RECENT PHOTOGRAPHIC IMPROVEMENT.

Dr. Angus Smith, of Manchester, England, has lately communicated to the Photographic Society of Scotland, a process for removing the last traces of hyposulphites from photographic prints, and thereby rendering them entirely permanent. This he accomplishes by the use of peroxide of hydrogen, which converts the hyposulphites into sulphate, which latter are innoxious and soluble salts. The discovery seems to have made quite a stir among photographer on the other side the Atlantic. The *British Journal of Photography says:—*

"From the experiments which we have already made, we feel justified in asserting that no contribution toward the improvement of photographic silver printing, since the introduction of alkaline toning, is comparable in importance with that which we announced and partially described in last week's *Journal.* Dr. Smith, although, we understand, not a practical photographer, has done the art great service.

"It needs no experimental proof, at the present day to show that hyposulphites are the primary cause of the fading of photographic prints. We have been long ago conscious of this, and have been devising every sort of possible and impossible means of getting rid of them, without, however, having achieved all the desired success. We know, unfortunately too well, how the least trace of hyposulphite of soda left in a silver print, slowly but surely entails its destruction, by forming, with the silver, another very unstable hyposulphite, which is rapidly decomposed into sulphide of silver and sulphuric acid. The jaundiced appearance of such prints is but too familiar to every one, and their sudden transition into the "sere and yellow leaf" has done more to lessen the public estimation of photographic work than all other causes put together. Hence it is of the utmost consequence to the full development of our art to annihilate, once and for ever, our treacherous friend in need, hyposulphite of soda, as soon as it has fulfilled its useful mission, otherwise we shall find it our bitterest foe.

"It is very doubtful whether any amount of washing in cold water will remove the last traces of hyposulphite of soda from the texture of the paper on which the print is impressed. The hyposulphite seems to be so entangled with the size that without removing the one we cannot succeed in entirely getting rid of the other by mere ablution. But if, by the method suggested by Dr. Smith, we have it in our power to convert the noxious hyposulphite into an innoxious compound, namely, the sulphate, our whole process is accomplished; for be it observed, a particle of hyposulphite of soda may be locked up in a position from which water cannot displace it, but still, like other substances, it is suitable of chemical decomposition *in situ* by a susceptible reagent placed within chemical contact. This fact is well known, and it constitutes the whole sum and substance of Dr. Smith's discovery. We shall presently show that peroxide of hydrogen possesses, in a remarkable degree, the desired property of converting hyposulphites into sulphates. For this reason it must henceforth take the position of an indispensable chemical in the photographic laboratory.

"*Peroxide of hydrogen* (HO_2) is a very singular compound, discovered by Thenard in 1818. The method of preparation is so elaborate and complicated that we need only just sketch its outline here. Very few photographers or even chemists are in a position to prepare it economically for themselves; indeed, we only know one firm in London which has hitherto manufactured it commercially, and that apparently for medicinal purposes. It is produced when the peroxide of barrium, sodium, or potassium, etc., is acted on by any diluted acid which forms a soluble salt with the base. Peroxide of barium is generally employed. When it is dissolved in hydrochloric acid and water the excess of oxygen does not escape, but is absorbed by the water which it converts into peroxide of hydrogen. The protoxide of barium in solution is then precipitated by means of sulphuric acid. After filtration the same process is again and again repeated, until the water becomes saturated with oxygen. The solution is then purified by eliminating from it the excess of acids and of dissolved salts, and that is done by a long and troublesome series of operations.

"Peroxide of hydrogen is a powerful oxidizing agent, and it is in virtue of this property that its value will henceforth be recognized in photography.

It converts many of the protoxides into higher oxides, and several acids—the hyposulphurous, for instance—into those of a higher class. Dr. Smith's announcement that it converts hyposulphite into sulphate of soda, can easily be proved to be true; but we shall only here give the following striking experimental illustration of the fact, which any photographer can test for himself with the ordinary chemicals at his disposal.

"Dissolve in a wine glass any quantity of sulphate of soda, and add to the solution a few drops of tincture of iodine. The solution will remain permanently discolored, showing that sulphate of soda does not dissolve iodine. In another wine glass half filled with plain water, drop sufficient tincture of iodine to strike a permanent dark sherry color throughout the liquid; then add drop by drop a weak solution of hyposulphite of soda till the color is discharged, taking care to add as little excess of hyposulphite as possible. So far this experiment shows that iodine is soluble in hyposulphite of soda. Now fill up the glass with an aqueous solution of peroxide of hydrogen, and observe the effects. After a few minutes the iodine is no longer held in solution, and the liquid will resume the dark sherry color it had before adding the hyposulphite of soda. The explanation is as follows:—The hyposulphurous acid (S_2O_2) combined with the soda has been oxidized by the peroxide of hydrogen, and has passed into a higher sulphur acid, the sulphurous (SO_2), and then sulphuric (SO_3), still holding the same base (soda) in combination; and this salt, whether sulphite or sulphate of soda, we have seen, does not dissolve iodine. Moreover, it has no injurious action on photographic prints, even if left to dry in the interstices of the paper.

"The best method of applying peroxide of hydrogen to the prints will readily suggest itself. After they have been thoroughly well washed, so as to be cleared of all except the mearest trace of hyposulphite of soda, immerse say fifty of the card size in a quart of water containing one ounce of ten-volume strength of peroxide of hydrogen, and let them soak for an hour. One ounce of this solution contains (besides the oxygen, which is a necessary constituent of the water, and which is not available) ten ounces of volume of oxygen, which it is ready to part with to the hyposulphite, and thus convert it into a sulphite or sulphate. Perhaps a less proportion than this might be sufficient for the purpose, but it will require more extended experiment than we have as yet been able to bestow on the subject to determine the approximate proportions."

Scientific Steel Pens.

These pens are manufactured upon an entirely new principle, the inventor having discarded the quill shape as being unfit for a metallic pen, and made this pen with three arches or corrugations, the two corrugations on the back acting in opposition to the forward arch or bowl of the pen, thereby rendering and keeping the points or nibs square together, which enables the pen to glide over the paper without any fear of catching. These pens are also covered with a solution which prevents them from corroding.

With this pen is connected a new ink-retaining penholder. This pen holder has been invented expressly to hold a quantity of ink near the point of the pen, and is extremely useful to the penman, when using very thin or limpid ink. This improvement is effected by a blade or tongue, which slides in the inside of the holder, and can be drawn in or out at the option of the writer. For further information, address Wm. B. Stimpson, No. 37 Nassau street, Room 8, New York.

An aerial navigation society has been organized in London for the purpose of pushing forward the interest of their science, hoping thereby to rescue it from ridicule and preposterous caricature. The secretary of the society regards the balloon as a fulcrum from which with comparative safety a man may learn to fly as easily as he can learn to swim with a cork jacket. No one can deny this statement, but the great question to be determined is, can the balloon be made serviceable for purposes of navigation?

OUR SPECIAL CORRESPONDENCE.

Trial of Breech-loading Rifles for the Army.

WASHINGTON, May 22d, 1866.

The SCIENTIFIC AMERICAN has for several years urged the manifest superiority of breech-loading rifles for infantry soldiers over the muzzle-loading small-arms, and the experience of the last war pretty fully demonstrated the soundness of these views. This experience having determined our military authorities to adopt breech-loaders for infantry rifles as well as for cavalry carbines, a commission was appointed last year to make a series of trials of all breech loading rifles that might be offered by their inventors for competition, in order to select the one which should prove to be best adapted to army use. The trial was made at Springfield, Mass.; some sixty inventors submitted their guns for competition, and the result was a report giving the preference to the Peabody rifle. A second commission was then appointed, with Major General Hancock at its head, to make another trial in this city; that trial is now going on, and I made it my business yesterday to learn the manner in which it is conducted.

The commission is composed of the following named gentlemen, all officers of the United States Army:—Major Gen. Hancock, President; Brevet Major Gen. Buchanan; Brevet Brig. Gen. Hagan; Brevet Brig. Gen. Griffin; Brevet Col. Benton; Brevet Col. Porter; Brevet Lieut. Col. Owens; Brevet Lieut. Col. Parsons, Recorder.

I found all but two of these officers dressed in civilian's clothes while engaged in this duty. Major General Hancock is a stout, powerful-looking man, and impresses you as being the incarnation of force. He looks as if he would go through or over anything that might stand in his way. He is one of the born leaders of men, and is in exactly the right place, as the commander of armies. General Griffin looks like a Southerner—one of that considerable number of our West Point officers who have resisted the most subtle, seductive, and powerful temptation that ever drew a soldier from fidelity to his flag. Col. Benton is a short, thick-set, vigorous-looking officer; but the soul of the commission is Lieut. Col. Parson, the Recorder. He is a young man of light complexion, clear eye, loud voice, prompt military manners, and courteous address. The whole commission is a most perfect tribunal for the decision of the question submitted to its arbitration. With large experience and thorough understanding of the problem to be solved, with the consciousness that their award will be subjected to the intelligent and impartial criticism of all army officers, not only in this country, but throughout the civilized world, their decision, after their long-continued and laborious trials, must be accepted as of the very highest authority.

To illustrate the number of considerations to be taken into account in making the selection, General Hagan showed me one of the guns submitted for trial, the breech of which opened with a gate swinging on a hinge. When the cock was down—the only position in which it could be when the gun was discharged—the gate was securely closed, but when the gun was cocked the gate was very easily opened. Gen. Hagan said that the consciousness of this had an unfavorable effect on the mind and nerves of the soldier, causing him to shrink in firing the weapon.

The following rules have been published for the guidance of inventors submitting their guns for trial:—

PROGRAMME FOR BOARD ON BREECH-LOADING ARMS.

I. Each arm will be taken apart by the inventor, or his agent, and its construction and operation fully explained to the Board. At the same time a written description of the arm, setting forth its special merits, patent claims, etc., should be furnished for the records of the Board.

II. After a suitable number of arms shall have been examined, the Board will proceed to the Arsenal and test their working qualities, and for this purpose each gun will be fired by the person submitting it not less than one hundred times.

III. After all the arms have been submitted to this preliminary examination and test, the Board will select those deemed most suitable for the military service, and subject them to further test, in the hands of soldiers, by firing for range, accuracy, penetration, and rapidity, and for strength and endurance by firing increasing charges.

IV. The question of caliber will be determined by the Board after due consideration of the experiments made by this and foreign Governments on this subject. The Board, however, will verify, by actual trial, the conclusions arrived at.

V. Each person will state, in writing, the lowest price at which his arm will be furnished by himself, or the rate per thousand at which he will allow the Government to make them. These proposals will be made separately on forms to be furnished on application, and will be directed, sealed, to the Recorder of the Board, and endorsed "Proposals for furnishing Breech-loading Arms," and will be opened at such time as the Board may direct.

After the hundred rounds fired by the inventor, the gun is taken by the Board, and without being cleaned, is fired first to test its strength. The powder used is fine-grained rifle powder. The gun is fired first with 65 grains of powder and 2 bullets, then with 70 grains of powder and 3 bullets, then with 75 grains of powder and 4 bullets.

It is then fired for accuracy at 200, 500, and 1,000 yards. In firing for accuracy the arm is secured in a clamp which has a sliding motion on ways to permit the recoil. The test for penetration is made by firing through a number of white-pine boards placed an inch apart, and each an inch in thickness; they are placed at a distance of thirty yards from the gun.

Among the inventors who were present to explain their guns to the Board were Governor Jackson, of Rhode Island, formerly of the Burnside Rifle Company, Dr. Maynard, of New York, and other gentlemen who had made the rifle, and especially breech-loading rifles, the subject of long study and experiment. The only objection made by these men to the trials was the extreme severity of the test for strength to which the guns are subjected. Governor Jackson said that the test of firing with four bullets was first adopted in examining the old muzzle-loading musket, on the ground that the soldier, in the confusion of battle, was liable to load his gun three or four times without firing it; but as it is impossible to get more than one charge into a breech-loader, he did not see the necessity of so severe a test for this style of arm. The reason assigned by the Board for this test is that cavalry carry their carbines with the muzzle down, and it is liable to become filled with mud. In reply to this, Governor Jackson says that if the muzzle is closed with mud, the barrel will burst, whatever the strength of the breech; he has tried the experiment of closing the muzzle with a cork, and the gun always bursts at the muzzle.

The inventors present seemed all to agree that no good shooting could be done by fastening the gun in a clamp; the proper way being to have a good double rest, and fire from the shoulder. I also put in the suggestion that for firing with any accuracy 1000 yards, a telescope is essential. No man can tell at this distance, by looking with the naked eye through the open sights of a rifle, whether the piece is, or is not, pointing at a barn door. In a trial for skill among rival riflemen, I approve of firing off-hand and with open sights, but in testing the gun, all errors of aim should be eliminated if possible.

When among men familiar with the subject, I always raise the question of the comparative accuracy of breech, and muzzle loaders. I found the men here all to agree that a good breech-loader is even more accurate than the American target rifle. Dr. Maynard said that Cyrus Bradley, of Otsego Co., N. Y., was ready at any time to bet that with his breech-loader he could beat any muzzle-loader, the barrel of which was not heavier than his entire gun. For this accuracy Dr. Maynard insists on the condition that the cartridge shall be of the right material, and shall be properly designed and made. Then, he contends, the axis of the bullet may be made to coincide more exactly and more surely with the axis of the barrel, than by swedging through Clark's false muzzle. I am now pretty well satisfied, though not fully, of the correctness of this position, and if it is sound, there can be no doubt that breech-loading rifles will rapidly supersede muzzle-loaders for sporting purposes, whatever may be the decision in regard to the army. A serious drawback from the pleasure of rifle shooting is the great amount of greasy and filthy labor in cleaning and loading the gun after every discharge. This is nearly all avoided in the breech-loader, and will be entirely avoided when inventors succeed in producing a cartridge that will effectually clean the gun at every fire.

G. B.

WEIGHTS AND MEASURES.

THE METRIC SYSTEM AND ITS EQUIVALENTS.

The bill passed by the House of Representatives to authorize the use of the metric system of weights and measures—now pending in the Senate—provides that the following tables shall be recognized in contracts and legal proceedings as the equivalents of the weights and measures of the metric system: Any apparent complexity of the system will disappear when it is observed that it depends upon a single unit—the meter—and that any denomination of measure can be expressed in meters, square meters or solid meters. The gram is the weight of a cube of water a hundreth of a meter on each side. For ordinary uses the words meter and gram are the only new words to be learned.

It should also be noticed that although the weights and measures are in value precisely the same as those used in Europe, the names have been so changed as to accord with the spirit of our language.

MEASURES OF LENGTH.

Metric Denominations and Values.		Equivalents in Denominations in Use.
Myriameter	10,000 meters.	6·2137 miles.
Kilometer	1,000 meters.	0·62137 miles, or 3,280 feet and 10 inches.
Hectometer	100 meters.	328 feet and 1 inch.
Dekameter	10 meters.	393·7 inches.
Meter	1 meter.	39·37 inches.
Decimeter	1-10 of a meter.	3·937 inches.
Centimeter	1-100 of a meter.	0·3937 inches.
Millimeter	1-1000 of a meter.	0·0394 inches.

MEASURES OF CAPACITY.

METRIC DENOMINATIONS AND VALUES.			EQUIVALENTS IN DENOMINATIONS IN USE.	
Names.	Number of Liters	Cubic Measure.	Dry Measure.	Liquid or Wine Measure.
Kiloliter, or stere	1,000	1 cubic meter	1·308 cubic yards	264·17 gallons.
Hectoliter	100	1-10 of a cubic meter	2 bushels and 3·35 pecks	26·417 gallons.
Dekaliter	10	10 cubic decimeters	9·08 quarts	2·6417 gallons.
Liter	1	1 cubic decimeter	0·908 quarts	1·0567 quarts.
Deciliter	1-10	1-10 of a cubic decimeter	6·1022 cubic inches	0·845 gills.
Centiliter	1-100	10 cubic centimeters	0·6102 cubic inches	0·338 fluid ounces.
Milliliter	1-1000	1 cubic centimeter	0·061 cubic inches	0·27 fluid drams.

MEASURES OF SURFACE.

Metric Denominations and Values.		Equivalents in Denominations in Use.
Hectare	10,000 square meters	2·471 acres.
Are	100 square meters	119·6 square yards.
Centare	1 square meter	1,550 square inches.

WEIGHTS.

METRIC DENOMINATIONS AND VALUES.			EQUIVALENTS IN DENOMINATIONS IN USE.
Names.	Number of Grams.	Weight of what quantity of water at maximum density.	Avoirdupois weight.
Millier, or Tonneau	1,000,000	1 cubic meter	2,204·6 pounds.
Quintal	100,000	1 hectoliter	220·46 pounds.
Myriagram	10,000	10 liters	22·046 pounds.
Kilogram or kilo	1,000	1 liter	2·2046 pounds.
Hectogram	100	1 deciliter	3·5274 ounces.
Dekagram	10	10 cubic centimeters	0·3527 ounces.
Gram	1	1 cubic centimeter	15·432 grains.
Decigram	1-10	1-10 of a cubic centimeter	1·5432 grains.
Centigram	1-100	10 cubic millimeters	0·1543 grains.
Milligram	1-1000	1 cubic millimeter	0·0154 grains.

It is intended to start the *Great Eastern* on her second attempt to lay the Atlantic cable July 1st.

EDUCATION OF WORKINGMEN.

The grand movement now on foot, confined to no particular section of the country, for the reduction of the hours of labor, urges, among the best reasons for its success, that of giving the workingman more opportunities for mental culture. Without arguing either for or against the claim that the two hours thus proposed to be taken from each day's labor will be employed, even partially, in study, there is an obvious need for a better mental and theoretical education among our workingmen, especially mechanics. Those departments of industry are the best paid and highest valued into which enters most of the intellect—the brain labor.

The expertness necessary to guide the machinist's drill, turning chisel, or planing tool, to use the file or the cold chisel, or to wield the blacksmith's hammer, necessitates only a certain amount of practice; but above this animated machine, working under another's will, there is a position where guiding, and managing, and controlling brain exerts its wonderful power. Still further we may look and see the scientific mechanic and the inventor, one the trusted and trustworthy means of achieving works which are destined to benefit coming generations, and the other a genius who, more than diplomats or statesmen, guides and controls the destinies of nations. These grades between the laborer and the thinker are necessary and will always exist. Machinery, well called "labor-saving," will more and more infringe upon the province of the muscle user, although it may never entirely dispense with his services. It cannot, however, more than trench upon the boundaries which defend the brain user; his position is one of comparative security.

Arguing from these premises, what ought to be the object of our delvers, our laborers, our musclemen? Evidently to qualify themselves to ascend another step on the ladder of improvement. Education of the reasoning faculties is the only means to that step; not book knowledge merely, but that alertness and discipline of the mental powers which is stimulated by study and maintained and strengthened by observation and practice.

Take a familiar example of the advantage of a knowledge of principles and the proper application of them to practice. A workman in a machine shop is required to cut on a shaft a thread of perhaps eight to the inch; the chart attached to all modern screw-cutting lathes gives him the gears for the spindle and the leading screw. The result is the required thread. But why? Somebody, he who planned the lathe, knew; why not he who uses it? How easy to know! The rules of arithmetic which enables the workman to calculate his wages by the day, the week, the hour; applied to this matter, would explain all. Suppose the leading screw which guides the cutter to be of a pitch of two to the inch; if it revolves at the same rate as the shaft to be threaded, the result will be a duplicate of the leading screw. But he desires to make four threads on the shaft to each thread on the screw. It is evident, therefore, that the latter should revolve only once, while the former rotates four times. Now the way is clear. If he places upon the spindle a gear of forty teeth that on the screw must contain just four times as many, or one hundred and sixty. So with any gear first selected, the proportions must be as four to one.

Simple as is this philosophy of relative motions, thus familiarly illustrated, it is well known that many machinists have never given it a thought. And it is a shame to some mechanics that they do not care to know "the reason why," but are content to worry through their week's work and receive their week's wages without having gained one iota of additional knowledge, beyond the mechanical expertness inseparable from constant practice. No appeal to professional pride or personal ambition can be of value to such men.

To the ambitious workingmen, of whatever branch of industry, we appeal to use their opportunities. A single half hour out of the twenty-four, devoted earnestly to the study of some department of knowledge applicable to their particular business, will result in one short year—if the mind is active to make application of the knowledge by observation and experience—in an improvement which will astonish them. They will notice it in an increasing interest in their work; what was before a distasteful drudg-