MASTHEAD ELECTRIC ILLUMINATION.

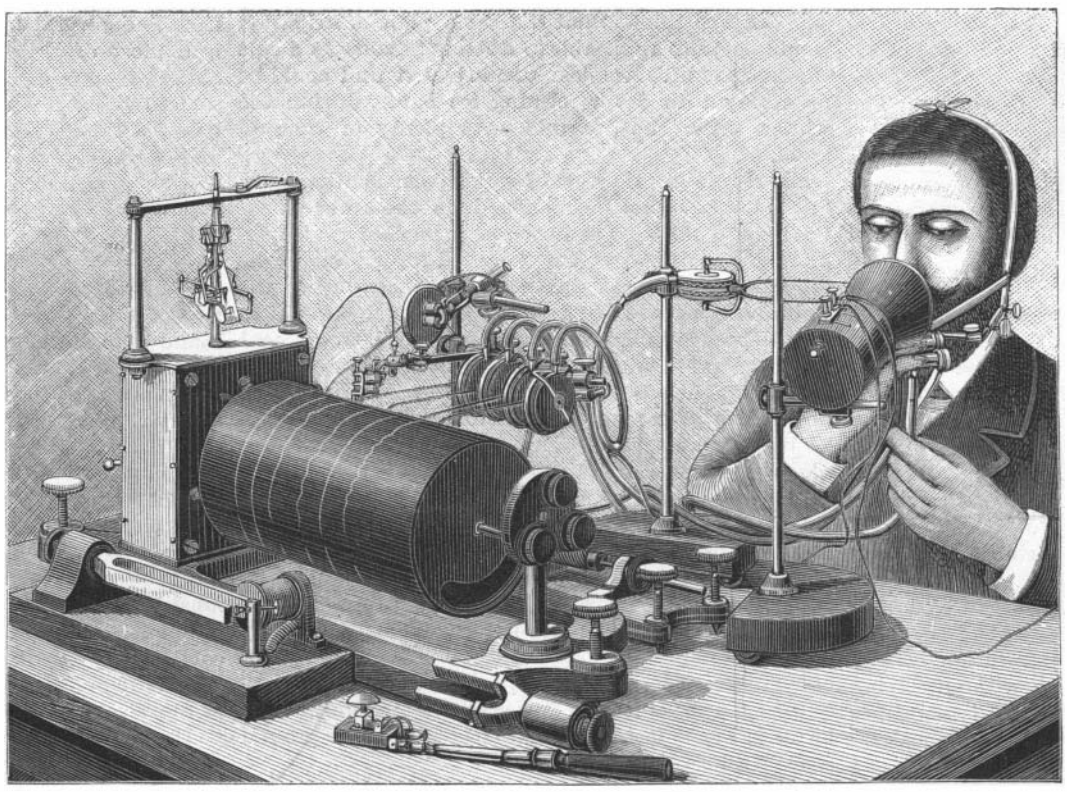
An interesting detail of naval operations in the supposed case of a war between England and France has lately appeared in *The Engineer*, London, from the pen of W. Laird Clowes, under the title of "The Captain of the Mary Rose," a tale of to-morrow. It gives particulars of various supposititious naval combats, and brings into clear light the defects as well as the powers of modern war vessels of all classes. The story is well illustrated. Among the engravings is one representing a plan for masthead electric lighting in which a zone of light is made to illuminate the waters in all directions around the ship of war, while the vessel itself remains in deep shadow. Concerning this device our author says:

"Masthead electric lights of novel design are being fitted to some of the larger battleships. These are so arranged as to shed a zone of illumination all around the vessel, but to leave the craft herself in comparative darkness, and it is confidently expected that they will be of great value should our squadrons be obliged to anchor at night within raiding distance of the enemy's torpedo boats. Some experienced officers, however, are of opinion that a ship which desires to remain exempt from attack should on no account exhibit a light of this kind, since it must of necessity be visible from a considerable distance to the foe, and they do not hesitate to say that, even if they be supplied with it, they will not use it. The advantage of the light lies in the fact that no ship so long as she employs it can possibly be closely approached by any enemy that does not expose himself to a very dangerous extent. On the other hand, it is pointed out that the apparatus is large, and offers so fine a mark for machine gun fire that it could doubtless be easily extinguished by moderately good gunners at 3,000 yards, or even more. Experts here are loud in their regrets that this device, which is quite new, in common with other electric lighting devices which are much older, has not been properly experimented with in peace time, and that, in consequence, no certainty exists as to either its practical utility or its vulnerability."

THE INSCRIPTION OF SPEECH.

Abbot Rousselot, professor at the Carmelite School, has very recently presented to the Faculty of Letters of Paris a thesis for doctor's degree which is apparently of a very special interest, for it treats of the "phonetic modification of language as studied in the patois of a family of Cellefrouin (Charente);" but this work, at first sight so limited, has a wide range, for the author definitely lays down therein the bases of a new science—experimental linguistics. Our readers already know of the important results obtained by Messrs. Rosapelly and Marey in their laboratories. It is by the aid of their labors and those of a few others, Scott, Barlow, etc., that Abbot Rousselot, in preserving the instruments of his predecessors, such as they are, in correcting them, or in devising new systems, has succeeded in creating the series of apparatus necessary for registering, one by one, the motions whose *ensemble* constitutes a word or a phrase.

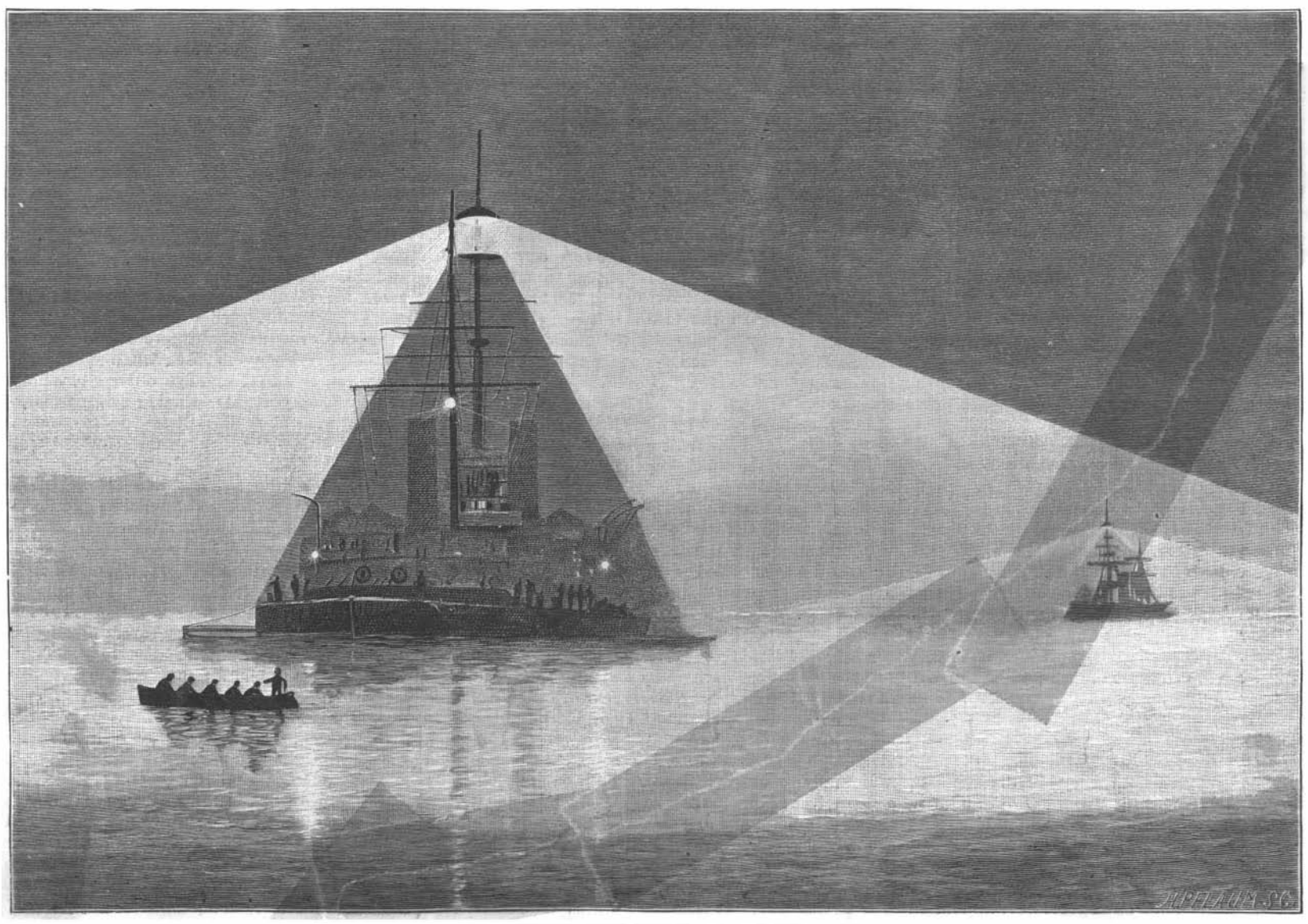
It is to be foreseen that the ingenuity of his successors, his own even, will still further improve these new apparatus; but at present the experiments made suffice to show that the problem of the mechanical inscription of speech is solved. The lines are inscribed upon the Verdin registering apparatus figured herewith. This, as well known, consists essentially of a cylinder upon which is fastened a sheet of glazed paper blackened with the smoke of a wax taper. A clockwork, with a Foucault regulator, permits of making it revolve with a speed that may be regulated at will. In front of the cylinder, upon a horizontal rod, is fixed a Marey drum and lever, made of a metallic capsule closed with sheet rubber. Against the rubber there bears a metallic plate with which is connected a horn lever that thus follows all the movements of the plate and rubber. The extremity of this lever rests upon the blackened sheet and removes the lampblack and thus draws a white line upon it. On another hand, there is an aperture in the drum into which a rubber tube may be fitted.



ABBOT ROUSSELOT'S APPARATUS FOR INSCRIBING SPEECH.

Evidently, every time that, for any cause whatever, the air contained in the rubber tube enters into vibration, the vibrations will be communicated to the air of the drum, and after this the rubber and then the plate and lever will enter into motion. If the cylinder is revolving at the same time, the line that will be inscribed thereon by the point of the lever, instead of being straight, will become a tracing—a tracing of the vibrations.

Now, if we reflect that speech is a motion and that a sound, a voice, is air that issues from the mouth and nose in vibrating under the action of the phonic organs, we shall understand the use to which the apparatus just described may be put. Abbot Rousselot does not, of course, make it note speech itself in all its complexity, but, one by one or simultaneously, all the motions that compose it. Let us begin with those of the larynx. It is here, in fact, that the first noises are produced when the air is expelled from the lungs. To the extremity of the tube that ends in the drum is adapted a metallic capsule about half an inch in diameter, which one applies to the throat, in the lateral curve of the thyroid cartilage, and then speaks. Then the vibrations of the larynx, transmitted through the skin to the column of air o



MASTHEAD ELECTRIC ILLUMINATION.

the capsule and tube, set in motion the rubber of the drum and consequently the lever, as above explained. This gives the first trace. In order to obtain the motions of the tongue, which rises and descends when one speaks, the process is analogous, but here, instead of a capsule, a drum similar to the receiving drum is held under the chin by means of a bandage. The lever follows the motions of the hypoglossal muscle and the drum transmits the motions, as before, to the receiving apparatus. In order to have the opening and closing of the lips, a double drum connected with the two inscribers is necessary. The levers are so arranged as to form a sort of clamp, upon one branch of which each lip rests.

The nose explorer is that of Dr. Rosapelly. The rubber tube here terminates in a small bulb which is held in the nose by friction. When the air makes its exit through the nasal fossæ, as happens, for example, when a nasal vowel is pronounced, these vibrations act upon the inscriber and receiver in the same way as before.

As the registering cylinder is capable of receiving several inscriptions at once and as all the levers can be placed in the front of the drum at the same time (as shown in the figure), we shall be able to read upon it simultaneously the motions of the larynx, tongue, lips and nose. Still other apparatus that it would be superfluous to add will permit of inscribing all the accessory motions. It results that we shall have at once a certain number of lines representing simultaneously the pronunciation of a word.

In order to comprehend the importance that such inscription of decompounded speech may have, we must reflect upon the results that can be derived from it, not only by physicians, but by linguists. It will be possible hereafter to note the pronunciation of any language, dialect or idiom whatever, without relying upon the testimony of the ear, which distinguishes but slight differences between the modes of speaking of several individuals. Hereafter there is to exist a phonetics of precision.

How, in fact, do languages change from one epoch to another and from one country to another? Contemporary science has shown that there is nothing arbitrary here, and that such mutations operate according to fixed and constant laws uninfluenced by caprice or convention. Thus, to take an example, a Latin *c* placed before an *a* at the beginning of a word has given *ch*; *carnem* has become *chair*, *caput*, *chef*, and *canem*, *chien*. A *t* followed by an *i* in the middle of a word has given *is* in *poison* from *potionem* and *raison* from *rationem*. But what it has been impossible to note up to the present is each stage of these insensible, and, so to speak, microscopic transformations.

To take a contemporaneous example, one has never precisely determined, in such words as *ennemie*, *année*, the exact influence of the mute *e*, which is written but not pronounced, properly speaking, without one being able to say, however, that it is no longer heard. Now, it is always by imperceptible modifications that a phonetic change begins. We do not ourselves perceive those that are beginning, but our children will perceive them, for they will not pronounce any more accurately than we, and it is these modifications, imperceptible at first, that make of one language another tongue. By means of his apparatus Mr. Rousselot has thus already been able to note a host of variations in the same family.

This is enough to show the interest that these new instruments of study present. In the future, they will furnish our descendants with absolutely exact ideas as to our present pronunciation. As for us, they permit us to enter much more deeply into an intimate knowledge of living languages, to establish their relations and differences more closely, and, by induction, to divine what has been the progressive course of the slow evolution whence our modern tongues have issued.—*La Nature.*

Snow as Material for Irrigation.

In a paper read by Mr. A. Podolsky, C.E., before the I.R.T.S. of St. Petersburg, he says: Want of irrigation is the principal cause of the last year famine in Russia. The usual process of carrying irrigation works from neighboring streams is too costly and slow, and besides is quite impracticable in South Russia, on account of excessive small falls in all the rivers of this part of the country, the average fall being under 0·0001, or about 2·5 inch in one mile; the streams, moreover, have very little water during the summer months, when the irrigation is principally wanted.

Now in several parts of Siberia and especially in the Semiretchensky district the water obtained from melting snow is used for irrigation. The climate of these parts is quite continental, with very hot, dry summer, a severe winter, with plentiful falls of snow, and consequently very similar to the climate of middle and south Russia. The snow irrigation is managed in the following manner. At the first warm winter day after a plentiful snowfall, the whole village, not excepting women and youngsters, meet at a previously appointed spot in the fields situated on a slope of a hill. One portion, consisting of strong men, collect and carry the snow to form a large bank, while others press the snow down and spread it evenly. This operation is repeated several times during the winter, after each abundant fall of snow, and by the spring a large bank of compressed snow is formed, a dozen feet deep and weighing several hundreds of tons. With the first approach of the spring, the snow bank is covered with pine branches, straw and dung; if such material is not at hand, earth and sand are used as covering, but in the latter case the layer has to be about 18 inches thick. The lecturer thinks that the same plan of irrigation would be quite applicable to Russia, because as a rule the crests of hills are left uncultivated and could be profitably utilized for forming ice banks during the winter, when the peasants have plenty of time on hand.

For regulating the flow of water from melting snow in the bank, a ditch is managed on the lower side of the bank with two openings, one to be used as an overflow, in case the water is not wanted for irrigation, the other leads to the irrigation ditch distributing the water on the fields.

With regard to figures, the experience is too recent to yield correct data as to melting of compressed snow in large quantities, influence of various coverings, etc., but we can approximately calculate the extent of an ice bank necessary to irrigate a certain surface of arable land, as follows:

In south Russia, the water necessary to grow one "dessiatna" (3 acres) of wheat is about 2,000 tons, half of which, or 1,000 tons, might be required to be supplied by artificial irrigation. On the other hand, 36 cubic feet of loose snow weigh about one ton. Assuming that pressure will reduce the volume of snow by one-half, each ton of water will represent 18 cubic feet of compressed snow. Consequently, one acre will require 6,000 cubic feet of space in the ice bank; if the latter is say 15 feet high, 20x20 feet will be the ground space required for each acre.

Such ice banks are the cheapest and the most practicable way of irrigation for south Russia and generally for countries where snow falls in abundance during the winter.

Production of India Rubber in Borneo.

There is a royalty charged on rubber collected from the jungles of Borneo of 10 per cent *ad valorem*. The different species of the plant found are, according to the United States consul at Singapore, (1) *Manungan pulan*, which comes chiefly from Northwest Borneo; it is a *Willughbeia barbidgei*, and is specially identical with the "gutta-singgarip" of the peninsula; (2) *Maugan buyok*, said to yield the best gutta of the Borneo forest; it is a *Leuconotis engenifolius;* this species is also found in small quantities on the peninsula; (3) *Manugan manga*, which yields a very good gutta, is possibly a *Willughbeia*, as also is *Surapit*, for the latter yields the same milky exudation as *Manugan pulan*, but is said to be a bad gutta, and seldom collected. *Bertabu*, or *Petabo pulan*, is referred to as of little value as gutta, except perhaps for adulterating the better kinds. The other kinds of gutta met with in the Malay Peninsula are: (1) *Singgarip putch*, or *Gutta sudek;* (2) *Singgarip hitam;* and (3) *Gutta jelutong*—the latter is only used for adulterating.

The gutta percha production and export is much larger than the trade in India rubber properly so called. The name is given to the inspissated juice, which is produced chiefly by *Dichopsis gutta*, called by the natives *getah taban merah*, and often confused with caoutchouc. The tree is of large size, from four to five feet in diameter, and from 100 to 200 feet in height. When growing in the forest it has a clean, straight stem, and it may be generally distinguished by the rich brown color of the under surface of the leaves. The flowers are small, white, and divided into six petals and six sepals. The seeds—generally two in each fruit—are oily, and are eaten by birds and monkeys. It flowers in March, and the fruit ripens in June.

The method of collecting the gutta is as follows: A tree having been selected is felled, and as it lies on the ground rings about an inch broad are cut in the bark at intervals along the whole length of the trunk and of the branches with a parang or Malay knife. These cuts soon become filled with the white, cream-like sap, and in about half an hour the gutta will have separated from the aqueous portion of the sap, and may be removed by rolling a small ball of it round in the cuts, to the edge of which the coagulated gum adheres and forms a disk, varying in size according to the number of scores it is rolled in. These disks are then boiled in water and made into balls, and sold by the collectors to the persons who export it to Singapore and Penang. The gutta is at first white, but soon changes to pink, and finally to a brownish-red. The amount yielded by a single tree about 100 feet high, and whose age was estimated to be over 100 years, was 2 pounds 5 ounces of fairly clean gutta, valued by a Malay dealer at 3s. 3d. per pound. The product, therefore, of the whole tree is worth only 7s. 6d. Other species of the gutta tree in the Straits Settlements are: (1) *Getah toban putch* (white), (2) *Getah toban sutra* (silk), (3) *Getah toban chayas* (liquid), and (4) *Getah toban simpor*. It is stated by the director of the botanical gardens at Singapore that there are over 92 species altogether on the peninsula.

American Bauxite.

Previous to the year 1890 all the bauxite used by American consumers was imported from France; in fact, it derived its name from a town in France (Beaux) near where it was first discovered. There are very few deposits of bauxite in the United States that justify their being worked. The high percentage of silica and iron most of these properties contain renders them almost, if not entirely, worthless. There are, however, some deposits in Alabama and Georgia that far surpass the French bauxite, in that they are more soluble and contain a larger percentage of alumina and a smaller percentage of iron and silica.

Bauxite is a ferruginous hydrate of alumina ($Al_2H_6O_6$). It occurs in "beds" or "deposits," and is mined very much like iron ore in an open cut, by blasting, etc. It is found in two distinct forms; one consists of birds' eyes and fine gravel, while the other is found in the form of a donix. These birds' eyes are very rich in alumina. This ore is found sometimes between layers of clay, and in such an instance it requires a very experienced miner to separate the two, from the fact that bauxite in some of its forms resembles clay very much. This is the most deceptive of all ores; you cannot form any idea of its quality by simply looking at it, but it requires analysis all along as you progress in the mine. When this ore is being shipped, analyses must be made of everything shipped out—each car must be carefully sampled. By sampling the mine at different stages and taking therewith samples of the cars gives results from which an average can be made.

Bauxite ore should always be shipped in box cars, so as to prevent the accumulation of moisture, and has to be shipped when perfectly dry, 6 per cent of moisture generally being allowed by the consumer.

There are two companies engaged in shipping bauxite to consumers in Philadelphia, Syracuse, Buffalo, and New York, viz., the Southern Bauxite Mining Company and the Republican Company. The former company owns most of the valuable ore in Alabama and two splendid deposits in Georgia. It has been stated that the shipments of bauxite by these two companies have greatly reduced the price of aluminum.

It is useless to go into detals as to the metal that is gotten from bauxite (aluminum), for upon that subject much has already been said. From the present outlook it is destined to be the coming metal, its lightness, durability, and the fact that it does not oxidize being recommendations that no other metal has. In nature aluminum exists very abundantly, and goes to make up a large portion of the earth's crust. Common clay contains about 30 per cent of aluminum, but in view of the fact that it exists in a combined form renders it difficult to separate.

The following is an average analysis of the ore found in Alabama and Georgia:

Alumina	55 to 60 per cent.
Silica	6 " 10 "
Iron	5 " 6 "
Water	24 " 30 "

The method for bauxite analysis is very simple. However, great care should be taken in the sampling, for upon that depends the accuracy of the result.

Method for Analysis.—Weigh out 2 grammes of the finely ground ore and place in a platinum crucible with cover on; place over flame and heat gradually at first, and then raise the heat to redness; allow this to continue for 15 minutes; remove crucible and allow to cool; weigh, and calculate loss as water.

To the crucible containing the dried powder add sodium carbonate and fuse; when at quiet fusion, remove crucible and dissolve out contents with water and a little hydrochloric acid; evaporate to dryness; take up with as little HCl as possible and water; filter and wash well with hot water; make up solution to 300 cubic centimeters; shake well to mix; take out 50 c.c. and determine the alumina by precipitating with ammonia; take another 50 c.c. and determine iron by usual method. The silica is also determined as usual.

A SEPARATE building at the World's Fair for the shoe and leather industry exhibit is now an assured fact, as the required $100,000 has all been raised. Leather dealers and manufacturers in all parts of the country have contributed to the fund. The building will be one of the handsomest on the grounds, having been designed by Sandier, an eminent French architect, now connected with the fair. It will measure 150 by 575 feet, and will contain everything in the way of leather and the products of leather exhibited at the fair. The most improved machinery used in leather manufacture will be shown, as also the manufacturing processes. The visitor may watch this from the rawhide to a finished shoe or dainty slipper. It is likely, too, that rubber goods and their manufacture will be shown in this building. Altogether the exhibit will be far larger and more complete than anything of the sort ever before attempted.