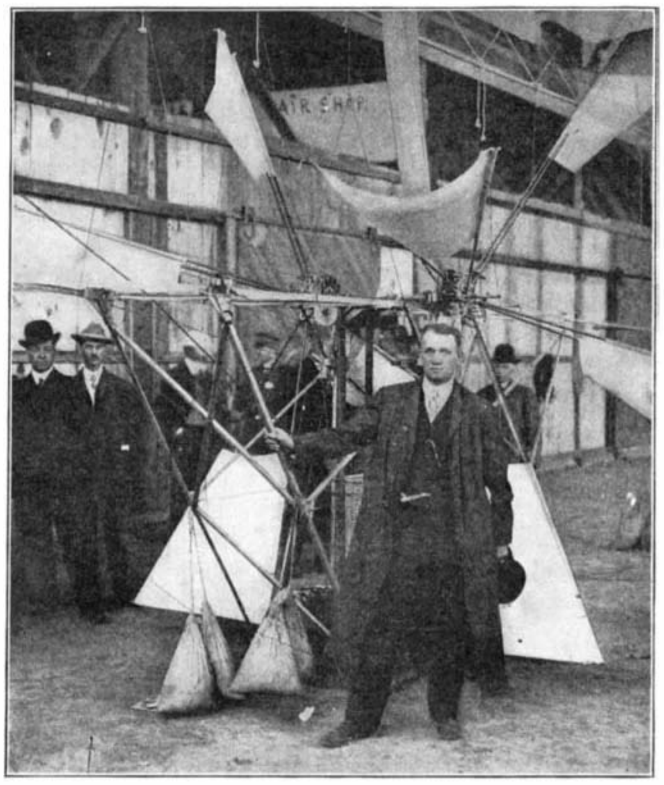
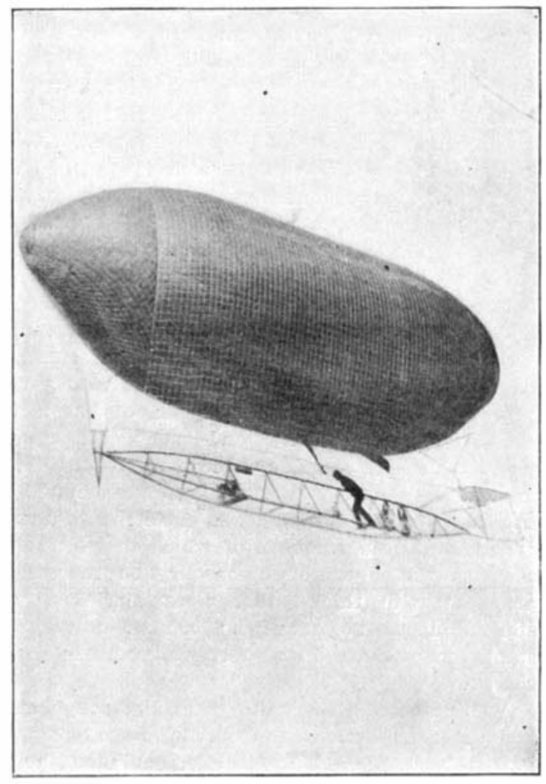
light for a ship of this displacement, the defect, if such it may be called, having been remedied in the latest ships of the "Washington" type, which will carry not only more and heavier armor, but a much more powerful armament. A careful inspection of the "Colorado" shows her to be apparently an excellent shipyard job; and there is no doubt that if this good work prevails through every ship of this class, the United States navy will receive a most valuable addition to its fighting power.

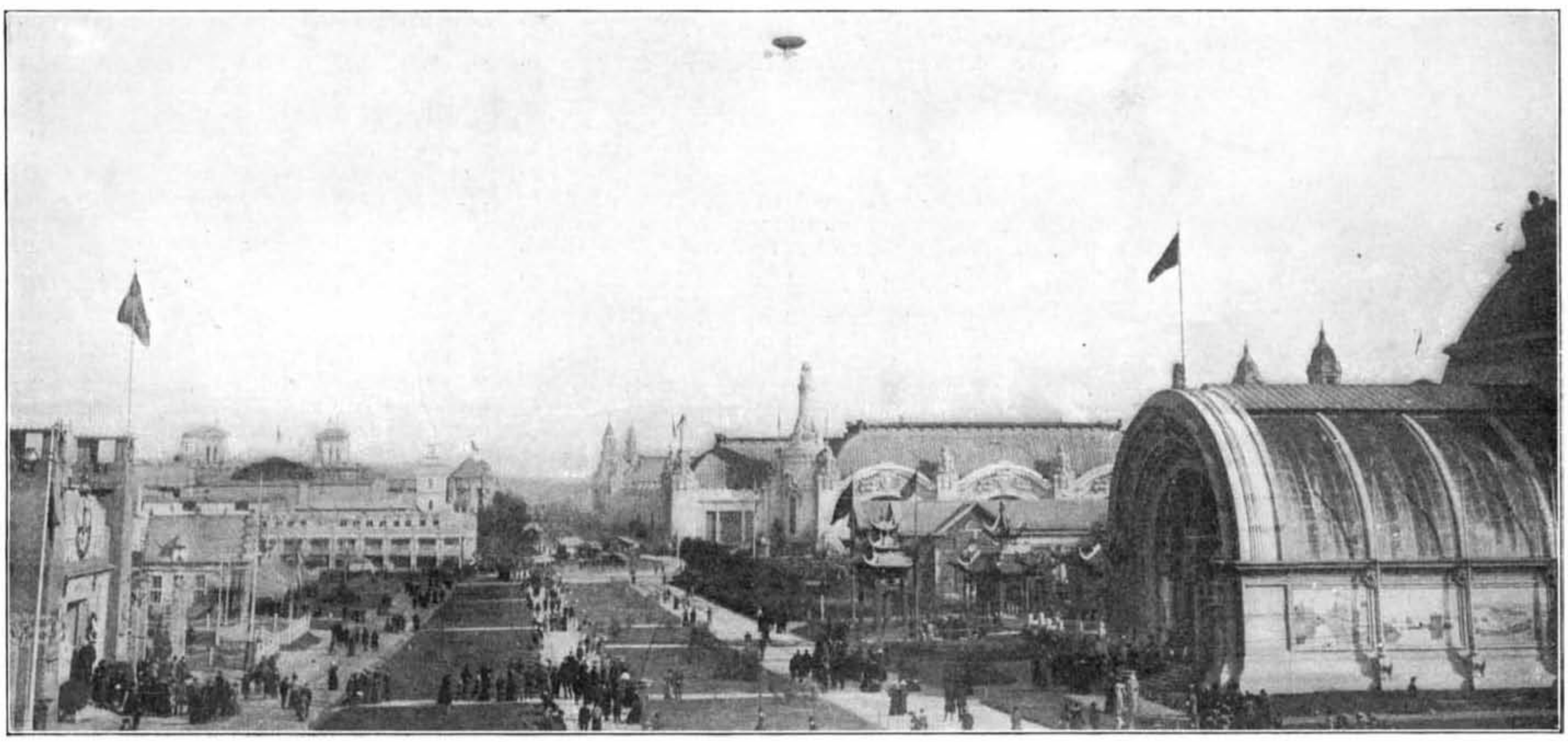
NOTABLE ST. LOUIS AIRSHIPS.

The newspapers within the last two weeks have had occasion more than once to comment upon the successful experiments conducted at the Louisiana Purchase Exposition with the Baldwin and Benbow airships, both of them craft built on the well-known lines followed by Santos Dumont.


The Ascent of the Benbow Airship.


Benbow Standing Beside the Propelling Machinery of His Airship.


Baldwin's Airship Under Way.


Baldwin's Airship at a Height of 600 Feet Above the Exposition Palaces.

NOTABLE ST. LOUIS AIRSHIPS.

Baldwin's airship has been described with some fullness in these columns. For that reason it is necessary merely to give in this place a brief account of its performances. Manned by A. Roy Knabenshue, of Toledo, Ohio, its first ascent was marked by the execution of evolutions in a 10-mile northwest wind that rapidly increased to 18 miles. In the teeth of this breeze, the airship moved back and forth at a height of from 300 feet and upward over the Exposition grounds, and twice returned nearly to the point from which it set out. On the occasion of this first ascent, the spark of the gasoline engine failed to work, the propeller stopped, and the airship drifted helplessly in the wind. By shifting his own weight and by cleverly manipulating the rudder and ballast, the aeronaut succeeded in turning the craft around, and in raising and lowering it in the air to a considerable extent. He succeeded in alighting without injury to himself or to the machine. The second attempt, which was made on October 13, was still more successful. After circling in every direction at a height of 2,000 feet above the Cascades, the aeronaut returned to the place from which he started, covering 3½ miles, part of the way against an 8-mile wind. On the return trip the airship sailed slowly over the exact spot from which it had risen twenty-eight minutes previously, and glided about 100 feet farther west, where it alighted. The vessel in this breeze seemed to answer her helm well, and seemed to be under perfect control.

On November 1 a third successful flight was made, high above the western portion of the Exposition grounds, the journey ending in the Stadium, adjoining the Aerial Concourse. The airship rose to an altitude of 1,600 feet, and descended upon the exact spot where the aeronaut had decided to land.

The last trip of the Baldwin airship ended unfortunately. After two accidents the airship started, broke away, and went a long-distance flight on its own account. After the aeronaut had descended to repair an exhaust cap, the airship broke away. The airship was found later sixteen miles west of St. Louis. It was uninjured by its wild night flight except for two small rents in the gas bag.

Another airship of promise is that invented by a Montana man, Mr. T. C. Benbow, in collaboration with Mr. H. J. Wells. The Benbow dirigible balloon is constructed on somewhat different principles from Baldwin's. It is much larger, the cigar-shaped bag being 74 feet long and 21⅓ feet in diameter, having a capacity of 14,000 cubic feet and carrying a weight of 900 pounds. Directly beneath the central line of the gas bag, and attached to its cords, is a horizontal spar, made of steel with the exception of a short prolongation of bamboo aft, to which the rudder post is attached. To this rod is suspended a framework of aluminium suspended by steel rods and stiffened with piano wire. The car is prolonged fore and aft into long beaks, similar to and parallel with the main spar. It is divided into two compartments, the forward one containing a 10-horse-power gasoline engine, and the other a rectangular wicker basket in which the aeronaut stands. This arrangement, it will be observed, is rather similar to that adopted by Santos Dumont. The engine is kept cool by means of an electric fan. The propellers are geared to the engine by a belt and pulley. Each propeller is composed of four 6-foot blades or wings, made of canvas stretched on bicycle tubing and braced with piano wire. The vanes are collapsible, and by an ingenious mechanical device are made to close up at each revolution, remaining open just long enough to seize and grasp the air, and presenting a minimum resistance while returning to the point of the greatest efficiency. An aerial propeller is thus constituted, not unlike the feathering paddle-wheels found on many river steamers. By this peculiar application Benbow hopes to obtain the motion of the human hand in swimming, the change of position of the vanes on the feathers of birds during flight being also imitated. The operation of the vanes may be modified by means of a crank placed conveniently to the hand of the navigator. These are to cause the vessel to ascend or descend at will. While vertical trimming is thus controlled by causing the opening and closing of the vanes to take place at different points of their revolution, the horizontal direction is governed by means of a cord attached to the rectangular rudder, 8 feet by 5 feet, made of canvas stretched on a bamboo frame.

On September 7 Benbow made his first flight from the Aerial Concourse. His bag having been filled with impure gas, it was necessary for him to sacrifice half of the propelling power and part of the ballast ordinarily provided. For this reason his first attempt may be considered largely in the nature of an experiment. The second attempt was more successful.

The Mürren Cable Railroad in the Swiss Alps.

One of the most remarkable railroads, that constitute such a feature of railroad communication and construction in the Swiss Alps, is that connecting Lauterbrunnen with Mürren. The former township, which is in the valley, is the terminus of the Bernese Oberland railroad, connecting Lauterbrunnen with Interlaken, and forming part of the Bern-Mürren trunk line. Mürren, however, is a small Swiss village situated in the Bernese Oberland, 5,385 feet above sea level, on the opposite side of the valley which is crowned by the Jungfrau. The mountain side is particularly steep, and the railroad stretches from Lauterbrunnen to the Grütsch Alp, 4,890 feet above sea level. Its terminus constitutes one of the most remarkable engineering feats in Swiss railroad engineering.

The track has a striking resemblance to a ladder, so sharp is the angle of the gradient. The mountain face is very rugged, abounding with small, sharp ravines, through which the mountain torrents rush toward the lower-lying country and river, which extends through the valley. The consequence is that in order to negotiate these undulations in the ground, it was necessary to erect viaducts, so as to insure a uniform gradient. These viaducts, of which there are several, are constructed of rough masonry on the small-arch principle with thick, stout piers carried to a substantial depth, to obtain sufficient rigidity to withstand the pressure of the torrent waters in the rainy season.

At other places the track extends through cuttings, and the ballast removed from these sections was employed for strengthening the embankment at points not too well served in this respect. Upon the inclined plane thus constructed the railroad is laid. The rails are carried upon transversely-laid sleepers. There is only one track; but as the railroad is operated upon the simple though highly efficacious principle of raising a pendant weight by the connection of a heavier one upon the other end of the attachment, there is a half-way station, where the ascending and descending cars pass, and at this point the track resolves itself into two loops.

The total length of the railroad from Lauterbrunnen to the Grütsch Alp is 4,530 feet, and the average gradient is 55 in 100, with a maximum of 60 in 100. Down the center of the track is laid a rack rail, in which runs a cog wheel carried underneath the car, which not only greatly assists the car in climbing, but in the descent acts as a highly efficient restraint over the force of gravity.

The railroad is operated by cable, the ascending car being connected by a wire rope, which passes over a drum in the power house at the summit, and thence to the descending car. The cables furthermore are water-balanced. Large pulleys are placed at frequent intervals to carry the cable.

The cars are self-contained, and start from the opposite ends of the road simultaneously, telegraphic communication being maintained between the two termini for purposes of signaling. Each car carries a water-ballast tank, but only the descending tank car carries the water ballast charge, in order to impart the necessary momentum to overcome the inertia of the car stationary at the lower station. As the car descends, water is gradually emptied from the tank. The displacement of the water coincides with the weight of the cable, which lengthens as the ascending car approaches the top. The skillful manipulation of this water ballast constitutes one of the most important factors in the safe operation of the railroad. Each car must travel at the same speed, and progress must be steadily maintained, so as to obviate any sudden jerks, which would throw severe strains upon the cable. Upon each car is attached a time indicator, and the rate of progress is regulated by the authorities. In order to guard against any inadvertent acceleration in the velocity, a powerful automatic brake is supplied to each car. Should the speed exceed that which is prescribed, the brakes come into operation, and thus check the engineer's progress. As a further precaution against careless or reckless driving, the engineer is subjected to a scale of fines, which are rigorously enforced by the authorities, information concerning this point being supplied by the time indicator.

To guard against any disaster resulting in the remote possibility of the cable rupturing, and to prevent the car running away and getting beyond control, each vehicle is equipped with two powerful brakes in addition to the automatic brake, and these are sufficient to hold the car stationary in conjunction with the rack wheel placed beneath the car, upon any part of the gradient. Accident is thereby adequately provided against, and it is this careful braking system which is responsible for that element of safety so characteristic of these mountain railroads in Switzerland. The cars pass each other half way, by the loops provided for the purpose, and at this point the cars make a momentary stop.

The cable has a breaking strain of 62 tons, and it is a splendid testimony to the care used in making it, that the same rope is in use to-day as when the railroad was first opened. The cable is thoroughly inspected at frequent intervals, and not even the weakening of a single strand has been discovered. The cars travel at the rate of 226.35 feet per minute, the whole journey occupying 20 minutes. This rate of progress is much greater than that attained by the locomotive-operated mountain railroads, such as the Rigi, where the speed is only 186.35 feet per minute, and the maximum gradient in three miles is 48 in 100. There is one other important cable-operated railroad in the Swiss Alps, that at St. Beatenberg. This railroad, which also has a maximum gradient of 60 in 100, is 12,795 feet in length and occupies 50 minutes to negotiate. Though the Mürren railroad is of practically the same gradient throughout, the St. Beatenberg track at one section has only a rise of 34 feet in 100, to cover which occupies 15 minutes.

From the Grütsch Alp station extends an electric railroad of the conventional overhead trolley type to Mürren. During the whole of the journey to the latter terminus, a distance of 3¼ miles, the railroad has only to climb 495 feet, the gradient thus being a comparatively easy one. The train is hauled by an electric locomotive. The whole journey from Mürren to Lauterbrunnen, including the negotiation of the cable section, occupies 55 minutes, and the fare charged is 75 cents.

The Largest Fruit Steamer.

The steamship "San Jose," the latest acquisition to the fleet of the United Fruit Company, arrived in Boston recently on her maiden trip from Port Limon, Costa Rica. The entry of the "San Jose" into this service is fraught with more than usual interest, from the fact that she is the largest fruiter ever constructed for service between the West Indies and the United States, and is also the first vessel equipped with refrigerating machinery to arrive at that port, which enables her to make long passages with perishable cargoes.

The keel plate of the "San Jose" was laid at the shipyard of Workman, Clark & Co., Belfast, Ireland, about nine months ago. The Fruit Company contracted with these builders for the construction of three steamers of the same size, all for this trade. The "San Jose" was the first to be launched. Her general dimensions are: Length between perpendiculars, 330 feet; length over all, 345 feet; breadth, molded, 44 feet 3 inches; depth of hold to the upper deck, 31 feet 3 inches. She is rigged with two pole masts, has three complete steel decks, also topgallant, forecastle, and orlop decks of wood, the latter extending throughout the forward part of the vessel. The engines and boilers are inclosed at all the decks by steel casings.

The novelty in the ship is in the introduction of refrigerating machinery. The cargo space is divided into separate compartments by steel bulkheads, which extend to the upper deck. All these holds and 'tween-deck spaces are insulated, and a very complete and efficient system of refrigerating machinery, with air ducts to every compartment, for the preservation of the fruit during shipment, has been fitted. By this means a low temperature can be secured in the tropical climates, and the fruit landed here in the best possible condition.

Each hold is fitted with a large hatch, supplied with the necessary steam winches, derricks, and special appliances for the expeditious and careful handling of the fruit cargoes.

A large steel deck-house has been built on the upper deck amidships, and at the fore end of this house is placed a dining saloon, with the passengers' staterooms opening on each side. A stairway from this saloon leads up to a steel deck-house on the promenade deck above, in which are additional staterooms and a smoking room. Rooms for the engineers and officers are provided in the midship deck-house, and the quarters of the crew are in a deck-house at the after end of the upper deck.

The spacious saloon is paneled in polished oak in a handsome manner, and is furnished with sofas, revolving arm-chairs, etc. The floor is covered with Brussels carpet, while the chairs and sofas are upholstered in moquette. The staterooms are finished in white enamel, with comfortable sofas, running water, etc., and are richly carpeted. The smoking room and other apartments are prettily furnished, and the lavatories are finished in white enamel with tiled flooring, etc.

The framing of the vessel consists of main and reverse frames of angle steel, to the entire exclusion of web frames except in the engine and boiler spaces. The stem is of rolled malleable steel carried above the forecastle deck. She is provided with bilge keels to minimize the motion of the ship, and her cellular bottom is divided into four compartments. She has steam steering gear and electric lighting plant, and carries a powerful searchlight.

The machinery consists of a set of triple-expansion engines of the latest type, with all the auxiliaries necessary for a modern steamer. The cylinders are 25, 41, and 68 inches in diameter, with a 48-inch stroke. Steam is supplied by three steel cylindrical multitubular boilers, 13 feet 6 inches in diameter, 11 feet 6 inches long, each with three furnaces, and having a total grate surface of 150 square feet, while the heating surface is about 6,000 square feet. The working pressure of the boilers is 190 pounds to the square inch. The "San Jose" was constructed under the supervision of the British Corporation Surveyors, and qualified for their highest class.

This immense fruiter calls attention to the evolution in this particular branch of our commerce. In 1870 Capt. Lorenzo D. Baker conceived the idea of bringing bananas to Boston from Jamaica, and with the comparatively small schooner "Telegraph" he made his first venture in this trade. For several years schooners made occasional trips between Jamaica and Boston, bringing small cargoes, which found a ready market here. In the early eighties the auxiliary steamers "Jesse Freeman" and "Lorenzo D. Baker" were placed in the trade, and later these were followed by more modern boats, especially built for the trade. The business made phenomenal strides, and at the present time the United Fruit Company own or have under charter a fleet of seventy-five steamers plying between their own plantations in Costa Rica, Colombia, San Domingo, Jamaica, and Cuba. Lines are operated to New Orleans, Mobile, Baltimore, Philadelphia, and Boston, and the fleet includes some of the finest vessels in the West India trade.

The "San Jose" on her trial trip exceeded her speed requirements; and while her speed is less than vessels of the greyhound class, it is ample to enable her to make excellent time between the fruit-producing countries and Boston, her great size insuring that she will keep time irrespective of the weather with the precision of the average railway train. The vessel has a capacity for 45,000 bunches of bananas.

The steamer "Limon," the second of the trio, has been launched and is now about ready for commission, while the "Esparta" will leave the builders' yard in a few weeks.

Iridium Lamp Filaments.

The objection to carbon filaments—disintegration, fusing with strong currents, and therefore waste of energy through the necessary employment of weak ones—have led to many attempts to construct a filament of greater efficiency and durability.

In the infancy of incandescent lighting experiments were made with metals of the platinum group. These experiments have lately been resumed, the greatest hope of success being placed on osmium. But osmium is by no means unobjectionable. Like carbon, it vaporizes at bright white heat, and if air is present, as in an imperfectly exhausted bulb, it forms hyperosmic acid which, even in very small quantity, is exceedingly injurious to the lungs and the eyes. Similar objections apply to ruthenium. Iridium is the only member of the group which is neither vaporized nor oxidized at white heat. Fused iridium is free from osmium, ruthenium, and palladium, which are vaporized during fusion.

Edison has recommended filaments of iridium wire—but the metal is extremely brittle and cannot, according to Guelcher, of Charlottenburg, be drawn into wire. With care it can be rolled into strips 1-32 inch thick, but it is impossible to make such a strip of either circular or uniform cross-section.

Guelcher has, however, succeeded in producing round and uniform iridium filaments by mixing fine iridium powder with vegetable glue, forcing the paste through a perforated plate by hydraulic pressure, drying the filaments and heating them to whiteness in an oxy-hydrogen flame. The filaments thus produced have a bright metallic luster, and though very hard, are flexible enough to be used in electric bulbs. They are said to be very durable and economical of power.

Instead of the chemically-pure metal, iridium powder as precipitated from solutions may be used. As this contains some oxide, the filaments, before being heated, must be exposed to the action of a stream of hydrogen.

Without this precaution they would explode on being heated. It should be noted that the heating must be done in an exposed flame, not in a covered crucible or a bed of charcoal, as the object is to effect complete combustion of the adhesive and leave nothing but pure iridium.—Condensed from Umschau, Prof. Russner, December 26, 1903.