THE NEW BRIDGE OVER THE HUDSON RIVER AT NEW YORK.

(Continued from first page.)

that the river navigation should be unobstructed, it was determined by the company to attempt the bridging of the Hudson River by a mammoth suspension bridge, with a great central span of 3,254 feet.

If there is one part of a bridge of greater importance than another, it is the foundations, and in the present case they are of colossal size and carried down to unusual depth. Beneath each tower there will be sunk eight steel caissons, forming in plan an oblong 85 feet by 168 feet between centers of caissons. At the outer corners of this oblong there will be four large caissons 62 feet in diameter; between them will be four 35 foot caissons. These will all be sunk to a depth of about 150 feet below the water level, until they rest upon solid rock. They will probably be sunk by the open dredging process, such as was employed by the Union Bridge Company (the contractors for the present undertaking) in building the Hawkesbury River bridge in Australia. The caissons will be so arranged that the pneumatic process can be adopted if necessary. They will rise to within 10 feet of the water level and will be filled with concrete; above this the piers will be carried up in solid granite masonry to a height of 30 feet above water level. Upon the granite foundation will stand the eight columns of the towers, rising to a total height of 587 feet above the water level. They will be built of steel plates and angles and will be strongly tied and braced together. The river and shore legs of columns will incline inwardly and meet at about two-thirds of their height, from which point they will be carried up as a single construction, as will be seen by reference to our engraving.

Strung across the towers will be twelve steel cables each 23 inches in diameter; each cable will consist of a large number of steel wires, about $\frac{3}{16}$ inch in diameter, laid parallel and bound together with a wire wrapping. The wire composing the cables was originally intended to have an ultimate breaking strength of 180,000 pounds to the square inch, but recent improvements in the manufacture of steel wire make it likely that the engineers will be able to secure wire of the strength of 200,000 pounds to the square inch. On the New York side the cables will be carried down to anchorages which will consist of two solid masses of masonry 180 feet square and 150 feet high. On the New Jersey side they will be carried down through tunnels far into the solid rock and secured to massive plate girder anchorages. The twelve cables will be hung in parallel vertical planes, and contrary to the usual custom, they will not be "cradled." There will be four cables over each of the outside columns of the tower and two over each of the intermediate columns.

To prevent any deformation of the floor of the bridge under the action of a moving load, it will be provided with two large stiffening trusses, each of which in itself will be longer than the central span of the Brooklyn Bridge. Each truss will be 1,600 feet long, 125 feet from center to center of trusses, and 200 feet deep at the center. Their ends will be hinged where they meet at the center of the span, also where they rest upon the towers. They will be divided into 40 foot panels, and at each panel point will be a plate steel girder 7 feet deep and 144 feet long, reaching across the full width of the bridge from truss to truss.

At each panel point the trusses, girders and whole floor system will be suspended from the main cables by twelve steel wire suspenders, which will be attached to the floor beams as follows: Two immediately on each side of the trusses and two at two intermediate points; there will be twelve lines of plate stringers, 5 feet deep, running through the whole length of the bridge, one under each rail. Above each floor beam, and high enough to give headway for the trains, will be a deep supplementary lattice work girder, riveted at its extremities to the vertical posts of the truss. The floor beam will be suspended from this upper girder at two intermediate points of support.

Both top and bottom chords will be braced to resist the wind pressure; the former lightly, the latter very strongly. The trusses will be hinged at the center to allow for a lateral movement, and the wind pressure will be resisted by the enormous dead weight of the trusses and floor system. Under the action of the wind the trusses will move out sidewise and thereby the suspenders will become inclined and will transfer part of the wind pressure directly to the main cables.

The maximum loads for which the bridge is designed are as follows: Dead load, about 40,000 pounds to the lineal foot; live load, 18,000 pounds to the lineal foot; wind load, about 1,600 pounds to the lineal foot.

There will be six railroad tracks, and the bridge is to be strong enough to carry all the tracks loaded with trains from end to end, or a total live load of about 30,000 tons; the maximum strain on each cable will be about 8,300 tons, or a maximum of 100,000 tons on the whole twelve. It will be noticed that the shore spans are not suspended from the cables, but consist of a number of steel trusses carried upon independent piers.

The cables are attached rigidly to the top of the towers, and do not, as usual, rest upon sliding saddles. The variations of strain in the towers, resulting from the alterations of load and temperature, will be as follows: Maximum strain in the river leg will occur under full load and high temperature. Maximum strain in the shore leg will occur under full load and low temperature.

It is estimated that the bridge itself will cost $25,000,000, and the cost of the whole, bridge, approaches and terminal works, will be about $60,000,000.

Should there be no legal or other obstructions, it is estimated that the work can be completed in eight years.

The design illustrated was made by the Union Bridge Company, of New York City. Our thanks are due to Mr. Charles Macdonald and Andrew Onderdonk, of this company, and Joseph Mayer, the engineer, for particulars received.

Defects in Negatives and Their Causes.

BY CHARLES L. MITCHELL, M.D.

So many amateurs are at a loss why certain defects occur in their negatives, and how in many cases they can be obviated, that the following summary of a few of the most prominent may perhaps be of aid to many a disheartened photographer:

Fog indicates either decomposition of the emulsion (a defect common in all extremely rapid plates), accidental exposure to light, over-exposure, or over-development. If the negative is foggy all over, excepting where covered by the rabbet of the plate holder, it indicates that the effect was produced in the camera, either by light leaking through some hole in the bellows, or through flange, woodwork, dark slide of plate holder, or that the plate was over-exposed, or that the sun was shining directly on the lens. If the edges covered by the rabbets are also fogged, it indicates light leaking into the dark room before development, or contaminated developer, excess of alkali, or deterioration of the plate. If the plate is partially fogged, in streaks, it indicates leakage of light at the junction of plate holder and camera, or at the edges or corners of the plate holder, or perhaps a leaky or burst corner of the plate box.

Abundant detail in the shadows, but lack of contrast, and general thinness of the negative, indicate over-exposure, too much alkali in the developer, the use of a spent developer, or using a weak developer for too short a time, or want of light and shadow in the subject.

No detail in the shadows, with excessive contrast, indicates too short an exposure, too great a contrast in the lighting of the subject, or the use of a developer very strong in restrainer.

Clear shadows and weak contrast are due usually to insufficient development.

Round or oval clear spots, with sharp dark edges, are caused by air bubbles clinging to the plate during development.

Pin holes and very fine clear spots are due to either dust on the plate during exposure, or (although the plate makers say not) a dirty, poorly filtered and impure emulsion. Small particles of insensitive haloid salts of silver remain in the emulsion, are not acted upon by light during the exposure, or by the developer, and hence when the plate is placed in the fixing bath, they dissolve out and clear a clear place in the film.

Yellow staining of the film is caused by prolonged development with a developer that is either very old, nearly spent, or contains too little sulphite. Also, by fixing in an old, used up fixing bath. Where the staining occurs after the negative has been fixed and dried, and takes place gradually, it is due to insufficient fixing and the presence of undissolved silver salts.

Irregular lines are due to delay in entirely covering the plate, at once, with developer, thus giving it an opportunity to act longer on one part of the plate than another.

General mottling of the film is due to contact of the face of the plate with impure paper, to imperfect fixing, or to allowing the plate to remain for a long time in a pyro developer, without rocking.

Clear corners means that the lens does not fully cover the plate.

Bare places or patches of uneven density (noticed particularly in films) indicates that the plate or film has not been evenly coated with the emulsion, and that while in some places a pool of it has formed, it has left other places nearly bare.—The Photographic Gleaner.

Witch Hazel Ointment.

Lanolin	oz.	4
Petrolatum	"	12
Glycerin	"	6
Distilled extract witch hazel	"	3
Boroglyceride, 50 per cent solution	"	2

Mix the lanolin and petrolatum; add the glycerin and boroglyceride; lastly, add the extract of witch hazel. Perfume with oil of lavender. This makes an excellent toilet cream.

Correspondence.

Interesting Shadow Phenomenon.

To the Editor of the SCIENTIFIC AMERICAN:

The composing room of this office is lighted by incandescent electric lamps, supplemented with gas jets fitted with Welsbach incandescent mantles. If either illuminant is used singly, ordinary dark shadows are cast when the light is intercepted. When the two lights are burning simultaneously, an extraordinary phenomenon is observed, viz., colored shadows, the direct electric rays casting a dark green shade and the incandescent mantle an orange drab. At the point where the shadows intersect each other the shade becomes denser and of a dark drab color, the green being completely destroyed by the orange drab rays. SAMUEL THOMSON.

Titusville, Pa.

[This seems to be a phenomenon partly of the subjective order, the shadow cast by one light being illuminated by the light of the other. The great difference in color of the two lights causes the difference in the colors of the shadows.—ED.]

Flash Light Powders.

To the Editor of the SCIENTIFIC AMERICAN:

I note that in your query and answer column of the March 28 issue of the SCIENTIFIC AMERICAN, you give several formulas for making photographic flash light powder. One of these is: Magnesium powder, 6 ounces; potassium chlorate, 12 ounces; antimony sulphide, 2 ounces.

I believe it will be well to call attention to the fact that mixtures of this nature, containing potassium chlorate or perchlorate, are extremely dangerous, for several reasons, and the making and handling of them must be carried on with the greatest care. Chlorate or perchlorate mixtures are, in the first place, sensitive to friction. This danger is one which may be met with both in manufacture and use, and especially in transportation.

In the second place, they are liable to spontaneous combustion, due to decomposition, which may set in sooner or later; and third, the explosion of these mixtures is of such a violent nature that serious accidents are most certain to obtain.

A few months ago a photographer's gallery in Chicago was nearly demolished by the explosion of a flash light mixture in which potassium chlorate played an important part, and a few weeks later in the same city a chemist had his right hand so badly torn that it had to be amputated. This was the result of an endeavor to compound a flash light powder in which potassium chlorate was used as the oxidizing agent.

I believe your readers will appreciate this statement, which will serve to caution any of them who are inclined to attempt to make any photographic flash light powder containing potassium chlorate or perchlorate. It will be well for those who are not versed in such matters to leave such mixtures alone entirely. SAMUEL RODMAN, JR.

Chicago, April 18, 1896.

The Fastest Ship Afloat.

This is an age of record breaking; and record breaking for its own sake too. The wish to have the biggest, tallest, fastest, most costly something or other "in the world" is a far more potent factor in modern progress in the mechanical arts than we ever suspect. Unquestionably the development of the modern steamship owes as much to the simple desire on the part of the ship builder to beat somebody else, as does the speed of the race horse or the agility of an athlete. This competition for its own sake has seized upon the builders of torpedo boats and driven them so hard that they are raising the limit for speed by leaps and bounds. It was only late last year that the Sokol startled the marine world by passing the 30 knot limit—for years the goal to which the builder of swift craft had looked as a remote possibility—and yet her record was quickly broken by a French torpedo boat. And now the palm has been transferred across the channel again and Her Majesty's ship Desperate stands as the fastest vessel in the world with a record of over 31 knots, or about 36 miles an hour. One would think this was sufficient; but almost before the little craft has had time to tie up at her dock, the British Admiralty is demanding 33 knots an hour in the contracts for her successors. That is about 38 miles an hour; and as these builders have always reeled a knot or two more than the contract speed out of the little fliers, we may look for a spurt of 34 or 35 knots on the trial trip. That would be 40 miles an hour, or fully up to the all-day speed of an average express train!

Such a speed will not be obtained with a horse power much under 8,000. This is one-fourth the trial trip horse power of the Lucania. The Lucania is of 13,000 tons displacement—these craft will probably be of less than 300 tons displacement. So that the Cunard ship which is 43 times as big only takes 4 times as much power to drive her.