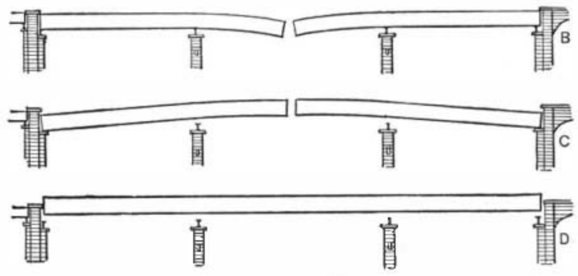
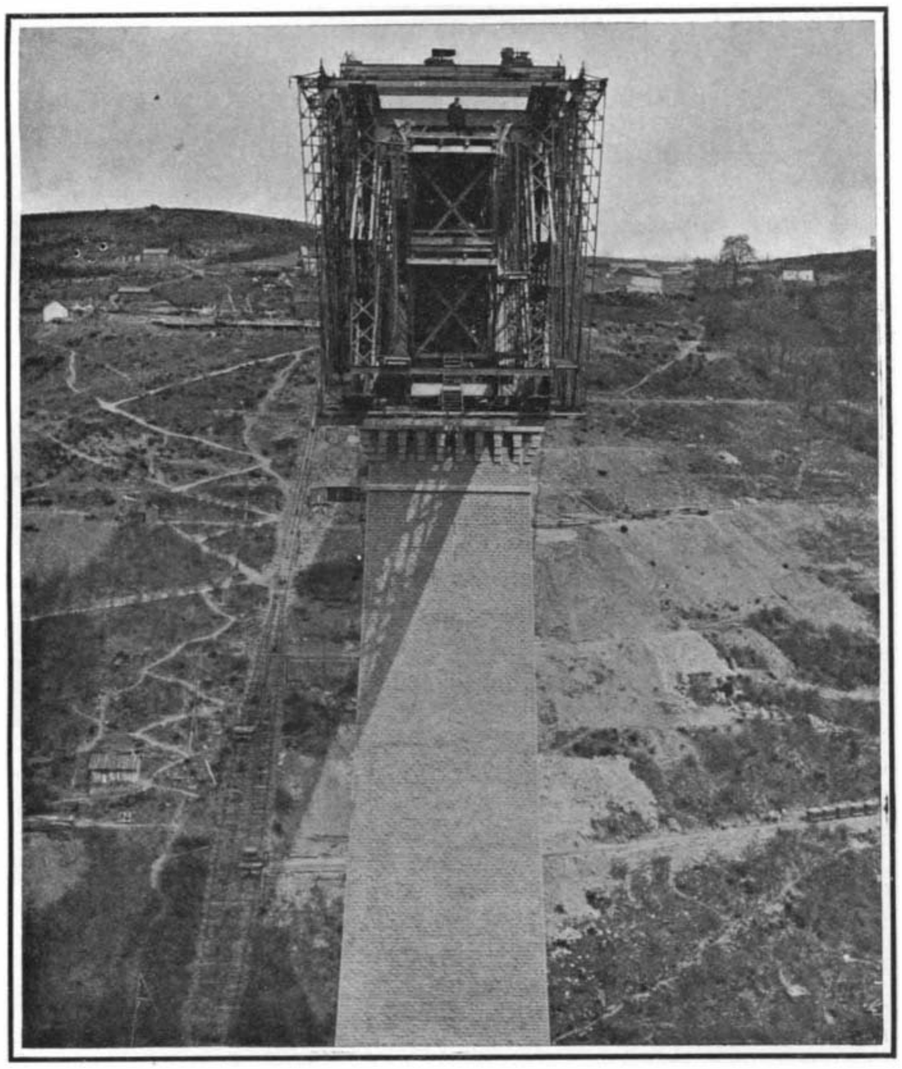
ERECTION OF THE FADES VIADUCT.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

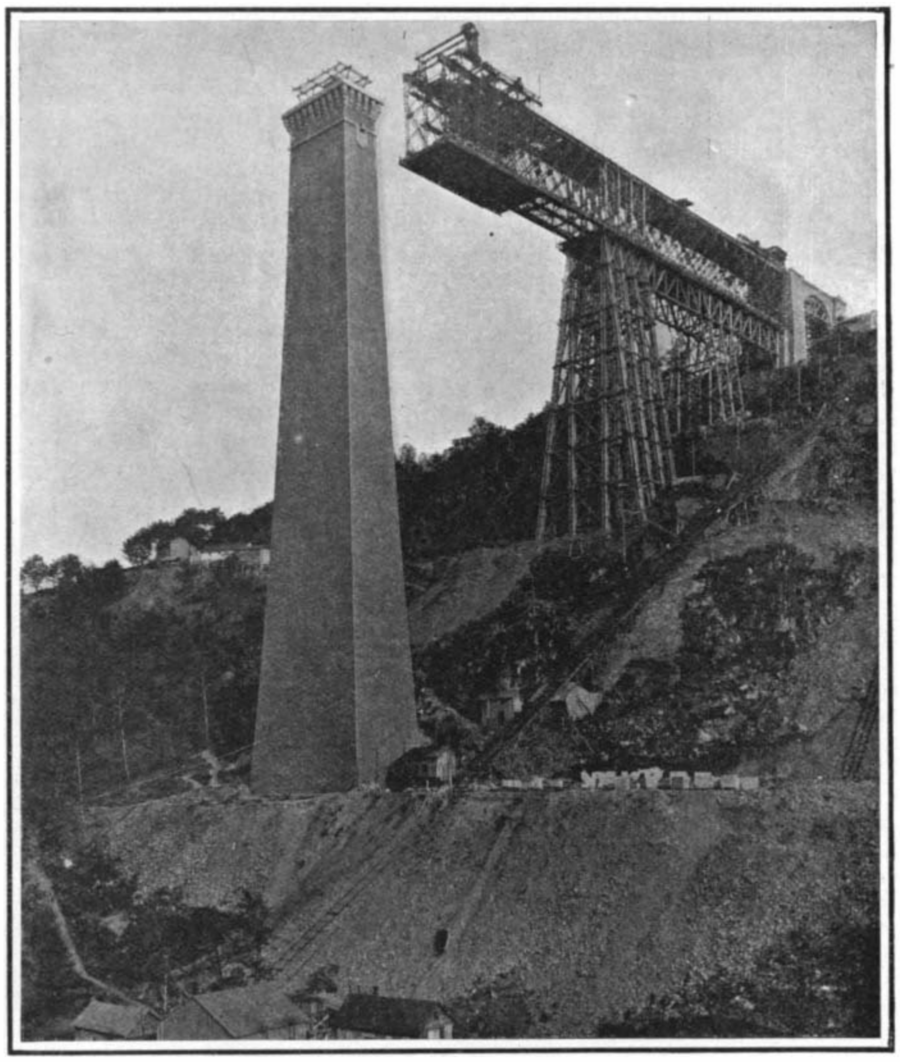
A piece of bridge construction work presenting some noteworthy features has recently been carried out in France. It is known as the Fades Viaduct, and is designed to take the railroad across the wide valley in which flows the river Sioule. The present work is notable for two reasons, one of these being the exceptional height of the masonry pillars, which are built in the valley, and in the second place for the considerable length of the central span. The viaduct has the form of a straight iron lattice-work bridge construction. It is carried upon two lofty piers and two abutments, the length of the consecutive spans being 383 feet, 475 feet, and 383 feet. The flooring of the viaduct lies at a height of nearly 440 feet above the level of the Sioule. The height of the great masonry columns of rectangular section is 304 feet, and they appear to be the highest pillars for a bridge built in Europe up to the present. The whole undertaking reflects great credit upon the constructors, the well-known Cail Company, and the work was carried on under the general direction of its chief, M. Le Chatelier, from whom we have obtained the following points: The most difficult part of the work was to make the junction between the overhanging halves of the central span. This was carried out on the 18th of May last and the operation was performed with remarkable precision. To make the junction, the whole bridge had to be lifted off the two main columns by hydraulic jacks, in order to make up for the slight sinking of the two fore ends and bring these exactly opposite each other and in true line. After joining the ends, the bridge was lowered again upon its supports. The present viaduct lies upon the railroad which runs in the southeastern part of France in the region of Clermont-Ferrand, and is built upon the section which runs between Saint-Eloy and Pauniat. On each side of the 475-foot central span there is a side span of 383 feet. In the rear of the stone abutments there is an approach to the main structure consisting of a small masonry arch of 46 feet span on one side, and at the other end is built a 162-foot truss span. The two main stone piers sup-



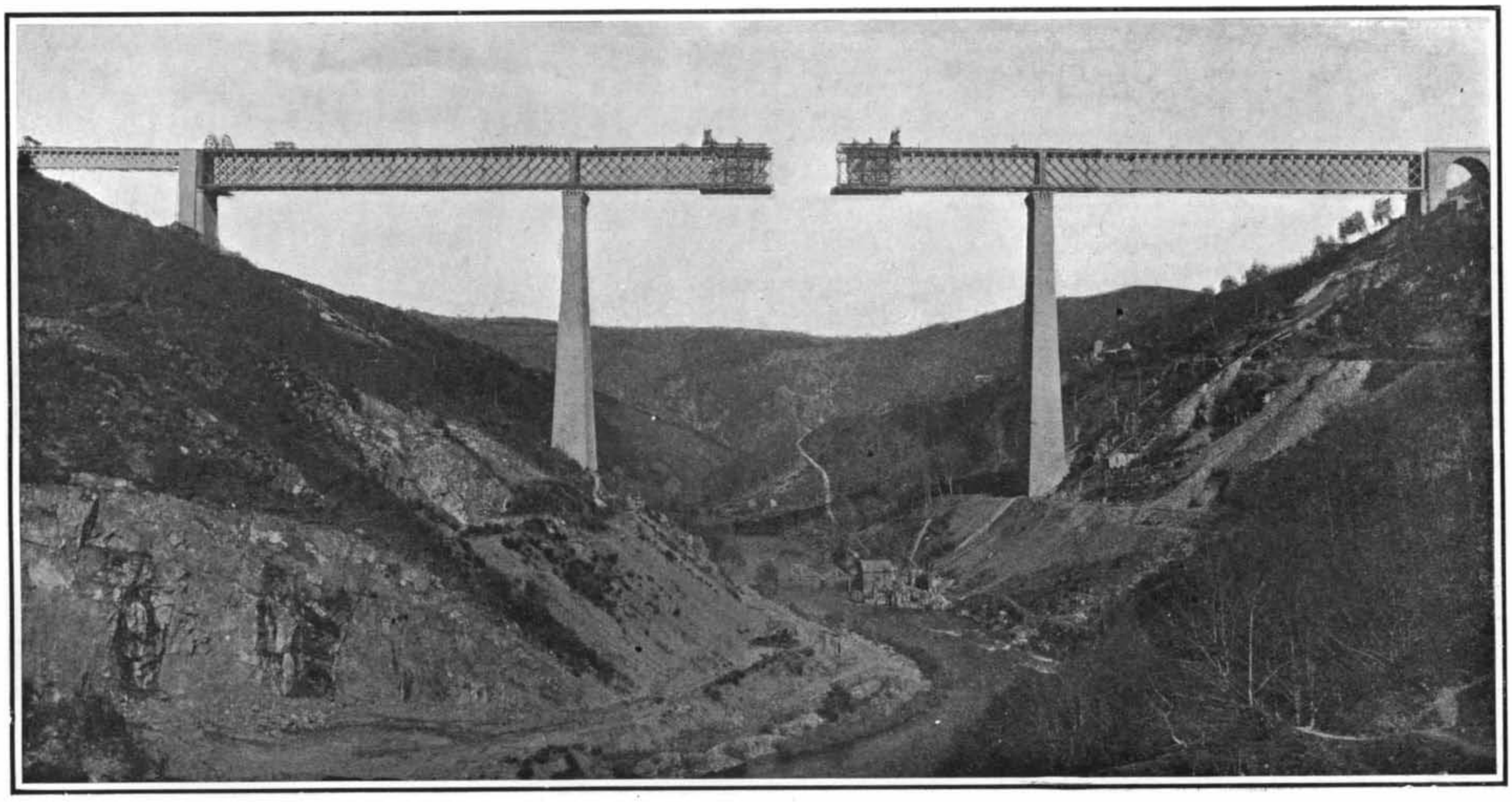
B. Ends overhanging. C. Lifting off the pillars and jacks and lowering at the buttresses. D. Lifting at the buttresses and joining ends.



End view of the truss.



Method of construction on end spans.



The meeting ends of the truss in the central span.

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porting the central span of the viaduct are built to a height of 304 feet above their foundations. These latter are carried down to a depth of 40 feet for the pier lying on the left bank, which makes the total height of the stone work to be 344 feet. For the foundation on the other bank the depth is somewhat smaller, making the total height of the pillar to be 312 feet. The bridge is constructed for single track standard gage, and is built of a rectangular cross section consisting of two main side lattice trusses 38 feet deep, which are spaced 22 feet between centers. Upon the top are laid the floor beams which serve to support the stringers, and upon these rest the rails of the track. The sway bracing is spaced at intervals of 48 feet. In order to allow for expansion and contraction, the structure is fixed at one of the abutments only, while upon the two main pillars and the other abutment it is mounted upon a movable support of the usual kind.

In constructing the bridge, it was not found possible to use the method which consists in building the spans on the ground back of the site and then driving them forward into place, seeing that there was not the available space for carrying this out. Another method, therefore, had to be employed, and it consisted in the use of a scaffolding which is mounted under the side spans. The bridge was built from the abutments to the end of the scaffolding; and from this point it was built across on the overhanging principle until it reached the main piers, falsework being used below the first half of the span. One of the characteristic features of the work is the erecting of the bridge in the overhanging portions. In order to carry this out there was used a cage-like traveler, which ran along upon the outside and surrounding the truss. It traveled upon rails which were laid upon the top of the truss and upon the two sets of rollers. Measured from the flooring and from the back end of the cage, the first roller lies at 13 feet and the second at 40 feet distance, representing the end point of the truss, but the fore part of the cage projected out from the finished end of the truss with an overhang of 33 feet. On the inside of the truss there was a corresponding structure, built of timber. Upon it were three working platforms, arranged to give access to the different heights. Supported from the inner timber structure and also from the outer cage there were hanging platforms which were let down by pulleys, for the workmen who operated the compressed-air riveters. These latter were hung down at the level of the platforms by traveling carriages, which ran upon upper rails at the top of the cage. On the top was also mounted a large traveling erecting crane, designed to take the beams and other material from the back end and bring it forward to the working point. In this way the work advanced at the average rate of 3 feet per day. The trusses were thus brought forward to the main piers at each side. They were built forward in the same way to form the middle span. When the halves of the middle span met they deflected below the normal position, and it was necessary to lift them to their true level. The operation was carried out by raising the trusses off the piers by hydraulic jacks, and at the same time lowering them at the abutments, thus tilting up the spans as a whole and allowing the ends to match at the middle. Upon the piers, where the weight was 1,200 tons, there were used for the lifting four hydraulic jacks of 300 tons each. The base of the jacks rested upon a set of rollers, so as to give the needed movements. A small 5-ton hydraulic jack gave the lateral movements which were required. In this way the two trusses were raised and brought into exactly the proper position at the meeting point. When this was done the chords were joined, by temporary bolts at first, so as to complete the truss from end to end, making a continuous structure. The bridge was then raised at the abutments and finally lowered into place upon the pillars, so as to bring it to its normal position.

German-American Patent Treaty.

The American Association of Commerce and Trade in Berlin issues the following announcement, prepared by Henry Schmidt, on the effect of the new patent treaty between this country and Germany:

The new patent treaty between the United States and Germany, which went into effect on August 1, places American citizens on a decidedly better footing in regard to the utilization of patent protection in Germany, as it frees them from the obligation to work their patented inventions in Germany within three years from the granting of the German patent. Heretofore any failure to comply with this working obligation would, in the case of an action for revocation of the patent being brought against the patentee, result in the loss to him of his German patent.

This is no longer to be the case with the German patents of United States citizens, as the new treaty provides that the working of a patent in the territory of one of the contracting parties shall be considered as equivalent to its working in the territory of the other party. Hence, an American citizen who works his United States patent in the United States will no longer be required to work his corresponding German patent in Germany in order to avoid loss of his German patent in case of an action for revocation being brought against him.

The question as to whether the provisions of the treaty are to apply also to existing German patents in regard to which the three-year term allowed for working already expired before the date on which the treaty went into effect, is not decided yet; but many persons are of the opinion that even such patents will now be entitled to the benefits of the treaty, provided that no action for revocation was actually entered prior to that date. At any rate, it may be assumed that, in addition to all German patents applied for after that date, such older patents in regard to which the three-year term extends beyond that date will enjoy the benefits of the treaty.

This new treaty, abolishing, as it does, a condition of affairs that has been felt as a hardship by American inventors, will no doubt induce many American inventors to apply for German patents in cases in which they would otherwise have abstained from so doing.

Electricity and Vegetation in Polar Regions.

Electroculture is an old subject, upon which opinions are still at variance. Some investigators have definitely rejected the hypothesis that vegetation is affected by atmospheric electricity. On the other hand, Prof. Lemstroem, of the University of Helsingfors, Finland, vigorously sustains this theory and adduces experimental evidence in its support. Lemstroem asserts that when plants cultivated in the polar regions escape destruction by nocturnal frosts, they grow far more rapidly and luxuriantly than plants growing in milder climates. Rye, barley, and oats, especially, yield very large crops, in spite of primitive methods of cultivation with wooden plows and harrows. The growth of plants depends not only on the fertility of the soil, but also on the supply of heat, light, and moisture. In the polar regions the supply of heat is very small. The rapid growth of plants in these regions has hitherto been attributed to the continuous daylight of two or three months in summer, but this explanation must be abandoned, since it has been proved that, even in those months, less heat and light are received from the sun in the polar regions than at the latitude of 60 degrees. Lemstroem finds several reasons for believing that the cause of rapid growth in the Arctic is to be found in the electrical currents which flow between the earth and the atmosphere, and produce the phenomena of the aurora borealis. The pointed leaves of conifers and the barbs of ears of grain facilitate the transmission of these currents through those plants, and this function supplies a reason for the existence of these peculiarities.

From a study of the concentric annual layers of growth of conifers growing in various latitudes, between the 60th and 67th parallels, Lemstroem finds that the thickness of the annual layer varies according to a definite law, showing maxima and minima which indicate a period of ten or eleven years, coinciding with the period of sun spots and auroras. The differences, furthermore, are greater in the great firs within the Arctic circle, at 67 degrees north latitude, than in trees growing further south. This appears to indicate that the atmospheric electricity of the polar regions exerts a beneficial effect upon vegetation.

Lemstroem has also made experiments on the effect of electricity, produced by a Holtz machine, upon barley, wheat, and rye, growing in pots and in the open ground. The results of these experiments appear to him to give support to his theory of the favorable influence of electricity upon the growth of plants.—Cosmos.

The Current Supplement.

The opening article of the current SUPPLEMENT, No. 1762, discusses in a most interesting manner the caisson method of sinking the Detroit River tunnel. Excellent illustrations accompany the article. "Platinizing or Platinum Plating" is the title of an article which gives some very interesting technological information. The comparison of the phonograph and photograph by Dr. R. Defregger in an article entitled "The Analytic Eye and the Synthetic Ear" illustrates the contrasts between the senses of sight and hearing. Our impression of the universe, as the article points out, would be curiously different if the functions of these two senses were interchanged, so that the ear would perform the work of analysis and the eye the work of synthesis. Thomas W. Rolph discusses the different practices of illumination. He points out that in the field of illumination practice is several thousand years old, while theory is only beginning to be developed. He gives also helpful suggestions as to proper illuminations for various types of interiors. A *résumé* of some recent processes for the fixation of atmospheric nitrogen is presented. L. Zehnder writes on the dangers of atmospheric electricity in aeronautics A telephone system for Peking is described. G. Millochau of the Paris Observatory discusses the subject of stellar evolution and the origin of worlds. How water and milk may be sterilized with ultraviolet rays is pointed out by P. Santolyne. The great monumental structures of the later stone age were necessarily erected without the employment of any more elaborate machinery than levers and rollers from trunks of trees. A discussion of the wonderful monuments thus erected is presented. Dr. George M. Gould's paper on the rôle of visual function in animal and human evolution is published.

The Highest Balloon Ascension in America.

Although a large number of *ballons-sondes* were dispatched from St. Louis in 1904-7 under the direction of the writer, none had been employed in the eastern States until last year. In May and July, 1908, four *ballons-sondes* were launched from Pittsfield, Mass., with special precautions to limit the time they remained in the air and so prevent them from drifting out to sea with the upper westerly wind. Three of the registering instruments have been returned to the Blue Hill Observatory with good records. The first instrument sent up on May 7th was not found for ten months and the record, forming the subject of the present article, is very interesting because it gives complete temperature data from the ground up to 17,700 meters, or 11 miles. This is 650 meters higher than the highest ascension from St. Louis, which, by a coincidence, was also the first one to be made there. On May 7th a general storm prevailed, so that the balloon, traveling from the east, was soon lost in the cloud and its subsequent drift could not be followed, but the resultant course was 59 miles from the southwest, as determined by the place where the instrument fell two hours later. At the ground the temperature was 4.5 deg. C., and this decreased as the balloon rose to the base of the cloud, which itself was considerably warmer than the underlying air. Above the cloud the temperature continued to fall with increasing rapidity up to a height of 12,500 meters (nearly eight miles) where the minimum of —54.5 deg. C. was registered. Here the great warm stratum was entered and penetrated farther than ever before in this country, namely, to the height of 17,700 meters, where the temperature was —45.6 deg. C. An increase of 10 deg. occurred, however, in the first 3,000 meters, for above 15,500 meters nearly isothermal conditions prevailed, confirming the belief of Teisserenc de Bort that what he calls the "stratosphere" is composed of a lower inverting layer with isothermal conditions above extending to an unknown height. In an ascension last November in Belgium the relatively warm stratum was found to extend from 12,900 meters to the enormous height of 29,000 meters, or 18 miles, where there was still no indication of its diminution.—A. Lawrence Rotch in Science.

Glass Espalier Walls.

When vines and trees are trained in espaliers on the south side of a wall, the north face of the wall is usually wasted, although it can be used for the cultivation of varieties of apples, pears, and cherries which are hardy and not subject to rot. If a transparent wall could be used, plants growing on both sides of it would receive the benefit of the sun's rays. Some experiments have been made with glass walls. Count de Choiseul recently published the results of such an experiment, with photographs showing heavily fruited pear trees on both sides of the transparent wall. The wall, which is about 60 feet long and 6¼ feet high, was erected in 1901. Each side of it was planted with 15 pear trees of the variety *Doyenne d'hiver* (Winter Doyen), giving a wall area of 232 square feet to each tree. In 1907 the trees on the south side bore 134 pears, weighing 91 pounds, and the trees on the north side bore 109 pears, weighing 77 pounds. All the pears were of very fine appearance and without blemish, and the pears from the north side were smoother than the others.

In the nursery of Croux et Fils is a glass wall, which is surmounted by horizontal glass sashes and planted with the same varieties of peaches, apples, and pears on each side. These espaliers also began bearing in 1907, and both sides have produced equally fine fruit. The difference in temperature between the sides of the wall is not very great, as the southern face reflects less heat and is therefore cooler than that of a masonry wall, while the northern side is warmed by the rays which pass through the glass. A masonry wall possesses, theoretically, one advantage over a glass wall, as it absorbs during the day a greater quantity of heat, and consequently exerts a greater heating effect at night. Longer experience will be required to determine which material is the better on the whole. The cost of construction is practically the same for both.—Cosmos.

A rust-preventing coating for iron, used by a German manufacturing company, consists in coating iron and steelware first with lead, then electrolytically with zinc, and finally heating this coating, so as to obtain an alloy of the two metals which has the same potential as zinc.