SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class matter. Copyright, 1896, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXIV.—No. 26. ESTABLISHED 1845. NEW YORK, JUNE 27, 1896. [$3.00 A YEAR. WEEKLY.

THE NEW DOUBLE-DECK-TURRET BATTLESHIP KEARSARGE.

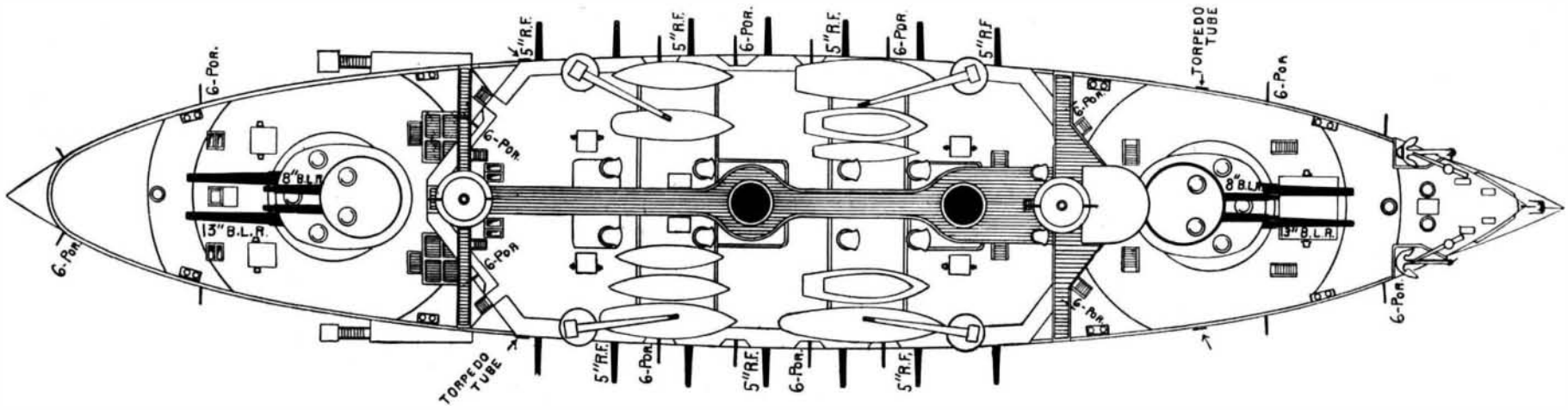
The science of warship design is nothing if it is not progressive, and we are glad to note that the new Kearsarge type of battleship is as great an advance upon the Indiana as the Indiana was upon the existing battleships of any foreign navy.

Whenever a naval board announces a new programme, the publication of the designs is awaited with the deepest interest, for they are expected to embody the results of the very latest experiments in ships, guns, and armor. It is gratifying to note that the bold originality which was shown by our shipbuilders in the early days of the armorclads is repeated in the up-to-date battleships of the new navy.

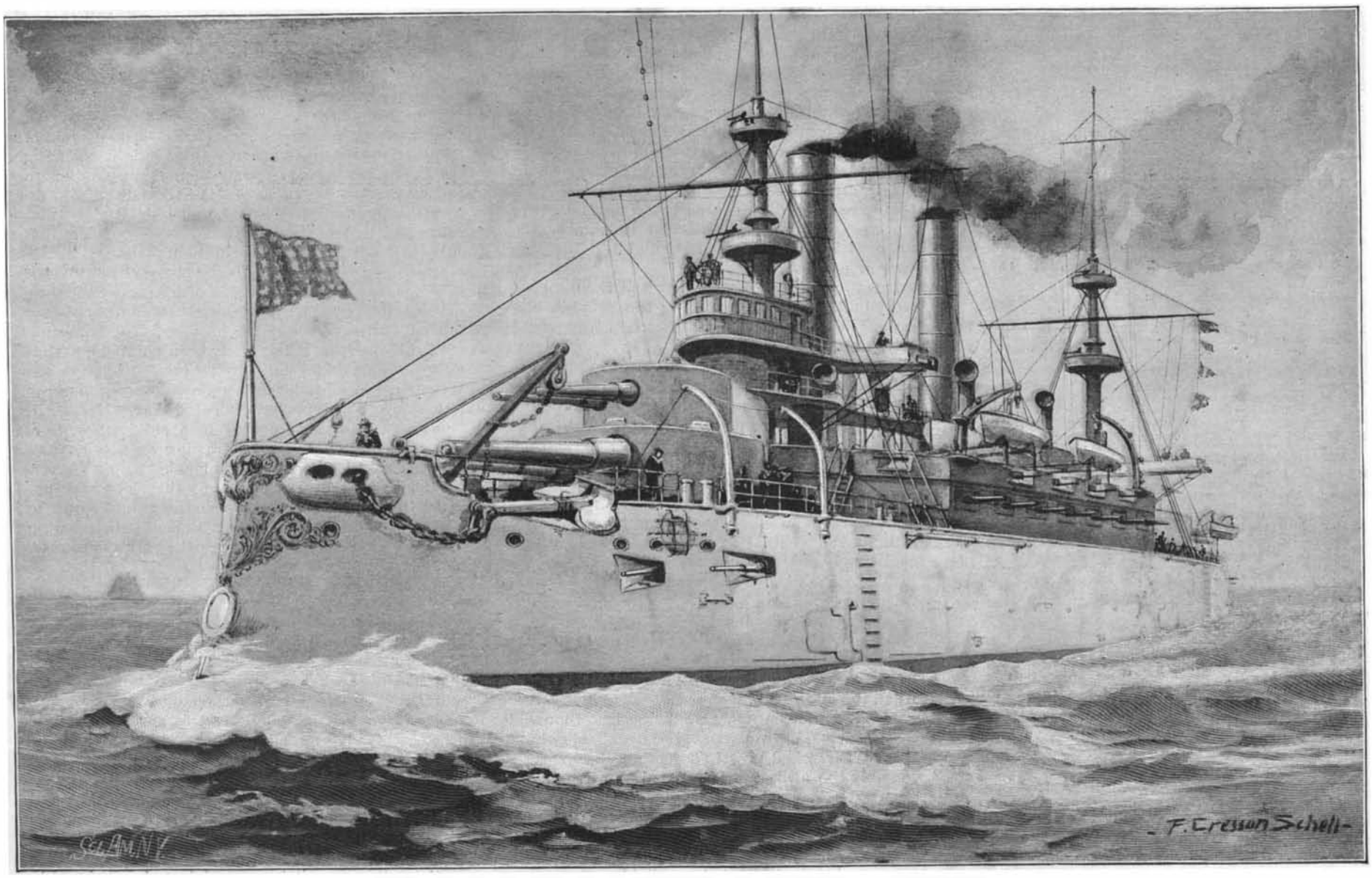
The designs for that splendid trio, the Indiana, Massachusetts, and Oregon, were a great advance, in their proportion of armament to displacement, upon anything afloat or building at the time of their publication. To flank the 13 inch guns of the main battery with eight 8 inch armor-piercing rifles placed within four heavily plated turrets at an elevation of 26 feet above the water line was a departure from existing ideas as daring as it was novel; and European designers expressed a doubt that the ships could ever carry so heavy an armament successfully. The Indiana has had her trials and justified the confidence of her designers. Indeed, on every point but one she has more than fulfilled expectations. In the gunnery trials, however, it was found that the arc of training of the 8 inch and 6 inch guns would have to be somewhat reduced on account of interference. In official circles this was not altogether unexpected, as the experience of certain European ships had shown that the effect of the blast of the heavy guns extended over a wider area than had been supposed at the time the designs of the Indiana class were drawn up. By reference to the accompanying plans it will be seen that the 8 inch guns were originally intended to fire full ahead or full astern, and also through a considerable arc of training on the opposite beam. To do this latter they had to fire across the top of the 13 inch gun turrets. In the gunnery trials it was found that if the 8 inch guns were laid any nearer to the 13 inch gun turrets than 80 degrees forward of the beam, the effect of the blast was so powerful as to render the sighting hoods of the latter untenable. It was therefore suggested that stops be placed on the turrets to prevent their training any nearer to the axis of the ship than 10 degrees. At the same time the blast of the 13 inch guns, when fired on the maximum train abaft the beam, necessitated the sacrifice of the axial fire of the 6 inch guns, and their ports forward of the beam have been plated in. These modifications are not so serious as they might at first sight appear; for naval engagements will very seldom be carried out in an end-on position; and for broadside firing the whole of the battery of the Indiana is still available. The difficulty of interference was foreseen at the time the plans of the Kearsarge were drawn up, and the way in which it was met reflects the greatest credit upon the designers.

It was decided to dispense with two of the 8 inch turrets altogether, and place the remaining pair upon the main 13 inch turrets, as shown in our illustration. By this arrangement the remaining four guns of the new design were rendered actually more effective than the eight similar guns of the Indiana.

(Continued on page 408.)



DECK PLAN OF THE KEARSARGE TYPE OF BATTLESHIP.



THE NEW DOUBLE-DECK-TURRET BATTLESHIP KEARSARGE.

THE NEW DOUBLE-DECK-TURRET BATTLESHIP KEARSARGE.

(Continued from first page.)

This is evident from a comparison of deck plans of the two types, when it will be seen that the Indiana is incapable of dead ahead or dead astern fire with her 8 inch guns, and that her maximum concentration of fire from the whole eight of them is four on either broadside. The Kearsarge, on the other hand, can not only concentrate an equal number of 8 inch guns on each broadside, but can swing each pair through an unbroken arc of 270 degrees ahead or astern. Experiments recently carried out at Indian Head on an improvised platform showed that there would be no inconvenience experienced in the 13 inch turrets from the blast of the superposed 8 inch guns.

Moreover the turning gear and ammunition hoists of the 8 inch guns on the Kearsarge have an unparalleled protection afforded to them by the 15 inch armor of the turrets and barbettes upon which they stand, whereas the funnel-shaped base of the Indiana's 8 inch turrets is plated with very light armor; and should a shell penetrate and burst within them, it would probably disable the guns altogether. From these considerations we think it is evident that the sacrifice of power in removing four of the 8 inch guns is more apparent than real; and that the disposition of eight guns in two turrets as against twelve guns in six turrets gives the Kearsarge slightly more power for attack and far greater endurance for defense than the earlier type of ship. As originally designed, it was intended that the 8 inch should be rigidly imposed upon the 13 inch turrets. This would necessitate their simultaneous training; but there are no structural reasons why they should not be given an independent motion, and we believe Mr. Irving Scott, of the Union Iron Works, San Francisco, has already put in a bid on a design of this nature.

Not only is nothing lost by the removal of these guns and turrets, but the equivalent weight has been put into a broadside battery of fourteen 5 inch rapid-firing guns, which is protected by a continuous wall of 6 inch Harveyized steel, with 2 inch steel splinter bulkheads worked in between each gun. This battery alone would render the Kearsarge a terrible engine of destruction. Each of the fourteen guns throws eight 50 pound shots per minute, each having a penetration of 13 inches of iron and an energy of 1834 foot tons. In one minute of a sea-fight one side of this battery alone could pour into the enemy fifty-six shots, or nearly 3,000 pounds of steel, at a velocity of 2,300 feet a second, and with a battering or crushing effect of 102,704 foot tons—a force sufficient to lift the ship itself bodily 9 feet in the air. The subjoined table gives a detailed analysis of the total broadside:

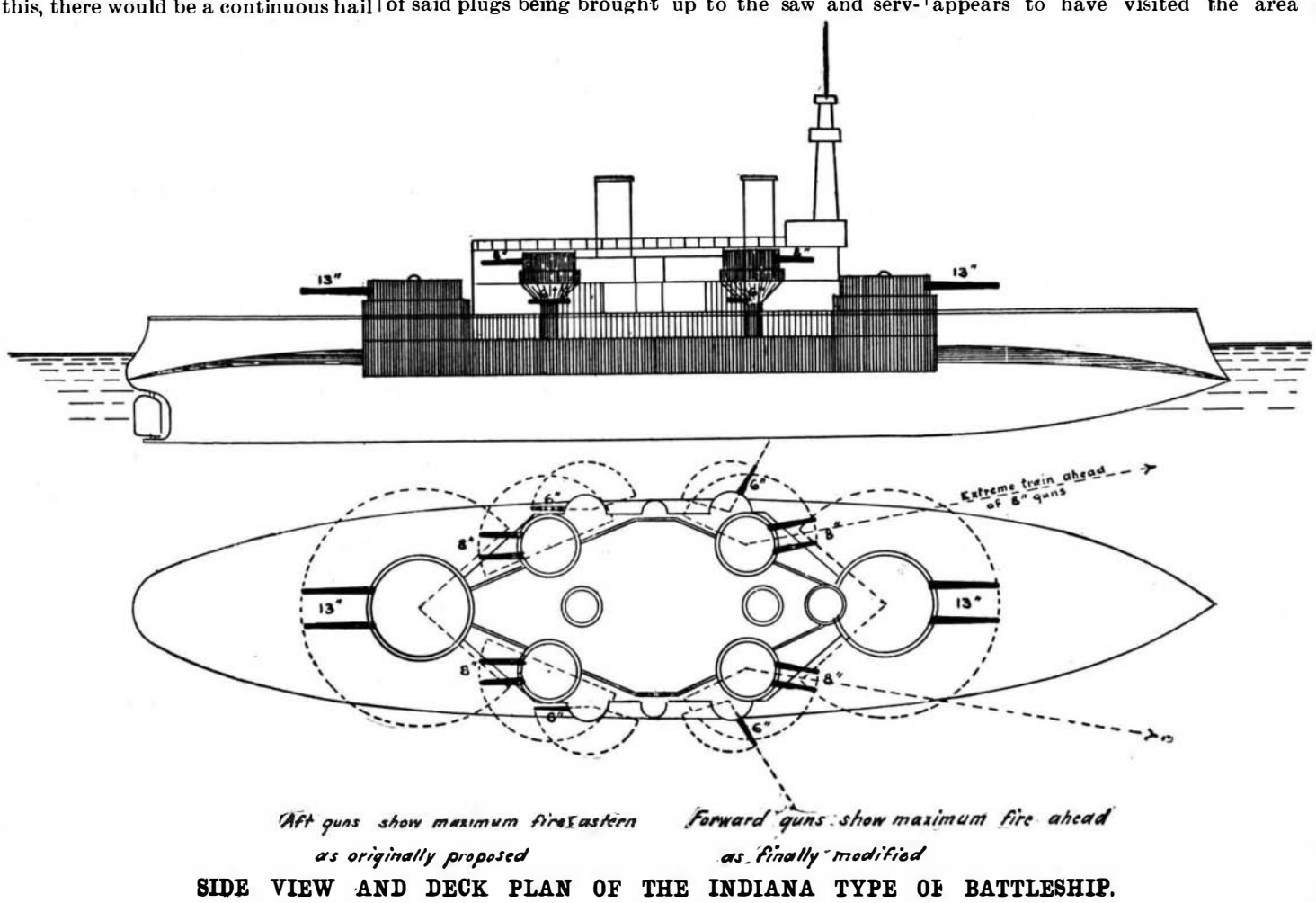
Number of Guns.	Diameter in Inches.	Weight in Pounds.	Velocity in Foot-Seconds.	Energy in Foot-Tons.	Total Energy.	Penetration in Inches at Muzzle.	Point of Attack in Enemy.
4	13	1100	2100	33,627	134,508	34·6	Belt and main turrets.
4	8	250	2150	8,011	32,044	21·6	Conning tower and casement armor.
7	5	50	2300	1,834	12,838	13·0	Thin armor, superstructure, and unarmored ends.

In addition to this, there would be a continuous hail of smaller projectiles from the 6 pound and machine guns located on the upper deck and in the fighting tops.

The armor belt, 7½ feet wide, will be 16½ inches thick amidships, tapering toward the bow, and it will be associated with athwartship bulkheads 10 and 12 inches thick. Over this will be placed a 2¾ inch steel deck, and in the wake of the engines and boilers will be a cellulose water-excluding belt backed by many feet of coal. Within the shelter of this inverted box of thick armor, with its cellulose and coal lining, will be located the "vitals," i. e., the engines and boilers.

The main dimensions will be: Length, 368 feet; beam, 72 feet 2½ inches; draught, 23½ feet; displacement, 11,500 tons; horse power, 10,000; speed, 16 knots; normal coal supply, 410 tons; complement, 520 officers and men; cruising radius at 10 knots with 1,210 tons of coal at 25 feet draught, 6,000 knots. The total cost not to exceed $4,000,000.

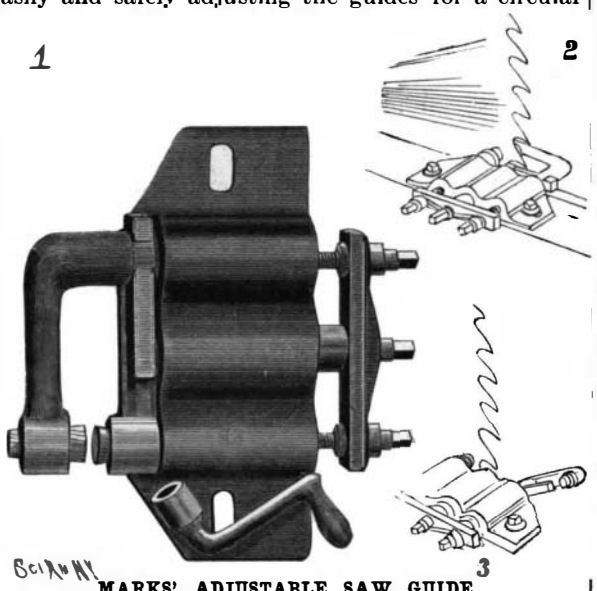
The unusual height of the smokestacks is in agreement with the latest practice, which tends to make all possible use of natural draught.



SIDE VIEW AND DECK PLAN OF THE INDIANA TYPE OF BATTLESHIP.

AN ADJUSTABLE SAW GUIDE.

The accompanying engraving shows a device for easily and safely adjusting the guides for a circular saw, for which a patent has been granted to Mr. Alphonso Marks, of McComb, Ohio. It consists of a stout pocket or holder, which is flat on its under surface, and is provided with slotted holes whereby it may be bolted down upon the frame of the circular saw. It is provided with two transverse circular openings, in which the shank portions of the guide jaws are adjustably held. These shanks are hollow and receive two adjusting screws, which are threaded in the ends of the shanks, and are held by means of fixed and loose collars and nuts in a suitable crosshead. This crosshead is provided with a hollow circular portion which is adjustably held in a transverse opening located in the pocket or holder and between the shanks of the guide jaws. The crosshead is adjusted relatively to the pocket by means of a screw. By this arrangement either of the jaws may be adjusted by means of its own screw, to suit the thickness of the saw, or both jaws may be simultaneously adjusted by means of the center screw actuating the crosshead. The two jaws are prevented from rotation by means of projecting arms or lugs, which bear upon the flat base of the holder or pocket. The outer jaw is L shaped, and it is provided at its outer end with a square opening which receives a wooden plug, a similar plug being provided in the opposite jaw, the ends of said plugs being brought up to the saw and serving to guide the same. By this arrangement the plugs can be easily replaced when necessary. The adjustment screws are operated by a suitable key or wrench which may be laid away when the saw is running.



MARKS' ADJUSTABLE SAW GUIDE.

On the Combined Action of Light and Water in the Liberation of the Perfumes of Plants.

It is light, and not oxygen, as it has been assumed, which is the principal cause of the transformation and destruction of odorous substances, but in many cases these two agents seem to act in concert. The action of light makes itself felt in two different manners: on the one hand, it acts as a chemical power, capable of furnishing energy to all the transformations through which the odorous products pass from their elaboration to their total resinification; on the other hand, it exerts a mechanical action which plays an important part in the general life history of plants; and this property explains the mode of the periodical liberation of the perfumes of flowers. The intensity of the perfume of a flower depends on the equilibrium which is established at every hour of the day between the pressure of water in their cellules, which tends to drive outward the perfumes already elaborated contained in the epidermis, and the action of light which combats this turgescence. The whole physiology of perfumed plants flows from this simple notion. It is thus explained why in the countries of the East the flowers are less odoriferous than with us, why the trees, the fruits, even the vegetables, are sometimes filled with odoriferous products more or less resinified. It is also explained why in those countries the vegetation is thorny: the vegetation in those countries has too much light and too little water.—Eugene Mesnard, in Comptes Rendus.

A DESTROYING VACUUM.

BY JOHN C. BARROWS, M.A., OF ST. LOUIS, MO.

A storm, unprecedented in its destructive and deadly results, which swept through the cities of St. Louis and East St. Louis between 5 and 6 P. M. on May 27, furnished abundant material for th news gatherers who hastened there to the number of several hundred. Both the amateur and professional photographer have been busy about the scenes of greatest havoc. Few, if any, however, have yet begun to study the devastated districts to ascertain and analyze the meteorological phenomena of what most of them have heralded to the world as "a regular Western cyclone," and others, including the local signal service officer, as "a straight blow of wind."

Does the storm's work fit either theory? The results are in many respects unusual, and I believe without recorded precedent. There are abundant indications that over an area half a mile wide and two miles long the destruction was not primarily and chiefly due to the force of a gale or hurricane. Nor does the fact that during the space of a few moments the direction of the wind changed to several and almost opposite points, as is testified to both by numerous eyewitnesses and by many unmistakable results thereof, appear to explain the most serious class of damage wrought to buildings.

I shall not attempt to give a new and scientific explanation of the meteorological phenomenon which appears to have visited the area from a block west of Jefferson Avenue east to Main Street, and about a mile wide, but for lack of an existing term, and for the purpose of this brief paper, will call it a vacuum storm.

To indicate that the conclusion that this in some features was not an ordinary cyclone, and that it was not "a straight blow" that was reached by the orthodox Baconian method, and that the observations were not made to fit a previously conceived theory, it may be well to state that the first object to attract