

THE WIESEN VIADUCT.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A piece of railroad construction in Switzerland which presents considerable interest is the great Wiesen viaduct, which has been building for some time past. The viaduct's central span is one of the longest as well as the highest to be found in the country.

The present viaduct forms part of a new section of railroad of short length which has been undertaken within a recent period in the region lying in the eastern part of the country. The line belongs to an extensive system of railroads known as the Rätische Bahn, and it is designed to give a long-needed passage through the picturesque Davos-Landwasser valley, for up to the present the valley has been traversed only by an ordinary road. Hereafter the well-known mountain resort of Davos will have a direct connection with the region lying to the south. The line thus gives an outlet to the center of the Graubunden canton, and passengers can easily reach the different parts of the Engadine region by rail. The new railroad section will thus be a great advantage for Davos, so that the resort, which is already much frequented, will have a still greater development after the railroad line is finished. Connection is now made with the Abula railroad, which is another of the Swiss lines recently built in this region.

Work on the construction of the new line, known as the Davos-Filisur route, is actively under way at the present time. The railroad is of short length, like many of the mountain lines in Switzerland, for it is scarcely over 10 miles long. Still it presents many interesting features. A gage of 1 meter (39.37 inches) is employed in this case. Davos, the starting point of the line, lies at an altitude of 5,019 feet above sea level, while the southern terminal at the locality of Filisur has an altitude of 3,521 feet, so that the gradients on the section are considerable. The maximum gradient is 35 per cent and the minimum radius of the curves 380 feet. The track is laid upon steel ties. Following along the valley of the Landwasser, which after Schmelzboden narrows to a deep gorge lying between high rock walls, the route is one which tourists will find agreeable for its picturesque character. On the section between the above locality and Wiesen a considerable amount of work has been done in the way of tunneling and building viaducts. In all, there are six tunnels, the longest of which is the Silberberg tunnel. In its construction springs were met with which gave some difficulty. After crossing the mountain torrent of Monatstein, the line reaches the locality of Wiesen, near which is situated the great viaduct, lying between Wiesen and Filisur. The main central span lying over the Landwasser stream is 182 feet, and the height of the arch above the level of the stream is about 300 feet. It was difficult to obtain suitable building stone in the region. Concrete was used for the main body of the work, and hewn granite for the facing. At the top of the arch the width is 126 feet, and at the base the width is 165 feet. The thickness at the summit is 6.0 feet and at the bottom 10 feet for the masonry. On each side of the main arch there are two arches of smaller size, having 65-foot span and lying at the same height above the level of the stream. In order to carry out the work of building the principal arch there was thrown across the stream between abutments an iron trelliswork bridge of 3 feet width, which was held upon two suspension cables, these latter being anchored at either end. The viaduct is built according to the designs of M. Hans Studer, one of the leading engineers of the road.

The Current Supplement.

Thanks to the speed of modern steamers and the development of the railroad system in India, the base of the Himalayas is now only twenty days' journey from Mediterranean ports. Hence, mountain climbers who wish to distinguish themselves by lofty ascents or explorations have undertaken summer expeditions in the high mountains in northern India. In the first rank of these explorers stand Dr. and Mrs. Bullock Workman, who since 1898 have made five expeditions in the Himalayas. Their latest exploits are recounted in the opening article of the current SUPPLEMENT, No. 1754. D. Geyer contributes much curious information in an article entitled "Snail Gardens." Dr. Reiner Mueller writes on the subject of the inheritance of acquired characters in bacteria, and shows how it is possible by artificial means to impress upon a living organism a new and definite character, which is hereditary and which remains constant through a vast and indefinite number of generations. An approximately correct idea of the form of our planet is a comparatively recent acquisition of science. Dr. Givet of the French Equatorial Geodetic Expedition tells us how this new knowledge is obtained. The yeast cell and its lessons are taken as the subject of an instructive article by W. Stanley Smith. The oxydric process of cutting metal is a new technical achievement painstakingly discussed by E. F. Lake.

Maria Parlo's excellent monograph on the canning and preserving of fruit is continued. Twenty-five years have elapsed since Arrhenius advanced the theory that acids, bases, and salts in aqueous solution are dissociated into their constituent ions. Now that the storm of contention aroused by this doctrine is clearing, it may not be inappropriate to consider more calmly this proposition of Arrhenius's, to reinspect the foundations, and to weigh without prejudice the successes and the failures of the ionic theory. This has been done by Gilbert Newton Lewis in a thoughtful article entitled "The Use and Abuse of the Ionic Theory." The Engineering, Electrical, and Trade Notes will also be found as usual.

The Glidden Tour.

The sixth annual tour of the American Automobile Association, better known as the Glidden Tour, was completed at Kansas City, Mo. on the last of July after a more than usually strenuous journey of fifteen running days from Detroit via Chicago to Denver and back to Kansas City.

It is impossible for us with the space at our disposal to give even an outline of the performances of the various cars or the incidents of the trip; but as at least half the space in a number of automobile trade journals have been devoted to such details for three successive weeks, it is perhaps hardly necessary.

There are, however, several features of the tour worthy of especial mention, even in a non-specialist paper.

The roads are agreed by a number of veteran Glidden tourists to have been the worst ever encountered, varying from axle-deep sand to mud as deep, and, perhaps worst, axle-deep ruts in hard-baked "gumbo." In several cases the entire crew of a car was thrown out by crossing too swiftly in descending a hill, a concealed water bar, or similar obstruction; grass hummocks and even boulders grazed axles and under pans, and bridges on the prairie roads had to be repaired before safe for passage. Considering these difficulties, the fact that 8 cars finished with perfect road scores (without losing marks for delay, breakage, repairs, or adjustment *en route*), as many as 21 out of the 32 contesting cars covering the first 830 miles to Minneapolis over perhaps the worst roads encountered without being penalized, is strong testimony in favor of the claim that the reliability of American manufacture has reached something like perfection. Even the expected spring troubles were conspicuously few.

Whereas in former years the Glidden has been considered to be a "big car" tour, small cars having hardly a fair chance to make a showing proportionate to their cost, an attempt was made this year in the system of marking and distribution of the trophies to place the smaller cars on equal terms. The result, however, still shows that the best low-powered car is hardly equal to so strenuous a journey.

Great hospitality was shown to the tourists at practically every town and village passed, Detroit, Minneapolis, and Denver particularly distinguishing themselves, and farmers' families lining the route even in remote districts. The latter seem to be overcoming their hostility to horseless vehicles, not merely making way for the automobile and taking its dust with a better grace, but themselves adopting its use to avoid those alternatives. The interest shown by the agriculturist in the tour should benefit participants in the latter commercially in these days of high-priced grain and promise of abundant crops, as well as materially assisting the universally beneficent cause of good roads.

The Glidden trophy for the largest cars and the Hower trophy for runabouts were won by "Pierce Arrow" cars, three of which finished with perfect road scores, the two winners actually having no marks deducted for any re-adjustments to be made at the finish to put them in the perfect condition in which they started, which is certainly a most remarkable showing.

The Detroit prize for intermediate cars was won by a "Chalmers-Detroit" car; two of the three "Premier" cars entered also finished with perfect scores.

A remarkable record was made by a "Rapid" commercial delivery truck, which was sent on the unaccustomed 2,600-mile journey by its enterprising manufacturers, carrying over a ton of baggage and accessories for the tourists on solid tires. It not only rendered yeoman service, but actually would have been unpenalized on several of the worst days' runs had it been competing with the touring cars, and climbed Pike's Peak as a diversion during a pause in the tour.

BLERIOT'S CHANNEL FLIGHT AND OTHER RECORDS IN FRANCE.

We reproduce herewith several photographs showing the start of Bleriot across the English Channel, and also showing him flying above the Channel when beyond sight of land. These photographs give an excellent idea of the birdlike appearance of Bleriot's monoplane when in flight. A full description of his

record flight and of other records which he has made appeared in our last issue.

The extremely rapid progress being made in aviation in France is truly astounding. One of the men who has made extraordinary progress is M. Roger Sommer. His record to date is truly remarkable, and shows that when one once learns to fly an aeroplane, there is a fascination even greater than that experienced with the automobile. During six consecutive days, from July 13th to 18th inclusive, M. Sommer made the following flights: July 13th, two flights of 15 and 19 minutes. On the 14th, a flight of 27 minutes at a height of from 30 to 65 feet, covering a distance of 12 kilometers (7.5 miles) outside the limits of the aerodrome within 10 minutes. On July 17th, a 30-minute flight, during which 12 liters (3.2 gallons) of gasoline were consumed; and on the 18th a flight of 1 hour and 4 minutes. On July 27th this time was increased to 1 hour, 23 minutes, and 30 seconds. On August 1st he flew 1 hour, 50 minutes, and 30 seconds, beating all French records. Three days later he made a flight of 2 hours and 10 seconds, which, up to the time of our going to press, is the longest record made by a foreign aviator. M. Gaudart is another beginner who has recently met with considerable success. On July 18th at Juvisy he made three circuits of the aerodrome in a gusty wind, covering a distance of about 4½ kilometers (2.5 miles). Starting at 3:14 A. M. on August 7th, in the moonlight, he made a flight lasting 2 hours, 27 minutes, and 15 seconds, the altitude attained varying from 20 to 90 feet. This surpasses the record of 2 hours and 20 minutes made on December 31st last by Wilbur Wright, and is an endurance record for an aeroplane.

Capt. Ferber made several flights on the Champ de Mars on July 18th with his Voisin biplane. Two days later he made six successful flights at Belfort, after which he shipped his machine to Vichy for the aviation meet. On July 19th Henry Farman made a flight of 1 hour and 23 minutes at Chalons. The flight started at 8:17 P. M. and terminated at 9:40, when the gathering darkness obliged Farman to descend. His new machine has the tail placed farther apart than the former one, and is fitted with runners instead of wheels. The balancing planes are placed between the ends of the main plane. On July 21st at Chalons Mr. Farman took up Mr. Cockburn in a new machine which the latter has just purchased. It made a circuit of the camp, a distance of about 1½ miles.

From the above it will be seen that the aeroplane is making great strides in France. No less than forty-six machines have been entered for the great aviation meeting at Rheims during the week beginning August 22nd, and at this meeting aviation abroad will for the first time be put on a sound footing.

COMPLETION OF THE GOVERNMENT CONTRACT BY ORVILLE WRIGHT AT FORT MYER.

With the making of the ten-mile cross-country speed test by Orville Wright at Fort Myer on July 30th, as mentioned in our last issue, the government requirements for a heavier-than-air flying machine were completely fulfilled. The speed averaged by the machine carrying Orville Wright and Lieut. Foulois as passenger, according to the timing of the officers in charge of the test, was 42.58 miles an hour. On the outward journey, when flying somewhat against the wind, the machine averaged 37.735 miles an hour, while on the return trip the average speed was 47.431 miles an hour. As the bonus offered by the government was \$2,500 for each mile per hour in excess of forty, without taking into consideration fractions of a mile, the Wright brothers received a bonus of \$5,000, which made a total of \$30,000 for their machine.

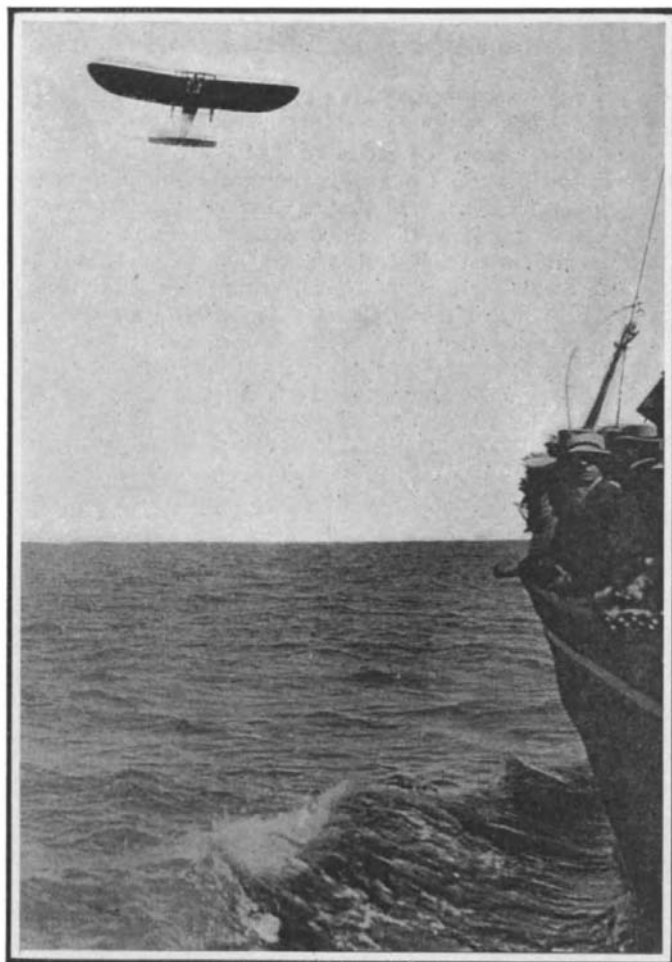
The more one considers this remarkable flight, the more the excellent qualities of the Wright biplane and the daring of Orville Wright in making the cross-country flight to Alexandria, Va., stand out. With a somewhat smaller machine than that used last year (the planes are 36 feet long by 6 feet from front to rear) some 1,200 pounds of weight was carried at a speed of 42½ miles an hour with an expenditure of not over 30 horse-power. This means that the machine lifted 40 pounds or more per horse-power expended, and carried this weight at a faster speed than has ever been shown in an official test by any other aeroplane. The weight lifted per square foot of supporting surface, however, was much less than in the case of Bleriot with his No. XII monoplane, for the Wright machine carried only about 2½ pounds to the square foot, whereas Bleriot lifted over 5. The speed the latter attained in an official test at Douai, France, last month was 10 miles per hour less than that reached by the Wright biplane in its test at Fort Myer, although Bleriot's monoplane had approximately the same horse-power and lifted practically the same weight. A comparison of the two machines shows very neatly, therefore, the greater lifting power of a single deeply curved surface over superposed slightly curved surfaces, and brings out

the fact that when such a surface is used, as was the case with the Bleriot machine, speed is sacrificed for lifting power. On the other hand, however, as a practical machine for the use of sportsmen, the monoplane of Bleriot offers distinct advantages in the way of small space occupied, light weight of the apparatus, and ready portability. After making his 25-mile cross-country flight from Etampes to Chevilly on July 13th last, Bleriot dismantled the wings of his machine, fastened them to the sides of the body frame, and towed the machine over the road on its three wheels to Paris, a distance of 61 miles, arriving there by evening. The performance of such a feat shows the superior adaptability, for war purposes and for all practical uses, of the monoplane type of aeroplane mounted on wheels as compared with the biplane type of machine mounted upon runners and requiring a starting rail and dropping weight to launch it.

The fulfillment of the specifications of the United States government for a heavier-than-air flying machine marks an era in the development of aerial navigation. When these specifications were issued in December, 1907, the Wrights had not demonstrated any of their claims, the chief of which was that they had flown for 38 minutes more than two years before. Santos Dumont, Farman, and Delagrange had made little more than jumps, and the art of aviation was in its infancy as far as any practical demonstration of what had already been done by the leaders was concerned. The specifications issued by the War Department required an endurance flight of one hour with a passenger; a cross-country speed test with a passenger for a distance of ten miles, in which a speed of not less than 38 miles an hour must be shown; and the carrying of sufficient fuel for a 125-mile (3-hour) flight. These specifications were so rigorous, that even the most hopeful aviators were doubtful whether they could be fulfilled; but when Wilbur Wright flew for 2 hours and 20 minutes on December 31st last in France, all doubt was dispelled as to whether or not the Wright brothers could fulfill the specifications. Nevertheless, the best speed shown by the Wright machine in France in the different speed tests there did not exceed 38 miles an hour very much, and there was consequently considerable doubt as to how fast the machine could travel, and how much bonus Orville Wright would win. After making the hazardous trip over several deep valleys and high hills, he expressed his belief that had there been no wind to drive him out of his course he would have made 44 miles an hour and received the full bonus. The height which he attained in passing over the valleys was 400 to 500 feet. When the fact is considered that had the motor stopped, both men in the aeroplane would have been in imminent danger of losing their lives from the descent of the machine on the tree tops, one can readily see that the making of this flight required more daring than the making of a flight across the English Channel. Not only this, but two lives were in jeopardy all the time.



A glimpse of Bleriot shortly after his start.



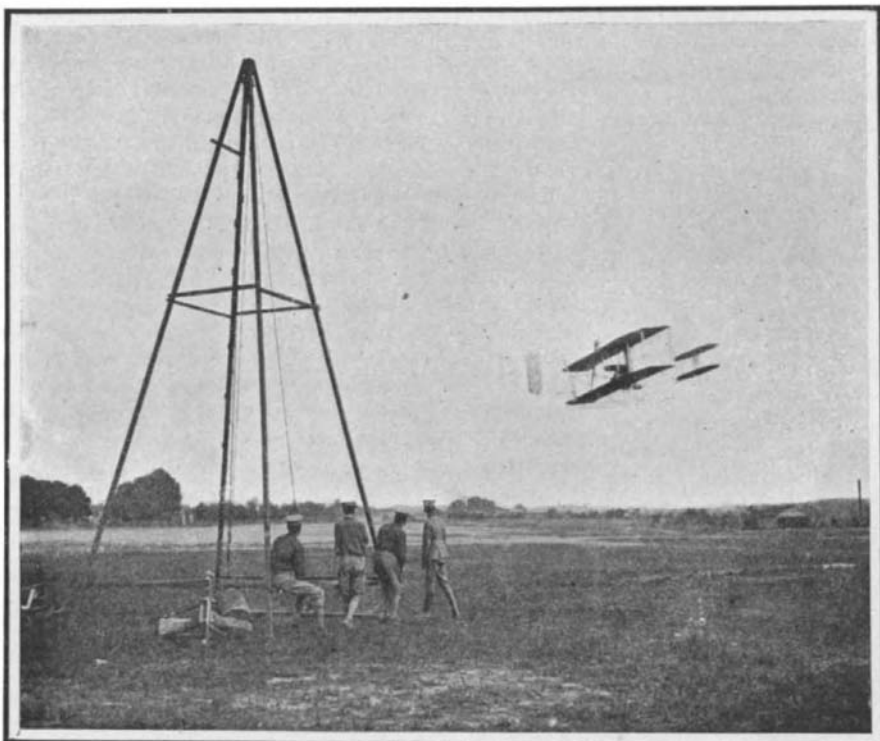
Bleriot in mid-Channel.

BLERIOT'S FLIGHT ACROSS THE ENGLISH CHANNEL.

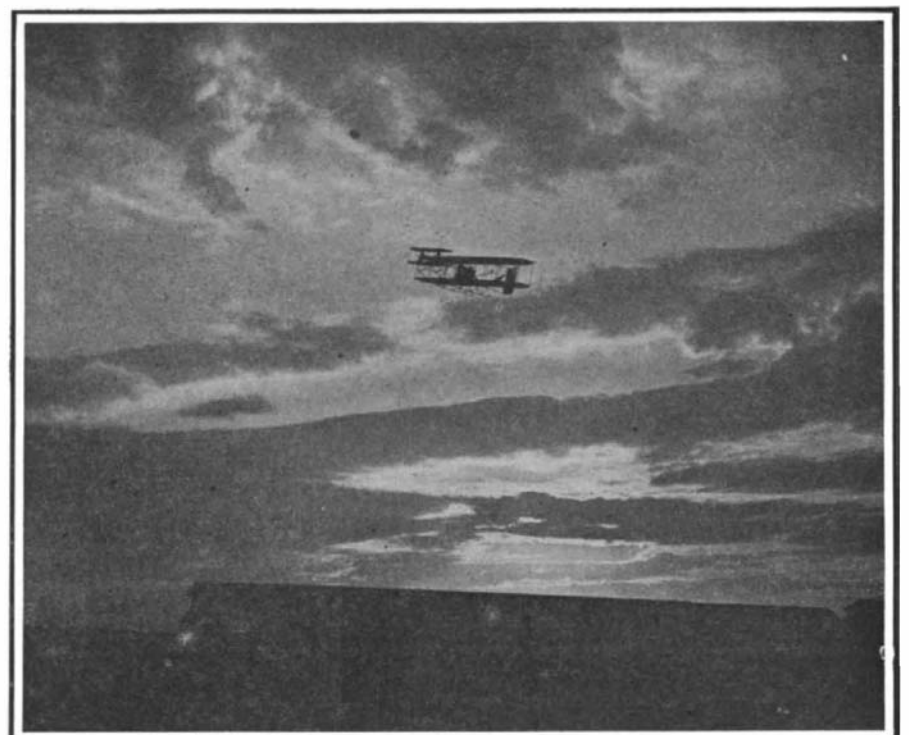
There are several new aviators in France who almost daily are making new records. Chief among these is M. Paulhan, who, with his Voisin biplane fitted with a tail and a Gnome revolving cylinder motor, on July 19th made a cross-country flight from Douai to Arras, a distance of 13 miles. The flight was made in 22 minutes, at an average speed of 35.4 miles an hour. Next to Bleriot, M. Paulhan holds the record for cross-country flying in France. He also holds the record for height, having flown to a height of 120 meters (393.8 feet), and thereby beaten Wilbur Wright's 110-meter (350-foot) record made on December 18th last at Auvours. Some of M. Paulhan's recent records made at Douai are as follows: 12 kilometers (7½ miles) in about 15 minutes at a height of 30 meters (98 feet); July 23rd, 1 hour 17 minutes 19 seconds, covering an official measured distance of 48.178 kilometers (30 miles), but actually traversing a distance of 70 kilometers (43.5 miles), when the wide turns are considered.

July 18th, M. Paulhan raced M. Bleriot with the latter's biplane at Douai, over a distance of a kilometer (0.621 mile) in a semi-circle. This was the first time two aeroplanes have engaged in a race, and the fact that these were a biplane and a monoplane with two distinctly different types of motors made this race all the more interesting. M. Bleriot won in the time of 1:09, an average speed of 32.4 miles an hour, while Paulhan's time was 1:37, an average speed of 23 miles an hour. The same day M. Bleriot won the Prix du Nord by covering 2 kilometers (1.4 miles) in 2 minutes 29 seconds.

Although America was the first to secure an aeroplane for the use of its War Department, several other nations are quietly working to develop machines of their own. In England, Capt. Cody, who however has not been aided very much by the government, has lately been making successful flights with a biplane nearly twice the size of Wrights'. On July 21st he flew 4 miles above Laffan's Plain near Aldershot. This is the first biplane, according to Capt. Cody, in which every possible effort has been made to avoid head resistance. He believes that his machine has less head resistance than any other so far constructed of the same size, and with an engine of about 30 horse-power he has flown successfully at good speed. The French government also is experimenting with a biplane, but up to the present no attempt has been made to purchase such a machine from any of the numerous constructors. Orville Wright expects to go to Germany very soon, with the idea of selling a number of machines to the German government. Italy has already acquired one Wright aeroplane, and will probably have several more soon. The Austrian and the Russian governments are also interested in aeroplanes for war purposes. Up to the present time, however, our country and Italy are the only ones which have aeroplanes, and which are ready to purchase more of these machines in the near future. It is probable that new specifications in which greater requirements will be made will be issued within a short time by our War Department.



A short turn.



The Wright machine in a sunset flight.

THE LAST WRIGHT FLIGHTS AT WASHINGTON.

SCIENTIFIC AMERICAN

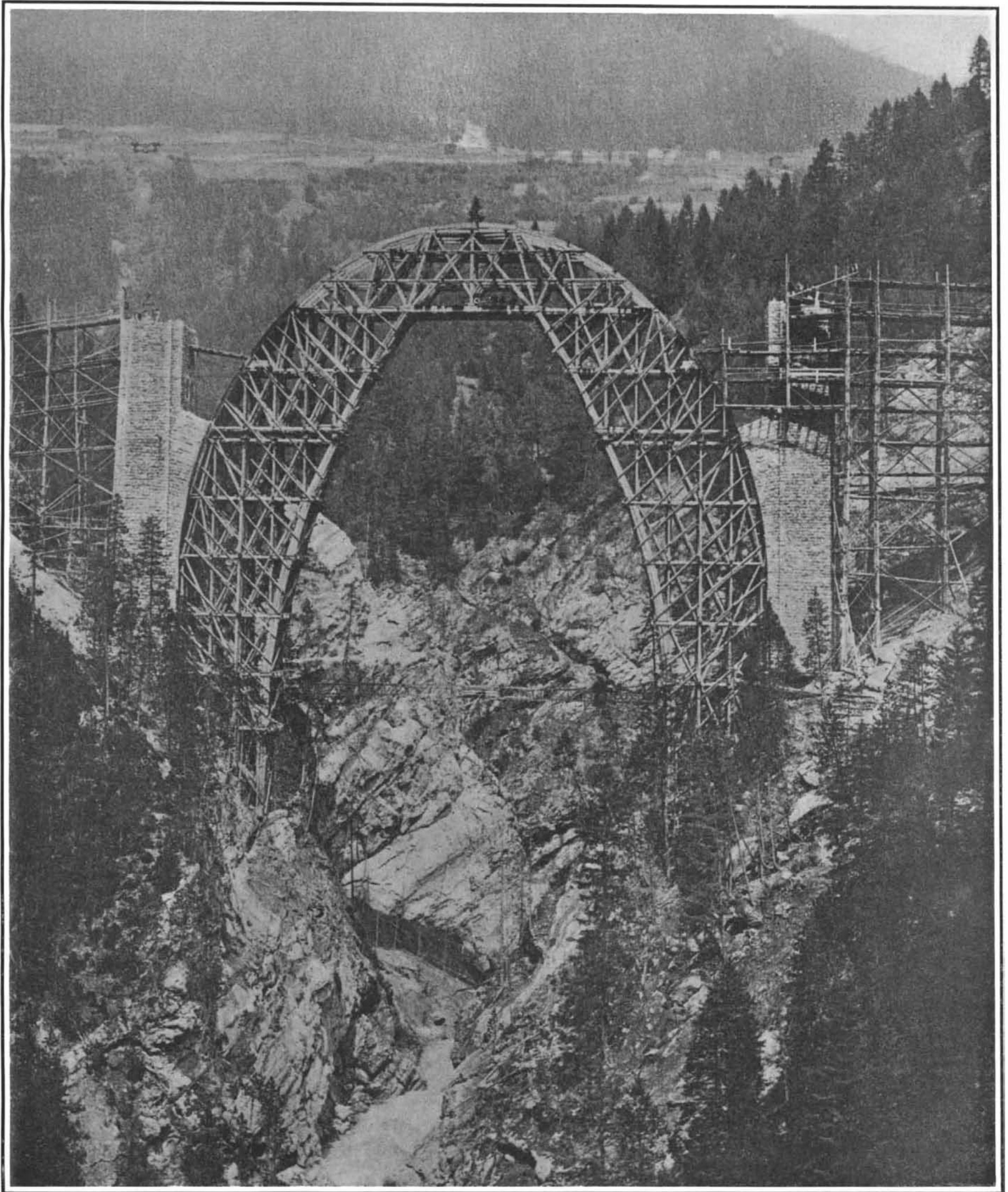
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The central span is 182 feet long and towers 800 feet above the torrent below.

FALSE WORK FOR THE GREAT MASONRY VIADUCT BETWEEN WIESEN AND FILISUR, SWITZERLAND.—[See page 111.]