Correspondence.

The Machinist's Shibboleth.

To the Editor of the Scientific American:

To form an estimate of a machinist's ability, in these days of improved methods, is not so easy a matter as it was thirty years ago. Almost everything is now done on machine tools, and the hammer, chisel, and file are little used. In the old time, it was by his manner of using these that we were accustomed to gauge the skill possessed by the new man. If he took hold of his hammer handle at the middle, and struck as if his elbow had no joint, or took up a file with his thumb under the handle and shoved it across the work with a teetering, jerky motion, he would at once be put down as an impostor.

Sometimes worse blunders than these were committed. For instance, grinding the cutting edge of a drill on the wrong side, or attempting to put a belt on a pulley from the wrong side.

The file test is a good one, and, if followed up, may put to shame some who claim to be good workmen. We wonder if one in ten of the thousands of machinists who read your paper can file a spot on a round iron bar, perfectly straight, crosswise. We have seen such a surface concaved by the slight rotundity of the file. One of the interesting features of this performance is the nice vibratory movements of the joints in the arms and body that are necessary to secure the perfectly parallel motion of the file. Comparing these with the mechanism in the beam engine, the latter is very simple, for in this there is but one point to be kept in a parallel line (the crosshead), while with the file both ends must be controlled and held true to a line. Yet the operation seems very easy when, by practice, the the art is acquired.

The plumber takes pride in his "wiped joint;" the slater in shearing and punching his brittle material, like so much putty; the blacksmith his perfect weld; and the machinist will ever esteem his dexterous use of the file as one of his best proofs of skill.

One of the modern tests, we believe, is the use of the scraper; and the fitting together of two surface plates so perfectly that they can only be separated by sliding them apart, may be considered no mean art.

QUIRK.

The Curability of Galloping Consumption.

The announcement by so well known a physician as Dr. McCall Anderson that acute phthisis, or galloping consumption, is curable, excites a good deal of surprise and quite as much incredulity, yet Dr. Anderson reports in the *British Medical Journal* seven cases of this character, of which five recovered.

Acute phthisis is considered by Dr. Anderson to have two forms, acute tuberculosis and acute pneumonic phthisis. Some of his cured cases were of the tubercular character. The treatment advised is given in detail and contains no especially new feature.

"The principal indications," he says, "are: 1, to keep up the strength; 2, to keep down the fever; and 3, to treat any special symptom or complication which may arise.

"1. Two thoroughly trained and reliable nurses are indispensable, one for day and the other for night duty; for without admirable nursing no hope of improvement can be entertained; and the hygienic and other surroundings of the patient should be satisfactory, so that we need not be surprised that when the disease occurs in the homes of the working classes it is almost necessarily fatal, and that hospital patients have the best chance of recovery. The patient must be fed constantly on fluid food (soup being avoided if diarrhea is present), both day and night, and stimulants (from ℥ ij. to ℥ x.) are required early in the attack, but should be given in small quantites, frequently repeated and along with the food. In fact, the dietetic treatment should correspond with that of a case of fever presenting symptoms of a similar degree of severity.

"2. At bedtime a subcutaneous injection of sulphate of atropine (gr. $\frac{1}{100}$ to gr. $\frac{1}{60}$) is given. This checks perspiration when present, acts as a sedative to the system, indirectly helps to reduce the fever, and diminishes the secretion from the lungs.

"3. Remedies are given with the view of lowering the temperature. This is a point of the utmost consequence, because the majority of the patients die consumed by the fever. Some benefit is derived by allowing the sufferer to suck ice freely, by giving the food and drinks iced, by sponging the body with iced vinegar and water, or even by using iced enemata. But our main reliance is upon one or more of the following methods:

"(*a*) Niemeyer's antipyretic pill or powder every four hours, containing gr. j. quinine, gr. ½ to gr. j. digitalis, and gr. ¼ to gr. ½ opium. The portion of opium may even have to be increased beyond this if there is much diarrhea. The effect of the digitalis must be carefully watched, and it must be omitted for a time if the pulse becomes preternaturally slow and irregular and the secretion of urine very scanty.

"(*b*) The administration daily—particularly shortly before the temperature tends to be highest—of from ten to thirty grains of quinine, given, as suggested by Liebermeister, either in a single dose or, at all events, within an hour.

"(*c*) The application of iced cloths to the abdomen for half an hour every two hours so long as the temperature exceeds 100°. The application of iced cloths is made in this way:

"The nightdress is pulled well up over the chest, so as to avoid any possibility of its being wet, and, for a similar reason, a folded blanket is placed across the bed under the patient's body. The usual bedclothes are arranged so they reach up to the lower part of the chest only, which latter is covered by a separate blanket in order to prevent unnecessary exposure while the cloths are being changed. Two pieces of flannel are employed, each being sufficienly large when folded into four layers to cover the whole of the front and sides of the abdomen. One of these, wrung out of iced water and covered with a piece of dry flannel to protect the bedclothes, is applied, while the other is lying in a tub of iced water at the side of the bed. The pieces of flannel are changed every minute, or so often that they still feel cold when they are removed. The changing of the flannel, particularly when two persons are in attendance, one to remove the bedclothes and the flannel, the other to apply the piece which is freshly iced, can be accomplished in a few seconds."—*Medical Record.*

PHOTOGRAPHIC NOTES.

The American Photographic Conference is the title of a new organization of scientific and amateur photographers recently organized in New York for the purpose of establishing an association which shall be national in character and have as its controlling element representatives of all the photographic societies and clubs in the United States or of America.

An annual conference is to be held in different cities, to last three days and be accompanied by an exhibit of photographs and apparatus. Papers and researches on different branches of photography are to be read and measures adopted for furthering the practice of photography. One of the objects of the conference will be the establishing of a photographic institute, where, for a given tuition, any special application or branch of photography can be learned. The next meeting is to be held April 21, 1891, in this city. Among the officers elected were: President, Dr. Ely Van de Warker, of Syracuse, N. Y.; Secretary, T. J. Burton, of the Society of Amateur Photographers, of New York.

The transactions of the conference are to be published and distributed to members. Any amateur or professional photographer may join the conference as a subscribing member, the annual fee being but three dollars.

How to Remove Nitrate of Silver Stains from the Fingers.—A correspondent gives the following harmless process:

First.—Paint the blackened parts with tincture of iodine, let remain until the black becomes white. The skin will then be red, but by applying ammonia the iodine will be bleached, leaving white instead of black stains of nitrate of silver.

Density in Negatives Developed with Eikonogen.—A correspondent having some trouble with eikonogen writes as follows:

Mr. Burbank in his excellent handbook on "Development of Dry Plates," mentions the fact that instantaneous views lose their density in the fixing bath. I find this trouble myself, and that my well developed plates are but ghosts of what they were before being placed in fixing bath.

Mr. Burbank makes no suggestion as to the remedy; can any of your readers give any advice in the matter?

I notice in another part of the book Mr. Burbank speaks of certain brands of plates having this trouble, but mentions no name. Is this the only cause?

Our correspondent signs himself Eiko, which we suppose means that he employs the Eiko developer. In general it may be remarked that the amount of density an instantaneously exposed plate is capable of giving depends on the actinic quality of the light at the time of the exposure and the duration of development. The stronger the light and the slower the shutter, the more deeply will the light penetrate into the film and affect a greater number of the particles of bromide of silver, which, being reduced by the developer, gives the relative density. Hence it follows that a film which has only been faintly impressed with light, as some of the instantaneous exposures are, cannot be brought out by the most powerful developer any further than the action made upon it by the light. That is, the particles of silver on the surface are reduced first and the picture appears on the surface fully developed and of sufficient density we will suppose by reflected light. But the light not having had time to pass through the film has not acted on the underlying stratum, thus the stratum is unaffected by the developer. When the supposed fully developed plate is now put into the fixing bath, the underlying stratum of bromide of silver is dissolved out, which necessarily reduces the density very much and gives the negative the appearance like that described.

There is no remedy for this, except, should the detail appear fully developed, to resort to intensification, or the building up of the image obtained. The precautions to be observed are to use a strong eikonogen developer, 11 grains of eikonogen to the ounce of water and 10 grains to the ounce of carbonate of potash, pouring the eikonogen solution, without the addition of potash, on to the plate for four minutes first, then by adding the potash. Development should be kept up until the high lights show through at the back of the plate and until the density looks sufficient by transmitted ruby light, though when this time arrives the plate may appear to be black over its entire surface.

The general fault is that insufficient time is allowed for the bringing out of the image. The eikonogen developer may be left on a plate for two hours without staining the parts that were in the shadow; thus it is admirably adapted for shortly exposed plates. It is true also as Mr. Burbank remarks that some brands of plates have too little silver for instantaneous work; such can only be found out by experiment. When an emulsion is found to work well, it is advisable to secure more plates of the same number, if uniformity and certainty are desired. In cold weather the temperature of the developer should be at 65° F.

Stokers on the Fast Ships.

On the steamship City of Paris there are sixty firemen, who feed the fiery maws of fifty-four furnaces, that create steam in nine steel boilers. Fifty coal passers shovel the fuel from the bunkers to the furnace doors, and the firemen toss it in. There is something more than mere shoveling in firing. The stoker must know how to put the coals on so they will not burn too quickly or deaden the fire. He must know how to stir or poke the fire so as to get all, or nearly all, the caloric out of the coal. He must know how to obtain the best results from the Welsh coal he burns on the voyage to this port and the American coal he uses on the trip eastward. Each kind requires different handling. Often the result of a race eastward has been determined by the superior knowledge of the handling of American coal possessed by the winning ship's stokers. To a man who thoroughly understands it, firing is easier than it used to be. But it is, nevertheless, so arduous that the veterans are not over forty-five years old. Nearly all the stokers on the City of Paris and the City of New York are between twenty and thirty years of age. They received $20 a month and their board. The leading stoker gets a few dollars more, and does not have to work quite so hard. He is usually the eldest of the crew he directs. The coal passer, the limit of whose ambition is to become a fireman, gets $17.50 a month. The leading coal passer, or trimmer, gets a little more than this.

Service in the fireroom is divided into six watches of four hours each. The fireman works and sleeps every alternate four hours. After the first day from port two out of every six furnaces are raked out to the bare bars during the first hour of each watch. Thus, in a voyage, all the furnaces are cleaned once in every twenty-four hours. The steam goes down a bit in the hour while the cleaning is going on. The perspiring stokers shovel into the furnaces fifteen tons of coal every hour, or 340 tons a day. The ship usually takes in 3,000 tons at Liverpool, and has between 500 and 800 tons left in her bunkers when she arrives here.

The engineers' department is entirely distinct and separate from the fireman's. On the City of Paris there are twenty-six engineers, including hydraulic and electrical. They are educated in engine shops on shore, and a certain number of them go on ships every year. They are all machinists, so whenever the ship break down they know how to repair the damage. In case the chief engineer should be disabled, any assistant could take his place.—*New York Sun.*

Laziness a Foe to Originality.

We do not know who said it, but it is a fact well stated, and we regret not being able to give the writer proper credit. The great enemy to individualism is laziness, and those who know anything of human frailties will, I am sure, bear me out when I say that "mental" laziness is far more common and far more difficult to overcome than that of the body. It is so much easier to accept dogmatic teaching, and to shift the responsibility of our views on to others rather than to concentrate our thoughts and work out the lessons of our own observations. It is much more pleasant to butterfly from theory to theory than to seek truth with patient tenacity; why trouble ourselves to learn self-reliance, when natural indolence protests against the sacrifice?

It is easier to imitate than to originate; plagiarism and mimicry are such prominent features in our lives, that their presence might almost be quoted as an argument in favor of our evolution in past ages from simian ancestry. How plausible are the excuses we make for our want of this individualism! We are so dreadfully afraid of being thought bumptious, we are so delightfully humble, we really do not wish to intrude our opinion, and yet all the brightest lights of our profession have been men of strong individualism.

The Railroad across South America.

El Echo de los Andes, a semi-technical newspaper, in its issue of August 28, gives the latest particulars concerning the Transandine Railroad. Attention is especially called now to the cutting of the tunnels which, under the snowclad mountain, will unite Chili and the Argentine Republic. The total length of the tunnels already cut is 1,800 meters (the meter being equal to 39·38 English inches); 750 meters on the Chilian side and 1,050 on the Argentine side.

The international railroad of the Andes, as is well known, is being built jointly by Chili and the Argentine Republic, the two countries which it will unite directly, and each of which is working on its own territory The frontier limit of the two nations is in the tunnel of la Cumbre, or "the Summit." The Buenos Ayres government began its tunnel work three months before Chili, which explains the fact that out of the 1,800 meters of pierced tunnel only 750 belong to Chili. But this difference will not be maintained, for Chili is now working more rapidly. For instance, 180 meters have been recently perforated on the Chilian side, while only 160 were cut on the Argentine side within about the same length of time.

The monthly progress in perforating amounts to about 450 meters. There is a succession of eight tunnels, crossing from one side of the Andes to the other. The tunnels, with their lengths, are as follows:

Tunnel.	Length in meters.
Juncal	1,104
Juncalillo	1,275
Portillo	1,885
La Calavera	3,750
La Cumbre	3,065
Las Cuevas	850
Navarro	756
Las Lenas	690
Total length	15,375

Of these tunnels, 11,158 meters are on the Chilian territory and 4,217 on Argentine. The work is, therefore, of greater importance to Chili than to the Argentine, not only on account of the large number of miles to be tunneled, but also because the engineering difficulties are greater. For instance, the tunnel of Del Portillo is really a curiosity. It is helicoidal in form, and is like an immense corkscrew, winding under the mountain. Its upper opening is 135 meters above its lower entrance. The tunnels are divided into three sections, two belonging to Chili and one to the Argentine Republic. The section of Juncal includes the two tunnels of Juncal and Juncalillo; and that of Calavera includes the tunnels of Portillo, Calavera, and Cumbre. All these are on the Chilian side, while the section of Las Cuevas is on the Argentine side.

In each of those sections are erected houses for engineers and workmen, hospitals, office buildings, etc. They are built of materials capable of resisting the intense cold of those high regions.

The tunnels are attacked in twenty-six different places; half on the Argentine and half on the Chilian side. The finest machinery and engines are used, and motive power is mainly furnished by electrical machines, working on a larger scale than has ever been attempted before in similar undertakings. It is calculated that, through the use of that kind of motive power, and of improved machinery, the work moves four or five times as rapidly as if it were done by the ordinary methods.

African Earthworms.

The last *Kew Bulletin* contains a report by Mr. Alvan Millson, the Assistant Colonial Secretary of Lagos, on Yoruba Land, the native territory adjacent to Lagos. After describing the wasteful system of cultivation employed by the natives and the wonderful rapidity with which the soil recovers from it, he says the mystery is solved in a simple and unexpected manner during the dry season. The whole surface of the ground beneath the grass is seen to be covered by rows of cylindrical worm casts. These vary in height from a quarter of an inch to three inches, and exist in astonishing numbers. It is in many places impossible to press a finger upon the ground without touching one. For scores of square miles they cover the surface of the soil, closely packed, upright, and burnt by the sun into rigid rolls of hardened clay. The rains ultimately break them down into a fine powder, rich in plant food and lending itself easily to the hoe of the farmer. These casts are very different in form from those familiar in English gardens. On digging down, the soil is found to be drilled in all directions by a countless multitude of worm drills, while from 13 inches to 2 feet in depth the worms are found in great numbers in the moist subsoil. It is impossible to estimate their number per cubic foot, as the quantity varies according to the season and the locality. Having carefully removed the worm casts of one season from two separate square feet of land at a considerable distance from one another, and chosen at random, Mr. Millson found the weight to be 10¾ pounds in a thoroughly dry state. This gives a mean of over 5 pounds per square foot, and a total of not less than 62,233 tons of subsoil brought to the surface on each square mile of cultivable land in the Yoruba country every year. This work goes on unceasingly year after year, and to the untiring labors of its earthworms this part of West Africa owes the livelihood of its people. Where the worms do not work, the Yoruba knows that it is useless to make his farm.

Estimating 1 square yard of dry earth by 2 feet deep as weighing half a ton, there is an annual movement of earth per square yard of the depth of 2 feet amounting to not less than 45 pounds. From this it appears that every particle of earth in each ton of soil to the depth of 2 feet is brought to the surface once in twenty-seven years. If seems more than probable that the comparative freedom of this part of West Africa from dangerous malarial fevers is due, in part at least, to the work of earthworms in ventilating and constantly bringing to the surface the soil in which the malarial germs live and breed. From specimens which Mr. Millson has sent home it appears the worm belongs to a new species of the genus *Siphonogaster*. The type of this genus has been quite lately described from the Nile mud.

BACILLUS OF TUBERCULOSIS.

It is well known that infectious diseases, such as consumption and cholera, have a parasitic origin, and that each one of them has its characteristic micro-organism. In 1878 Dr. Koch published his "Untersuchung ueber die Aetiologie der Wundinfectionskrankheiten," which embodied the results of his investigations in this field of research and formed the basis of future study, the result of which was the discovery of the bacillus of tuberculosis. The course followed by Dr. Koch has been so fully explained in former issues of the SCIENTIFIC AMERICAN that it seems unnecessary to treat the subject again in detail, but we publish to-day two excellent cuts, for which we are indebted to the *Illustrirte Zeitung*, showing the bacilli alone and as they are found in the tubercles.

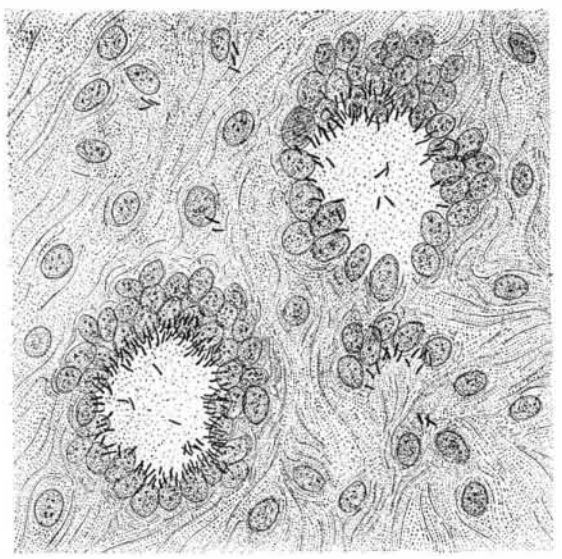

Fig. 1.—SECTION THROUGH TUBERCLES OF THE LUNGS, SHOWING TWO LARGE CELLS WITH NUMEROUS BACILLI.

The specimen having been colored, the bacilli appear as dark dashes. Magnified 500 times.

Dr Koch's methods, which have been so strikingly confirmed by his work, have opened new fields in the science of bacteriology, and the results of his work have been felt in every department of medicine.

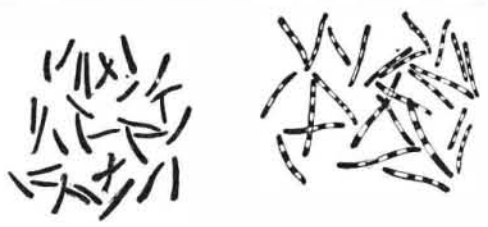

Fig. 2.—TUBERCULAR BACILLI, MAGNIFIED 2,000 TIMES.

At the left, bacilli free from spores. At the right, bacilli with colorless places which are supposed to be spores.

Photo Carbon Printing.

BY T. C. ROCHE.

The principle or foundation of carbon printing is based on the action of light on bichromate salts when combined with organic matter. This discovery was first brought to public notice by Mungo Pontou in 1839. M. Becquerel, Mr. Fox Talbot, and others experimented on this new reaction, but M. Poitevin, in 1855, was about the first to bring out any real practical results. It was through him that photo-lithography, photo-mechanical printing and kindred processes were put into commercial use.

The first to introduce prepared carbon tissue, and a practical formula for working the same, was Mr. J. W. Swan, in 1864. Since then there have been several important improvements made, simplifying the process still more. A suitable paper is coated in long rolls with a pigmented gelatine; this is cut to the required size and sensitized for use in a bath of bichromate of potash, 15 to 20 grains per ounce of water. When dried in a dark room it is ready for exposure, under the negative, to the action of sunlight. It is important that the negative has a safety edge about half an inch all around it, to prevent the light from acting on the margin of the tissue. After exposure, which must be judged by a photometer, the tissue is placed in cold water until it lies limp and flat. Your glass or porcelain, which has been cleaned and coated with plain collodion, is wetted or washed in water, then laid on a table, some water sprinkled on, the carbon paper is laid face down on it, a thin rubber cloth laid over, and then a squeegee passed over lightly to bring the carbon paper in contact and drive out all air bells. It is now allowed to rest for a few minutes, then placed in a pan of tepid water and rocked. The first portion of the gelatine mixture to dissolve is that which had been protected by the safety edge on the negative. Now the paper which had been coated can be peeled off and the transferred picture washed out according to the gradation or tones in the negative and the action of light on the sensitive compound. The coating is rendered more or less insoluble, and all soluble portions will wash out in the warm water. The picture is then washed in cold water, and finally a solution of alum water is flowed over and the plate set up to dry. While the surface is wet it is very tender, but will dry hard and sharp.

The collodion is used to prevent the delicate detail or half tone from washing away. In sensitizing or washing, the light has no effect on the material while wet. After sensitizing, the paper will keep two weeks if put in an air-tight tin box. Porcelain or zinc plates that have been cleaned, slightly waxed, and then collodionized, can have the proofs developed on them re-transferred when dry on to transfer paper by wetting the paper until it feels slimy, then squeegeeing it down on the picture, and when dry it can be peeled off easily. Proofs on porcelain or for lantern slides should be printed light; those for window transparencies, deeper. The proofs can be, after printing, transferred to almost any material, such as celluloid, metals, or wood. When you hang the paper up to dry after sensitizing, it must be in a room well ventilated; if not, the coating is apt to dry insoluble and will be of no use. All carbon pictures are considered permanent.—*Jour. Soc. Am. Photo.*

Completion of the Great Mountain Bridge.

The new Verrugas bridge was lately opened for traffic. The bridge is of the cantilever type, supported on two iron towers. Its total length is 575 feet, its suspended span being 105 feet long. At its middle point it is 252 feet above the bottom of the valley which it spans. The bridge is entirely of wrought iron, and was constructed by Cooper, Hewitt & Co. at their works in Trenton.

The Verrugas bridge is one of the features of the Oroya Railway, now known as the Central Railway of Peru. This railroad starts from Callao on the Pacific, runs through Lima, and thence ascends the Andes by difficult grades, reaching its greatest elevation at Chicla, about 12,300 feet above the level of the sea. The bridge spans a chasm of 235 feet in width, with precipitous sides, and replaces the old Verrugas viaduct built in 1871, which was destroyed in March, 1889, by floods.

The Harvester Trust.

A mammoth combination has been effected between the harvester machine companies of the United States. The new trust is to bear the name of the American Harvester Co., and it has been organized under the laws of the State of Illinois, with a capitalization of $35,000,000. The following companies have acknowledged their allegiance to the new company: The McCormick Harvesting Machine Company, Chicago; the Walter A. Wood Mower and Reaper Machine Company, Hoosick Falls, N. Y.; Warder, Bushnell & Glessner, Springfield, O.; Aultman, Miller & Co, Akron, O.; the Whitman & Barnes Manufacturing Company, Akron, O.; the Plano Manufacturing Company, Plano, Ill.; the Milwaukee Harvester Company, Milwaukee, Wis.; the Esterly Harvesting Machine Company, Whitewater, Wis.; the Minneapolis Harvester Works, Minneapolis, Minn.; Emerson, Talcott & Co., Rockford, Ill.; the J. F. Seiberling Company, Akron, O.; Seiberling, Miller & Co., Doylestown, O.; Amos Whitley & Co., Springfield, O.; Hoover & Gamble, Miamisburg, O.; D. M. Osborne, Auburn, N. Y.; the Richardson Manufacturing Company, Worcester, Mass.; Adriance, Platt & Co., Poughkeepsie, N. Y.; D. S. Morgan & Co., Brockport, N. Y.; the Johnston Harvester Company, Batavia, N. Y.

The incorporators are Cyrus H. McCormick, Wm. Deering, Hon. Walter A. Wood, Hon. Lewis Miller, Gen. A. N. Bushnell, and Col. A. L. Conger.

Some idea of the interests that will be affected by the trust may be inferred from the fact that nearly all the farmers will be affected favorably or unfavorably by the trust, and it is stated that the companies included in the corporation employ some 15,000 men.