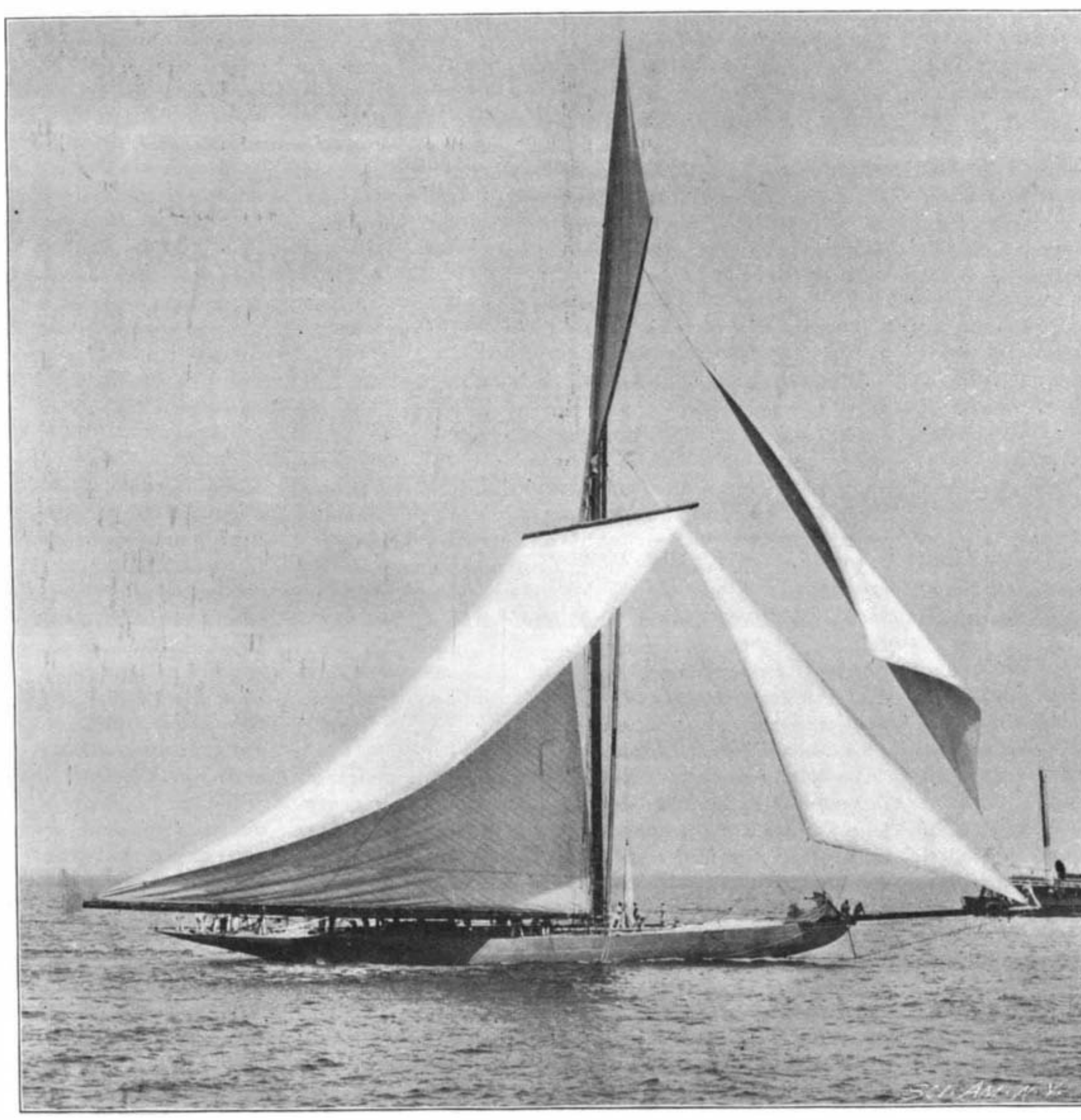
THE "SHAMROCK" DISABLED.

A few weeks ago we presented an illustration showing the "Columbia" disabled off Newport during one of her tuning-up trials; and now it is the "Shamrock" that serves to "point a moral and adorn a tale." We suggested at the time of the "Columbia" mishap that in his desire to save weight aloft Herreshoff had probably ventured nearer to the limit of safety than was justified by the few seconds of time or fractional increase of speed secured thereby. "Columbia's" broken mast, however, was taken out and repaired in the Bristol shops, additional diaphragms and longitudinal stiffeners no doubt having been inserted at the point where it buckled. Let us at least hope so, for it would be a pitiful ending to all these months of preparation if the races should be won through the carrying away of spars or any other fortuitous causes.

The breakdown of the "Shamrock" happened on the very first trial of her new and large mainsail. At the time of the "Britannia" races, Sir Thomas Lipton stated that "Shamrock" was not carrying her full canvas, and promised a "surprise" when her racing canvas was spread in American waters. The "surprise" came when the 103-foot boom was unshipped and an immense spar of nickel steel, whose length is supposed to be 111 feet, was shipped in its place, the gaff being replaced by a hollow nickel-steel gaff of duly increased proportions. The new mainsail, unlike the first, had the cloths running from luff to leach, a type of sail which Ratsey the sailmaker said his firm had experimented with half a century ago and found wanting. Evidently he has discovered some positive advantages in the system, for there the sail was, with its cloths running square, instead of parallel with the leach or after edge of the sail. The object aimed at is to reduce the friction of the wind as it slides past the sail when the boat is close-hauled or on a close reach.

The "Shamrock" had just started in a light eight-knot breeze for a ten-mile run down the wind, with main boom swung to starboard and spinnaker set to port, when suddenly the hollow gaff buckled and bent into a sharp angle at the point where it was bearing against the shrouds. The peak at once dropped and allowed the mainsail to fall into the position shown in our engraving, the clubtopsail remaining aloft and assisting to give the yacht her curious and truly original appearance.

The accident illustrates a fact which is well known to bridge builders and all who have to do with framed structures involving the use of hollow built-up members; namely, that a hollow metal post or strut which is subject to great compressive strains (as in the case of a hollow gaff) will give way very quickly if a comparatively small bending strain be brought upon it. The enormous strain put upon a gaff by the pull of the peak halliards is largely resolved into a compression strain along the axis of the gaff, which accumulates in that portion of the gaff between the jaws and innermost point of attachment of the halliards. In running before the wind a bending strain was brought upon the gaff by its bringing up against the shrouds and spreader, with the result that it bent over like a boy's tin horn. That the accident should have happened in a light, eight-knot breeze suggests that in the matter of lightness of construction Fife has outheroded Herod, and makes one ask what will become of these spars in a blow. Solid wooden spars will give and bend before they break and afford some evidence that they are being strained to the breaking point, but there is no such ample warning in these hollow and largely unstiffened shells which do duty for spars in the modern racing machine. The experience of this season's cup races suggests that for topmast, gaff, and clubtopsail yards there is nothing to surpass a sound wooden spar.



"SHAMROCK" DISABLED.

A FEW years ago a western railroad planted 600 acres of land with trees, with the idea of growing timber for railway ties and telegraph poles. The trees have made good growth, but are not quite ready for use as poles, and some of the trees are now being cut out and made into fence posts in order to thin the forest.

Bromide Enlarging.

It was quite a shock to me a few days ago—the beginning of August—to see the fall styles displayed in the windows of the dry goods stores. But so it is, summer is melting into autumn, and long evenings are coming. This means for many of us artificial light to work by, and a few remarks on bromide enlarging may be useful. For some of the hints which I give I am indebted to Mr. J. H. Baldock. The choice of the lens to be used is a matter usually decided by taking the lens which made the negative. This is a rough and ready rule, and one easily remembered. But if a wide-angle lens has taken the negative, it may be necessary to use a longer focus lens for the enlargement; it might be a good rule to have the focal length of the lens at least the diagonal of the enlargement. For light daylight is, of course, cheapest; and on a clear day with no clouds it is perhaps the best.

Illumination should be from the north or northeast, and a reflector placed at an angle of 45° should be used. Of course, care must be taken that the reflector is turned against clear sky—there must be no branches or buildings to interfere with even illumination. The distance between the negative and the lens, and the lens and sensitive bromide paper, will depend upon two things, i. e., the focal length of the lens to be employed, and the number of times the enlargement has to be. The next point for consideration, and it is a very important one, is the exposure, which is the one unknown quantity. Unfortunately, no hard and fast rule can be laid down to indicate what the correct exposure is, because it depends on so many factors, viz., the density of the negative, the degree of enlargement, the focal length of the lens, the intensity of the light, the sensitiveness of the bromide paper, and the size of the stop used. With reference to the second and fourth of these factors, must be borne in mind the rule that the intensity of the light varies inversely as the square of the distance from the source of light. But in practice this is comparatively simple and easy. A little experience with negatives of his own making will soon indicate to the worker the approximate exposure, and then by means of trial slips, pinned diagonally across the picture, so as to embrace, as far as possible, all the gradations, and exposing these slips for different times, say ten, twenty, forty, and eighty seconds, and developing the slips, it will soon be seen which of these times is the correct one. Indications will also be given as to whether any part of the negative requires shading, masking, etc., so as to stop exposure of certain parts, allowing a longer exposure to other parts. Of course, this can only be done when the image is projected onto an easel; it cannot be done if the enlargement is made in a camera.

Taking next development, bromide paper is not quite so amenable to development, as a compensation to errors of exposure, as are dry plates. Another thing, too, is that more light may be used with bromide paper than with dry plates; consequently, its development can be carried on with greater safety and comfort in working. There is a good choice of developers, but pyro cannot be used, on account of its liability to stain. I do not altogether recommend hydroquinone alone, though in conjunction with metol it forms a capital developer. Ferrous oxalate has always been a favorite, and is still largely used; but it is no good for under-exposed prints, and it requires the use of an acid fixing bath. With proper exposures it gives a brilliant, plucky, clear black image. Two good developerss are amidol and metol, either of which gives good black tones; they are easy to use, clean, nonstaining, and can be used more than once. Amidol is used with pure and good sodium sulphite alone, while metol requires sodium carbonate in addition; either requires about two grains of potassium bromide to each ounce of developer. Should it be found that some parts of the print do not develop up by the time the rest of the picture is well out, pour off the developer, wash the print (with acid water if iron is being used), and then by means of a brush, or the tip of the finger, locally develop those parts which lag behind. In the case of clouds, tilt the dish, pour in a little developer, and try, by means of local work, to get detail in the sky. Finally, give the print or prints a good rinse, and fix them for about twenty minutes in the acid fixing bath, and then wash thoroughly for about two hours.

Next comes the question of clouds. If in a small picture the lack of clouds may sometimes prove fatal — and the introduction of clouds is essential—how much more necessary is it in the case of an enlargement, in which nothing looks worse than a vast expanse of white paper, supposed to represent the sky. Proceed as follows: Throw the image on an easel, and roughly cut out a cardboard mask, following the horizon line fairly correctly, but if trees or a church spire project into the sky, these may, as a rule, be disregarded, as they will print over the clouds. Having done this, select a cloud negative, soft and with not too pronounced effect, lighted from the same direction as the landscape, place it in the lantern, cap the lens, and make a trial exposure; having done this, pin up the enlargement paper, and make the necessary exposure on it, shielding the landscape portion with the already prepared mask, which must be kept moving, and as near the lens as possible. To soften the effect, and prevent the formation of a hard line, recap the lens, remove the cloud negative, and replace it by the landscape negative, the exposure necessary for which has been previously ascertained; uncap the lens and give this exposure, recap, remove bromide paper, and develop. You will probably find that a certain amount of local development has to be resorted to here.

There is sometimes a difficulty in mounting large bromide prints. When the print is pasted over it begins to curl, and when it is dry on the mount the whole thing cockles. I lay the mount on a table face downward and well dampen its back with a sponge. Then I lay the back of the print on the back of the mount and put them under slight pressure for a minute or two. This moistens the print just enough to let it lie limp when pasted, and the dampness of the back of the mount will counteract the strain of the paper in drying, and so the whole will dry flat.—Thomas Wood in Wilson's Photographic Magazine.

SOME of our Western railroads have been using weed burners to protect their tracks. One worked over 900 miles of track last year at a cost of $2.35 per mile. The speed is very slow, being only 1½ miles an hour, and a barrel of oil is used for each mile. Compressed air is forced through the oil, forming a vapor which is ignited. This vapor is kept close to the track by a shield over it. The intense heat burns the weeds between the rails. Once at work, the shield is lowered within four inches of the rail, and when not in use it is raised to eighteen inches above the rail.

Women in Science.

A complete treatment of this subject is to be found in a work by Rebière, "Les Femmes dans la Science," a second edition of which has just been published in Paris. In this edition Mr. Rebière has arranged in alphabetical order the names of all women who have publicly engaged in scientific work. From a brief résumé of this work by Senator Paolo Mantegazza, in Nuova Antologia (Rome), which The Literary Digest translates, we take the following data:

Maria Agnesi, at least for the Italians, is the most illustrious among women scientists. It was she who was called the oracle of seven languages. She was born in 1718 of noble parents. Among the letters of De Brosses we find the following description of a visit made by him to Agnesi: I entered into a grand and beautiful apartment, where I found thirty persons of all European nationalities in a circle about Signora Agnesi, who was seated under a canopy with her sister. She is a girl of eighteen or twenty years of age, neither plain nor beautiful, with a very sweet and simple air. The Count Bellini addressed a discourse in Latin to her, to which she responded with great vigor, continuing the discussion with him in the same language. She wrote a work on the theme that algebra and geometry are the only provinces of thought in which peace reigns. This was in two volumes, dedicated to Maria Theresa, and cost her ten years of work. It was for this that Pope Benedictus rewarded her by the gift of a rosary made of gems and a gold medal. Later he also called her as professor of mathematics to the University of Bologna. She afterward became a nun and died on the field of battle—that is, in her dear hospital—at the age of 81.

In 375, to Theon, professor of science in the celebrated school of Alexandria, a daughter was born. This was the distinguished Hypatia. It seems that in her early youth she went to Athens, where she attended the lessons of Plutarch the younger and his daughter, Asclepigena, who together directed the philosophical school. Leaving her country as a pupil, she returned as master, and the magistrates of Alexandria invited her to lecture in public. Later she taught mathematics and philosophy. She also taught geometry, algebra, astronomy, and several inventions are attributed to her, as the aerometer, planisphere, astrolabe, and the alembic. Her works were lost, but the historians attribute to her a commentary on the "Treatise on Conic Sections," by Apollonius; a commentary on the Arithmetic of Diophantus—the first algebraic works known; and an astronomical rule. No other woman has had greater glory. Beautiful, eloquent, with a voice which was called divine; honored, admired by all, Hypatia had many celebrated disciples, among them Synesius, who called her "my benefactress, my sister, my mother." After the most luminous glory came the most ferocious torture. At that time Alexandria was torn by religious strife, and three rival religions contested the ground—Judaism, Paganism and Christianity. In 415 she was dragged from her cart into the church of Cæsar, where she was stoned to death; then the poor limbs, lacerated and bleeding, were taken to Cinaron, the place of torture, where they were burned. We have no portrait of Hypatia, but all of us can imagine her with the luminous halo of a martyr to science.

Besides these two great stars, Hypatia and Agnesi, we can introduce a number of minor planets, all of whom revolved in the great heaven of mathematical and astronomical science. To Margaret Bryan, an English astronomer of the beginning of our century, we owe several works on astronomy, hydrostatics, etc.

Miss Clark is our contemporary. She was born in the south of Ireland, and is author of a "Popular History of Astronomy in the Nineteenth Century," which has already passed through several editions, and other astronomical works.

Maria Cunitz (1610-64), of Silesia, through her astronomical works published in 1650, merits her title of "the second Hypatia."

Sofia Germain, born at Paris in 1776, was said by Biot to be "probably the person of her sex who has most deeply penetrated into mathematics."

Caroline Herschel, sister of the great astronomer, passed entire nights with him observing the stars, aiding him most efficiently, and herself discovering comets. She died at the age of 98, in 1848.

Maria Margaret Kirch, born Winkelman (1660-1720), the wife of the astronomer, continued his work after his death, studying the skies. She published an important work on the conjunction of Jupiter and Saturn which took place in 1713.

Another illustrious woman astronomer is Dorothea Klumpke, born at San Francisco, who, after a splendid examination at the Sorbonne, became chief of the bureau for the photographic catalogue of the stars. She is a worthy rival of the celebrated Sofia Kowalevski, born at Moscow in 1853, who was the author of several famous mathematical works, made important discoveries in the science of the calculus, and was professor in the University of Stockholm, where she died in 1891.

Madame Lepante, the Greek astronomer, calculated the annular eclipse of the sun which took place in 1764, for entire Europe. It was a woman, a Miss Maury, to whom we are indebted for the discovery of the periodic revolution of some of the fixed stars, observed by her for the first time in the observatory of Harvard College.

Maria Whitney was the pupil of the great astronomer, Maria Mitchell. The latter was born in the island of Nantucket, and at the age of 29 had already discovered a new comet. In honor of this discovery the King of Denmark sent her a gold medal and her admirers gave her a magnificent telescope. At the age of 47 she was called to the chair of astronomy at Vassar College, where she afterward became director of the observatory. She died in 1889.

Among the professors at Bryn Mawr College we find Carlotta Angas Scot, born at Lincoln, England, in 1858, who is one of the best living mathematicians.

Everybody has heard of Maria Somerville, who died at Naples in 1872 at the age of 92. Lord Brougham, wishing to render popular that great work by Laplace, "Mécanique Céleste," which was in five volumes, requested Miss Somerville to place this in accessible form. "The Mechanism of the Heavens" appeared in 1831, and was such a perfect work that Herschel is said to have read it with admiration, and only regretted that Laplace no longer lived to admire it. Miss Somerville not only occupied herself with astronomy, but with physical science. Among other works she published a physical geography, which was translated into many languages and ran through many editions. Serene, tranquil, happy, it is said that she never studied more than two hours a day, and to this fact is ascribed her long life of almost a century.

In addition to those already mentioned, Senator Mantegazza calls attention to Laura Bassi, of Bologna (1711-73); Saint Hildegond (1100-86); Sofia Pereyaslawzewa, celebrated for her original observations in comparative anatomy; the French anthropologist, Clémence Royer, and others.

Some Drawbacks to the Use of Acetylene.

BY PROF. J. VERTESS.

While coal gas has had to struggle for a whole century before becoming the almost universal lighting agent, its rival, acetylene, has already—after only a short time—achieved a certain success. Of course acetylene is not a newly discovered body, but it is only since the economic production of carbide of calcium that it has become practicable as a lighting agent.

Theoretically the production of acetylene is a very simple matter, but such is not the case practically.

Carbide of calcium, as is well known, is a black, crystalline, very hard material, not decomposed by heat, but easily decomposed by water into acetylene and lime. It has a density of 2·2, and it is not soluble either in petroleum or in benzine.

Concentrated acids have no action on it.

Acetylene consists of a colorless gas, with a penetrating odor of garlic. Its density is 0·1; 1 liter of acetylene weighs 1·16 grammes. It is easily soluble in water, and can be liquefied at 0° under a pressure of 48 atmospheres. In this state it is very explosive. It burns with a white flame, without a dark cone; the temperature of this flame is lower than that of coal gas.

Unfortunately, lighting by acetylene still presents numerous difficulties, to which I am desirous of calling the attention of specialists and others, now that I have had the opportunity of examining the installation which supplies the town of Veszprim in Hungary.

Let us first consider the carbide, the source of all the trouble. This body is never pure, but always contains at least 20 per cent of impurities. Theoretically, 64 parts by weight of carbide should give 26 parts of acetylene, that is to say, that 1,000 grammes of carbide ought to produce 406·25 grammes of acetylene; and, as 1 liter of this gas weighs 1·16 grammes, we ought to get 350 liters. But the Continental factories will not guarantee a return of more than 300 liters, and practical experience shows that we can hardly depend on more than 280 to 290 liters. It is true that the estimation of the return is not free from causes of error, inasmuch as during the weighing the carbide absorbs a certain amount of moisture from the atmosphere; this causes a loss of acetylene, but the small errors which result, when calculated on 1,000 grammes of material, are multiplied in proportion. We are obliged to work with small quantities, seeing that only 100 grammes of material give off 30 liters of gas, and it is difficult to arrange graduated gas-holders to store such large quantities. Further, the carbide is so little homogeneous that several samples must be tested and examined in order to obtain a mean value. If, on the other hand, we only take 10 grammes, the error resulting from the disengagement of acetylene in the air will be multiplied one hundred times if the results are calculated, as they should be, on 1,000 grammes. I have examined the manner in which the carbide behaves in the presence of acids, and I found that concentrated sulphuric acid has no action on this body; but, no matter how little water the acid may contain, bubbles of gas are formed until the whole of the water is consumed. This property of the carbide of not being attacked by concentrated sulphuric acid enables us to estimate its producing power of acetylene. I have made several experiments in this direction, and the results obtained were fairly correct and concordant.

I must here again mention that the carbide contains sulphur, phosphorus and nitrogen, from which it results that the acetylene will be contaminated with sulphureted hydrogen, phosphureted hydrogen and ammonia. The acetylene must, therefore, be purified to the same extent as is coal gas, for fear that its use in closed places might cause serious accidents.

But the greatest drawback of all is that acetylene burns with a smoky flame. Certainly the flame does not smoke at first, but after 200 or 300 hours smoke begins to be formed. This is caused by the burners attaining a temperature higher than that of the decomposition of the acetylene, and thus the gas is decomposed into carbon and hydrogen.

I have also noticed a very curious phenomenon in the gas pipes. I there found a deposit of finely divided carbon, like soot. I also found a very remarkable liquid condensation, consisting of carbides of hydrogen. These bodies are also formed in the generators, whence the necessity of using siphons. We thus see that it is quite erroneous to imagine that acetylene does not require purifying.

There is still another inconvenience resulting from impurities contained in acetylene. It is by no means uncommon to see, in a closed place, a sort of fog fill the room after a longer or shorter interval. What is the cause of this phenomenon? The acetylene is decomposed in the burner, the carbon is deposited while the hydrogen burns, giving rise to the formation of watery vapor; and it is this, in conjunction with the ammonia, the sulphureted hydrogen and the phosphureted hydrogen, which produces the fog, causing headache and nausea.—Chem. Zeitung, 1898, p. 174.

The Climate Adapted to Tobacco.

In the report of the Virginia section for May, Mr. E. A. Evans, section director, gives a summary of our knowledge of the soil and climate adapted to raising tobacco. So far as climate is concerned, tobacco raising is profitable over a very wide extent of territory throughout the world. The range of climate that is found in the United States by no means exhausts the adaptability of the plant; in fact, with tobacco it is as much a question of soil as of climate. The climatic peculiarities of the regions in which the best tobacco is grown are not especially dwelt upon by Mr. Evans, but would make an interesting subject for study. The cultivated plant is evidently more susceptible to weather than the native tobacco of Virginia, and is, probably, the descendant of some variety imported by the early settlers, so that both soil and climate must be adapted to it. In general, the agriculturist labors to overcome the natural climate of any spot, and his resulting crop represents not the plant, or the soil, or the climate, but the intelligence of the skilled labor.

We hardly know how one should proceed in order to obtain botanical or agricultural material for a fair comparison between different climates as to their effect upon any given plant. The question of the relation between climate and crop belongs to the division of soils even more than to the Weather Bureau, since the meteorological climate must be considered in connection with the underground conditions. The roots have one climate, the leaves and the fruit have another; the crop results from a combination of both, with a very large admixture of agricultural skill.—Monthly Weather Review.

The Current Supplement.

The current SUPPLEMENT, No. 1238, contains many articles of great interest. "The East India Village in the Vienna Zoological Gardens" is described and illustrated. "The Nature of Valence" is an important chemical article by F. P. Venable. "The Use of Acetylene Gas for Street Cars, Street Lamps and for Automobiles" is described and illustrated. "Pulque, Mexico's National Drink," is an illustrated article. "Zoological Discoveries in Carthage" is the continuation of an article begun last week and describes the Punic necropolis. "Outline History of Brick Making" contains many curious facts. The "Blake," the first large cruiser of the British navy, is fully illustrated by sectional views. "Russia's Great Naval Enterprise" is an elaborate article. "The Catalogue of Science" gives particulars of the new schemes which are being made for an international catalogue of all scientific literature.

Contents.

(Illustrated articles are marked with an asterisk.)