forms an annular chamber, and the large piston has two rods, and is packed on its inner and outer circumference; with this exception, the engine is of the usual form; but the advantage of admitting steam of high pressure, full stroke, or nearly so, on to the piston of the small cylinder, and expanding it into the large cylinder, must be apparent, as the great shock caused by the admission of steam of high pressure on to the area of a large piston, is almost entirely got rid of, and the method of expansion is more efficient. The following are some of the dimensions of the Buckeye State:—

	Fect.	Inches.
Length on Deck,	282	0
Breadth of Beam,	32	11
Depth of Hold,	12	0
Tonnage,	tons, 1187	
Diameter of Water Wheel,	35	0
Length of Paddles,	9	8
Depth " "	2	2
Dip of Wheel,	3	10
Average number of Revolutions,	16	
" Pressure of steam,	lbs. 40	
" Consumption of Bituminous Coal per hour, "	3158	

While the *Mayflower*, a boat of about the same size and speed, consumes 6160 lbs per hour, showing a decided saving of fuel. She has three boilers with square fronts, 9 feet wide, and round shells 9 feet diameter, and in length 17 feet 9 inches. Each boiler has but one furnace, 8 feet wide, with grates 6 feet 6 inches long, with two lower flues of 20 inches diameter, and one of 26 inches; the return to the chimney, which is in front, is through 190 tubes of 3 inches internal diameter, which tubes rise 4 inches at the front end; whole number of tubes 570; diameter of chimney $6\frac{1}{2}$ feet; height above grate, 65 feet; draft natural, and steam abundant; no trouble has yet been experienced from the great length of tube. It would be desirable to know the temperature in the chimney, as it is possible that the tubes may be longer than is necessary, as it has generally been supposed that very long tubes gave no additional evaporating power. This question is an important one, and I shall have it examined into, and will report at some future time. X.

Recent Improvements in Photography. By ROBERT HUNT.*

With the advance of this beautiful art there appears to be a progressively increasing desire to produce more artistic results; and numerous manipulatory improvements have recently been introduced, many of them with the most decided advantage. It is thought desirable, therefore, to devote a short space to the description and consideration of such of these as are the most important.

The use of collodion promises to be of exceeding importance. Collodion is a peculiar preparation, formed by dissolving gun-cotton in ether; it is a very mucilaginous solution, of a volatile character, and the ether evaporating, leaves a film of the utmost transparency behind. It is not all kinds of gun-cotton which dissolve equally well in ether; the most easily soluble is prepared by soaking good cotton in a saturated solution of nitrate of potash for some time: it is then, in a moist state, plunged into

* From the London Art Journal for July, 1851.

sulphuric acid, with which but a small quantity of nitric acid has been mixed. After remaining in the acid for about a minute, it is well washed with water, until no trace of an acid taste is discovered, and then dried at a temperature but very slightly elevated above that of the apartment.

Having obtained the collodion, the mode of proceeding best adapted for insuring success appears to be the following :

Iodide of silver is precipitated from a solution of the nitrate of silver by adding iodide of potassium to it, the yellow precipitate being well washed so as to remove every trace of nitrate of potash; it is then dissolved in a saturated solution of the iodide of potassium. This mixture is added in small quantities to the collodion, and the whole well agitated; by this means we obtain a combination of this peculiar substance with iodide of silver and potassium. Mr. Archer, who has devoted considerable attention to this preparation, prepares what he calls a collodiodide of silver, whether in the above manner we are not certain. Mr. Archer's preparation is exceedingly sensitive, but the above is believed to be equally so. To use it, no other manipulation is necessary than to pour the mixture over a glass plate held upon the hand, moving the glass to and fro, to ensure the complete coating of every part; the fluid is poured off by one of the corners, and the film which adheres to the glass dries almost immediately. This is then washed over with the gallo-nitrate of silver, in the same manner as on the albuminised glass plates, and it is ready for the camera. Where the proportions have been happily hit upon, the result is the production of a picture almost instantaneously. Very fine portraits are obtainable in about ten seconds in diffused light; the image is developed in the same manner as in the calotype process, by the use of the gallo-nitrate of silver, and fixed by means of the hyposulphite of soda.

By the kindness of Mr. Horne we are enabled to add the following mode of operating. Mr. Horne has been so successful an operator with the collodion that we print his communication entire, that no part of his instructions may be lost :—

“The first article is the collodion, and most persons are aware that this is a solution of gun-cotton in ether, but, for the purpose now under consideration, should contain a small quantity of iodide of silver dissolved in excess of iodide of potassium. It should be sufficiently limpid to run freely over a plate when poured on, or ether must be added until this result is obtained. If the collodion is too thick, great difficulty will be experienced in obtaining an even coating; but when of a proper consistence, plates of any size may be readily coated.

“The plan which I have adopted, and with great success, is as follows:—Take a piece of flat glass cut to the size of frame, and, having washed it with water, and wiped the same quite dry, then, either by holding at one corner, or if large, placing it on a levelling-stand, pour on the centre of the plate a good body of liquid which will readily diffuse itself equally over the surface. Immediately pour the liquid off again into the bottle from one corner; and by bringing the hand holding the plate down a little, that the liquid may run to the lower edge, and drawing the mouth of the bottle along, those lines first formed will run

one into the other, and give a flat even surface. Very little practice will soon enable any operator to obtain this result. The plate is now *immediately*, and before the whole of the ether has had time to evaporate, to be immersed in a bath of nitrate of silver; 30 grains to the ounce, *until the greasy appearance which it first presents on immersion is entirely gone, and the silver solution flows freely over the surface.*

"The plate should now, and in its moist state, be placed in the camera and the picture taken; the time of exposure varying, of course, with the light, but for a portrait, and with a moderately quick lens, from three to thirty seconds will be sufficient. Mr. Fry, who was the first to practise with collodion, has obtained beautiful portraits by placing the sitter in the open air, and simply removing the cap from the lens, and closing it again as soon as possible.

"The agent for developing these pictures is unquestionably the pyro-gallic acid, as recommended by Mr. Archer; and I am told the proto-nitrate of iron also answers equally well. The solution of pyro-gallic acid should be made as follows:—

Pyro-gallic acid,	3 grains.
Glacial acetic acid,	1 drachm.
Distilled water,	1 ounce.

The plate having been placed, face upwards, upon a levelling-stand, a sufficient quantity of the above solution should be poured equally and quickly over the surface, and the picture allowed to develop, occasionally slightly moving the plate, to prevent the deposit which will take place settling at one spot. A few drops of a solution of nitrate of silver, five grains to the ounce, may also, in dull weather, be added to the pyro-gallic, with advantage, just before pouring it over the plate; but in very bright weather the picture will develop sufficiently quick with the pyro-gallic acid solution alone.

"The development may be readily judged of by holding a piece of white paper occasionally under the plate; and as soon as sufficient intensity has been obtained, the solution must be poured off, and the plate washed by a gentle stream of water. After this, the surface should be covered with a saturated solution of hypo-sulphite of soda, which will almost immediately remove the iodide. Another stream of water must then again be poured over, to free the plate from hypo-sulphite, and the picture is finished.

"In this state they are more or less negative by transmitted light, and, if not too much brought out, positive by reflected light. But I have found the most beautiful and decided positives may be obtained by the simple addition to pyro-gallic solution of a minute quantity of nitric acid; care being taken not to add too much. I have also obtained purple and green pictures, the former by adding acetate of lead, and the latter with acetate of lime and ordinary gallic acid.

"In the hands of skilful operators, who have time and inclination to follow up this interesting branch of photography, I have little doubt but we shall see some beautiful results. At present it is quite in its infancy; but, notwithstanding this, it has been allowed by those who have seen the portraits which have been taken, that they possess far greater beauty than any hitherto produced."

The resulting negative picture on the glass is not quite so adherent as

those formed with albumen; care must therefore be taken to avoid rubbing it off, or the glass plate may be covered with a colorless spirit varnish; by which, when dry, the photographic image is perfectly fixed. In this process the ether, without doubt, plays a very important part; although the largest portion evaporates readily, on intimate chemical combination of this hydro-carbon with the peculiar substance, gun-cotton, employed. At a very early period of photographic investigation, it was found that both alcohol and ether produced several remarkable effects—in some cases the processes were very much quickened; in others the resulting tone of the darkened paper was of a much deeper and richer color. Experiments are yet required to determine the operation of these organic compounds; from the action of many of them it would appear that it is to this order of chemical agents that we have now to look for the greatest improvements in photography.

Lactarine and caseine have been both recommended as media for preparing glass surfaces for the photographic processes. These compounds, which are of a very analogous character, are prepared from buttermilk, by the action of acids; it is proposed that they should be used in solution in ammonia. When this is done, the glass being uniformly coated by flooding the solution over it, it must be allowed to stand in a warm place, free from dust, to dry; this occupies some time, but if the process has been carefully attended to, the resulting coating is very uniform and clear. Iodide of potassium, or of ammonia, may be mixed with the caseine solution, before it is applied; the other parts of the process being precisely similar to those already described.

It has always been deemed of the utmost importance, in the processes on paper, to keep the chemical agents which are to be operated upon by the solar radiations as much as possible upon the surface. Several plans have been proposed, and albuminized paper, has been largely employed. It is, however, found that waxed paper answers far better than any other. The fact that water cannot be spread upon wax may appear to be a difficulty in the way of successful manipulation; but there are means by which this can be overcome, the most successful being the following:

A sheet of good writing paper is placed upon a hot iron plate, and rubbed over with wax until thoroughly saturated, taking care that the wax is uniformly diffused. If there should be an accumulation in any part, the paper is to be held up by one corner, in front of a fire sufficiently hot to liquefy it and allow it to flow off from the opposite corner. A great many sheets of this paper can be prepared at a time, and kept until required. To give these the sensitive coating, a large dish must be procured and filled with a solution of the iodide of potassium; if the paper is simply dipped in; and then removed, it will be found to remain quite dry, owing to the repulsive action exerted between the water and the wax. Sheets of waxed paper are to be passed into the solution one after another, taking care to remove any air-bubbles which may form on the surface of each, until as many as may be required are inserted, and the whole allowed to remain for two or three hours. In that time a considerable quantity of iodide of potassium has been absorbed, and, on removing the papers and drying them, it will be found, upon the application of the nitrate of silver, that a beautiful surface of the iodide will be produced. These papers are highly sensitive, whether we employ the

calotype or the ferrotype process, principally from the circumstance that the chemical agents are retained on their very surface. The resulting pictures are beautifully transparent, not in any respect inferior for copying from than those negatives which are waxed after the picture has been obtained, and all the details are very charmingly preserved.

The addition of the flouride of sodium to the iodide or chloride, is the first preparation of the paper we have alluded to, and there can be no doubt but it possesses considerable accelerating power. This preparation has been recently introduced as a novelty, but the following process is described in the author's "Researches on Light," published in 1844:—

"The fluates of soda and of potash have been used in many different manners, and variously combined. It has been found that the fluat of soda, has the property of quickening the sensibility of bromidated papers to a very remarkable extent; and from this quality, a new process, which I would distinguish by the name of the Fluorotype results. THE FLUOROTYPE. This process, which is characterized by its easy manipulation, and by the sensibility of the papers, when carefully prepared, consists in the formation of a salt of silver, which I suppose must be considered as a fluo-bromide of silver. It is at present somewhat difficult to say which is the most efficacious manner of proceeding; but the difference, as it regards the sensibility of papers, is so very trifling, that this is not of much consequence. The paper may be washed, first, with the bromide of potassium, and then with the fluat of soda; or, which will be found on the whole the best plan, the two salts may be united. The strength of the solution should be as follows:—

Bromide of potassium	20 grains.
Distilled water	1 fluid ounce.
Fluat of soda	5 grains.
Distilled water	1 fluid ounce.

Mix a small quantity of these solutions together when the papers are to be prepared, and wash the paper once over with the mixture, and when dry apply nitrate of silver in solution, 60 grains to an ounce of water. These papers appear to keep for some weeks without injury, and they become impressed with good images in half-a-minute, in the camera. This impression is not sufficiently strong to serve, in the state in which it is taken from the camera, for producing positive pictures, but it may be rendered so by a secondary process. The photograph is first soaked in water for a few minutes; it is then placed upon a slab of porcelain or stone, and a weak solution of the proto-sulphate of iron applied, which very readily darkens all the parts on which the light has acted, to a dark brown; and every object is brought out with great sharpness. When the best effect is produced, the process must be stopped, or the lights suffer. All that is necessary is to soak the paper in water, and then fix with hypo-sulphite of soda."

The processes now recommended are in all respects similar to this:—

It has been found in operating upon landscapes, that the best effects are produced by employing weak solutions of the gallo-nitrate of silver; by choosing clear daylight rather than sunshine—and then allowing the paper to remain in the camera obscura for a prolonged period; that is, from half-an-hour to an hour. In this manner, all the delicate details are brought out—every blade of grass and every leaf impresses its shadow

on the paper, and there are not any of those violent contrasts which destroy the picturesque harmony of many of the calotype landscapes.

The "Daguerreian Journal," published in New York, has just announced the discovery, by Mr. Hill, of a process of obtaining photographs colored by Nature. The manipulatory details are not complete; but we quote Mr. Hill's own words, hoping his expectations may be fully realized:—

"Some two years ago, I took to experimenting, with a view to this great desideratum, but with little faith. In one of my experiments a phenomenon presented itself which greatly surprised me, and, in the nature of the case, compelled me to believe the thing practicable. One color, the red, in a figured dress, was developed as bright as a ruby. I then repeated the experiment, and failed; but, from that hour until a few months ago, I continued to repeat it in every form I could think of, always failing, but never despairing; for I had reasons for believing in the correctness of my theory, that, under certain circumstances, there is on the impressed plate a latent-colored image. I at length commenced experimenting on the developing power of the vapors of different metals, and found that a large number of them, such as arsenic, cadmium, zinc, selenium, bismuth, potassium, and sodium, would, when properly vaporised, bring out the latent image in light and shade. The same result followed the use of several gases; the impressions differed so little from daguerrotypes, that I was on the point of abandoning the pursuit, when I one day, unexpectedly, formed a singular compound, and, without much hope of success, applied it to my purpose.

"My surprise and joy were unbounded when I found on my plate a true Hillo type. The same process, with some variations, I have followed since, always with good results. I now have forty-five specimens, all of which present the several colors, true to a tint, and with a degree of brilliancy never seen in the richest daguerreotype, and this is true also of the whites and blacks. The pictures have much the appearance of an enamelling, and, I believe, are equally durable, for it is very difficult to efface them by scouring; and, as far as I can judge, they are not acted upon by light. My process bears no resemblance to Becquerel's, and is essentially different from Daguerre's. My success in quickening the plates has been equally gratifying, and I have but little doubt of being able to operate in diffusing light instantaneously, having already reduced the time of setting to much less than that required for daguerreotyping. I have now forty-five specimens; they are all equally perfect. It is quite remarkable that I have never yet made a partial failure. Those impressions which have had too much light, are nearly as strong, sound, brilliant, and beautiful, as those correctly timed in the camera; being inferior only in having the colors less deep; even the whites retain their strength. The folds of the linen are always well defined; blue or solarised linen is unknown in my process, and there is always a strength and clearness in the whites unattainable by mercury. During the last winter I have several times taken a view, in which there is a deep red house, while the ground was covered with snow. For experiment I exposed the plate so long as to reduce the bright red of the house to a very light red, while, at the same time, the white snow was developed with a beautiful whiteness. I have copied several very highly colored French prints; the copies are far supe-

rior to the originals, in that, while they have every tint of color, they are exceedingly brilliant. This is a characteristic in which I never fail, even with the plates merely cleaned with rotten-stone; the brilliancy depending on other causes. Well-polished plates, however, are preferable, for other reasons. It is essential that the plates should be very pure, free from scum, dampness, and organic matter of every kind; and I am experimenting with different substances, in hopes of finding something that will more perfectly cleanse, while it thoroughly polishes. I would be very thankful to any person who might furnish me with valuable hints on this point, as I am convinced that here lies one great cause of uncertainty."

In America there is certainly much zeal displayed in the cultivation of the art of photography. Many of our greatest advances in the art originated in the United States; the first portraits from the life being taken in New York by the professor of chemistry. We are now promised a process by which the great desideratum of impressed color is to be obtained; and the advertising columns of our Journal contain the offer of a prize of 500 dollars for the most important improvement in the art of photography, during the current year. The advantages of stimulating enquiry by offers of this kind, are numerous, and we have but little doubt but that Mr. Anthony's prize will be contested for by the photographic artists and amateurs both in Europe and in America. We hope the result may be the development of some new process by which, with ease and certainty, we may be enabled to obtain still more perfect reflexes of nature than those afforded by the processes we already possess.

Specification of a Patent granted to JOHN MERCER, of Oakenshaw, Lancashire, for improvements in the preparation of cotton and other fabrics and fibrous materials.—[Sealed 24th October, 1850.]*

This invention consists in subjecting cotton, flax, and other vegetable fibrous material, and fabrics made therefrom, either alone or mixed with silk, wool, or other animal fibrous material, to the action of caustic soda, or caustic potash, or dilute sulphuric acid, or a solution of chloride of zinc, of such strength and at such a temperature as will produce the effects hereafter mentioned.

The mode of operating, according to this invention, upon cloth made wholly or partially of any vegetable fibres, and bleached, is as follows: The cloth is passed through a padding machine, charged with caustic soda or caustic potash at 60° or 70° of Twaddle's hydrometer, (sp. gr. 1·3 or 1·35,) at the common temperature of the atmosphere, (say 60° Fahr., or under;) then, without being dried, it is washed in water; and, after this, it is passed through dilute sulphuric acid, and washed again. Or the cloth is conducted over and under a series of rollers in a cistern containing caustic soda or caustic potash at 40° to 50° Twaddle, (sp. gr. 1·20 or 1·25,) at the ordinary temperature (the last two rollers being set so as to squeeze the excess of soda or potash back into the cistern); and then it is passed over and under rollers placed in a series of cisterns, which are charged at the commencement of the operation with water only; so

* From the London Journal and Repertory of Arts and Sciences, for June 1851.