heat in absolute contact with it, he devised the plan of studding the bottom of the metallic vessel with a number of copper rods, each passing through into the water space, and being there flattened to a broad head, which gives its heat up rapidly to the water. The proof of the value of this novel invention was shown before the audience by Mr. Fletcher boiling a quantity of water in a new form kettle in little more than the half of the time needed by one of the old form, while at the conclusion of the lecture he in a strong four-quart kettle, weighing over six pounds, boiled a pint of water in fifty seconds. This was a very marvelous achievement, and renders it probable that, as we say, photographers may hope soon to be provided with an apparatus for quickly heating water for the many purposes for which it is needed by them—carbon printing, for example, with numerous other processes—that will perform its work in less time and with greater economy of fuel than is possible with any apparatus yet introduced.—*Br. Jour. of Photo.*

PHOTOGRAPHIC NOTES.

How to Change Blue Prints to Dark Brown.—Dissolve a piece of caustic potash about the size of an ordinary soup bean in five ounces of water. It will dissolve in a few minutes. Place your blue prints in this solution, and in a short time they will fade to a pale orange-yellow color. When all the blue tints have disappeared, wash in clean water. Now dissolve a partly heaped up teaspoonful of tannic acid in about half a pint of water. Put your yellow prints into this bath, and they will immediately begin to assume a brown tone. Permit them to remain in the tannic bath until they are as dark as you desire. Then take them out, wash well, and dry. F. S.

Sensitizing Albumenized Paper—Precautions to be Observed in Hot Weather.—There are always some troubles in connection with printing on albumenized paper, but during very hot weather these difficulties are increased in various ways. We are assuming just now that the printer sensitizes his own paper. Using ready sensitized paper, there is certainly no great difference in the ease with which results can be got at different temperatures.

The modern tendency to use very highly albumenized paper makes the difficulties, perhaps, somewhat greater than they used to be. The sensitizing solution is liable to run into tears on such papers at all times, but particularly when the temperature is very high. The bath appears to have more tendency to get out of order in hot weather than in cold, and certainly the evil results when it is out of order are more noticeable. We have known cases in which, when the temperature was very high, the air somewhat damp, and the bath only a little out, the paper could not be dried before it commenced to turn brown.

We believe that there is no better way of keeping a bath in order than to keep a little carbonate of silver in the bottom of the stock bottle, frequently to stir this up, and to keep the bottle in bright light for as long as possible. The carbonate of silver is insoluble in water or in nitrate of silver solution, but it decomposes any acid which may form in the baths, thus keeping the solution neutral. At the same time, being in a fine state of division, it serves as well as kaolin to carry down organic matters.

The carbonate of silver is, of course, produced by pouring a little solution of carbonate of soda into the bath. So much should be added that the resulting precipitate is sufficient to make the solution quite opaque when it is shaken up.

When the solution is in use for the greater part of the day, far the best course is to have two baths mixed up, one in use and one in the sun continually, the two being changed daily, and that in the sun being shaken up twice or thrice during the day. We have known of cases in which many reams of paper have been sensitized with a total amount of solution equal to only two gallons, without any treatment of the solution beyond that just described, and, of course, the addition of silver as it was used up, and in which the bath was as clear at the end of working as at the beginning, and even giving as good results.

It is probable that a good deal of harm is done in very hot weather by floating for too long a time, or we should, perhaps, say for an unnecessarily long time. It is not generally appreciated how great an accelerating influence rise of temperature has in the sensitizing process; that only about one-half the time is, on an average, required in very hot summer weather that is required in winter, even in rooms heated up as rooms commonly are in winter.

We advise all to follow the plan of brushing a little solution of chromate of potash on to the back of the first sheet sensitized on any day, and of observing how long it takes for the wetted part to turn orange in color. It may be taken for granted that any sensitizing after this change has taken place is of no use, and probably does harm both to the paper and to the bath. Of course, the amount of time required to sensitize the first sheet may be taken as a guide to the time that should be allowed for others; although we have known some who rejected all measurement of time, and simply put a minute drop of the chromate solution on one corner of the back of each sheet, removing the sheet when the spot changed color.

It is a common practice to allow the bath to get weaker in hot weather, and no doubt something is to be said for the custom. It has the effect, if nothing else, of making it less likely that tears will form on the paper while it is drying, and it has a slight influence in the direction of causing the paper to keep well. It may probably be taken for granted that so long as the sensitizing solution dries in tears, it may safely be reduced in strength without any danger of injuring the surface. We have not known a case in which, if a solution as weak as 10 per cent, or say 45 grains to the ounce, be used, the running of the solution in tears, even with paper of the very highest surface, has occurred.

Next to attention to the condition of the bath, there is, perhaps, nothing which adds so much to facility in printing in hot weather—or, indeed, in every weather—as the free use of blotting paper that has been steeped in a solution of carbonate of soda.

Probably most readers know more or less definitely that soda paper has a preserving influence with sensitized paper; yet, in our experience, few use it as freely as they should, or appear thoroughly to appreciate the benefits to be derived from it.

We will describe the use of it, especially as there is a little manipulative difficulty in preparing the paper, on account of its extreme softness when washed in water. This softness makes it by no means a very easy thing to handle a sheet without tearing it.

The precise strength of the solution does not appear to be of much moment. We generally take about a pound of washing soda, and pour about a gallon of water over it in a dish large enough to sensitize half a sheet of paper on. We then take the sheets of blotting paper, folded in two, and lay them on the liquid until they are saturated, which, of course, takes only a very few seconds. They are then hung over a string to dry, no attempt being made to open them up, otherwise they are almost certain to be torn.

To secure the best results in the matter of preserving the sensitized paper, each sheet should have a sheet of soda paper on each side of it—that is to say, sensitized paper and soda paper should be piled alternately. If this be done, and the whole be surmounted with a flat weight, there appears to be scarcely a limit to the length of time that the paper can be kept—certainly for many weeks. If this paper requires to be kept for only a few days—or, say, even for a week—it is sufficient to roll it up tightly, and to inclose the roll in soda paper.

The precise action of the soda we will not attempt to explain, but it is probable that it acts as a *sulphur trap*, preventing the access of any sulphur in the air to the paper. A piece of the soda paper should always be kept be kept behind the sensitized paper in the printing frame.—*Photo. News.*

Natural Gas Belt.

Professor J. P. Lesley, in a recent report of the Pennsylvania Geological Survey, has the following:

Shall I bore for gas at my works? is a question so often asked, and so seldom answered with intelligence, that a short statement of the principles involved in a correct answer to it will probably be of use to more than one reader of this report.

First of all, there can be no gas stored up in the oldest rocks. This at once settles the question in the negative for the whole southeastern third of the State. To bore for gas in Bucks, Montgomery, Philadelphia, Delaware, Chester, Lancaster, York, or Adams counties would be simply absurd.

Secondly, there can be no gas left underground where the old rocks have been turned up on edge and overturned, fractured and recemented, faulted, and disturbed in a thousand ways. If there ever was any, it has long since found innumerable ways of escape into the atmosphere. This settles the question in the negative for all the counties of the great valley—Northampton, Lehigh, Berks, Lebanon, Dauphin, Cumberland, and Franklin; as any one can see by looking at the present condition of their limestone, slate, and sandstone formations.

Thirdly, there is not the least chance that any gas is left underground in the greatly folded, faulted, crushed, and hardened formations of the middle belt of the State—Carbon, Schuylkill, Lehigh, Luzerne, Columbia, Montour, Northumberland, Union, Snyder, Lycoming, Perry, Juniata, Mifflin, Center, Clinton, Huntingdon, Blair, Bedford, and Fulton counties. Where the oil and gas rocks rise to the surface in these counties, as they do in a thousand places, they show that all their oil and gas have escaped long ago.

Fourthly, where the rock formations lie pretty flat, and have remained nearly undisturbed over extensive areas—as in Wayne and Susquehanna, parts of Pike and Lackawanna, Wyoming, Bradford, Tioga, Potter, and all the counties west of the Allegheny Mountains—there is always a chance of finding gas (if not oil) at some depth beneath the surface determined by the particular formation which appears at the surface; but as yet we have no satisfactory evidence of the existence of quantities of rock gas in any of these counties east of Potter.

Fifthly, wherever the bituminous coal beds have been changed into anthracite or semi-bituminous coal, it is reasonable to suppose that the same agency which produced the change, whatever it was, must have acted upon the whole column of formations, including any possible gas rock at any depth.

Sixthly, wherever rock oil has been found, there and in the surrounding region rock gas is sure to exist.

Natural Gas in New York.

The striking of a heavy gas well recently at Knowersville, near Albany, New York, brings the supply of this valuable fuel within measurable distance of a number of our great industries situated along the Hudson River. Each succeeding month brings new discoveries of gas nearer to New York, and recalls the prediction of Mr. Henry Wurtz, the eminent chemist, made seventeen years ago, that nautral gas will be found in a belt following the outcrop of the great gas-bearing beds (the principal of which is the Marcellus shale), at such a distance from their outcrops as will give a depth of about 400 feet to the bed. Professor Wurtz, as long ago as 1869, urged the use of natural gas in the region of which the great gas well at West Bloomfield, Ontario County, New York, was the center.

In a discussion before the Lyceum of Natural History of New York, October, 1871, he gave the quantity of gas sent out by this well as 5 cubic feet per second, and the composition 82½ volumes per cent marsh gas, 10 per cent carbonic acid, 3 per cent illuminating gases of the olefine group; estimated its heating power equal to 14 tons of anthracite a day; and discussed at length the question of carrying the gas under heavy pressure to great distances for use as a heating and lighting agent. Professor Wurtz indicated five or six beds running across New York State, "lying deep enough, and thick and porous enough," to pour out combustible gas when tapped. And he repeated a statement he made long before editorially in the columns of the American *Gas-Light Journal*, that "It may be accepted with implicit confidence as a fact that there are vast districts of country throughout the United States in which, by judicious exploration, and immense number of such fountains of natural gas may be developed; furnishing a fuel which raises itself out of the mine, and which may be made to transport itself, up hill and down dale, to any point required, independently of seasons and circumstances, miners' strikes and railroad monopolists to the contrary notwithstanding. A future lies before this new art of developing the gifts of Mother Nature, big with a promise for which even the wondrous history of American petroleum production has furnished no parallel."

In conclusion, Professor Wurtz said: "I will venture to enounce as my own conviction, which, however visionary it may be deemed by many, I claim to be strictly founded on induction from known facts, that, (throughout large sections of the United States throughout the middle tier of counties in Western New York for example), every town, nay, every house in the land ought to be both warmed and lighted by gas drawn from the bountiful bosom of Mother Earth, without money and without price."

Undoubtedly to this clear minded and able chemist are due the first suggestions of the possibility of finding natural gas over great areas and of carrying it to great distances for general manufacturing purposes.

Many theories of the formation of natural gas have since been proposed; but it is none the less interesting to quote here that suggested by Professor Wurtz nearly seventeen years ago in these words: "As to my views of the mode of formation of the gas that exists now in such enormous compression in these different strata, I ask first, What is this gas chemically? Always essentially, from whatever horizon obtained, it is marsh gas, that hydrocarbon of all others which contains the most hydrogen and the least carbon: the compound which naturally and necessarily forms the final residue of the abstraction of carbon from organic matter by a powerful oxidizing agent, since in nature we scarce find elementary hydrogen as such a residue. Now, what oxidizing agents are there, or, rather, what have there been in all these rocks that could effect such a combustion? I reply, oxides of iron, now represented in these rocks by iron sulphides, showing the iron oxides to have passed through the forms of sulphates;" an action similar to that "evolution of marsh gas going on in every stagnant pool, loaded with vegetable matter, and blackened by sulphide of iron, which is occupied in conveying the oxygen of the water to the carbon of the mud."

The development of the natural gas industry during the past two years has been marvelous; yet it is almost as extraordinary that it required fifteen years after Professor Wurtz's prediction to awaken even enterprising men to what they all now know to be so incalculably important.—*Engineering and Mining Journal.*