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NEW YORK, SATURDAY, JULY 6, 1907.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

OUR NAVAL FORCES IN THE PACIFIC.

When the British Admiralty decided, a few years ago, to call home the squadrons which she had been in the habit of maintaining on the Halifax and West Indies stations, reducing the garrisons both at the famous Nova Scotian fortress and also on the Island of Bermuda, the step was interpreted by the world at large, and very properly so, as an evidence of the cordial relations existing between Great Britain and ourselves. The concentration of the weightier portion of a country's fleet in any particular place may be taken as indicating where that country considers that its interests are, for the time being, most threatened. It is equally true that the withdrawal of naval forces is invariably accepted as indicating that the relations of the two powers affected are thoroughly amicable.

We have heard a great deal of loose talk, lately, about the possibility of a war with Japan. Had the Japanese been a less highly civilized people, this irresponsible chatter might easily have blown the war spirit of that warlike people to a white heat long before this. We hold it to be a proposition indisputable, that if the Japanese press and certain Japanese officials had discussed the possibility of war with the United States with as much reckless abandon as a certain daily journal in this city and certain men of more or less prominence in the country have done, Congress would long ago have resounded with threats and denunciations, and not a small section of the country would have been eagerly awaiting the call to arms.

Fortunately, the governments both of the United States and Japan have been entirely unaffected by this foolish and utterly baseless talk of possible conflict; and that the Navy Department, at least, is satisfied that Japan is friendly, and intends to remain so, is proved by the fact that our naval forces in the Pacific have been reduced to a very conservative peace footing. By way of proving our proposition, we submit below a statement of the number and type of the ships of our navy which are stationed at present in those waters which the alarmists would have us believe are shortly to witness a disastrous naval conflict.

Stationed on the home coast, then, we have at present in commission not a single battleship. Of the three which are there, the "Oregon" is just now undergoing reconstruction; the "Wisconsin" is repairing; and the new "Nebraska," very much behind her date of completion, is only now getting ready to go into commission.

We have no coast defense vessel in commission, the "Wyoming," which is the only vessel of that type at present on the Pacific coast, being now at the yard undergoing repairs. The most effective ships in commission on the coast are the three semi-armored cruisers "Charleston," "St. Louis," and "Milwaukee," vessels of 9,700 tons and 22 knots speed, protected by a partial and light belt of 4-inch armor and a 3-inch deck, and carrying a battery of fourteen 6-inch guns. Two more powerful armored cruisers, the "California" and "South Dakota," of 13,400 tons and 22 knots, protected by a 6-inch belt, and armed with four 8-inch and fourteen 6-inch guns, will shortly be placed in commission, the "California" during the present summer, and the "South Dakota" during the autumn. We have also in commission on the home coast the protected cruisers "Chicago" and "Albany," old boats, built respectively in 1885 and 1897, and the gunboat "Princeton." In the same class, but out of commission, are the cruisers "Boston" and "New Orleans" and the gunboats "Bennington," "Marblehead," "Petrel," and "Wheeling." Of destroyers on the coast we have in commission the "Preble" and "Perry," and out of commission the "Paul Jones"; while there are three torpedo boats in commission and two out of commission. Out of commission also are the two submarines "Grampus" and "Pike." Among the fleet auxiliaries we have in commission the collier "Saturn" and the transport "Buffalo," while out of commission are the transport "Solace" and the hospital ship "Relief." Down in Central American waters is stationed the gunboat "Yorktown."

On the Asiatic side of the Pacific the strength of our fleet lies in its armored cruiser squadron, which consists of four vessels of the "California" class, namely, "Colorado," "Maryland," "Pennsylvania," and "West Virginia," all of which are in commission. In addition to these we have the old monitor "Monadnock," and out of commission the monitor "Monterey." In the protected cruiser class the United States is represented by the sister vessels "Cincinnati" and "Raleigh," built in 1892, each carrying eleven 5-inch guns, and three sister ships "Denver," "Chattanooga," and "Galveston," of 3,200 tons and 16½ knots speed, each armed with ten 5-inch guns; while two other vessels of the "Chattanooga" class, the "Cleveland" and "Denver," are now *en route* to the Asiatic station. Our representation in gunboats is quite numerous, but if we exclude the comparatively modern "Concord," "Helena," and "Wilmington," of between 1,400 and 1,700 tons, the other seven, which are small and very much out-of-date gunboats, captured from Spain during the last war, must be reckoned as of little value. The Asiatic fleet also includes five destroyers, two of which, the "Barry" and "Chauncey," are in commission, and the others in reserve. The fleet auxiliaries attached to this station include three colliers and three supply vessels in commission, and a transport and a collier out of commission at Cavite in the Philippine Islands. Down in the south mid-Pacific, at Samoa, is stationed the gunboat "Annapolis."

In summing up, then, it will be evident that the Navy Department of this country has no apprehension of any near or even remote hostilities, inasmuch as there is not a single battleship in commission, and our fighting strength is represented only by the six armored cruisers of the "California" class, the three semi-armored cruisers of the "Charleston" class, eight small protected cruisers from ten to fifteen years of age, four modern gunboats, four destroyers, and three torpedo boats.

THE ENEMIES OF STRUCTURAL STEEL.

Too much cannot be said of the excellent qualities of structural steel of the standard composition and workmanship. Its reputation for the combined qualities of elasticity, toughness, resistance to compression, and shear and durability has been established by years of useful duty in a thousand different forms and under a thousand different conditions. Steel, however, is subject to two insidious forms of attack, the peril of which lies in the fact that the damage is done under conditions where inspection is difficult and in many cases impossible. We refer to rusting and electrolysis.

The destructive effects of rusting are so well understood, that the efforts to protect the steel commence at the very time that the material receives its finishing pass in the steel mills. In all well-regulated works the finished work receives a coat of protective paint before it is placed in the storage yard, or shipped to the purchaser. If the paint be applied to thoroughly clean surfaces, quite free from rust, and if the steel work be again carefully painted before it is inclosed in the concrete, terra cotta, or other fireproofing material of the building, and the space between the fireproofing and the steel is carefully filled in with cement, experience has shown that it will probably be safe against deterioration by rusting for all time to come. But these theoretical conditions are seldom perfectly fulfilled. Too often the finished shapes at the mill are exposed to the moisture and acids of the atmosphere long enough to take on a coat of rust; and unless this be very carefully removed, the mere application of the ordinary paint of commerce will not prevent oxidation from taking place under the paint on the surface of the steel. In proof of this, we direct attention to the case of the reconstruction of the Mutual Life Insurance Company's building in San Francisco, when, in tearing down the six upper stories, an excellent opportunity was afforded to observe the behavior of structural steel in a steel and masonry building. We made editorial reference to this subject in our issue of March 16. From the account there given it seems that, where the steel had not been thoroughly cleaned before painting, there were occasional instances of some rust under the paint, and although these were rare, they indicated the necessity for a thorough cleaning of the steel before it is painted. Furthermore, there is a sense in which the preservative paint may defeat the very object at which it aims, by serving to conceal badly-rusted surfaces from inspection. The ideal protective covering, both for steel which is to be inclosed from view, and that which will be permanently exposed to the attack of the weather, would be a covering which, like varnish, would be sufficiently transparent to enable the condition of the underlying steel to be carefully inspected. If some composition could be produced, which combined transparency with protective qualities, a long step would be taken in the direction of rendering all steel work, whether exposed or concealed, imperishable.

The problem of the electrolysis of steel is one that we have always with us. Interest in the question was recently revived by the presentation before the American Institute of Electrical Engineers of the experiments of Mr. Knudson of this city, an account of which will be found in our issue of April 13. In these experiments three lengths of wrought-iron pipe were set in three blocks of Portland cement sand concrete. When the blocks were three years old, one of them was placed in a tank of sea water, another in a tank of fresh water, and direct current was fed to them, pieces of sheet iron being placed in the tanks to act as negative electrodes. The third block was placed in sea water; but no current was fed to it. After the blocks had been immersed for thirty days, the third block was found to be in perfect condition and the embedded pipe perfectly bright; but the two blocks to which current had been fed had developed cracks during the test; the pipes were considerably corroded; and the concrete had so greatly deteriorated, that it could be cut with a knife. In drawing deductions from this experiment it must be remembered, of course, that the conditions were unusually severe; but they were not so severe but that the ever-present danger of electrolysis is strongly emphasized. We mention this case, because it not only illustrates the action of electrolysis upon steel work as shown in the corrosion of the embedded pipes, but it indicates how increasingly necessary it is, in these days of reinforced concrete, to prevent the leakage of current from conductors. Although the evils of electrolysis have undoubtedly been greatly exaggerated, we believe that the mischief done is more far-reaching than the electrical companies and the owners of large electrical power plants are willing to admit. The remedy lies in more careful insulation. In the case of armored concrete buildings or buildings of skeleton steel, care should be taken to absolutely insulate the foundations and all that portion of the building which lies below the line of saturation of the earth. Much of the insulation of underground electrical conduits is undoubtedly very faulty, and it has become a question whether the thorough insulation of all forms of conductors should not be made the subject of legal enactment.

SIX MONTHS ELECTRIC OPERATION OF THE GRAND CENTRAL STATION.

The results of electric operation at the Grand Central station and terminal yard, as shown during the six months which have intervened since the electric current was turned on, have been very gratifying. Already the new system has loosened up the congestion, practically abolished the delays to incoming and outgoing trains, and restored the spirits and good temper of the company's patrons to their normal reading.

In proportion to the size of the yard, there was no other terminal in this country, or probably in the world, which was placed at such a disadvantage, from the operator's standpoint, as the Grand Central terminal. The area was so restricted that, outside of the express and mail cars, which of necessity had to be unloaded there, it was possible to store very few trains in the yard, and therefore the majority of the trains, after discharging their passengers, had to be run back over the main lines for a distance of 5½ miles to the Mott Haven yards. Furthermore, these yard movements had to be made in the midst of the regular train movements, and all of them through the two and a quarter miles of the Park Avenue tunnel, which was as badly steam- and smoke-obscured in winter as it was insufferably hot in summer.

At the present time, in spite of the inexplicable, but seemingly inevitable, delay of the New York, New Haven and Hartford Company in getting its electric system into operation, the New York Central Company, by the use of its multiple-unit local trains, and the almost complete substitution of electric locomotives for steam locomotives on its through trains, has made a vast improvement in conditions, both in the tunnel and the station yard. The atmosphere in the tunnel is greatly improved, and were it not for the continuing nuisance of the New Haven steam locomotives, the air of the tunnel would to-day be absolutely clear and sweet. The reduction in the number of train movements in the yard and station has been remarkable. Formerly, every time a steam train entered the station and left it, there were four separate operations connected with the train, involving eight signal operations. First, the train pulled into the station; secondly, a locomotive backed up to the rear end of the train; thirdly, the train was pulled out from the station; and fourthly, the locomotive which brought the train in backed out of the station. But the multiple-unit train merely enters the station and leaves it again, the only transfer being that of the motorman, who walks from one train to the other.

When the electric operation was commenced in De-

cember of last year, the total number of movements to and from the Grand Central terminal was, according to the official time table, 1,213. By the introduction of electric operation, the total yard train movements have been reduced by 690. It is this reduction more than anything else which has loosened up the congestion that completely disorganized the schedule during the autumn and early winter of last year.

Over and above the adjustment of the train schedule, the station and yard have been greatly improved in other respects, and notably in the reduction of noise, and the abolition of steam, smoke, and cinders. The multiple-unit trains, as used in local service, and even the large 97-ton locomotives, run with a smoothness and quietness which are very noticeable. When that greatly hoped for, but long-deferred day arrives on which the New Haven Company shall have been able to make its high-tension system work, and that company's steam locomotives shall have been withdrawn, there will be very little visible or audible evidence of the existence in this part of the city of one of the greatest terminal stations in the world.

ORIGINAL METHODS OF TONING DEVELOPED PHOTOGRAPHIC PRINTS.

BY MILTON B. PUNNETT.

The desire to obtain colors other than those given by development *per se* has led the manufacturers and users of bromide and so-called gaslight papers to resort to different methods. Of the many methods used, the one that has found the greatest application is the so-called sulphide method, of which the Velox redeveloper may be taken as a good example. About twelve years ago the writer recommended in one of the photographic magazines a similar method for obtaining sepia colors on lantern slides. Sulphide tones properly made are permanent. Sufficient time has elapsed since their introduction to thoroughly prove this. Facility of production is also in their favor. The tones are, however, not very varied, nearly always being some shade of sepia. Experiments to obtain some other permanent sulphide tone were made by the writer with what appeared to him to be a fair degree of success. It was found when finished prints made on Velox or Nepera bromide paper (I mention these papers because my experiments were confined to them) were immersed in a solution of ammonium sulphocyanate and sodium sulphide, a good purplish tone, very often equal to a gold tone on printing-out paper, was obtained.

The following formula has proved the most satisfactory of any tried:

A.

Ammonium sulphocyanate	8 ounces
Water to make	16 ounces (fluid)

B.

Sodium sulphide (crystals)	½ ounce
Water	3 ounces

Following are condensed instructions for its use:

Bath No. 1.

Solution A	1 ounce
Water	3 ounces
Solution B	1 drachm

Mix just before toning.

Immerse the fixed and washed (and preferably dried) print. The toning action begins almost immediately, ranging through the purple tones first and then into the sepias.

Allow the print to remain in the toner till the desired color is reached, then wash fifteen minutes in running water and dry as usual.

With the bath at 70 deg. to 80 deg. F., prints will tone in from fifteen to forty minutes; at 90 deg. to 100 deg. F. five to fifteen minutes will suffice, but it is not advisable to use the bath at a higher temperature than 100 deg. F., owing to its softening action on the film.

Prints developed with Velox N. A. developer tone quicker than prints developed with ordinary developer.

The rapidity of the toning may also be increased by adding more of solution B, but not more than one drachm should be added to the original solution at one time, as this would render the bath too alkaline and soften the film.

It works best when freshly mixed, and after forty minutes or so more B solution may be added.

The old bath may be kept for future toning, but before use it should be filtered or decanted to remove the white precipitate formed, and fresh B solution added, but it should be discarded when it becomes so alkaline as to affect the film.

It will be found that the toning is influenced somewhat by the character of the negative used, different degrees of density in the negative affecting the silver deposit on the print and the subsequent action of the toning solution.

It will also appear that matt papers tone more readily than the glossy, and that purple tones are easiest secured on glossy papers.

It must be confessed that the laws governing the action of this bath are not as thoroughly known as could be desired. Sometimes it will work quite rapidly, and again under apparently the same conditions it works much slower.

Further experiments have shown that its certainty of action could be greatly improved by mixing with it hypo alum toning solution, made according to the following formula:

C.

Hypo	10 ounces
Water	50 ounces
Heat to boiling and add	
Powdered common alum	2 ounces

Allow to stand until cold. It improves by standing.

Bath No. 2.

A	½ ounce
C	½ ounce
Water	3 ounces
B	1 drachm

When B is added the solution is clouded by the precipitated aluminium hydroxide. This precipitate does not interfere with the toning action.

This latter bath (No. 2) yields tones equal to and quite often superior to the former bath (No. 1).

It also smells more strongly of hydrogen sulphide, and it is not advisable to use it where the ventilation is poor. As its action ceases, more of B can be added.

The latter bath has also better lasting qualities. I have known it to tone without adding an additional quantity of B after it has stood over night.

AS A PRELIMINARY BATH.

Prints from some negatives when bleached and redeveloped with sulphide solution sometimes incline more to the yellow than is desirable. Having ascertained this fact, colder tones can be obtained on subsequent prints to be toned by using bath No. 1 as a preliminary bath. How long the print should remain in bath No. 1 cannot be stated with exactness, as there are several factors to be taken into consideration; chief among these are, 1, how much the color given by the bleach and redeveloping method differs from the desired color; 2, how fresh bath No. 1 is. The fresher the bath, the quicker it works. Other things being equal, the longer the print remains in bath No. 1 the colder the tone. In a freshly-prepared bath at the ordinary temperature, even fifteen seconds is enough to effect a change in color in the finished print.

As a general thing, any immersion, even one falling far short of the time necessary to produce a visible effect, is quickly made apparent by the print refusing to bleach as much as it would have done were it untreated, when placed in the bleaching solution.

Prints should be well washed before placing in bleaching solution, and should remain in it from 5 to 10 minutes or until it is certain that the bleaching is completed.

After bleaching, prints should be rinsed free from bleaching solution and redeveloped as recommended in the Velox redeveloper instruction.

What chemical reactions take place in what I would call the sulphide sulphocyanate method of toning I have not investigated far enough to state.

However, hydrogen sulphide is released, and this in its nascent condition no doubt has power enough to attack the silver of the image. It is also certain that other reactions have an effect, for if the ammonium sulphocyanate is replaced by an equal weight of the potassium salt, the toning action is *very* much slower.

To the question, Why does this method give a different color from that obtained by simple bleaching and redeveloping with sulphide solution? it might be answered, Because the conversion of the silver is not so complete as in the latter process. In reply would say that it would be hard to imagine the colors obtained on some prints as resulting from a combination of sepia and black.

As they are, the processes described are practical, but there is room for improvement.

To the photographic chemists the reactions involved will also prove worthy of investigation. Bearing on this subject three other experiments which were made are, without doubt, worth mentioning. A developed gaslight paper print partially immersed in a dilute solution of sodium sulphide, toned only on the parts which were exposed to the combined influence of the solution and the air. A print wet with water and used as a cover to a glass containing a sodium sulphide solution toned in the parts exposed to the fumes. When hydrogen peroxide was used to wet the print in place of water, quicker and better results were obtained. With the necessary fuming box this method might prove a commercial possibility.

To Dredge Nevada Placers.

Plans have just been perfected to dredge placers in Nevada on a colossal scale. The purpose is to operate placer mines at Osceola, Nevada. An immense pumping plant and gasoline hoist will be purchased; also two large dredges, capable of removing 2,500 yards of earth a day, are to be installed. Churn drills will also be employed to ascertain the extent of ground that is capable of being worked by dredges.

SCIENCE NOTES.

What is known as the poisonous bean of Java, which caused a number of serious accidents, was studied not long ago by M. Guignard. It appears that a poisonous grain has also been found in France by M. Bertrand, and this is the grain of vetch (*Vicia angustifolia*) which is used in the Medoc region for feeding cattle. This variety is different from the ordinary vetch (*Vicia sativa*) and gives a grain which shows an odor revealing the presence of hydrocyanic acid when ground up in water. To isolate the active body, which appears to be a glucoside known as *vicianine*, the grains are exhausted by cold alcohol. The extract is then treated by ether, which takes off the chlorophyls and the fatty matters. There remains a pasty mass which is taken up by alcohol and the latter deposits crystals of the vicianine. After re-crystallizing in water this body is seen in the form of brilliant colorless needle-like crystals which melt at 166 deg. C. The aqueous solution has a certain action upon polarized light. It appears that the grains of *Vicia angustifolia* which M. Bertrand observed can furnish about 0.75 part per thousand of hydrocyanic acid. Accordingly it is not safe to use it for feeding domestic animals.

In order to eliminate the disturbing effect of the severe vibrations set up by the London County Council's electric generating plant at Greenwich upon the adjustment of the transit telescope at the adjacent observatory, an ingenious modification of the device generally adopted for such purposes has been evolved. Earth tremors such as are set up by vehicular and railroad traffic are damped, as is well known, by means of a mercury trough with an amalgamated metal bottom. But the vibrations caused by the four engines installed in this station are of a much more serious nature, the image reflected in the mercury trough moving in such a manner as to show that the mercury is being subjected to forced oscillations, while the period agrees with the impulses due to the inertia of the reciprocating masses in the generating engines. Consequently, the ordinary means for damping these oscillations are abortive. The tremors formerly arising were more or less intermittent, whereas the present tremors are never wholly absent. Instead of using the saucer-shaped trough, a receptacle is adopted in which the mercury assumes the form of a thin film lying on an amalgamated metal surface, the curvature of which is so slight that the depth of mercury is less than 0.5 millimeter at the center of a circle 15 millimeters in diameter. By this means a perfectly steady surface is presented, in which the reflection is not disturbed by the heaviest vibrations set up when the four engines at the generating station are running simultaneously. The viscosity of the thin film is so great that even these long-period oscillations are completely damped out, and a satisfactory solution enabling observations to be effected by reflection in a mercury surface is assured. The film though still sufficiently fluid to assume the form of a horizontal plane participates in the motion of the ground like a rigid body, so that there is no relative displacement of the image with respect to the telescope. The committee of investigation, comprising the Earl of Rosse, the distinguished astronomer, the late Sir Benjamin Baker, and Mr. J. A. Ewing, appointed to inquire into the effect of this generating station upon the work of the observatory instruments, while satisfied with the efficiency of the above solution of a difficult problem, were not fully convinced as to whether the vibrations exercise any other injurious influences upon the utilization of the instruments, and suggested that a period of two years should elapse before a definite opinion is expressed, the question as to the extent of obstruction through the chimneys or discharge therefrom being similarly deferred. The committee, however, pointed out that the oscillations might have been reduced to the minimum, had the engines installed at the generating station been perfectly balanced, the type of plant adopted being eminently adapted to complete balance; but this precaution had not been adopted, and to rectify this error would be somewhat costly. When the outcry arose as to the work of the observatory being seriously affected, only one half of the designed generating plant had been installed, and the committee point out that the second section should comprise turbines, which with their attendant generators must be of the perfectly balanced type. The height of the chimneys is also restricted to the maximum of 204 feet above ordnance datum. The discharge of the gases from the chimneys is also to be carefully maintained, and must not materially exceed 250 deg. Fahr., while the capacity of the station is not to be extended beyond the contemplated 20,000 kilowatts of the second portion. In this way the committee hoped that the troubles which have arisen, while not entirely eliminated, may at all events be reduced to the minimum; and although they deprecated the fact that the site was ever selected for the generating station, they were of opinion that provided all precautions are observed, the work of the observatory will not be appreciably disturbed.