth polished shells and simple form make for a much more hygienic machine that its earlier predecessor in fig 13.2 Hoover's Model 150 Vacuum cleaner of 1936 shows the new symbolism. The smooth organic shell cuts out all the sharp edges and screw heads that might damage furniture.

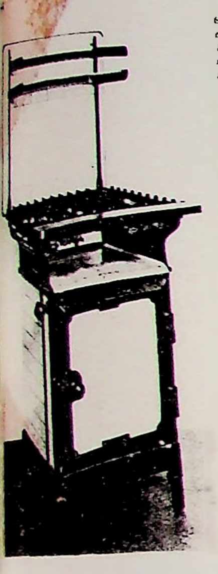
The basic principles of streamlining in transport designs do not apply to stationary products yet streamlining could offer not only new asthetics but simplified construction techniques and lower costs to the domestic product.

Fig 13.2 shows two cookers, one typical of the 1920's and the other, on the right typical of the 1930's. The whole form of this one has been greatly simplified. The design has cut out many of the expensive castings with the extensive use of cheap sheet steel pressings. The modern version is also much easier to clean having only smooth surfaces to its shell. The streamlined toaster in fig 13.3 shows the introduction of plastics in its



166. The American Sales Book Wiz Register before (ABOVE) and after (BELOW) re-designing by Walter Dorwin Teague in 1934. (*Walter Dorwin Teague Associates, Inc.*)

Fig 13.1



69 (Right) Creda electric cooker, 1933, the first made to have thermostatic control of oven. Hot plate has two elements, one of the new spiral tube type, the other a metal plate with coiled wire element beneath to heat the grill

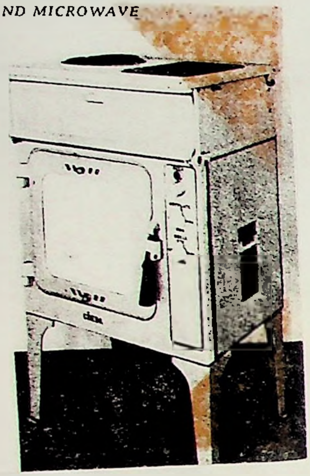


Fig 13.2

167. Raymond Loewy, International Harvest Cream Separator. Before (LEFT), and after (RIGHT) redesign in 1939. (*Raymond Loewy/William Snaith, Inc.*)

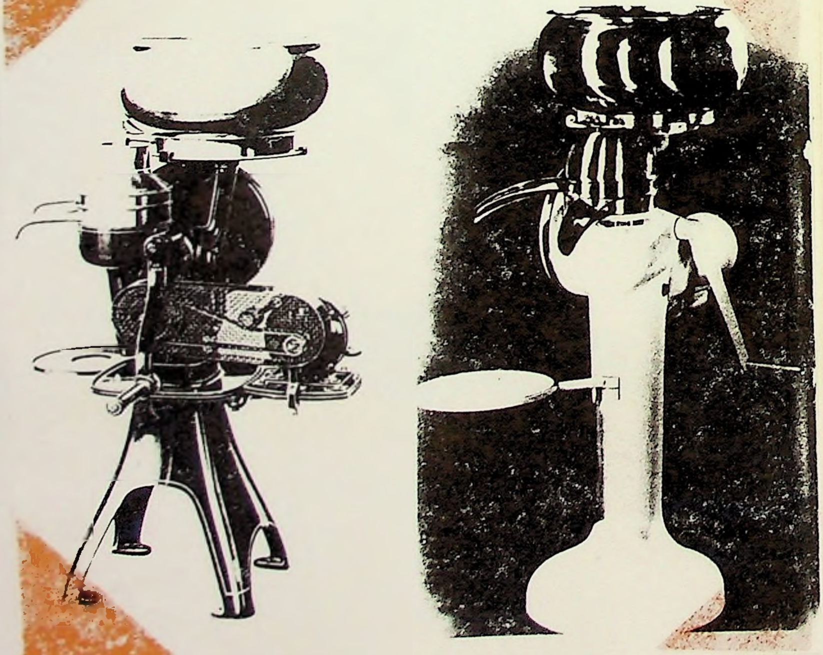
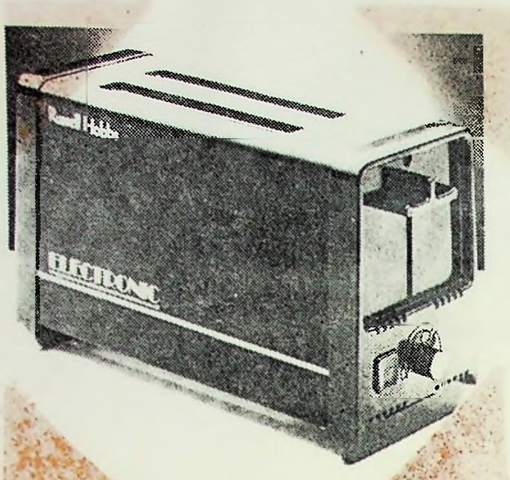


Fig 13.2

192 Salmic streamlined electric toaster, in current production 1947

Fig 13.3

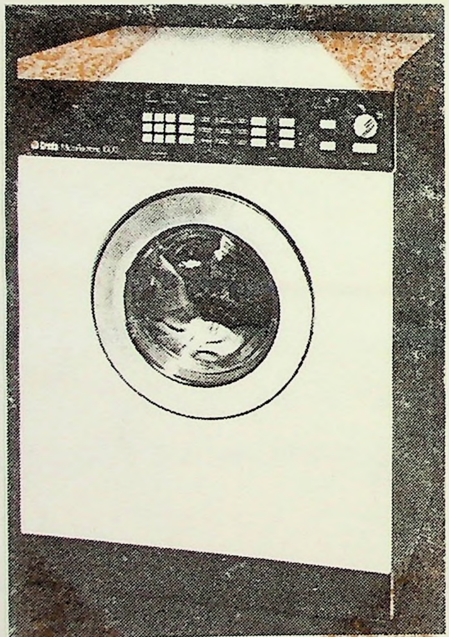


261 Russell Hobbs electronic pop-up toaster. Model [illegible], 1980. Microprocessor control with seven settings

Fig 13.4

258 Creda Carefree electronic cooker, 1981. Microprocessor control of [illegible] timer, six digital display panels, ceramic hob

Fig 13.5



259 Creda MicroElectronic 1000 Washing machine, [illegible]. Microprocessor program control

Fig 13.6

shell. Plastics were found to be very suited to the curving lines of the Moderne style.

The modern toaster in fig 13.4 shows the same simple form. Advanced injection molding has allowed us to bring detail back into styling such as the ventilator grid and control knob graphics, without increasing costs. However the main styling priority is still with simplicity of form. See fig 13.5 and fig 13.6

The fire grates, gas and electric heaters in fig 13.7 are all typical of such fittings to be found in the modern home of the 1930's. The general effect is of something that is visually quiet.

The evolution of the telephone can be seen in fig 13.8. It was Henry Dreyfuss who gave it a simplified organic form most suited to the human hand. This can be traced from his 1937 design up to todays telephones.

One of the great designs of the decade is the Parker 51 Pen. Fig 13.9 This was not just a restyling job but was designed from scratch. It was to use a new quick drying ink Parker had developed. The pen barrel's elegant lines come from a study of what form most suited the hand. Furniture design also followed the Moderne mode. New materials were introduced such as tubular steel and other metal extrusions as can be seen in figs 13.10 and 13.11 Fig 13.12 shows a table following the same extruded style, made from laminated plywood.

Many people said that aerodynamic principles should never have been applied to stationary products. There were some products, such as the teardrop pencil sharpner that did go too far and were even considered to have done so by the most ardent 'streamliners'. Lastly in defence of the high speed toaster or streamlined objects in genral a comment by Siegfried Giedion."it is only natural that an age of movement should adopt a form associated with movemant as its symbol, using it in all places at all ocasions."

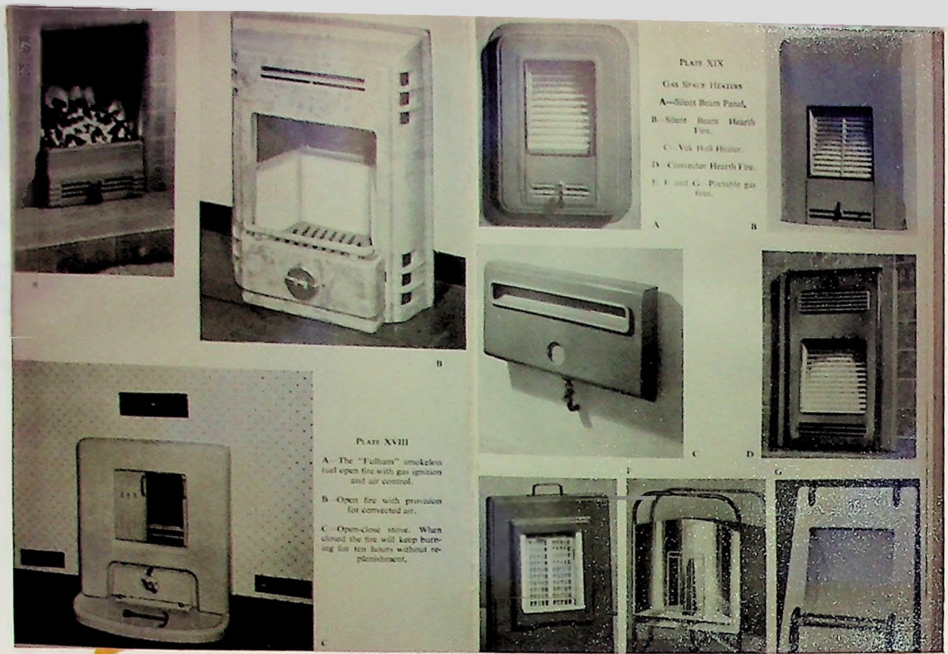
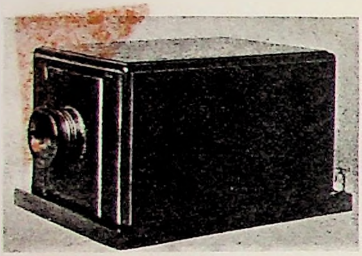
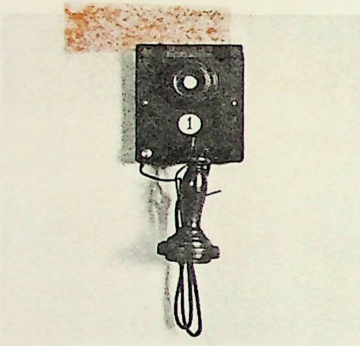


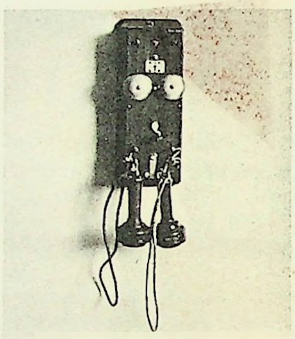
Fig 13.7



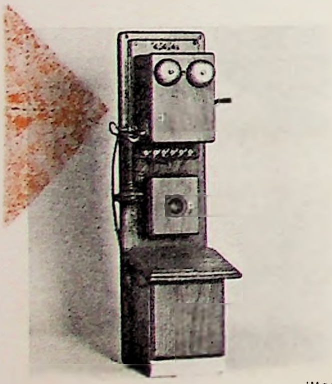
Alexander Graham Bell. First commercial model phone, U.S.A. 1877



Alexander Graham Bell. Butterstamp model, U.S.A. 1878



Alexander Graham Bell. Wall model, U.S.A. 1878



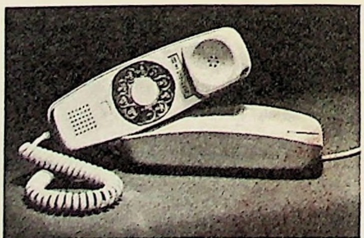
Francis Blake, Jr. Improved transmitter combined with Bell's receiver, U.S.A. 1882

Staff design. Desk model, U.S.A. 1897

Staff design. Desk model, U.S.A. c. 1916

ienry Dreyfuss. "300" desk model, U.S.A. 1937

Henry Dreyfuss and Western Electric staff. Desk model, U.S.A. 1949



Western Electric staff. Trimline model, U.S.A. 1965

Fig 13.8

Joseph Platt and Kenneth Parker. The Parker 51 Pen.
Pen Company.)

Fig 13.9

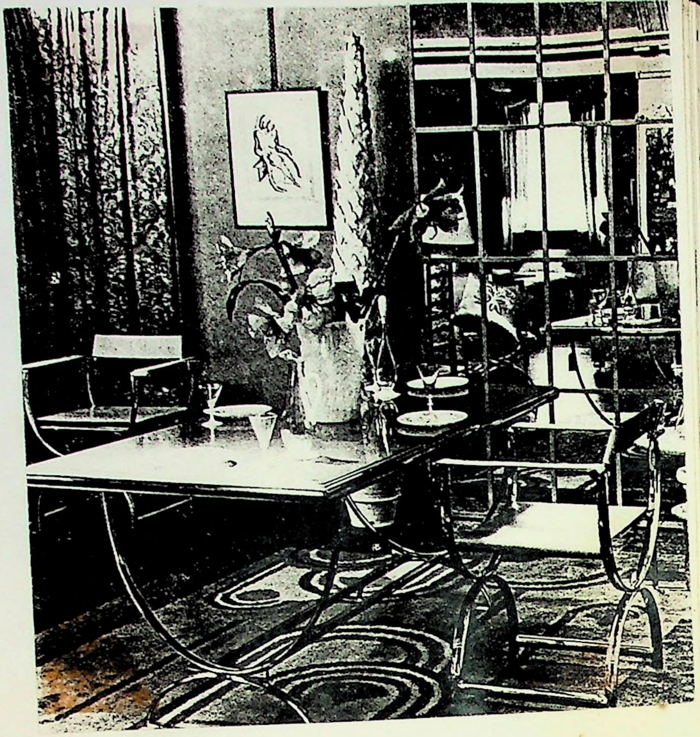
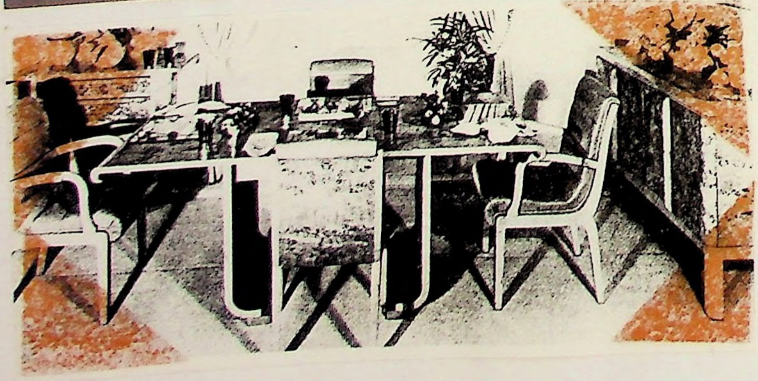


Fig 13.10

Fig 13.11

Fig 13.12



CHAPTER 14

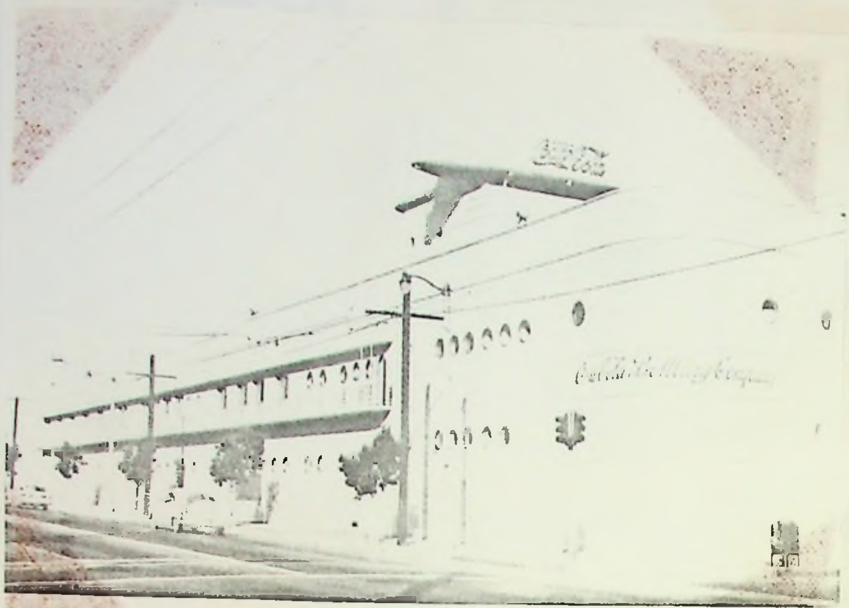
14.1 Architecture of the future:

With architecture the streamlined Moderne style was just that, a style. One could talk about buildings that can be structurally lighter due to good aerodynamic design, but this has little application to most building, with maby the exception being 'Port-a-loo' cabins.

The Moderne in architecture was a variant of the International Style. It liked the same functional look of the machine age but was more flexible than those designers from the Bauhaus of Stijl schools. Its hallmarks are flat and curved walls, silvery hand rails of tubular steel, extensive areas of glass, fluoreseent lighting and that 'were about to take off', feel about the building. The Coca-Cola bottling plant in fig 14.1 shows an example of the extreemessome architects went to. It is spared no nautical motif, being full of portholes, catwalks, hatches, decks and even a flying bridge, complete with mast. Another marine design is the 'Aquatic Park Casino' in San Fransico. Fig 14.2 This combined Art Deco motifs with its Moderne ship architecture.

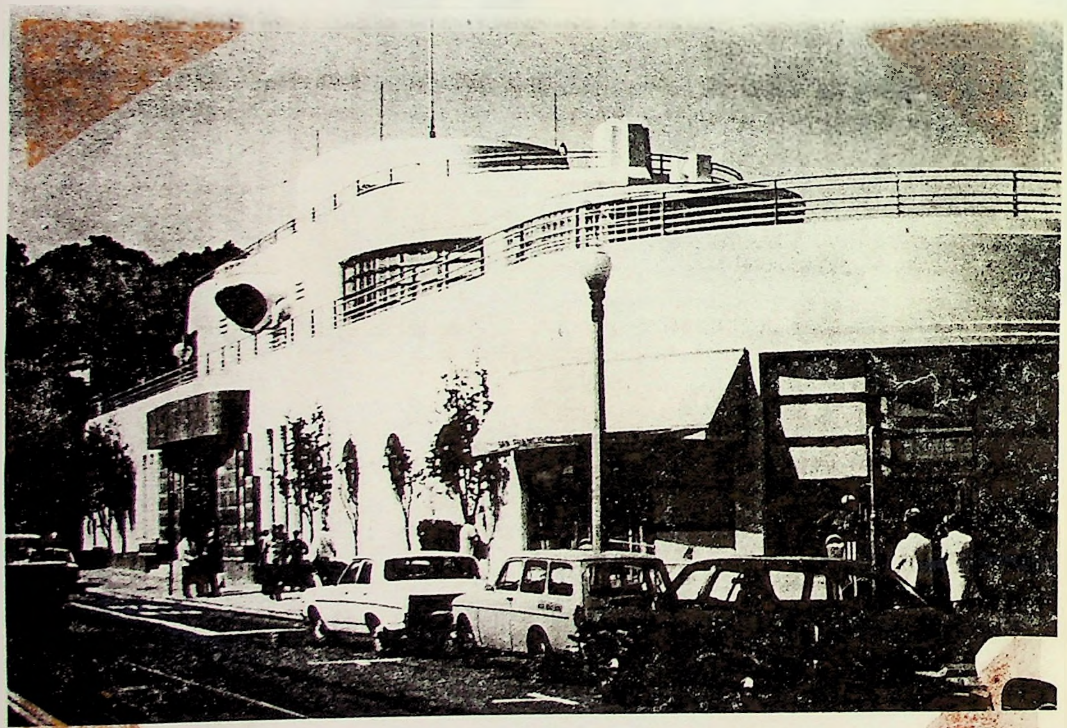
Norman Bel Geddes also had a go at architectural design with his 'House of tomorrow' in fig 14.3 He said that the public would have to throw out some old ideas about the function of the house before they could accept the house of the future. His design was completely devoid of any applied decoration so loved by the Art Deco and Art Nouveau designers. He said that, "it must be realised that at the moment we are only on the threshold of what will undoubtedly be the universal architecture;" The house was very much of the International style and completely devoid of decoration. However the spartan architecture was relieved by works of art, potted plants and colourful furniture.

The streamlined Moderne sytle was identified as being up-to-date and many large companies remodeled their buildings in the style, to improve their public image. Fig 14.4 This shows the Electricity Showrooms



149. Robert Derran. The Coca-Cola Bottling Plant, Los Angeles. Remodeling begun in 1937. (*Courtesy Coca-Cola Bottling Company of Los Angeles.*)

Fig 14.1



148. William Mooser, Jr. The Aquatic Park Casino (now the Maritime Museum), San Francisco. 1935–39. (*Author's Collection.*)

Fig 14.2

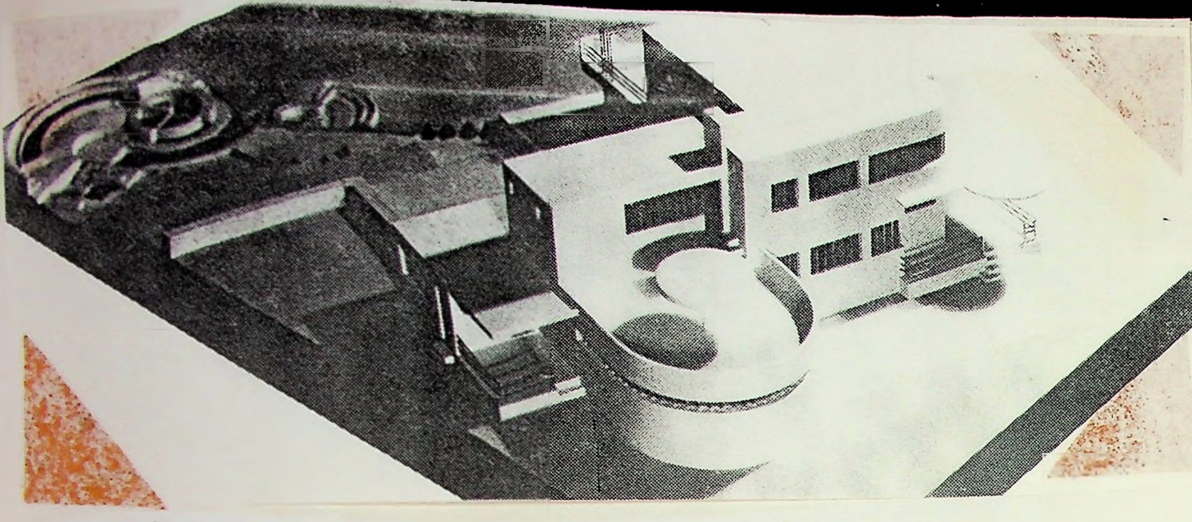


Fig 14.3

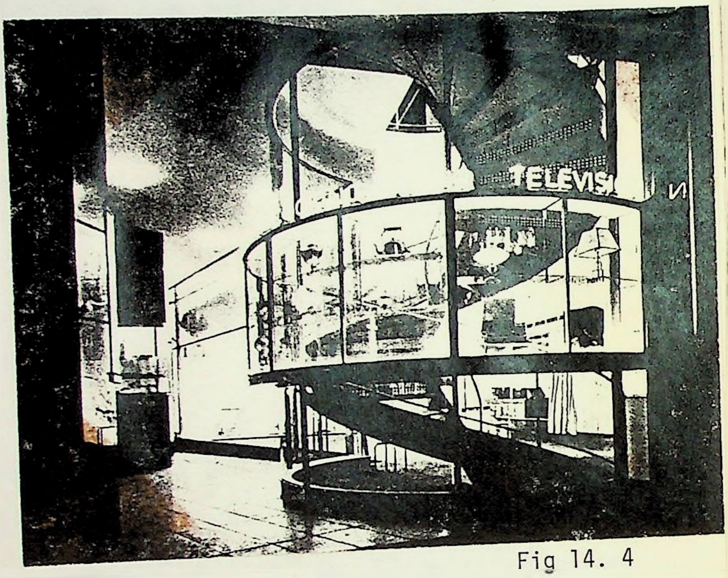


Fig 14. 4

147. Eric Mendelsohn. The Einstein Tower, Potsdam. 1921. *(Courtesy Mrs. Eric Mendelsohn.)*

Fig 14.5

in London.

The Einstein Tower of 1921 in fig 14.5 though predating the Moderne era, was looked up to as being a good example of 'Organic architecture'. Though streamlined in the extreme it lacks thesymmetry and repetition of most Moderne buildings. The stair case in fig 14.6 shows the same very flowing organic form. This is sharply contrasted by the stern more geometric pattern of the window frame behind it.

Many of the elements of Moderne architecture were first seen in the comic strips and films of the time. Fig 14.7 shows a early Walt Disney still. This little house holds most of the Moderne elements and even has a porthole window.

14.2 Cities of the future:

The artists of these comic strips and films were able to let their imagination run wild. The result was many streamlined versions of the ultimate city. A writer described H. G, Wells city in his film, "Things to come." "Deep in the sunless caverns, a new society, clad in garments containing complete radio telephone systems, inhabits windowless buildings, strolls along avenues from which automobiles are conspicuously absent and stands on broad flights of anachronistic steps. Communication seems to be largely by means of suspended railways, and elevators, mysteriously rising and descending in mammoth tubes of glass, give access to the different levels." A still from this film can be seen in fig 14.8

Anotherside of this world can be seen in the comic strip cartoons of Buck Rogers and Flash Gorden, both of which appeared in in the early 30's. Here the future is slightly more fantastic with space wars and huge space ships all in the streamlined style. As these stories developed the designers realised that streamlining is not neccessary in the vacuum of space. Their images became more fanciful but will always be stamped with that 30's look. Fig 14.9 shows a selection of toys from the late 30's designed for the

Fig 14.6

Fig 14.7

150. Vincent Korda. Model set for *Things to Come*. 1936. (*The Museum of Modern Art/Film Stills Archives.*)

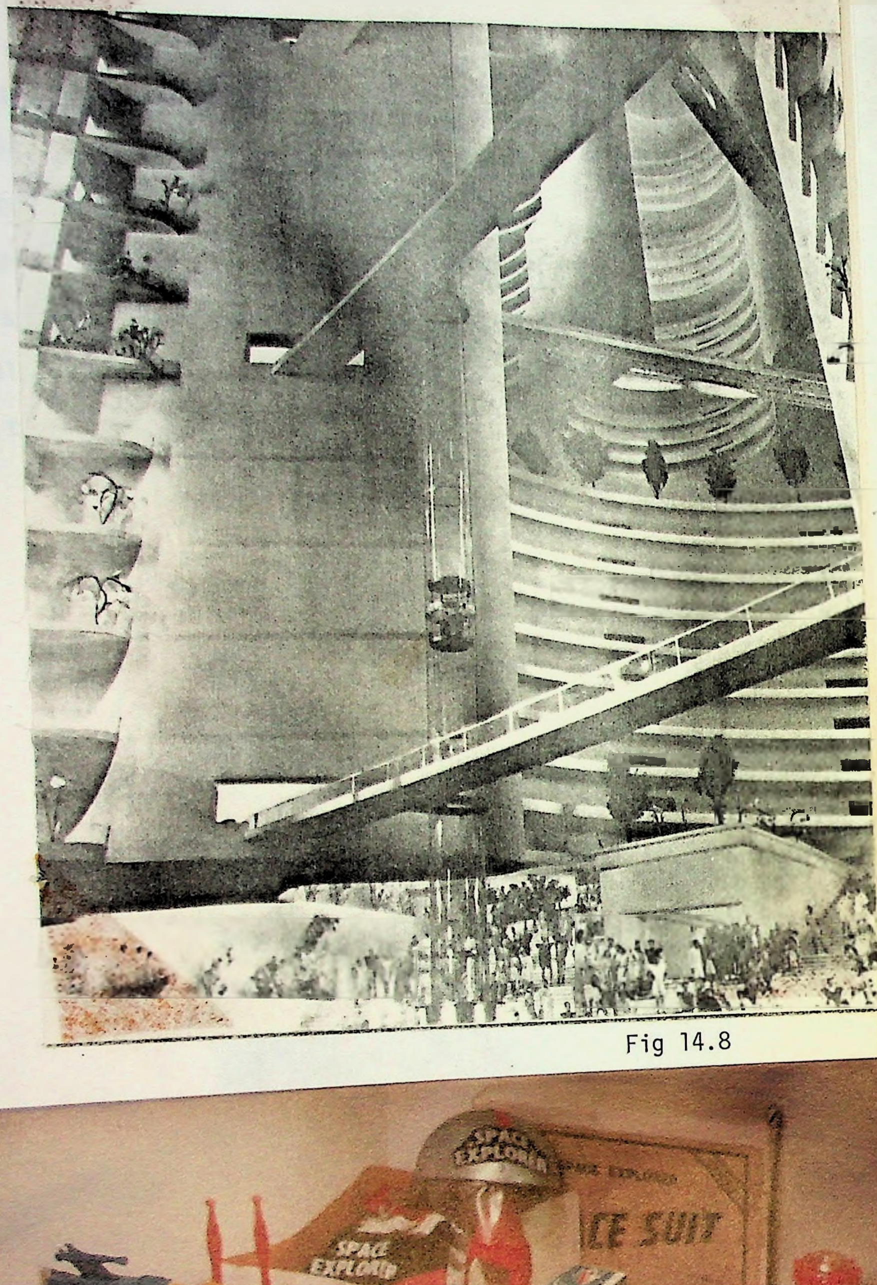


Fig 14.8

Fig 14.9

forward minded child. It was towards the end of the decade that U.F.O.'s or unidentified flying objects became popular. Records were kept by such bodies as the U.S. Air force and the number of entries ran into thousands every year. These were generally claims of sightings of the traditional flying saucer. See fig 14.10 Durning the sixties there was a shift in popularity towards cigar shaped objects. Could this have been a reaction to the Saturn rocket image.

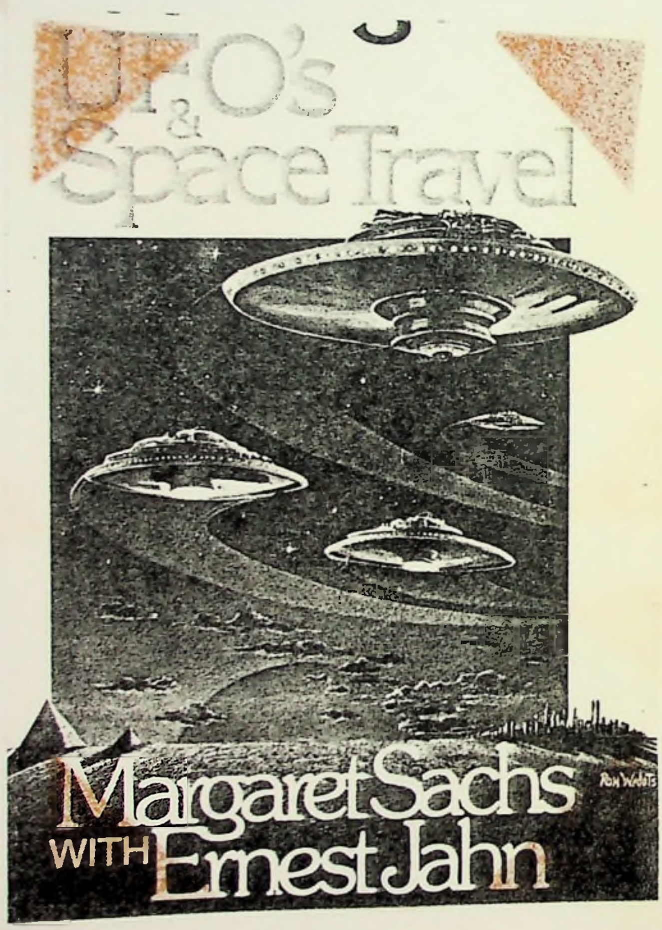


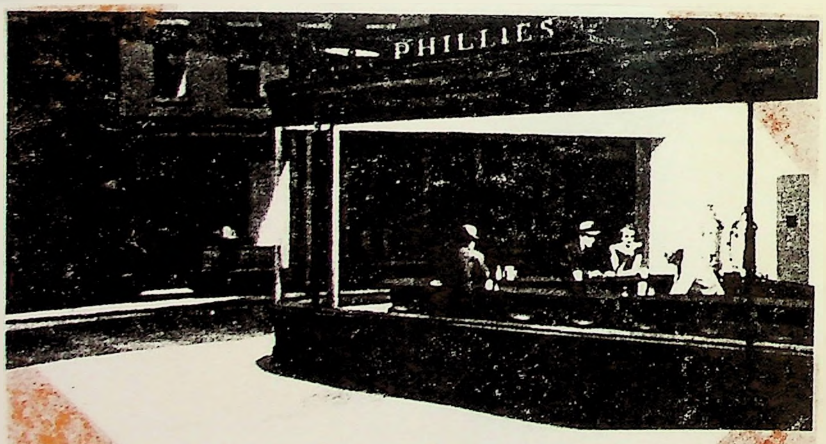
Fig 14. 10

CHAPTER 15

15. CONCLUSION:

If it hadn't been for world war 11, design might have followed the streamlined image to the present day. The future of the designers of thirties could have been our present. As it was the war knocked the movement off its rails. When it had finished people had largely forgotten about the teardrop life style. Designers retained some of the streamlined simplicity but were now able to try out other images. People had time to try a fresh start, dream up new utopias, such as the Hippy movement of the sixties. Machines and objects had their part to play in society but were no longer the star of the story. The era leading up to the thirties could be looked on as mankind discovering the machine and then trying to find aplace for it in our society. It seemed that instead of it adapting to our needs, we should fit into its "Streamlined functionilism." Our whole life style should follow under the laws of the machine.May be at the time of the thirties we were still a bit over-awed by what the machine could do for us. If this was the case, then it was world war 11 that was to be the testing ground where we could really put the machine to use and become its master.

I want to leave the last image of the streamlined era with the American Realist painter, Edward Hopper and his 'Nighthawks' This shows a somewhat depressing scene. People are housed inside a beautiful modern streamlined building, the dream architecture of the future, but they are alone and look lost.May be today we have learnt that people are not machines and dont react well when treated as such. Fig 15



Above: Edward Hopper. *Nighthawks* (1941–2). A masterpiece of the American Realism which Abstract Expressionism would soon displace.

Fig 15

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BIBLIOGRAPHY

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NOTE ON THE BIBLIOGRAPHY.

In all over one hundred books were consulted in the research stage of this thesis. The Bibliography given represents only a small selection of the books consulted.