Why Zeppelins Are Frightful

How a Zeppelin is built, how it navigates, and how it drops bombs

By Carl Dienstbach

THERE are three ways of building a dirigible airship. The first and the oldest consists simply in suspending from a cigar-shaped gas-bag a car in which the motor is carried. Such an airship (the non-rigid type), made famous in our time by Santos-Dumont, is apt to "buckle"—in other words, to break or bend in the middle. It can never be made very long for that reason. To prevent buckling the "semi-rigid" type of airship was invented—a type in which a stiff keel is attached to the under side of the long gas-bag, from which keel the car is suspended. The French built many semi-rigid ships of large size and proved conclusively that the idea is fundamentally sound. Then came old Count von Zeppelin, with his rigid type. Zeppelin had been an *attaché* in our Civil War and watched with great interest our attempts of over fifty years ago to use captive balloons for reconnoitering.

An Airship Must Preserve Its Shape at All Altitudes

Von Zeppelin had a good deal more in view than the building of a long airship which would not buckle or break in two. When a balloon or an airship of any kind rises, the gas within the envelope expands. At great heights it becomes necessary to let out some of the gas to prevent the bursting of the envelope. When the aeronaut drops later to a lower altitude the gas contracts, with the result that the envelope is only partly filled. That condition is dangerous because the strains are no longer distributed properly. What is more, the shape of the gas-bag is not the best for speedy propulsion. Therefore, all airships, with the exception of those of Count von Zeppelin, use what are known as "ballonets"—small air-bags within the big gas-bag. As soon as the airship drops, a blower connected with the air-bag by a pipe is started up in the car, and the air-bag is inflated to such a degree that the gas-bag in turn is distended to the full.

Count von Zeppelin wanted an airship that would preserve its shape at all altitudes, something that would not buckle. So he conceived an airship which consists of a very light but strong frame several hundred feet long. Within the frame he disposed a dozen and a half separate gas-bags. The outside of the frame was covered with a tightly stretched fabric. From the frame two cars were suspended in the earliest models. The cars were connected by a gangway and they contained the motors.

The Art of Building a Zeppelin Is Not Acquired Over Night

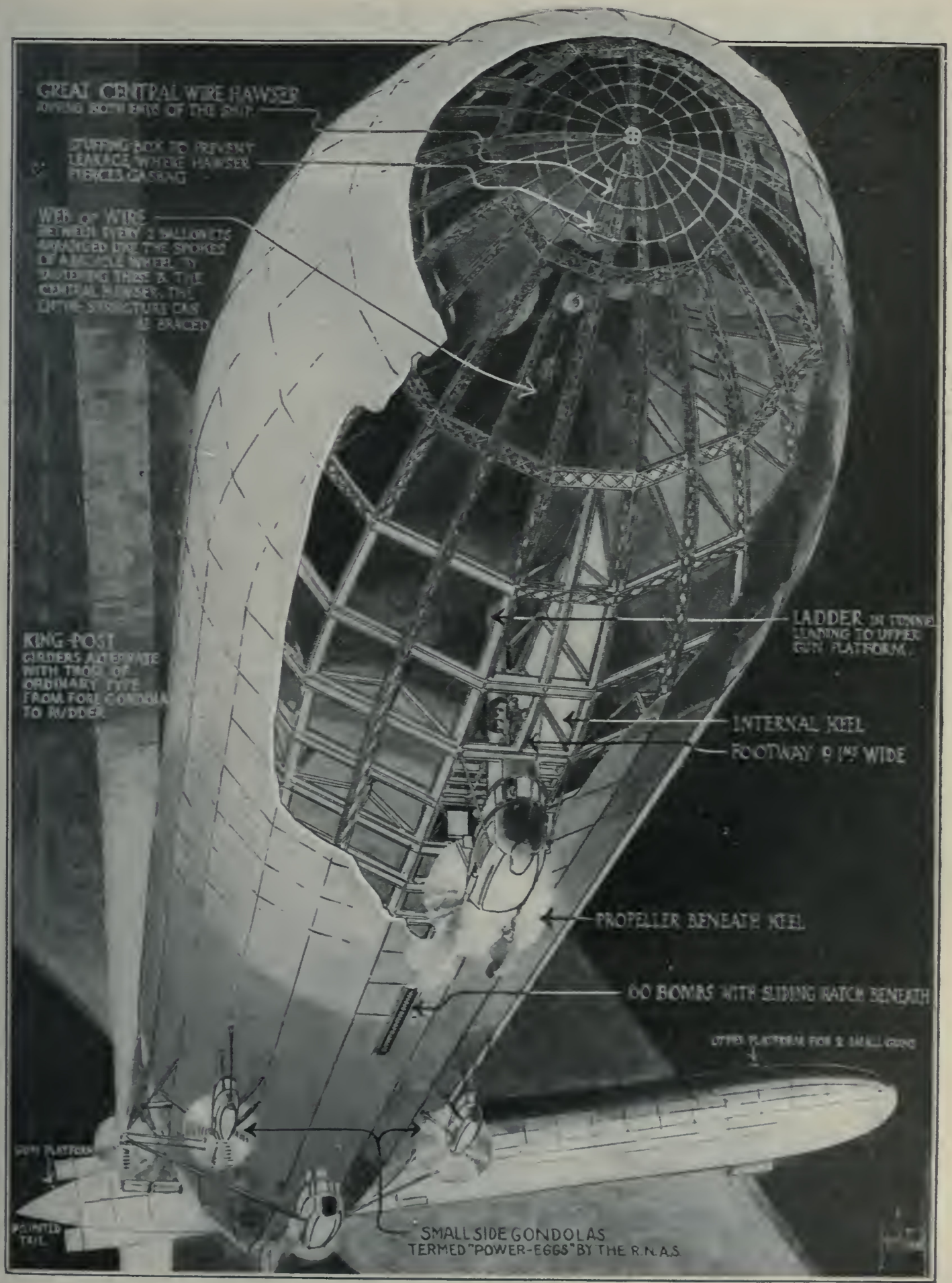
Now it is immediately evident that a Zeppelin thus constructed will always have the same shape no matter at what altitude it may be navigated. What is more, only a rigid Zeppelin can be made large enough to travel at very high speed. Everything depends on speed in a Zeppelin. Moreover, several gas-bags can be punctured without endangering the lives of the navigators.

It is doubtful if any country could start in at once and build Zeppelins. Indeed, England has tried it and failed. Knowledge of the kind that Count von Zeppelin acquired only after the loss of his entire personal fortune in experimenting and only after much financial assistance from the German people and from the German government is not gained over night. A nation cannot merely copy fallen Zeppelins and hope to succeed. It must do original thinking.

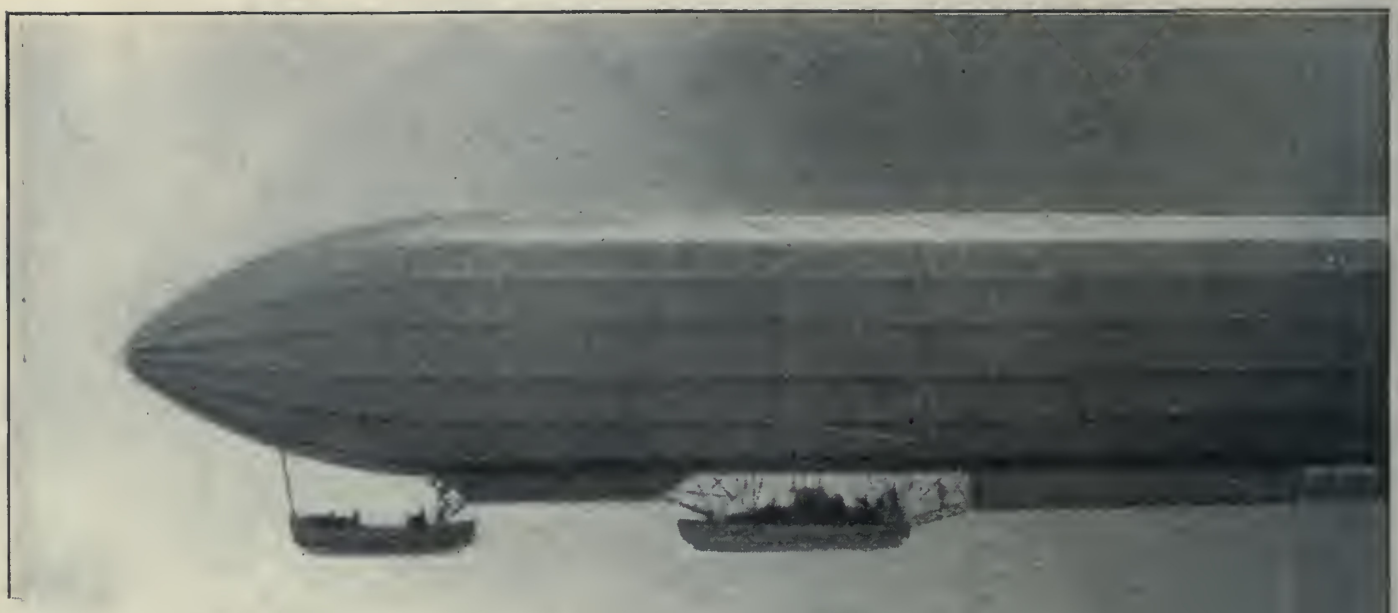
Is the Zeppelin the Surviving Type?

It is still much too early to write the aeronautic history of the present war. This much, however, is certain: With the exception of very small British motor balloons, called "convertible aeroplanes," and suitable only for short patroling journeys in fair weather, the Zeppelin is the only dirigible type that has survived the test of warfare. It seems to have totally eclipsed even the German non-rigid and semi-rigid airships. The war has apparently proved that speed is the life and soul of a dirigible, and speed the Zeppelins certainly have when it is considered that they are capable of making as much as sixty miles an hour against a twenty-mile wind and are on the

For All Its Bulk, a Zeppelin Has Not Much Substance



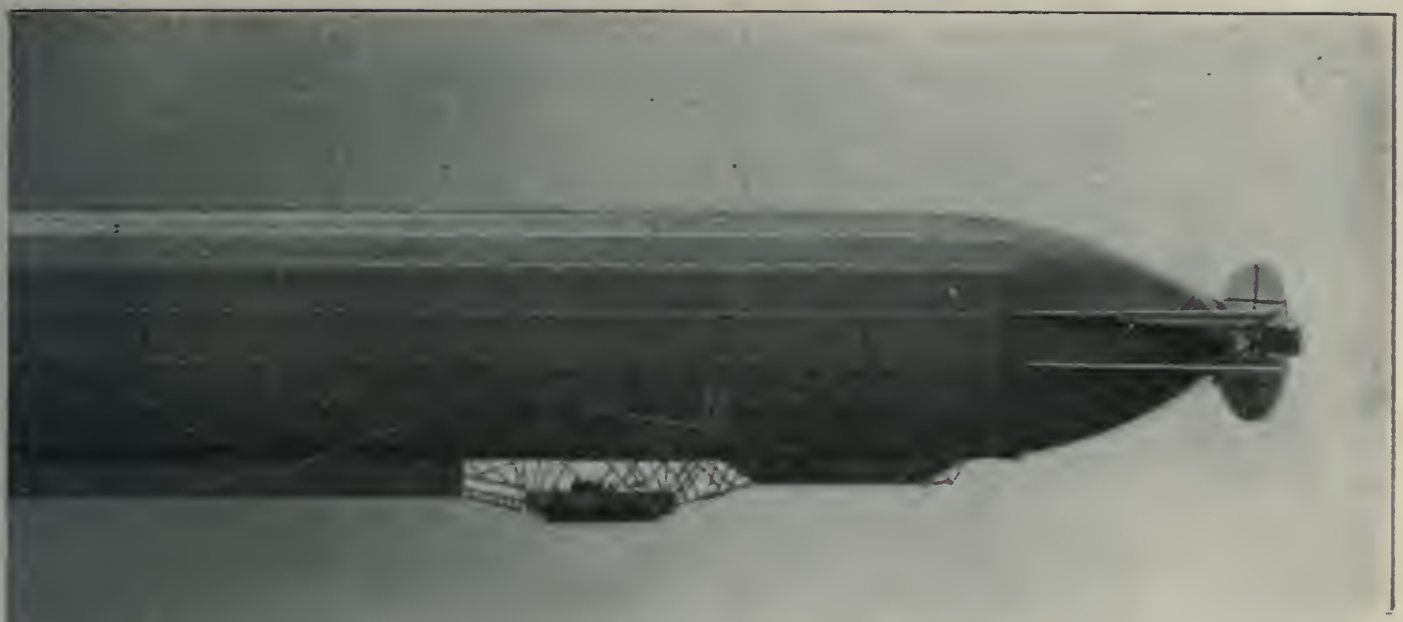
A broken-away view of a modern Zeppelin which gives a good idea of its internal construction. In the Zeppelin the gas is confined in about seventeen independent bags which are contained in a long cylindrical frame. A number of the bags may be punctured, but the balloon will still be buoyant enough to carry its navigators to safety and will retain its shape at any altitude



whole as fast as racing aeroplanes. Next in importance to speed, come great carrying capacity and great radius of action, both dependent on bulk.

Speed makes the Zeppelin practically independent of adverse winds. But speed is essential not to drive a Zeppelin obstinately against the wind in a straight line all the time, but rather to overcome an interfering gust in order to reach a region where favorable winds prevail. So, a Zeppelin may describe rather a devious course instead of that straight line which the geometries tell us is the shortest distance between two given points.

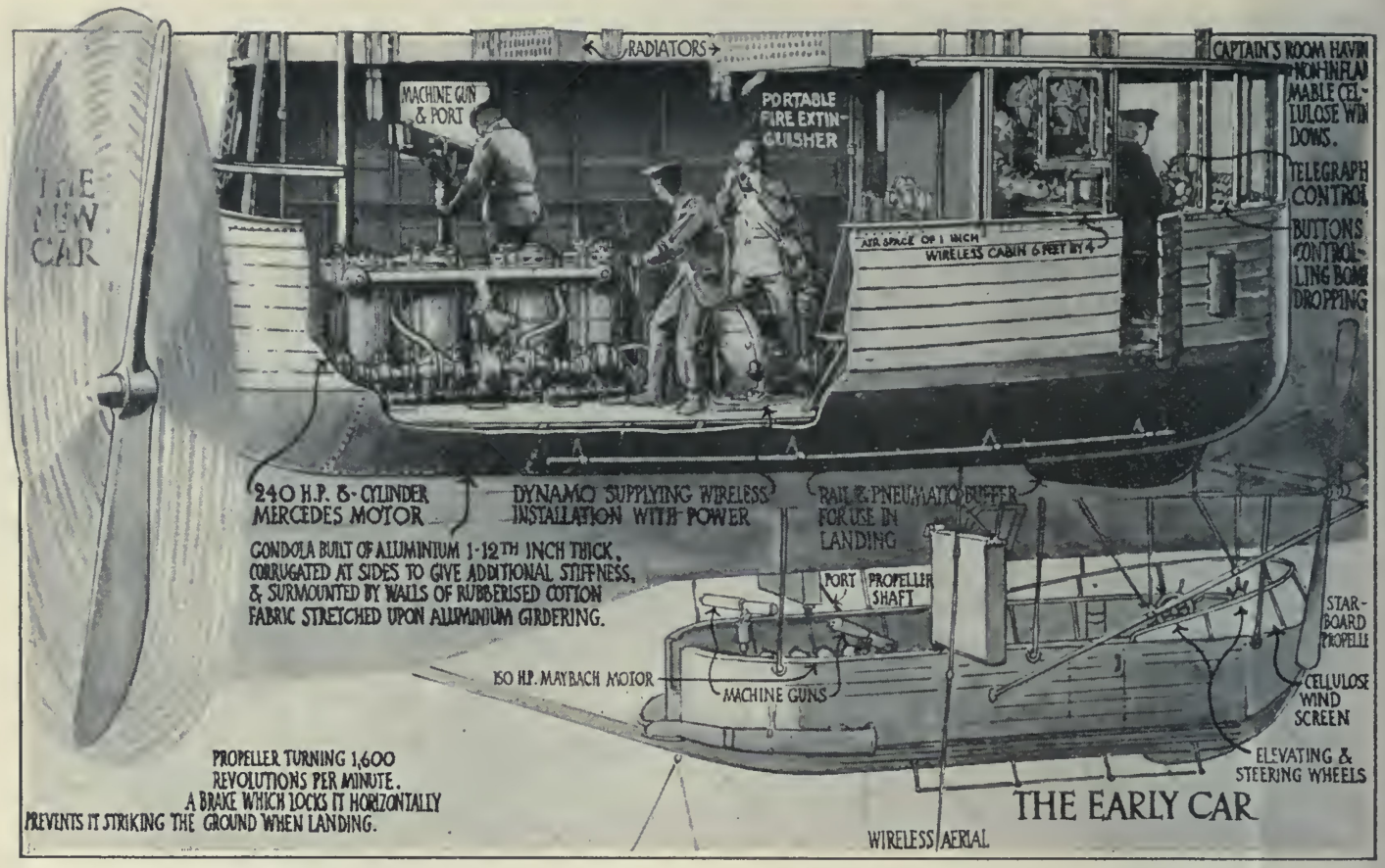
In this picture a Zeppelin is placed above the United States superdreadnought Texas. The comparative sizes have been carefully maintained. The Texas has an over all length of 573 feet, the latest Zeppelin is 670 feet long. But the battleship is more powerful



A Zeppelin Acts Like an Aeroplane

Speed converts a Zeppelin into a kind of aeroplane. Early in his experiments, Count von Zeppelin provided his giants with flat steadying planes. They are like the feathers on an arrow—steadying devices. Their effect must not be confused with that of the envelope itself. Any surface driven at high speed through the air has a lifting effect. That is why aeroplanes stay up at all. When the speed is very high and when the surface is designed as a Zeppelin's is, the lifting effect is so pronounced that the gas plays almost a negligible part in keeping the

A Zeppelin can drop bombs on the Texas all day without doing any more damage than blowing away the unarmored superstructure. She is armed with machine guns to ward off attacking aeroplanes and she carries a powerful wireless set for long-range communication



The early car of the Zeppelin and the new car are here contrasted. The new car is far more comfortable. It is roofed over probably to prevent the possibility of a chance spark reaching the gas envelope above rather than for any protection required by the navigators. Note the positions of the machine guns near the motor, which is unfortunate because of the motor vibration

craft aloft. The gas in a Zeppelin (but not in other types because they are too slow) is required for buoyancy only when the ship is standing still or merely drifting. Down on the ground, in starting and landing, the gas is a blessing.

By giving his titanic structures a speed greater than that of most railway trains, Count von Zeppelin has at one stroke removed all the fatal imperfections of balloon support—the fluctuations in displacement resulting from the chilling effect of high altitudes on confined gas as well as the changes in volume that take place in rising and falling.

I have spoken at some length about speed and the aeroplane lifting effect of a Zeppelin because the entire future of the dirigible depends on its transformation when in motion into an efficient aeroplane. Moreover, the Zeppelin is regarded both in Great Britain and in the United States as an out-and-out dirigible. Only recently an illustrated London weekly attempted to demonstrate the harmlessness of a Zeppelin by graphically depicting its diminishing gas lift at increasing altitudes. The powerful aeroplane lift was not considered at all! Similarly, in a presumably authoritative American review of European dirigibles, published just before the war, the aeroplane lift of a Zeppelin was considered negligible. And yet the Germans themselves constantly harped upon it! In one German official publication, for example, it was plainly enough stated that without aeroplane lift, a Zeppelin would be an impossibility.

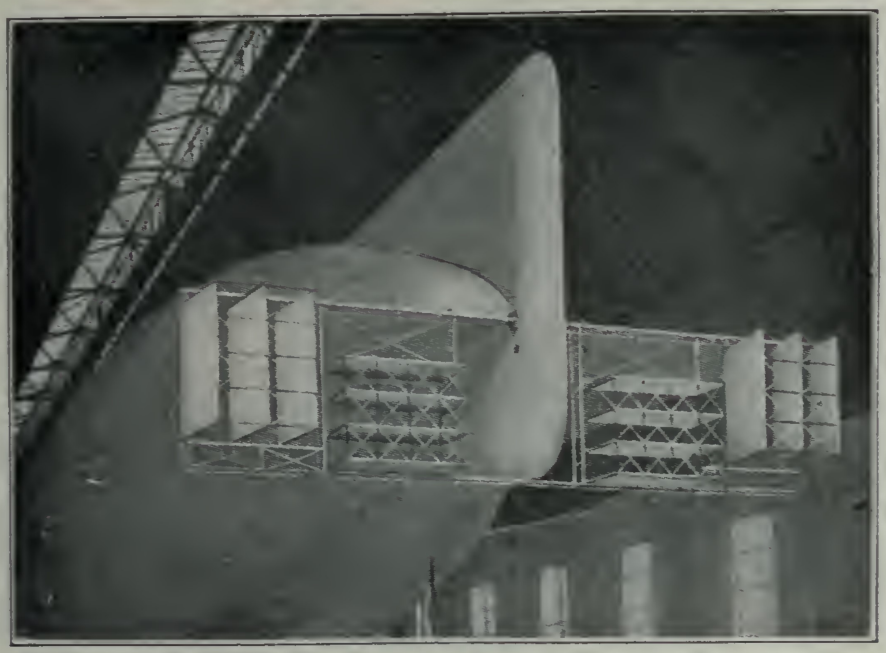
Advantages of Speed and Carrying Capacity

Next to speed, the most astonishing feature of a Zeppelin is its carrying capacity. That has its merits, especially in a fighting craft. It means that much cargo can be supported at high altitudes and that the favorable swift upper currents, prevailing chiefly at high altitudes, can be utilized for speedy journeys. It costs thousands of dollars to inflate a Zeppelin with hydrogen gas. Unlike other airships a Zeppelin need not be inflated to the full at low altitudes, but with just enough to allow for complete expansion at high altitudes. No loss is incurred to relieve pressure.

The third advantage which accrues to a Zeppelin because of its great size, the advantage of enormous radius of action, is of

minor importance. Radius of action has simply the military advantage of rendering it unnecessary to alight at sea or in the enemy's country for lack of fuel or gas.

The frame of a Zeppelin is built like a bridge. But no one would dare concentrate at one point all the load that a bridge is designed to support. The load on a bridge and the load carried by a Zeppelin must be distributed. Hence the new Zeppelins have four cars. The two in the center are each sixteen feet long and the others, placed fore and aft, are thirty feet long. The cars are roofed over in order that a chance spark may not fly up to the gas-bag, with results that may be imagined. There used to be a long well-equipped central cabin between cars into which the crew would retire when off duty. Now, the crews apparently confine themselves to the cars.



Stern view of a Zeppelin showing the vertical rudders, the horizontal rudders, and the lifting surfaces which serve to steady the Zeppelin like the tail feather of an arrow

The Guns and Bombs of a Zeppelin

The most modern super-Zeppelin carries a battery of nine machine guns—six in the cars and three on top of the gas envelope. Two guns are sometimes mounted on the envelope near the bow. This distribution of armament does not seem to make the best use of the possibilities of a Zeppelin as a gun platform, for a Zeppelin is as steady as a rock, except the stations near the motors. Vibrating motors are but poor companions for guns, and the guns on top seem to lack shelter for delicate sighting instruments. Perhaps no other arrangement is possible. It must not be forgotten that for all its bulk a Zeppelin has not much substance. In that respect it may be compared with an immense cloud or with a filigree structure. The vibrating motor cars may be the stanchest gun platforms that can be provided under the circumstances. The passage-way between the cars is certainly too narrow for guns. In view of the British aeroplane victories over the Zeppelins it may well be that Count von Zeppelin's designers have now decided to invest more weight in favorable gun positions. But it seemed wiser to put weight into such strict necessities as a powerful electrical equipment for a dependable long range wireless equipment; into dynamos coupled with six 240-horsepower motors (dynamos used to supply current to the searchlights as well as for illuminating the cars, for heating and for cooking); into a large supply of heavy bombs and strong motors for speed and lift; and above all, into much fuel for remaining aloft many hours.

The bombs are carried under the belly of the vessel, like the roe of a fish. Indeed, in military slang, bomb-dropping is called "laying eggs." The bombs are electrically released. Each of the sixty bombs is controlled by a button. When the captain pushes a button a 120-pound bomb drops.

Americans will naturally wonder whether New York or Philadelphia may not be compelled to put out their lights at eight o'clock and conceal themselves. While a Zeppelin undoubtedly could cross the ocean, it could not do so with any great load of bombs. Great as the radius of action of the Zeppelin is, it must remain within navigating distance of its base. And even a Zeppelin would hardly venture upon a bomb-dropping excursion which would entail a voyage of eight thousand miles, at the very least, without replenishing its fuel tanks.

Unlike an aeroplane a Zeppelin cannot alight anywhere with impunity. A *Mauretania* must have her wharf; Zeppelin must have its shed. To be sure a Zeppelin, like a *Mauretania*, can anchor. But she runs risks in doing so.