

strength, it is pointed out in the report that they are unsuitable for ferro-concrete, as in practical work not only would there be a danger of "drying out" the concrete while hardening, but wet mixtures give a more intimate union with the steel. The elastic modulus of the different concretes was also determined. The results obtained with the cinder concrete were discordant, but more consistent results were obtained

in the case of the other aggregates. In general, with these the modulus was found to vary with the age of the concrete, but there was no very serious difference between the results obtained at the end of thirteen and twenty-six weeks. In the case of the granite, gravel, and cinder concretes the modulus was higher at the end of thirteen weeks than after the lapse of half a year. Up to a load in compression of 2,000

pounds per square inch the modulus in the case of the limestone and granite aggregates was about 4,000,000 pounds per square inch, and was higher, or about 4,800,000 pounds per square inch, for the gravel concrete. As stated, the values obtained with the cinder concrete were irregular, but at twenty-six weeks old the modulus up to loads of about 1,000 pounds per square inch was about 2,000,000 pounds.

THE FIRST AERODROME IN THE WORLD.

A RACECOURSE FOR ARMY FLYING MACHINES.

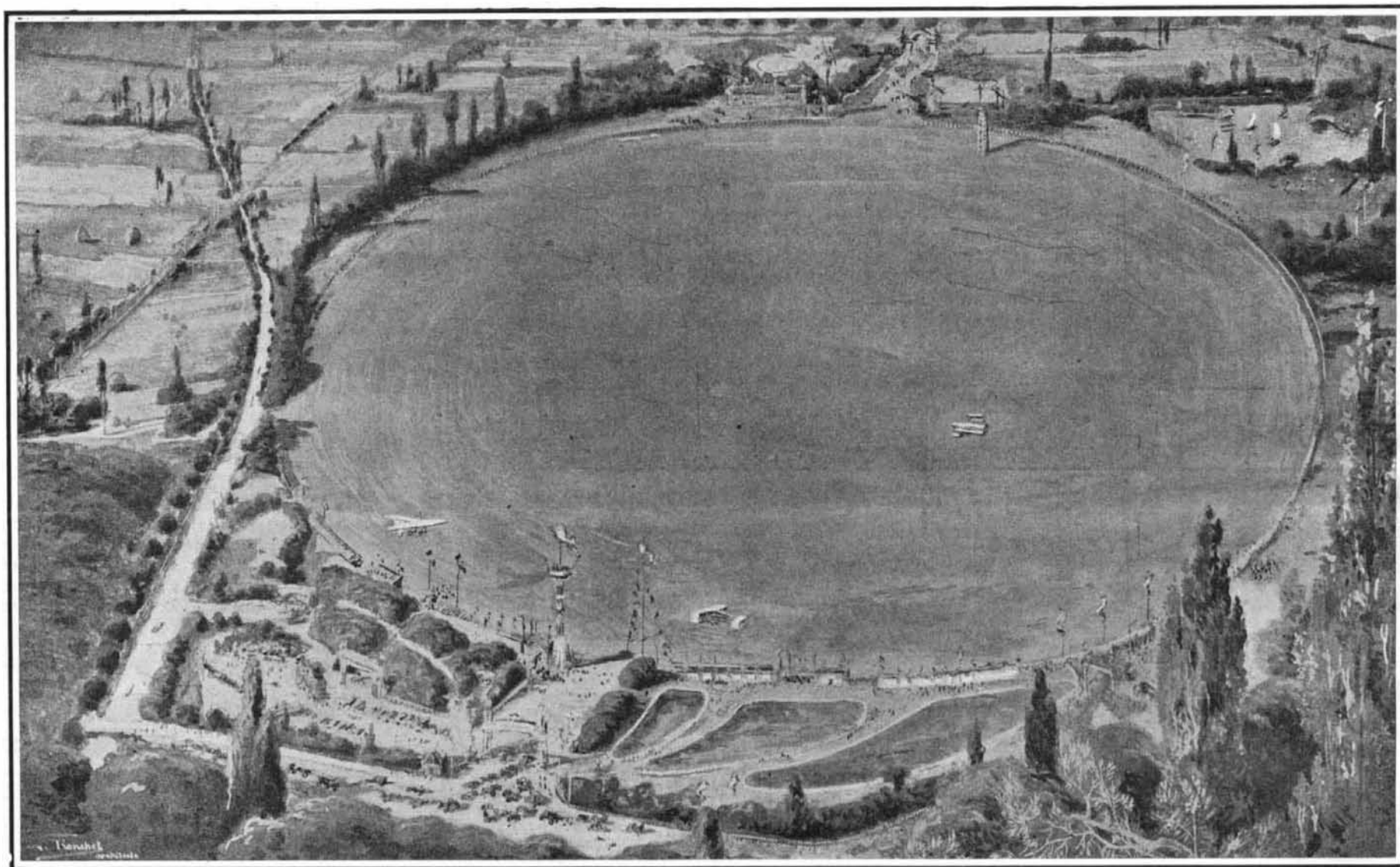
ABOUT twelve miles from Paris, in the center of a large plain, the French Society for the Encouragement of Aviation has established a trial ground and racecourse for aeroplanes and other airships. This aerodrome, the first of its kind, has been named Port Aviation. It is slightly larger than the racecourse at Longchamp, and contains an oval track about two miles long and stands accommodating 7,000 spectators, besides shelters for aeroplanes and dirigible balloons, repair shop,

upon it, it should prove a strong rival to the Lumière process.

It may be well to briefly describe the autochrome plate. This name has been given to a photographic plate manufactured by Lumière in Lyon. By means of this plate a nearly color-true image of a colored object can be made by one single exposure. The essential feature of the autochrome plate is a tri-colored grain-film prepared in a most ingenious manner. Starch

gelatine. Among the latter is, for instance, powdered gum arabic.

Szczepanik prepares three solutions of gelatine or gum arabic. Each solution is colored with a suitable dye, and is then cautiously evaporated to dryness. The particular dyes used must, of course, have a preference for collodion. The "solid" masses of gelatine or gum arabic obtained by evaporating the solutions are finely powdered, and the three powders of different



THE FIRST AERODROME IN THE WORLD. "PORT AVIATION," NEAR PARIS.

restaurant, post office, telegraph station, meteorological observatory, etc. The decorations are suggestive of flight. At the backs of the stands are trellised porticoes, with pylons surmounted by eagles and vultures with extended wings, which produce a very graceful effect.—L'Illustration.

A NEW DEVELOPMENT IN THE ART OF INDIRECT COLOR PHOTOGRAPHY.

By FRIEDRICH LIMMER.

THE Lumière autochrome plate for indirect color photography represented a marked step forward worthy of the highest commendation. It was an advance which only those can fully appreciate who have themselves worked in a similar field, and who know what perseverance and attention to detail are required in the field of color photography for every small improvement.

The autochrome plate has in a short time made a triumphant tour around the world. While professionals and amateurs have been rejoicing in this the latest development of color photography, Mr. Jan Szczepanik (known as the inventor of the three-layer paper) has filed (August 14, 1907) a patent application for a process which promises to be of great importance for indirect color photography. If the new method fulfills the expectations which seem to be rightly placed

granules colored blue, green and yellow, and mixed in a definite proportion, are dusted over a specially prepared plate. The unavoidable interstices between the individual starch grains are filled out with a black material. The sensitiveness to light of the autochrome plate is comparatively small. This is partly owing to the imperfectly transparent character of the starch grains, but the black filling-in material, of course, also absorbs light. These two drawbacks are absent from Szczepanik's tri-colored film. The following is an extract of the essential points of the patent specification.

Szczepanik bases his new process on the law of "migration of colors." This law is empirical; no satisfactory explanation seems to have been offered for the same. Certain coloring matters show a preference for certain substrata. Thus, if a layer of collodion colored red with erythrosin is placed over a colorless layer of gelatine, the erythrosin "migrates" (almost) completely from the collodion into the gelatine. It has been observed that (with few exceptions) basic dyestuffs show a marked preference for collodion, acid dyestuffs for gelatine. Thus, as soon as the opportunity is given, acid dyestuffs "migrate" from collodion into gelatine, and basic dyestuffs from gelatine into collodion.

There is a class of substrata which behave toward coloring matter in somewhat the same way as does collodion, while another class acts much like

colors are carefully mixed. The mixture of these colored powders is then sifted over a slightly moist collodion plate by means of a special apparatus. The coloring matters migrate from the gelatine powder into the collodion film, producing a mosaic of small colored patches similar to the starch granules of the autochrome plate. The powder originally dusted on the plate, which has lost its color, is washed off.

It may happen that particles of the powder overlap on being dusted on the plate. Nevertheless no transference of color between the individual particles themselves takes place. The overlapping particles are washed off subsequently together with the spent particles. Owing to imperfect contact between the powder and the collodion film, colorless patches are apt to be formed here and there. This may be remedied by using a little less of one of the colored powders than is actually required. The plate is then, after dusting over, placed in a bath of a gelatine solution of that dye of which an insufficient quantity was used previously. In this way the uncolored patches also are properly pigmented.

According to this process of Szczepanik, a tri-colored film is obtained which has a number of obvious advantages over the autochrome film. It is considerably more transparent than the latter. It contains no kind of filling-in material. Every color patch is directly contiguous with its neighbors. The advantages gained are:

"Greater sensitiveness to light. Increased brilliancy and brightness of the pictures. Freedom from parallax—a matter of much importance in preparing copies from the plates."

The new plates are not as yet upon the market. If they make their appearance and fulfill the inventor's expectations, Szczepanik's process represents a further advance in the field of indirect color photography.

Szczepanik's ingenious application of the law of migration of colors should prove of interest for quite a number of branches of industry.—Translated from the *Zeitschrift für Angewandte Chemie*.

POLES FOR POWER TRANSMISSION.

THEIR DESIGN AND STRENGTH.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

DESPITE the rapidly increasing developments in the overhead distribution of electric current at high pressures, hitherto but little data has been available concerning the strength of wooden poles on which the transmission lines are carried, with the result that in some countries the elaboration of overhead carrying systems has been severely restricted, thereby severely handicapping the progress of distributing electrical power upon an extensive basis to industrial districts. Especially is this the case in Great Britain, where the Board of Trade, which has control of such work, has hitherto stipulated the very high wind pressure of 30 pounds per square foot and a factor of safety of 10. Under such circumstances it was somewhat difficult to settle precisely the size of pole that should be adopted for a given line; and in order to fulfill the government conditions, care was observed

about 5 feet above the ground, or 10 feet from the butt. In order to obtain conditions similar in character to those prevailing when a pole is erected, the lower end of the pole was anchored rigidly in a timber housing for a length of 5 feet from the butt, corresponding to the depth to which it is sunk into the ground. Four 13-inch square barks were driven

tendency to slip. All the poles selected were from $7\frac{1}{2}$ to 8 inches in diameter at a point 5 feet from the butt, and in each instance were of red fir. The double pole, scarfed and with the feet spread out to the desired angle ready for erection, was laid in the housing, and at a point 2 feet 6 inches from the butt two heavy blocks of timber were bolted thereto, one below

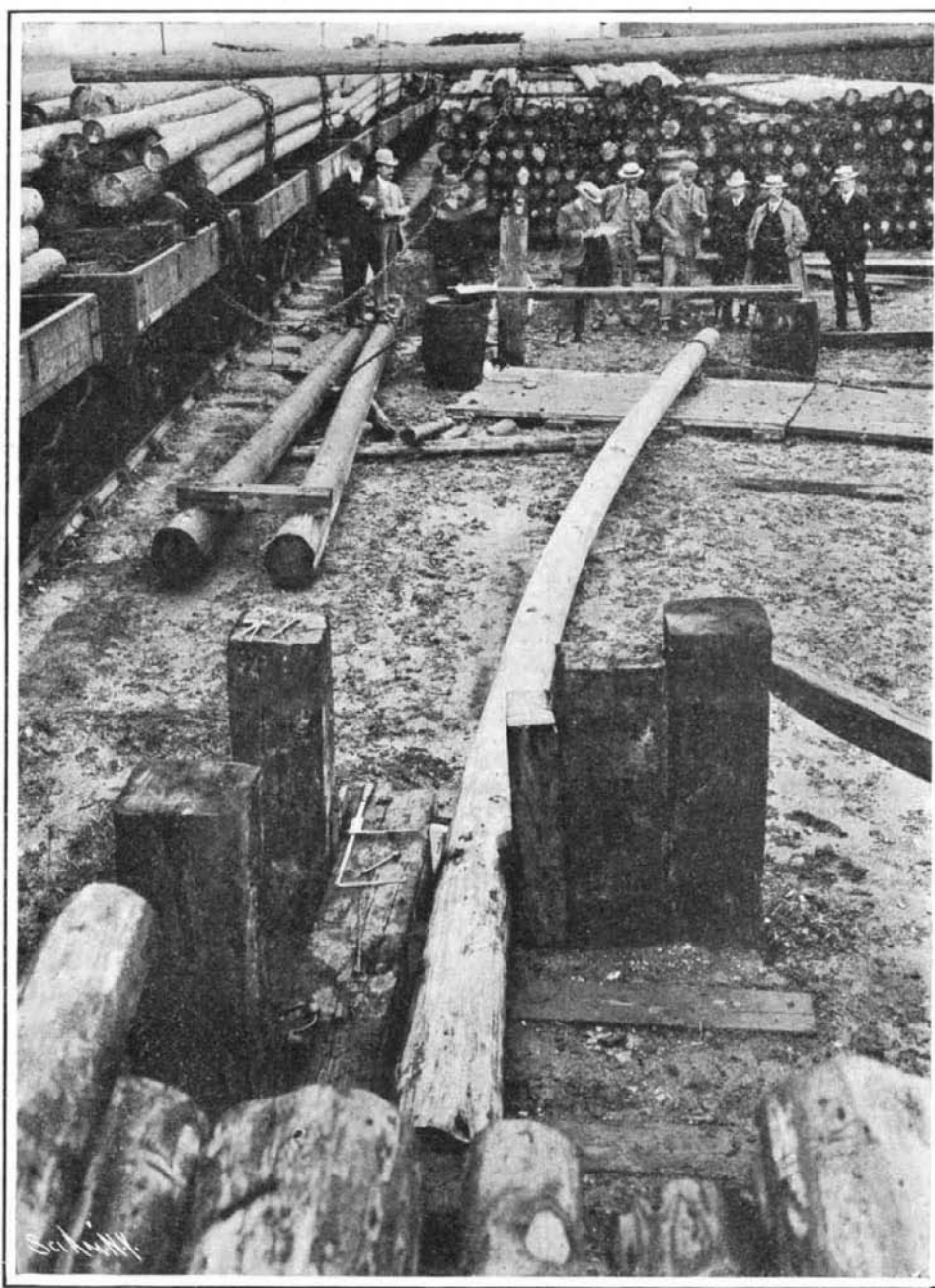


THIRTY-TWO-FOOT A-POLE UNDER TEST.
NOTE TWIST OF COMPRESSION LEG
AND SKEWING AT TOP.

to err on the side of safety, with the result that the pole-carrying system has been somewhat more elaborate than the exigencies require. In many instances, owing to these factors in regard to wooden poles being an unknown quantity, distributing companies chose to incur additional expense in laying their distributing mains underground, which enhanced expenditure naturally tended to maintain higher prices for current than would have been possible had the distribution system been carried out on the cheaper overhead system.

Realizing that such considerations pressed somewhat unduly upon the electric power producing and distribution industry, Mr. A. P. Trotter, the electrical adviser to the Board of Trade, suggested to Mr. C. Wade, a member of one of the largest firms in the country supplying wooden poles for telegraph and telephone services, that a series of exhaustive tests on wooden poles of varying form, lengths and diameter should be carried out, in order to determine the breaking load, wind pressure, deflection, etc., that the poles can stand, and to embody the scientific results thereby obtained in such a manner that an electrical engineer can determine at a glance what size and type of pole is necessary for any prescribed line. These tests were forthwith carried out at the Hull yards of the firm by Prof. Goodman of the Leeds University, assisted by the engineers of many of the most important power-distribution concerns of the country. Trials were conducted with both single and A-poles.

The principle upon which these tests were carried out may be gathered from the accompanying illustrations. The breaking point of a pole appears to be



SINGLE POLE UNDER LOAD JUST BEFORE BREAKING.

to a considerable depth into the ground, and stayed to insure absolute stability. The butt of the pole was then laid in this housing, and tightly wedged in position. At the other or free end of the pole a chain was attached running to a set of pulley blocks operated by hand, a dynamometer being inserted in the loading chain to determine the strain imposed. In order to insure the results being absolutely correct, Prof. Goodman introduced a telescope attached to the butt of the pole, and by which means it was possible to sight a plumb bob at the free end of the pole, so that any slip in its housing could be easily detected and allowed for. The employment of the telescope in such a test as this is a highly essential refinement, and its provision proved so useful that it was adopted in every test carried out. When all was ready, the load was applied to the top of the pole by hauling on the load chain as shown in the illustration, and in some instances the pole, which projected from its housing for a distance of 35 feet, deflected 13, 14, and 15 feet before breaking, while those that were released before the breaking point was reached showed a very slight permanent set.

With regard to the tests of the A-poles, a different method of housing had to be adopted to obviate any

and one above the legs of the members against the faces of the vertical supports of the anchorage. A heavy iron ring was also bolted to the tension leg of the pole below the blocks, to prevent them slipping down when the load was imposed, while the feet of the pole rested against a massive timber balk supported on the vertical timber supports. Further stability was insured by the insertion of a block between transverse members of the anchorage on the compression pole side. The effect of this arrangement was that when the load was imposed, the leg of the pole under tension was unable to move away from the balk and its supports, owing to the cross timbers, while similarly the leg under compression was unable to move, as its foot was pressing against the transverse member. The pole was thus held with absolute rigidity in position in its housing, the security in this direction being obviously much greater than prevails in actual practice. As before, the opposite or free end of the pole was sighted by means of the telescope and plumb bob, and the load was similarly imposed by means of pulleys and chains with the dynamometer inserted. The weight of the pole at the top end was carried by a chain hung from a pulley slung from an overhead cross pole supported at either end on tripods, and this