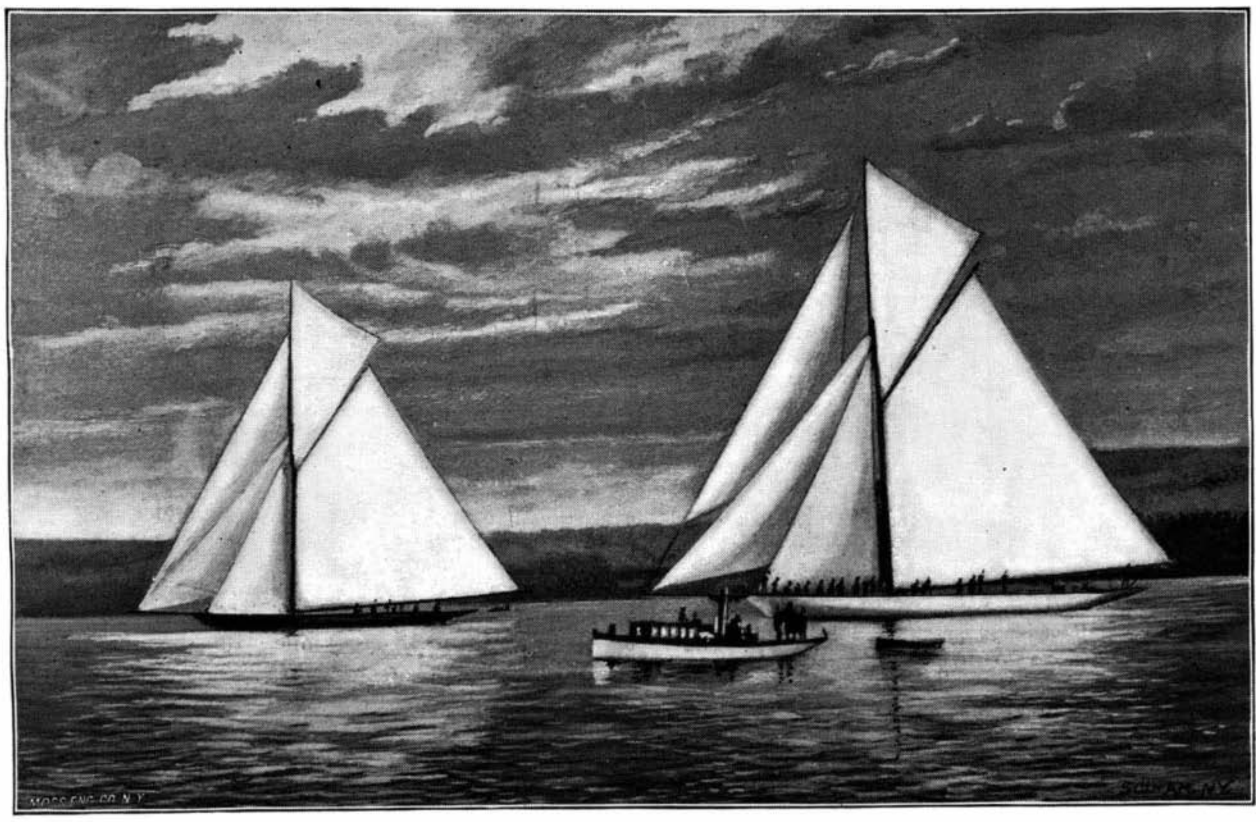
### THE INTERNATIONAL YACHT RACES.

In England the present yachting season has been one of unusual interest, owing to the races which have taken place between the fastest British yachts and the American yacht Vigilant. The champion boat on the British side has been the Britannia, owned by the Prince of Wales, and in several of the contests the royal vessel has beaten the Vigilant. The latter vessel triumphed last year in every race with her British antagonist, the Valkyrie, and it was supposed the Vigilant could easily outsail the Britannia. In almost every race when stiff winds were blowing the Vigilant has been the victor; but in light winds the Britannia has come in ahead. The races of last year, it will be remembered, were sailed off the port of New York. This year the Vigilant went over to England, and it is a curious fact, on one of her races she went victoriously over nearly the same racing ground that the America sailed in 1851, when she gained her memorable laurels over the British boats.

Our engraving, which is from the Yachtsman, shows the Britannia and the Vigilant as they appeared at the beginning of the race off Cowes, August 4, 1894, on which occasion the Vigilant beat the Britannia by 6m. 33s. The prize was a purse of $500 for a race over the Queen's course.



Britannia. Vigilant.

THE BRITANNIA AND THE VIGILANT.

### A TRIAL OF MAXIM'S FLYING MACHINE.

A reporter of the Pall Mall Budget recently visited Mr. Hiram Maxim's establishment, near London, and describes what he saw as follows: There was a hissing and a spluttering as some pumps got to work, and then, presently, the port propeller began to revolve with a rapidly increasing whirr-r, and the cry went up to "look out." In a few seconds whirr r-r-r went the starboard propeller also. The platform on which we stood rocked and quivered with the vibration. A hurricane seemed to spring up, laying the hay flat far and wide, and scattering like a whirlwind the shavings in the workshop twenty yards away. Every one grabbed his hat with one hand, and clung for dear life with the other to a rail. Suddenly, when the tornado had reached its height, and the whole machine was shaking and straining at its anchor like a greyhound in the leash, a shrill whistle gave the order to "let go," and the huge structure bounded forward across the meadows with a smooth sailing motion, at a rate increasing up to forty miles an hour.

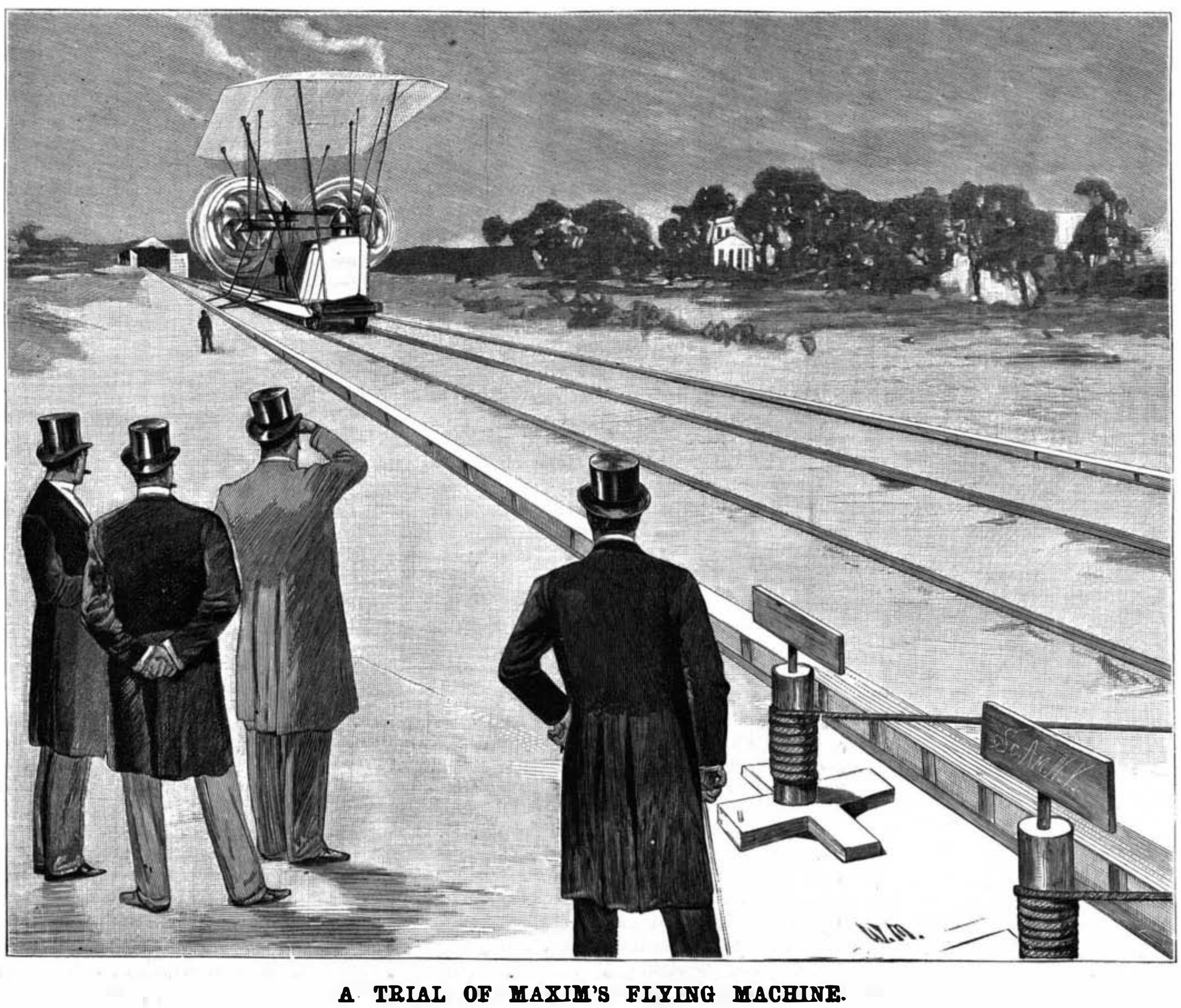
As the end of the track came in view a look of horror set in. There was nothing apparently but a quick-set hedge to arrest our wild career. A rope was stretched across the path. We crash through it. Then another; then another, and finally we come to rest in the easiest, gracefullest manner imaginable, within a few feet of what looked like perdition. Then we all laughed. It was a most delicious sensation, wiping out forever such tender memories as switchbacks, toboggans, and the seductive water chute. It was unique, in fact, and unlike anything that the world has ever seen; for the occurrence just described represents the crude residual impressions of a first trip over the rails on Mr. Hiram Maxim's giant flying machine.

The inventor beamed pleasantly as he noted the effect, for he had a distinguished company on board. There were Lord Kelvin and Lord Rayleigh, Sir Douglas Galton, Professor Vernon Boys, Sir Guilford Molesworth, Earl Russell, Professor Pettigrew, of Edinburgh, and the science representative of the Pall Mall Budget. After the first trip there was a unanimous demand for a second, and the huge structure, weighing but some 7,000 pounds in all, was pushed back along the rails on which it runs to the starting point, where steam was got up once more and the performance repeated.

Then the questions began. How was the power generated? What was it all made of? and (most important of all) Would it really fly? To take them in order, the machinery for developing and applying power is one of the most ingenious bits of steam engineering to be seen. It consists of a novel water tube boiler, built of asbestos cloth at the sides, and the thinnest sheet steel on top. The water is contained in about 2,000 bent copper tubes, only three-eighths inch in diameter, heated by over 7,000 gas jets arranged in rows. The fuel is naphtha or gasoline, which is stored in a liquid form and pumped into a vaporizer which transforms it into gas, and supplies it at a high pressure. All manner of cunning dodges are associated with this fuel supply. For instance, there is an exceedingly pretty automatic escapement which controls the fuel pump according to the pressure in the vaporizer; and the inrush of the gas, at a rate of two miles per minute, is utilized to suck in the necessary amount of air as well, both being under the most perfect regulation.

The feed water for the boiler is supplied through rows of pipes no larger than 1/8 inch in diameter. These are heated by the waste products from the flames with such success that the water is raised to 250 degrees (at which temperature it does not boil, on account of the pressure), and the gas products themselves are so completely robbed of their heat that they do not even blister the Brunswick black on the thin sheet steel covering which represents the top of the boiler. There is a beautiful automatic gauge for registering the amount of feed water passing into the boiler, and another ingenious device by which the pressure of the water itself is made to give the necessary circulation. With this apparatus steam can be got up in the incredibly short space of half a minute. Condensers were used at first, but an unlucky smash about three months ago damaged the apparatus, and now the steam exhausts into the air in two long wavy jets from the corners of the great aeroplane overhead.

So much for the steam generating appliances, which weigh only 1,000 pounds in all, and are placed in the very front of the machine, the boilerend tapering off like the bows of a ship so as not to catch the wind. The engines themselves are an equally remarkable piece of engineering. They are compound two-cylinder engines, poised about eight feet from the floor, and about six feet apart. They are independently governed, and will furnish 150 horse power each, which, considering that their total weight is only 600 pounds, gives the extraordinary efficiency of 2 pounds weight per horse power. This is something which will make engi



A TRIAL OF MAXIM'S FLYING MACHINE.

neers sit up and wonder whether they are dreaming. The high and low pressure cylinders are five and eight inches in diameter respectively, and the stroke is twelve inches long. A beautiful device is used for regulating the by-pass for the steam into the low pressure cylinder.

When going full speed these engines give 425 revolutions per minute to the gigantic propellers that drive the machine along. These are in appearance like two-bladed marine propellers, except that they are square instead of rounded at the ends, and are broad and thin. Inquiry revealed the fact that they were built up out of overlapping strips of American pine, planed smooth, and covered with glued canvas. The propellers weigh 135 pounds each; the length of the blade is close on 18 feet, the width at the ends 5½ feet, the pitch is 16 feet, and the maximum thrust they give is about 2,000 pounds measured on a dynamometer. They are carefully stayed by steel wires to their own shafts, or the first revolution would snap them off short.

The propellers are by no means the least wonderful part of this wonderful machine, and were evolved out of endless experiments. Arranged as a trophy inside Mr. Maxim's house are no less than thirty-two different models of propellers of every sort and shape, which were used in making the experiments.

To turn to the structure itself, the material of which the framework is built is thin steel tubing. It is so light that a length of it taken in the hand gives the same shock of surprise as does a piece of aluminum, which Mr. Maxim considers far inferior to steel for purposes of strength. All the ropes and ties are of the best steel also, capable of standing a strain of 100 tons to the square inch. The body of the machine is practically a "bogie," oblong in shape, with the forepart cut away like a water chute boat, and a long counter at the stern over which the propellers revolve. It has canvas stretched all over it, and a wooden grating to walk on. Four strong flanged wheels run on a pair of broad gauge rails, and at the end of a pair of long "outriggers" are other wheels which run under a wooden railing when the machine leaves the track. By these means it is prevented from rising at present more than an inch off the ground.

So far the description might have served for a skeleton locomotive. What transforms it into a flying machine is the aeroplane. This is made of fine balloon cloth. High overhead, like a gigantic awning, is the main aeroplane, tilted toward the front at an imperceptible angle, and stretched taut. The area of this is 1,400 square feet. This is increased by side wings to 2,700 square feet, the total width of the umbrella being then 150 feet. But besides these there are side aeroplanes arranged in three tiers, and large aeroplanes in front which are pivoted, and serve for vertical steering. When all these are on, the machine would probably rise like a bird. But Mr. Maxim is a careful man. He tests every step and every detail first; and it may be months, or even years, before he ventures to crowd on all his canvas at once and chance the result. At present he is quite content to run his machine on wheels down the little track a third of a mile long, and take his speed by a chronograph, and the pressure of the wind by an anemometer, and the push of the propellers by a dynamometer, and the lift of each particular aeroplane by a registering contrivance. For the whole machine is arranged as it were like a spring balance, and any diminution from the 7,000 pounds of its actual weight on the springs means lift in the air. Frequently it rises entirely, on one side or both, in its efforts to soar from the ground, and then the sensation as the upper rails hold it down is that of gliding in air.

Fools may laugh at a man who devotes whole years of his life and many thousands of pounds to constructing a flying machine which runs on rails; but it has been said of old, he laughs best who laughs last. There can be small doubt that Mr. Maxim holds in the palm of his hand a contrivance which little more is required to make perfect for aerial flight, and he is too old, or rather too young, a bird to spoil it by premature efforts which might end in disaster. What is wanted is a longer run for the machine, and probably more money —for it is doubtful if one man, however wealthy and enthusiastic, could go on for ever spending at the rate Mr. Maxim must have done. It seems a splendid opportunity for some government more alert and vigorous than our own to take the matter up and see it pushed through; for, sad to say, the first and most obvious use of such a machine as this would be for destructive purposes in war. Other possibilities are all subsidiary to this one.

### The Russian Magazine Rifle.

The Mouzin (Mosin) rifle is the invention of a French officer, and was adopted by Russia at the end of 1891. Since then it has been manufactured at Chatellerault in large quantities, and is now replacing the old Berdan. The caliber of the Mouzin is 7·6 mm., and it is provided with a five cartridge magazine beneath the chamber. When the magazine is empty it can be used as a single loader, but it is not provided with a cut-off. The cartridges are rimmed, and are held together by a clip like that of the Mannlicher, by which they can be inserted in lots of five into the magazine, from the top of the breech, the clip being forced upward as the cartridges are pressed in. There is a closed base to the magazine. The barrel is protected by a movable wooden sleeve, and during firing the fingers of the left hand are inserted in two long grooves in the forepart. There are four grooves in the rifling, 0·15 mm. deep, with a right hand twist in every 24 cm., the lands being half as wide as the grooves. The leaden bullets have a mantle of "maillechort," and weigh 13·6 gr., a charge of 2·2 gr. of smokeless pyroxyline is used, and the cartridge weighs 25·5 gr., the packet of five weighing 137 gr. With the bayonet, the rifle weighs 4·3 kg., without it, 3·99 kg.; its length with the bayonet is 1·73 m., without, 1·29 m.

### Notes on Science and Industry.

Curious Property of Aluminum.—Mr. Charles Margot, preparator at the physical laboratory of the University of Geneva, has recently made a curious discovery concerning aluminum. He has found that if glass be rubbed with a piece of this metal, very brilliant markings will be obtained that no amount of washing will cause to disappear. This property of aluminum of adhering firmly to glass, and to silicious substances in general, is especially manifested when the rubbed surface is wet with water or simply covered with a stratum of aqueous vapor.

Mr. Margot has constructed a small aluminum wheel which revolves very rapidly and with which he makes designs upon glass after the manner of ordinary engravers. The designs are metallic, chatoyant and brilliant, and, by burnishing with a steel tool, they may be even made to have the appearance of metallic inlaid work. The adhesion is absolute. But it is necessary to see that the glass as well as the aluminum point are perfectly clean.

This property of aluminum permits of immediately distinguishing the diamond from strass. While, in fact, aluminum leaves a very apparent trace upon crystals of the latter, it has no action whatever upon the diamond.

Artificial Cotton.—A Mr. Mittchell, according to La Science en Famille, has recently brought out an artificial cotton, which is made from the wood of pine, spruce or larch ingeniously defibrated, and then disintegrated and bleached with a hot solution of bisulphite of soda and chloride of lime. The pure cellulose obtained is treated with chloride of zinc, castor oil, caseine and gelatine, which give it body and cohesion. In this way there is made a paste which is passed through a perforated plate, as in the manufacture of macaroni, and is dried between steam heated cylinders. It now only remains to weave it in order to obtain a fabric that has a very presentable appearance and a certain amount of strength. It may be finished, dyed and printed like natural cotton, than which it is said to be much cheaper.

The Electricity of Waterfalls.—That cascades communicate a negative electric charge to the surrounding air has been known for some time. From some observations that he has had an opportunity of making in the Alps, and from numerous laboratory experiments, Mr. Lenard draws the following conclusions:

Drops of water that fall upon the surface of water or upon a wet body disengage electricity, the water becoming charged positively, and the surrounding air leaving the place of the fall charged with negative electricity.

A jet of water that resolves itself into drops is thus capable, in a closed room, of causing great enough differences of potential to produce sparks.

The least impurity of the water greatly lessens the effect.

Other liquids, besides water, show themselves active in various degrees and take either positive or negative electricity. The simple flow of water in the air, the friction of water against a stone, and the variation of potential of the free atmosphere exert no sensible influence. This latter point is confirmed by Messrs. Elster and Geitel, who have observed several subterranean cascades producing a negative electrification of the air just as aerial falls do.

Mr. Lenard thinks that it is necessary to consider these phenomena, as a whole, as resulting from the difference of potential of the air and water in contact, or, more generally speaking, of any gas or liquid whatever.

Gum Tragacol.—According to the Revue de Chimie Industrielle, a gum under the name of "tragacol," possessing valuable properties, is now being manufactured commercially from the seeds of the carob tree. The seeds or beans, after being removed from the pod, are split and divested of their germ and are then treated several times with boiling water. The resulting mass is then submitted to a vigorous kneading operation and afterward introduced into a hydro-extractor. The gum thus separated passes through a fine metallic sieve, and the exhausted seeds, still saturated with water, are left behind.

The Photographing of a Falling Drop of Water.—Under the patronage of Capt. De W. Abney, president of the Camera Club, of London, Mr. E. J. Marey, president of the French Society of Photography, Mr. J. Janssen, president of the National Union of Photographic Societies of France, and Mr. J. M. Eder, professor at the Photographic School of Vienna, the Revue Suisse de Photographie has opened a competition with the object in view of determining by photography the exact form of a drop of water during its fall.

There are several factors of a nature to cause the form of a drop of water to vary during its fall: (1) The size, which may be determined by the diameter of the drop tube; (2) the velocity, which may be known by noting the distance of the fall; (3) the density, which will be known in employing distilled water; (4) the presence or absence of currents of air; and (5) finally, the temperature of the water.

The water employed must be distilled, and the temperature of it noted in Centigrade degrees. This water must be dropped from a glass or metal tube, whose internal and external diameter must be measured. The outflow of the water must be regulated, by means of a cock, at the rate of about one drop per second, in order to prevent the drops from coalescing. The distance between the starting point of the drop and the point where it is photographed must be accurately measured. The dropping of the water must be effected in a closed room protected against currents of air.

The photographic dimensions of the drop of water are not prescribed, but those will have most value that are nearest the natural size.

The photographs may be taken upon glass, films or paper, and should be addressed as phototypes or negatives without retouching to the manager of the Revue Suisse de Photographie, Place du Molard, Geneva, before the 15th of October, 1894.

Each phototype must carry a very distinct sign, repeated upon a concealed envelope, which must contain, in addition to the name and address of the sender, the precise circumstances under which the photograph was taken, conformably to the prescriptions of Article 2 of the conditions of the competition.

The prizes offered are a silver-gilt, silver and bronze medal and three honorable mentions.

The best photographs will be enlarged to a uniform size and be published.

### Influence of Diameter in Single Landscape Lenses.

If a landscape lens of, say, eighteen inches focus and only one inch in diameter will cover a plate twelve by ten inches in dimensions, of what use will it be to increase the diameter of such lens? This is a form of question which has, we know, often simmered through the minds of many photographers, both experienced and inexperienced, and is answered as follows in the British Journal.

The center of the picture is produced by the center of the lens, and its margins are likewise formed by the margins of the lens. It is quite true that a lens of small, even the smallest practicable, diameter may be made to cover a plate sharply to its margin by a proportionate reduction of its stop, but such stop will have to be very small indeed to effect this. The smaller the diameter of the lens, the smaller must be the stop or diaphragm which is necessary to fulfill the condition of equal sharpness throughout, and a very small stop is subversive of all rotundity in the objects included. It gives a map-like, flat sharpness only.

An improvement in this respect takes place by the employment of a larger working aperture, but, in proportion as this is attained, so is all marginal definition degraded, until eventually it becomes little else than a blur.

With a lens of larger diameter this condition of things is altered. The stop is placed at a greater distance from the surface of the lens, its mount being longer to permit of this being done. Here lies the advantage —marginal definition can be obtained with a stop very large in comparison with that necessary for securing an equal degree of sharpness with the smaller lens. Hence much greater pluck and rotundity of the objects in the picture, and a greater rapidity of action. This permits also of groups, and even portraits, being obtained in a light which, with a lens of smaller diameter, could not easily be obtained without a long exposure.

THE New York Edison Electrical Illuminating Company has contracted with the Electric Storage Battery Company, of Philadelphia, for a large storage battery installation.

The installation will consist of 150 elements of chloride accumulators, type G, 41 plates, having a capacity of 8,000 ampere hours at 150 volts, at normal rates, or a total capacity of 1,200 kilowatt hours.

The installation will be furnished with the most modern and complete appliances for the control and operation of the battery, and everything possible will be done to make it a model, and at the same time the most modern and complete battery plant ever installed. The battery is to be installed immediately, to be ready for the heavy winter load.