THE PARSEVAL AIRSHIP

BY CARL DIENTSBACH

When the "air balloon" was invented by the Montgolfiers and Charles, the belief was general that the most difficult part of the problem of human flight was then solved, and that it would require but slight additions to the inflated bag to make it a useful means of transportation. Hundreds of schemes and attempts were suggested to supply the "slight additions." How astonished one of these early naïf "improvers" would be if he could see his dream come true!

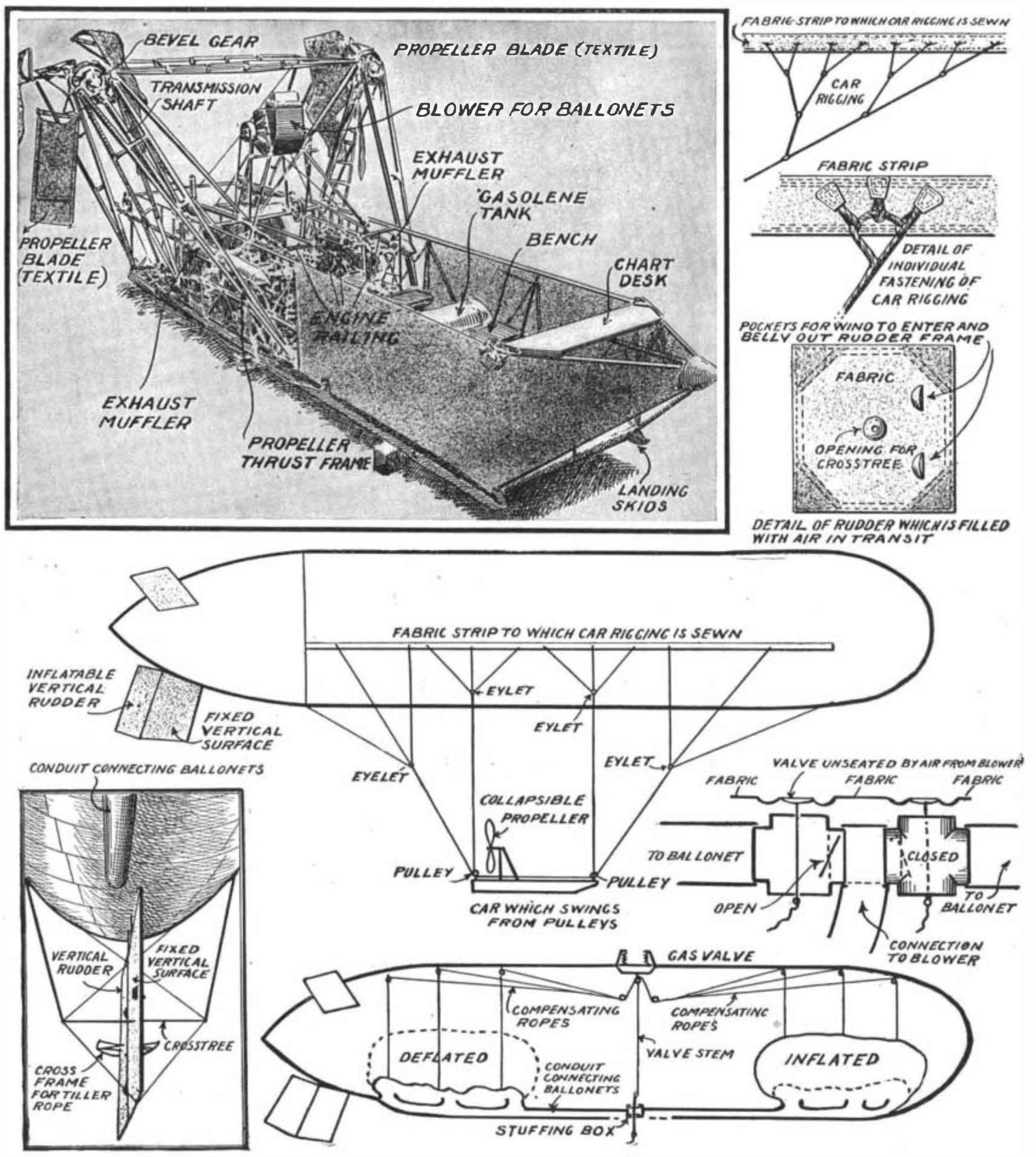
Perhaps the most practical airship of our day is the Parseval, which in truth may be called a gas bag with slight additions. The Parseval airship owes its great advantages precisely to the fact that its inventor did not aim at creating something essentially different from a balloon, that he intended to preserve every single good and practical feature of the time-honored "spherical," and that he strove for his comparatively modest goal with so much ingenuity.

A sight not altogether unfamiliar, would greet the eye of Parseval's eighteenth century admirer. First, he would be pleased to learn that the aircraft of his own day, after remaining exactly the same for over a century, had suddenly seen great technical improvement at the beginning of the twentieth century. The gas-retaining qualities, the strength and toughness, the lightness of the new double rubberized and biased balloon cloth would be a revelation to him. Without that fabric the new airship would never have come into existence. But what should otherwise appear really novel to him might only seem as if it were like a "touch" added here and there, but the "touch" of a master hand—comparable to the slight application of the brush, by which great painters are known to have turned a pupil's work into an everlasting masterpiece. Thus the fundamental change from the spherical balloon—the elongated gas bag—means in the Parseval an almost true "form of minimum resistance." This fact is due to the very propitious circumstances which favored the work of Major von Parseval.

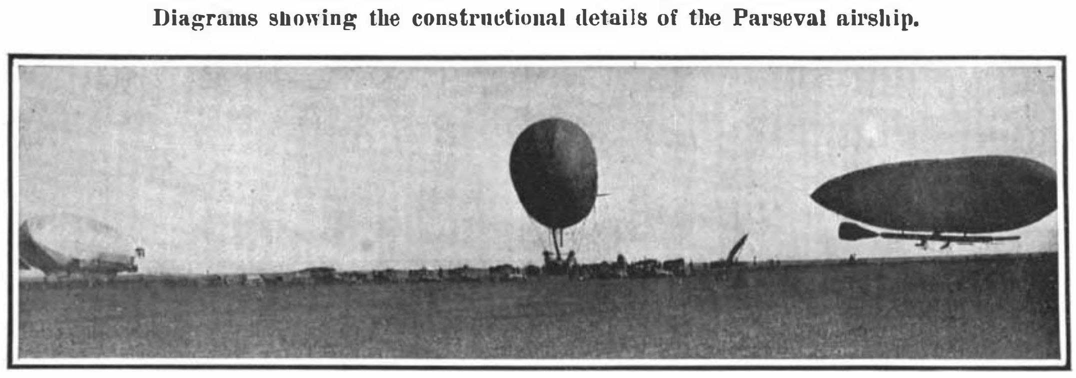
It happened that the great German "Society for the Study of Motor Aeronautics" was founded at the initiative of the emperor at the exact date that his first experimental airship was tested. This organization counted among its members the most prominent financiers and the ablest scientists and engineers of the fatherland. Major von Parseval's work presently became the point around which its endeavors crystallized.

All its energies were soon concentrated on the improvement of his simple system, which was justly recognized to promise immediate success. After the model of Professor Zahm's aero-dynamical laboratory in Washington, the society built a laboratory for aerodynamical research at Goettingen, and put Prof. Prandl of the Goettingen University in charge. In a big Zahm wind tunnel the best shape for the hull was developed on tin models, thus verifying the prediction of Prof. Woodward, president of the St. Louis International Aeronautical Conference, 1904, that the result of Prof. Zahm's and Prof. Nipher's work combined (the latter on the distribution of wind pressure on structures), both submitted to that conference, would result in a form of least resistance for the hull of an airship. Professor Prandl investigated the pressure by means of small holes bored along the whole surface of his models and communicating with many interior compartments, which were alternately connected to pressure gages. He was thus enabled to draw accurate curves. The almost spherical front of the shape evolved by Prof. Prandl would seem most familiar to the man of the eighteenth century. The big fish-like steadying fins at its stern, so conspicuous by their simplicity, would be a surprise. These are indeed the principal contribution of the twentieth century to the old balloon. Invented by the late Col. Renard as early as 1884, they remained a secret up to 1902. The reason for the specially efficient use to which they were put by Major von Parseval is the fact that he, in a way, had independently reinvented them. Even the rudder is so deftly hinged to these fins that it hardly shows. Yet it has an unusually efficient shape and position.

The resemblance of the Parseval to an ordinary spherical is due to the fact that it was evolved from a balloon. Parseval first developed an elongated captive balloon that could be operated in heavy winds. In co-operation with the late Capt. von Siegsfeld, he did this so well that his so-called "Drachen Ballon" is to-day introduced into the military service of most powers. To his airship it is almost as closely related as a glider is to an aeroplane, or a towing barge to a steamer. It offered two formidable problems, steadying it in the wind, and properly suspending the car. To arrive at the nucleus of the Parseval airship nothing more was needed than to modify the "Drachen Ballon." The rounded, sausage-shaped steadying bag of the "Drachen Ballon," whose excessive drag prohibited its use as an airship, was first turned into three rectangular hollow "mattresses" stiffened by internal pressure and part of the balloon. The "Drachen Ballon's" ingenious suspension, flexible to prevent excessive rocking in the gusts, was easily turned into the famous Parseval airship suspension, which allows a "car on wheels" to roll ahead or back on steel ropes, with the air pressure against the gas bag.



Diagrams showing the constructional details of the Parseval airship.


The Zeppelin. The Parseval. The Gross.

Three typical German airships.

THE ZEPPELIN AIRSHIP.

To these ingenious devices the Parseval airship owes its existence. Without them it would not be feasible to suspend the car low enough to distribute its weight sufficiently over the whole length of the bag to make it possible to dispense with any sort of a stiffening frame. The ship would pitch so violently that it could not be propelled. Still this very feature is a weak point of the "non-rigid" system. Its inventor personally remarked to the writer, when complimented on the truly beautiful appearance of the "rigging": "Its air resistance is something to be reckoned with." The great saving of weight it permits is thus partly offset. A Parseval has also most of the faults as well as the virtues of an ordinary balloon, while the purely rigid construction, as represented by Zeppelin, Schuette, and others, aims at turning the aerostat into a true "ship." Their goal is infinitely higher, and therefore fundamentally entitled to a more lenient criticism. The ample carrying power of a non-rigid airship makes indeed a large Parseval (type B) a thing of amazing solidity. For instance, the thinnest rope in the suspension has the thickness of a man's finger. The steel wire cables on which the car rolls have the same thickness. The car, detached, as to size and strength, looks almost exactly like a "freak" gasoline launch.

Its board floor, solid as a boat's deck, is 30 feet long and over 6 feet wide. The frame carrying the propellers is made of steel tubes as thick as a man's arm. The center of each propeller is about 12 feet above the floor of the car, and each is also slightly over 10 feet in diameter. The width of each of the four rectangular blades is slightly less than 2 feet. The non-rigid propellers, very inconspicuous when at rest, and directly attached to the car, also increase the resemblance of the Parseval to an ordinary balloon. Each propeller has a girder work hub of steel, skillfully designed to withstand all working stresses with a minimum of material, to which hub four cloth blades are fastened like so many flags. The blades are made of two strong wire ropes with cross-pieces of steel, sewn into a double layer of heavy balloon fabric. Major von Parseval explained to the writer that by correctly proportioning the weight of different parts of the flexible blade to a given speed of revolution and a given pitch, any desired form of the blade could be obtained from centrifugal force acting against the pressure of propulsion. It has indeed been claimed that these blades are more efficient than solid ones. In the newest Parseval ships they are made semi-rigid—just stiff enough to preserve their shape when at rest—as a matter of convenience.

The Parseval power plant has been brought to such a state of reliability that it should furnish a fitting model for any kind of aircraft, especially flying ma-

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Show case, D. A. Huffman	966,019
Sign, illuminated, J. Swenson	966,267
Sink cover, E. M. Beland	966,298
Sled, W. Gillaspie	966,006
Sliding gate, L. M. Parsons	966,047
Smoke consuming apparatus, Marshall & Hargreaves	966,109
Smoke washer, Schroeder & Kessler	965,954
Snap switch, rotary, G. B. Thomas	966,368
Soils and for other purposes, apparatus for testing, W. H. Bowman	966,078
Solar heater, W. G. Bailey	966,070
Soldering iron, self heating, K. Erler	966,183
Spark plug testing device, H. R. Willard	966,146
Spindle and bearing for slubbing, spinning, twisting, or like machines, W. R. Erskine	966,184
Spirometer, G. W. Ramage	966,050
Spout for water columns, F. C. Anderson	965,849
Spray burner, A. T. Rigg	966,124
Spring wheel, Bailey & Jansen	966,296
Stacker, hay, J. L. Bowman	966,304
Stair nosing and the like. G. B. Staples	966,133
Stamp, time, C. M. Crook	966,384
Stamps, detachable pad for self inking, T. H. Cox	965,874
Stand. See Flower stand.	
Stationery for transmitting and recording bank collections, J. L. Price	966,359
Steam boiler, T. E. Durban	965,883
Steam generator. W. G. Hay	966,201
Steam power apparatus, W. C. Anderson	965,850
Stenciling apparatus, G. Dezavis	966,174
Strainer, milk, Mowry & Mullaney	966,039
Sub irrigation system, J. P. Hardin	965,895
Sugar mill housing, W. G. Hall	966,199
Sweeping composition, O. W. Severns	960,060
Switch controller, Gunthorpe & Wade	966,397
Tamping device, G. A. Anderson	966,292
Tandem spring and friction draft rigging, J. F. O'Connor	966,234
Tank heater, E. B. Wills	966,147
Tap wrench, F. O. Wells	965,970
Target finder, H. J. Hegwer	966,332
Target, recording, S. A. M. Rose	966,361
Telegraph and other poles, protector for, R. B. Lamb	966,337
Telephone exchange system, J. L. Wright.	965,976
Telephone exchange system, C. E. Hague.	966,013
Telephone receiver, E. Schwartz	966,247
Telephone system, O. C. Dennis	965,876
Telephone trunk circuit, C. S. Winston	965,973
Temperature indicating system, G. W. Levengood	966,224
Tetramethylendiamin, making, Hofmann & & Coutelle	965,903
Tile, composition for the manufacture of a, J. P. Hardin	965,894
Time switch, W. C. Pugh	966,118
Tire repair vulcanizing device, F. A. Blanchard	966,302
Tire, resilient, E. B. Merigoux	965,922
Tire tool, P. F. Bellew	965,858
Tires, making cushion vehicle, J. A. MacMillan	966,031
Tobacco pipe, C. A. Jansson	966,021
Tobacco press, W. L. & R. L. Russell	966,126
Toilet comb, J. M. McCall	966,113
Tool, combination, J. H. Dunstan	966,321
Tool holder, B. M. W. Hanson	965,893
Toy, H. F. Samstag	966,127
Toy dump cart, H. T. Kingsbury	966,103
Toy target, W. S. Root	966,056
Train order deliverer, N. Forsythe	966.392
Transplanting machine, G. E. Autry	965,980
Trap, L. Jauregin	966,213
Tray, bottle, F. Sochurek, Sr	966,258
Trolley, S. H. Smith	966,255
Trolley safety lock, J. L. Blair	966,301
Trousers supporter, F. M. Hilgert	966,093
Truck, V. A. Jenks	966,214
Truck frame bolster guide, H. T. Anderson	966,376
Truck frame, car, W. F. Richards	966,123
Truck frames, bolster guide for, H. T. Anderson	966,375
Truss, W. Lange	966,221
Tubing, E. T. Greenfield	966,396
Turbine blade fastening means, C. E. Sweet	966,138
Turbine, combined liquid and gas, C. E. Brockhausen	965,085
Turbine, gas, L. Samoje	966,363
Turbine rotor, O. D. H. Bentley	966,157
Type for typewriting machines, manufacturing, W. R. Fox	966,188
Type into classes for distribution, apparatus for separating, D. B. Ray	965,939
Typewriter back spacing device, C. Mercer	966,035
Typewriting machine, C. E. Smith	965,957
Typewriting machine, M. S. Cumner	966,169
Typewriting macbine, H. E. Curtis	966,170
Typewriting macbine, A. G. F. Kurowski.	966,219
Urinal, N. Frost	966,189
Valve, E. J. McCarty	966,040
Valve, S. H. Woodridge	966,150
Valve, Haig & Porter	966,198
Valve, R. W. Elder	966,390
Valve, exhaust muffler cut-out, H. Miller	966,345
Valve, flush, J. Rothchild	965,946
Valve for air pipes, butterfly, A. Faget	965,999
Valve for dash pots, regulating, C. Dorn	966,320
Valve, inflation, J. E. Keller, Jr	966,023
Valve mechanism for internal combustion engines, H. Steingassner	966,367
Vaporizer, formalin, J. J. Van Dandaigue.	965,966
Vehicle running gear attachment, R. Grube	966,327
Vehicle step, C. P. H. Nelson	966,043
Vehicle top, G. F. Brewster	965,864
Vending machine, coin controlled stamp, C. Elliott	965,996
Veneer applying machine, A. S. Nichols	965,927
Ventilator, L. S. Levi	965,916
Voting machine, L. R. Winslow	966,148
Wagon dump and grain elevator, portable, H. S. Swanson	966,062
Wagon reacb, D. Cosner	965,990
Washer. See Smoke washer.	
Washing machine, D. Cameron	966,080
Watch winding and setting mechanism, E. Wolf	966,149
Water closet valve, B. T. Beardsley	966,407
Water gage attachment, Z. C. Ferris	966,323
Water gage glass, N. Zucke	966,288
Water meter, H. I. Dilts. 966,316 to 966,319,	966,388
Water softening apparatus, K. W. Bartlett	966,071
Weeds, destroying, W. Hoskins	965,905
Weighing machine, automatic, A. Sonander	965,959
Welding apparatus, electric, A. E. Buchenberg	966,382
Wheel rim, vehicle, J. M. Alderfer	965,847
Whip rack, E. Dillabaugh	966,315
Window, O. M. Edwards	965,995
Window provision holder, A. W. Sutherland	966,266
Window screen, C. J. Wallen	966,065
Windows, antirattler for, Clark & Rosenberg	965,988
Windows, antirattling, dust and weather guard for, I. H. Athey	965,851
Wire clamp, H. R. Ritter	966,243
Wire netting, manufacture of woven, A. W. Storey	966,137
Wire splicer, A. V. Anderson	966,152
Wire with yarn or its equivalent, machine for covering or insulating, D. Noble	965,928
Wooden articles and preventing straightening thereof, forming bent, T. R. Bruffy	966,308
Woodworking machine, C. W. Borg	965,983
Woodworking machines, guide and chip breaker for, C. W. Borg	965,984
Wrap, N. T. Mercey	965,921
Wrench, W. E. Paulson	965,929
Wrench, W. C. Schneider	966,130
Yoke holder, neck, H. E. Dey	965,993
Zinc oxid from zinc ores and products, obtaining, Hommel & Sulman	966,209

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since October 4th, 1859, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

THE PARSEVAL AIRSHIP.

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chines. There are, of course, two motors. To insure the highest possible economy when only one motor is running there is a coupling arrangement by which two propellers in tandem may be driven by either motor alone. The girder construction of the hubs has been fashioned into a mechanism that permits altering and even reversing the pitch of the propellers while they are running. This is done by a convenient hand wheel at the side of the car. The pitch is always adjusted to the most economical number of the motor's revolutions. With one motor driving both propellers the pitch is lowered until the propellers run quite as fast as with two motors.

The last reason for the striking resemblance of the Parseval airship to an ordinary balloon is the absence of any horizontal rudders. Steering up and down, i. e., tilting the keel, is effected by a principle similar to that which makes an ordinary balloon go down. Gas is removed from the end to be lowered. It is not lost, but merely transferred to the opposite end, whose lift is thus increased at the same rate that the buoyancy of the other end is diminished. This is done by means of two air ballonets (each with ⅛ of the cubic capacity of the gas space) in the opposite ends of the envelope, a powerful blower, driven by a double belt from each motor, and large distributing valves for the air blast. All this forms a specially substantial and conspicuous part of the machinery, and has been designed to stand rough usage. The blower is carried in the propeller frame, some 8 feet above the floor of the car. The vertical air hose leading to the bag is stiffened by strong wooden rings. The large distributing valves of aluminium are at the same time automatic safety valves. They are so attached to the envelope that any excessive gas pressure moves a plunger and allows the air to escape. The gas pressure is relieved in this manner as long as either ballonet contains any air. If both are completely emptied they automatically pull the maneuvering gas valve on top of the envelope open, an arrangement copied from the "Drachen Ballon." There is considerable mechanism inside the gas bag which has never been described. This was sketched for the writer by Major von Parseval himself. In order to keep a certain amount of control over the "convulsions" of the ballonets inside while they swell or collapse, a series of cords is fastened to their upper surface. They are united into one rope that runs over a pulley suspended above either ballonet from the inner "ceiling" of the gas bag. Thus the ballonets are made to swell and collapse more evenly. If excessive expansion of the gas by heat or height should ever squeeze all air out of the ballonets this rope, under tension, would exert a pull strong enough to open the gas valve on top. A single gas valve is thus made to serve as both a maneuvering and a safety valve. The valve stem is led through a stuffing box in the bottom of the bag. Two ripping panels and cords, one at either end, are provided, as in a spherical balloon. For the guidance of the pilot there are four pressure gages, one for each air ballonet and one for each end of the gas space. They register in centimeters of water, and consist of U tubes of glass filled with red liquid. The front end of the car is covered by a chart desk. A compass, designed by Prof. Marcuse, is suspended over the pilot's head, who reads the inverted dial from below. A small vertical steering wheel shaped like that of a ship is directly in front of the chart desk. The pressure gages mentioned are attached to the right "gunwale" of the car, and the lines controlling the distributing valves press down from above also on starboard. The compass may easily be taken down and with an iron tripod attached to "ship shape" brass fittings sunk into the car's board floor. This is done for nautical measurements of the sun's

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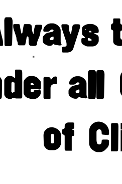

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position. There is, of course, in addition to the usual barograph, barometer, statoscope of the spherical balloon, also an air bubble to indicate the "tilt." The frame of the car is made of steel tubes and T girders, covered with wire netting and heavy canvas. A large cylindrical gasoline tank in a cloth casing serves as a back to an elegant bench upholstered in red leather, running across the car, and dividing it into a "bridge" and "engine room." This bench accommodates six passengers. For the pilot and his aides there are camp chairs. The spacious engine room, with the smart iron railing around the motors, differs in no sense from that of a boat, even as to its minute cleanliness. The motors are of the six-cylinder type, each good for 120 horsepower maximum. They were selected after a competition and have never given trouble. The radiators, arranged like an inverted V, close the car in the rear. They are of aluminium, very imposing, each about five feet square, but quite light. Cooling is effected by powerful blowers set in a casting. These spread the blast evenly over the whole radiating surface. The motors are cranked with the throttle almost closed and the propellers are thrown in by clutches.

The rigging is as elaborate and picturesque as that of a clipper ship. It was found that anything could be attached directly to the gas bag, to reinforcing "patches," which doubled and trebled the thickness of the cloth. There is an "equatorial belt" carrying the suspension, and there are many other "patches," some of them shaped like a star, to hold a single rod. The stablizing fins are now made of steel frames covered with cloth on both sides. The "air mattress" idea has been dropped, but the cloth is still kept from fluttering by allowing the wind to catch in a "mouth" and blow between the two layers. The tiller rope ends in a steel band that fits around a large semi-circular pulley fastened to the rudder. This insures precise action. The stablizing planes are held in place by a very simple and strong arrangement of rods and stays fastened to the envelope as described above. The suspension branches back with innumerable "crows' feet" (the original ones made of three loops of rope each, sewn to the equatorial belt) from many short hemp ropes into fewer and fewer wire ropes. Everything is flexible. All loops are lined with fittings of aluminium or steel, allowing the ropes to slide with little friction and preventing excessive wear and tear. The car, with four grooved wheels, rolls on two strong inclined cables of twisted steel wires, into which most of the branch ropes finally consolidate. But at the same time it swings like a pendulum with parallel motion from six vertical ropes.

A Parseval's handling is nearly as simple as that of the ordinary round balloon. It has been inflated in the open, and it can be landed, by valve and ripping cords, with safety, with disabled motors in a storm. There are many "handling ropes," each with a series of loops, giving a firmer grip. They hang down from the whole length of the bag and are an integral part of the rigging.

At Frankfort in 1909, during the International Aeronautic Exposition, where the ship ascended, one of these dragging ropes coiled around a man's legs and raised him into the air like a feather, although the balloon had no surplus lift. Thus the lifting power of the propellers and the tilted hull was forcibly shown. The ship was always actually heavier than the air when it left the ground in a slanting direction. Coming down was harder than going up. The consumption of fuel lightens the ship, and it is considered "unsportsmanlike" to let out gas. The low center of gravity, in spite of the flexible suspension, prevents a tilt as sharp as that of the Zeppelin III," which swoops down like a hawk. The "Parseval III." must "screw itself down" in many spirals. On one occasion, in bright sun-

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shine, it could not come down at all, much to everybody's amusement.

At Frankfort, where the Parseval system was permanently represented by its largest and most serviceable type (6,600 cubic meters, or 223,079 cubic feet, displacement) comparison with the "Zeppelin II." and "Zeppelin III." by visitors at the exposition could easily be made.

The virtues of the Parseval system are so obvious and simple that they can be easily understood from theory. With the Zeppelin system it has been mostly results that counted with the public. Like the Wright flyer among aeroplanes, the Zeppelin among airships has gone farthest and fastest with the lowest power and the least consumption of gasoline and oil. It has lived through the change from night to day and day to night and morning again in a single trip without stopping. It is well known how much less gas these changes in temperature and height would have meant for an airship made like an ordinary balloon. Still, compared to the Parseval, which may be said to have practically reached the pinnacle of its development, the Zeppelins may not have half realized as yet the inherent advantages of a rigid construction. They had to pay the full toll for their "extravagant" mode of handling, but did not nearly enjoy the full recompense. The Parseval is the airship of to-day, the Zeppelin that of the future.

The fundamental difference between the two systems may be stated thus: The Parseval, with its sharp distinction between "car" and "balloon," always remains a "unit," more or less. A Zeppelin, in larger sizes, becomes purely a conglomeration. A Zeppelin's weight, therefore, increases at a lower rate than its lift. The "Deutschland" points the way to the giants of the future, with no cars, but a continuous "hold" and the load everywhere directly under the gas that lifts it. A Zeppelin may also have an "upper deck." It is there already; for on the uppermost "strake" a man may now safely walk from end to end after having ascended through the hull. A few thin boards and a light aluminium railing will complete it.

The Parseval ships at present are built in the following dimensions:

Displacement, Cubic Meters.	Length, Meters.	Maximum Diameter, Meters.	Maximum Width Over Fins, Meters.	Maximum Height, Meters.	Car Length, Meters.	Width, Meters.	Height, Meters.	Speed, Meters a Second.	Endurance, Hours.	Height Obtainable, Meters.	Passenger Capacity.	Men Needed for Handling the Airship.
Type A, 4,000	60	10.4	16.0	20	0.6	1.3	1.2	13	15	2,000	6	3
Type B, 6,600	70	12.3	17.0	22	1.0	2.0	1.4	14	20	2,500	10–12	3 or 4
Type C, 2,000	50	8.6	14.0	18	5.5	0.8	1.1	11	8	1,000	4	1 or 2
Type D, 1,200	40	7.7	12.0	16	5.0	0.7	1.0	9	5	600	3	2 or 3
Type E, 3,200	60	9.4	15.0	19	7.0	1.3	1.2	10	6	1,500	6–8	1 or 2
Type F, 1,600	45	8.2	12.5	17	5.5	1.0	1.0	8	5	600	3	....

Types A and B have two propellers and two motors. They are so far, perhaps, the only craft completely immune from failure of the power plant.