Assuming the boiler to be at work at a pressure of 45 lbs., the water will be at a temperature of about 290 deg. Now fresh water cannot for an instant be maintained at a temperature much greater than 212 deg., under the ordinary atmospheric pressure. If, therefore, the pressure upon it be suddenly liberated when heated to (say) 290 deg., a most violent disengagement of steam, and projection of water along with it, must inevitably take place. The shells of boilers are constantly liable to rupture from original unsoundness of the iron, bad riveting, corrosion by bad water, or furrowing. This being the case what are we to expect when the opening of a weak point suddenly liberates the steam pressure from 30, 40 or even 60 tuns of heated water, which are waiting below to burst partly into steam? To render the matter perfectly intelligible, we will state the distinct and consecutive operations into which, according to Mr. Colburn, a boiler explosion, although practically instantaneous, may be resolved. They are first, the rupture, under hardly if any more than the ordinary working pressure, of a defective portion of the shell of the boiler—a portion not much, if at all, below the water line. Second, the escape of free steam from the steam chamber, and the consequent removal of a considerable part of the pressure upon the water, before its contained heat can overcome its inertia and permit the disengagement of additional steam. Third, the projection of steam, combined, as it necessarily must be, with the water, with great velocity, and through a greater or less space, upon the upper sides of the shell of the boiler, which is thus forced completely open, and perhaps broken. Fourth, the subsequent disengagement of a large quantity of steam from the heated water now no longer confined within the boiler, and the consequent projection of the already separated parts of the boiler to a greater or less distance. This unique theory harmonises so well with the circumstances of steam boiler explosions, that we can admire and accept it. It is so consistent with all the phenomena attending these explosions that it leaves no room for doubt or questioning as to its soundness. It receives support from the well-known fact that boiler explosions frequently take place at the starting of the engine, when there is a sudden withdrawal of pressure in the boiler. The most conclusive evidence of the soundness of the theory, however, would be suddenly to condense steam in the steam chamber of a boiler at work, and to watch the results. If a boiler were half filled with water, and the steam got up to 30lb. or 40lb., and if a quantity of water were suddenly thrown into the steam space, the steam would be suddenly condensed, and an explosion of the boiler would doubtless follow. Such an experiment would of course be attended by considerable danger, and the object gained would probably after all be very inadequate to the risk involved. It seems to us, however, that the question has just been practically solved, and the only evidence wanting actually supplied, although under most distressing circumstances. We allude to the recent loss of the *Ceres*, in the reports of which catastrophe it is stated that the sea rushing suddenly in upon the boilers caused them to burst with fearful results. If this be correct—and all accounts agree upon the point—here is a singular though melancholy confirmation of Mr. Colburn's theory. The cold water suddenly cooled the boiler plates, condensed the steam in the steam space, relieved the pressure on the lower part, and forthwith the steam and water from below burst forth with resistless energy upon their errand of destruction.

THE COTTON MANUFACTURE--CARDING AND DRAWING.

In our last issue we traced the manufacture of cotton from its gathering to its preparation for carding, describing the preliminary process, intended mainly for cleaning it from foreign substances.

The next process is the carding. The cotton as it comes from the picker is wound, as a bat, on a core of wood. It is of a width calculated for the carding machines upon which it is to be placed. The "lap", as it is called, is placed in a frame over rollers which insure its rotation, the lap being guided by the journals of the core, in slots made in side pieces attached to the carding machine. The lap is fed into the card by fluted rollers as in the "picker," and is received by a small cylinder called the "licker-in," which is covered with card—fine wire teeth held in leather. This cylinder revolves with great rapidity, taking the fibers of cotton as presented by the lap and depositing them on the teeth of a large cylinder similarly covered with card. This larger cylinder is enclosed in a frame that supports on it, for about one-third of the circumference of the cylinder, cross lags of wood, having on their inner surfaces a layer of card, the teeth of which are bent in a direction contrary to the revolution of the cylinder. These lags are removable, being held in place by pins and adjusted to hight by set screws on which their ends rest. They must be often cleaned from the coarse and dirty fibers, which is done by an operative called a "stripper," who lifts the lags and with a hand card removes the accumulation of dirty cotton. The centrifugal motion of the large cylinder throws the heavy particles of dirt to the outside, and what is not deposited on the claw-like teeth of the lags is left in a receptacle under the cylinder. All this is "waste," of a dark gray color and filled with dust. It is used for the manufacture of coarse bagging and for similar purposes.

In the front of the carding machine and in close connection with the surface of the large cylinder is a smaller cylinder, larger however than the "licker-in," and called the "doffer," because from that the cotton is delivered after being carded. This delivery is effected by the action of a vibrating bar, armed with saw teeth, which has a vertical and horizontal movement by the action of a crank. This "comb" takes the film of cotton from the surface of the "doffer" and throws it down into a flat funnel that delivers it in an endless cylindrical belt, under a roller actuated by an endless belt, on which the cotton travels to its debouche at the end of the train. Usually this train of cards consists of a number of machines—a dozen or thereabouts—each in its own action independent, but in the delivery of their products acting in harmony. These streams, one from each card, meet and mingle together and debouch at the end of the train between iron rollers which compress them together into two flattish ribbons of white cotton.

But this product must be again submitted to the operation of carding. To do this the ribbons are combined in another "lap," by means of a winding machine, technically denominated a "lapper," and then are placed into another set of cards called "finishers," the first being known as "breakers." In these no rollers are necessary to give rotation to the "lap," as the ribbons of which it is composed have considerable tenacity and can turn the "lap" by their own strength, as it is gradually drawn into the card by the fluted feeding rollers.

The operation on the "finishers" is precisely or very nearly like that on the "breakers," and the result is similar, the cotton being delivered in ribbons, but much purified by this second operation. It looks beautiful as it pours from between the rollers at the end of the train of cards in an endless stream of snowy purity.

Now comes an operation which acts directly upon the fibers. Hitherto the object of the different processes—differing only as regards the means used, but all aiming at one result, the cleaning and purifying the material—has been to fit the cotton for its ultimate work. Now it is to be tested as to its tenacity. Machines called "drawing frames" do this work. The cotton in deep cylindrical cans is placed in front of the "drawing frames." It goes through rollers which deliver it to another series of rollers, revolving at an accelerated speed, thus drawing out the fibers and depositing the cotton in semi-cylindrical ribbons in other cans. This process is repeated on additional "drawing frames" until the cotton is drawn into delicate strips of perhaps an inch or less in width. The union of the ends of the ribbons, as they empty from the cans, is readily secured by rolling them together with the hands, the union being facilitated by a slight moisture on the fingers.

In this form of a slight, untwisted ribbon, it is placed at the "speeder" or the "jack" to be drawn and slightly twisted into "roving." The "speeder," of which there are several varieties, is only a modification of and an improvement upon the "drawing frame." Neither the "drawing frame" nor the "speeder" are intended to clean the cotton: that has been done by the "picker" and the cards. The object of these is to straighten and thus elongate the fibers, and reduce the cotton in proper form for the spinning operation. The "roving," when prepared for the "mule" or the "spinning frame," is a slightly twisted thread of cotton about the diameter of a straw, wound on bobbins adapted in form to the machines upon which it is to be spun.

All these preliminary processes must be watched with great care. If the lags on the cards are too high above the cylinders they do not properly cleanse the cotton, and specks and knots and dirt in various forms combine with the product, and do not leave the material in all its future processes but show their injurious presence in the finished cloth or the thread, as the case may be. The carding department is by all odds the most important in a cotton factory. The card teeth may become dull and straightened, and it is a great responsibility to keep them in proper shape. At times they must be ground and inclined to the proper angle. This is effected by the operation of a cylinder covered with emery revolving against the surface of the cylinders of the carding machine. No less important are the results of the drawing machines. Changes of gears are provided for the sections of rollers which "draw" the cotton as it passes through, so that the weight of a given amount of cotton can be tested, and its proper "drawing" secured at any time, to insure a grade suited to the yarn that is to be spun.

In our next we shall take up the process of spinning into yarn.

[For the Scientific American.]

STOVES VS. GRATES--FRICTION NOT A FORCE.

BY PROFESSOR CHARLES A. SEELY.

STOVES VS. GRATES.

I desire to give my voice very distinctly in favor of stoves. All my considerable practical experience, and all the science I can bring to bear, unequivocally urge me to the decision I have made. Grates ought to be considered relics of the past: at the best they are only compromises between the vast fireplaces of the last century, and the perfected plans for warming houses of the present day. The advocates of grates are generally either very old fogies whose sympathies cling to whatever is antiquated and musty or misinformed sanitarians, whose theories are inspired by their own infirmities. But all this is not argument.

Stoves are more economical of fuel. This proposition, perhaps, was never doubted, yet I find few people who know how great the saving actually is. At least nine tenths of the heat from a grate goes up the chimney: of what earthly use to mankind are these nine tenths? I have recently made a practical test at my own house. I have two rooms of equal size, and similar in other respects; but one is warmed by a grate, the other by a stove. I find that the stove does better service than the grate with less than one fourth the fuel. A stove will generally pay its cost in a single season. The saving in kindling wood is a small item, but in the city it amounts to some dollars in the course of a winter, when a stove is used which keeps the fire all night. It is a common thing to have a stove running for weeks without ever lighting the fire.

The stove is more cleanly. All the coal, ashes, smoke and dust are snugly corked up in the stove, while the grate being open to the room, all of these have frequent chances of getting where they are not desired. The dirt from a grate ought to be intolerable to the tidy housewife.

Grates are more dangerous on account of fire, and require more attention and labor to operate them and keep them going. It is never safe, night or day, to leave the fire in a grate. The labor of carrying coal and ashes is something formidable, especially when it is to be performed by women, and the grate is up several flights of stairs. In the use of the grate, the difficulties incident to any plan of artificial warming are more than quadrupled. The consumption of four times the amount of coal by the grate, involves more than four times the amount of ashes and dirt and labor and bad temper.

But the friends of the grate plume themselves on sanitary considerations: they claim that grates are needful for ventilation. I have seen people who even pretended that there was danger of suffocation in rooms warmed by stoves. A few simple figures will show that the fundamental facts are not understood by these gentlemen. A robust man consumes 2 lbs. of oxygen in a day: 1 lb. of pure coal in burning consumes 2½ lbs. oxygen: 2½ lbs. oxygen represent say 150 cubic feet of air. The pound of coal therefore, burning in a stove, withdraws from the room at least 150 cubic feet of air, which of course is replaced by the air sucked in from the outside. In fact, however, the burning pound of coal brings into the room two or three times that amount. Assume that each pound of coal brings into the room 300 cubic feet of fresh air, is not that enough to expect or desire from it? Moreover in the cold season, the difference between the external and internal density being greater than in summer, the ordinary ventilating currents are more vigorous and efficient, and would probably be sufficient without the assistance of the coal. I hear very little complaint about ventilation from those who warm their houses by steam, or even from the sanitarians on those days when it is not quite cold enough to keep a fire, and yet it is prudent to have the windows and doors closed. In this last case there is little provision for ventilation by nature or art.

On the other hand, I indict the grate as being dangerous to health. It compels us to be in a gale of chilling air. On a very cold day it roasts one part of our bodies, while another may be freezing. The grate is one of the fruitful sources of coughs and the consequent diseases of the lungs.

There are those who pretend that the grate is highly ornamental, and that they like to look at the cheerful fire, etc. These are questions of taste and are not to be argued. For myself in all such cases I fall back on that homely old maxim: "Handsome is as handsome does."

FRICTION NOT A FORCE.

The new doctrine of the conservation and correlation of forces, which is now almost universally accepted, makes sad havoc with many dogmas which have prevailed for centuries. Thus our old notions of friction need complete remodelling to be made consistent with the present status of science. We now know that a force is never lost or destroyed, and consequently there can be no such thing as a resistance of force. All that can be done with acting force is to change its direction or to put it into the condition of "potential energy."

Friction does not destroy or diminish in the least the force which starts out from the prime mover. It simply changes the direction or form of the motion: the visible motion of the machine takes the form of heat, and this heat in amount is precisely equivalent to that motion which has disappeared to the eye. If friction may in any sense be considered a force, it can be only from the fact of its changing the direction or form of other forces, and thus perhaps might be brought under the category of the lever and the other so-called mechanical powers. And if in this way we regard friction as a force, how shall we measure it?

Practically it is perhaps sufficient to consider friction as simply indicating a leakage of force. A machine may be regarded as a device for conveying power from its source to a place where it is to be utilized, and friction a hole in the conductor. But the force is thereby no more destroyed, than the water which leaks out of an aqueduct.

Razors--How They Are Made.

The inquiry is sometimes made, "why does one razor cost so much more than another?" Both blades are made of steel and there seems to be but little difference in the cost of the handles. Razors are usually made of the very best quality of cast steel, properly tilted, hammered, and rolled—worth in England about $300 per ton, in gold. The forging of razors is performed by a foreman and striker in the same manner as the making of table knives.

"The bars or rods, as they come from the tilt and rolling mill, are about half an inch broad, and no thicker than sufficient for the back of the razor. The anvil on which the razor-blades are forged is rounded at the sides: by dexterously working the blade on the rounded edge of the anvil, a concave surface is given to the sides, and the edge part thus made thinner, which saves the grinder a deal of labor. The blade having been cut off the bar, the tang is formed by drawing out the steel. The blade is then properly hardened and tempered. The last and most important process which the razor-blade has to undergo is that of grinding. The difference in the prices of blades, made all of them of the same material, is owing entirely to the circumstance that stones of much smaller diameter are used for grinding the higher priced blades, and much more time and labor are given to the operation than is the case with the cheaper sorts. Thus, the best kind of razor-blades are ground hollow on stones measuring one and seven-eighths to two inches in diameter. The two-shilling English razors are ground on seven-inch diameter stones; the common shilling razors, on ten-inch diameter stones. The difference in the labor is very considerable. A grinder will turn out per week from twenty to twenty-four dozen of the common shilling razors, whilst he can manage only about five dozen a week of the better, and only a couple of dozen of the best, sort.

"The razors ground on a six-inch diameter stone are more suitable for hard, those ground on a two-inch diameter stone for soft, beards. The more common sorts are after grinding lapped on the glazer, and the backs glazed and polished.

The three-shilling blades are polished first then drawn over a wood buff. Razor-blades are, in a great measure, ground on dry stones, which unfortunately causes the atoms of stone and steel to fly about freely, to the great injury of the workmen, and imparts to the place where the operation is carried on a peculiar brownish-yellow hue. The minute particles of stone and metal flying about are inhaled by the workmen, and, lodging in the lungs, produce asthma, consumption, and other fatal diseases. This most dangerous feature of the dry-grinding business has, however, been very considerably modified of late by the introduction of an apparatus which in a great measure protects the grinders from the dust flying from the stones. This apparatus consists of a fan on the principle of a winnowing machine, with a flue to take away the dust from each of the stones in the room. The fan is worked, of course, by steam power.

"The difference in the price between the three shilling and the dearer razors is simply in the handles with which they are fitted, the blades being exactly the same in every respect. There are horn handles, ebony handles, plain and carved ivory handles, silver and German silver handles, mother-of-pearl handles, etc. Some idea of the importance and extent of this branch of the cutlery business may be conceived from the fact that some 1500 different patterns of razors are made.—*England's Workshops.*

GLEANINGS FROM THE POLYTECHNIC ASSOCIATION.

Reported for the Scientific American.

The regular meeting of this branch of the American Institute, was held on Thursday evening, December 27th, Prof. Tillman presiding.

THE EARTH A SOLID SPHERE.

After some preliminary proceedings, Mr. Wood read an article, arguing that the interior of the earth is in a solid state, yet having an intensely high temperature. Mayer has shown that when a globe of matter is once in a molten condition, in cooling one common temperature must exist throughout the entire mass; that from its nature one part can not possibly cool faster than another, and even if it were possible, we should look for the first signs of solidification at the center. The formation of the earth's crust, inclosing a molten mass, is hence inadmissible. The temperature certainly increases as we go toward the earth's center, but the pressure becomes greater in an increased ratio, and this latter force prevents the interior matter from assuming the liquid form.

The statement accredited by the speaker to Mayer was disputed by several members, and the existence of molten lava coated with a crust of varying thickness was brought forward as a notable example to sustain this latter view. After some further discussion the society listened to a paper by Prof. R. P. Stevens.

THE IMAGINARY SCHOOL OF PHILOSOPHERS.

Investigation, or the discovery of new facts, principles or truths, must always be conducted with a rigid adherence to truthful experiments. Standing on the borders of the known, we may patiently gather from the unknown, till from the accumulation we are enabled to classify, generalize, and reason, and thus extend our bounds.

It is interesting to show from the past how men of so-called science have found it so much easier to call on their imagination for facts from which to form or support theories, than by continued labor to discover their actual existence.

According to the Phœnician, Sanchoniathon, Chaos and a spirit were the authors of all things. The spirit fell in love with his own principles, hence a commixture, hence an agent capable of performing all we see in nature. The stoics supposed that moisture was the medium through which Deity acted on matter. *Ab mare omnia* was the belief of Ocken, and Prof. Grimes must be ranked in this school, as by his theory the continents are born of the sea. Even Kepler speaks of an animal in the moon drawing the earth toward it. Leibnitz imagined nomads endowed with inward energy and spontaneity, and each a perfect world within itself. Herschel and Laplace call to their aid cosmic matter so attenuated as to fill all space. Aristotle and Epicurus taught that matter was eternal and the world without beginning. The Pantheists hold essentially the same views.

The imaginary school continued with unabated force till Bacon established his inductive philosophy, teaching to observe facts, institute experiments, and from effects reason to causes.

THE NEBULAR THEORY.

Against the nebular hypothesis of Laplace, the following objections were urged. "The impossibility from *known* facts, of matter being so attenuated as to fill all space. It is doubtful that if so attenuated there would be many centers or even one center of gravity. If in this state and heated to so high a temperature, there could be no commingling of gases. We have no reason to suppose matter endowed with motion; rather, that unless moved upon by an extraneous force it would remain quiescent. The *primum mobile* of the centrifugal and rotary forces is merely assumed. The hypothesis fails to account for the eccentric movement of Herschel and Neptune, the movement of Herschel's moons, the movements of the comets, and their unequal rapidity of motion. It is opposed to all our present knowledge of matter as now existing, and this we have reason to believe is but a reappearance of itself in successive phases or rounds of phenomena, manifested by chemical changes and reactions.

THE OCEAN CURRENTS.

The first statement made by Prof. Grimes was that the ocean primitively covered the globe. Physicists calculate that had this ever been true, the sea would have been from one to two miles deep, too deep to fortify his second assertion, for currents do not abrade in deep water, hence the forming of vast continents by them is absurd. His second statement was that currents in this primitive ocean moved in six ellipses. We do not know the conditions attending the movement of currents in a shoreless ocean, and the mechanical problem proposed to account for this elliptical motion can not be shown by experiment. In the North Atlantic the current is exhausted at the 45th degree of latitude: then how was land above this parallel formed? Finally, he has not cited one fact or illustration from geology that has the remotest application to his hypotheses.

[For the Scientific American.]

BOSTON INSTITUTE OF TECHNOLOGY.

IMPROVEMENT IN TELESCOPES AND MICROSCOPES.

At the second regular meeting of the Boston Institute of Technology, a miniature telescope was exhibited (the invention of Mr. Tolles, the celebrated maker of microscopes,) four inches long, with an object glass only seven tenths of an inch in diameter, and magnifying thirteen diameters. This was proved equal in power to ordinary telescopes of two inches diameter of object glass and four feet long. In this small instrument the satellites of Jupiter and similar astronomical objects had been seen. This invention tends to diminish by one half the cost of telescopes, by diminishing the size of the lenses. Mr. Tolles had also invented a method of throwing light upon an opaque object when under examination under the microscope, by means of a rectangular prism introduced into the side of the instrument just above the lower glass, so that the light is thrown directly down upon the object; a long sought for improvement in the examination of opaque objects.

A NOVEL PLAN FOR FIRE-PROOF SAFES.

At a meeting of the Massachusetts Institute of Technology, in December, 1866, Rev. Rufus S. Sanborn, of Wisconsin, exhibited and explained a fire-proof safe invented by himself, in which steam acts as the preserving medium.

The nature of this invention consists in placing one or more boxes, or unfilled safes, one within the other, the outside case being filled or otherwise in the ordinary way, and these inner boxes detached from each other and the outside case by means of flanges or spurs, so as to form air chambers all around said inside box or boxes; and into these air chambers are inserted metallic vessels for holding water, with simple steam valves, which will be opened so as to allow the steam to escape when the heat of the inside of the safe shall become sufficient for that purpose.

This steam saturates the air chambers, and its surplus escapes by the doors, so as to keep the temperature of the inside of the safe about that of boiling water, in which temperature none of the papers of the inside box can either burn or char so long as any steam can be maintained.

By a peculiar arrangement of a succession of these vessels, one is exhausted after another, and thus for a long time there is the most complete protection in addition to the other protection which the filling and air chambers afford. In an ordinary sized safe there would be about fifteen gallons of water, which, under the arrangement described, would require a very long time for its conversion into steam and its total escape by the door.

A trial has since been made, of six hours' duration, in a fire so intense as to melt the knobs from the door, the safe being kept red hot for over five hours. In the trial, a safe of one of the best makers, on being opened after three hours' exposure, presented all the interior wood work on fire and its contents completely destroyed: on the contrary, the Sanborn safe showed its contents entirely uninjured, and its steam would have formed a perfect protection for six times, at least, the time of the exposure. An account of the trial may be found in the Boston *Advertiser* of Dec. 24, 1866. K.

A NEW EARTH EXCAVATOR.

Mr. B. A. Oliver, of Bunker Hill, Ill., has sent us a model of what appears to be an excellent machine for cutting ditches, canals, and railways, and also for grading roads, etc. It can be very easily described, being simple in construction and operation. A platform supports an upright frame, in which revolves a disc, carrying on its outer circumference a number of scoops closed at one end. In front of the machine are two plows with side attachments for cutting down the bank, which may be fixed to cut a perpendicular wall or one inclined at an angle. The shape of the plow shares is such that the earth loosened is thrown directly in the path of the revolving scoops. These take the earth up and carry it over the top of the disk, discharging it at the rear in two windrows, one on each side of the excavation. This division of the debris is secured by a partition passing through each scoop in the direction of its rotation, and also by doors on the sides of the scoop which, while in the act of digging, are closed automatically by side fixtures like cams, and are opened when in the proper position by the same means.

The large central disk to which these scoops are affixed has neither spokes nor hub, but is kept in place and rotated in a vertical plane by means of two friction wheels. Inside, the disk is furnished with segments of cogs in which a cog-wheel meshes, which is revolved by suitable connections with the main axle. The driving power is the supporting wheels of the apparatus, which have projecting lugs on their outer peripheries. The machine is drawn by horses or oxen, attached so that the animals walk on each side of the excavation. Direction is given to the machine by means of a lever in front of the driver's seat.

The principle of the machine seems to be correct, and Mr. Oliver has succeeded—so far as can be judged by his model—in applying it in a practical and efficient manner. He desires to procure some party to assist him in taking out his patents and introducing the machine to the public, and is willing to cede a portion of his rights as inventor, for the accommodation.

How to Straighten Hardened Steel.

To straighten steel after it has been hardened is a great annoyance to the machinist. It is one thing to finish a tool or mechanical appendage requiring hardening, and another to bring it out, hardened as it should be, right. Many a drill, turning tool, tap, etc., is ruined simply for want of knowledge of this art. To be sure, the bulk of the responsibility rests with the temperer or hardener; but what they fail in may in many cases be remedied by a knowledge of simple fact.

To straighten a piece of steel already hardened and tempered, heat it lightly, not enough to draw the temper, and you may straighten it even on an anvil, if not really dead cold, by a hammer; but it is best to straighten it between the centers of a lathe, if a turned article, or on a block of wood with a mallet, where the article, cold, would break like glass. Warm, it will yield readily to such blows as are said to kill the devil easy.

The Gatling Gun.

This destructive piece of field ordnance, of which we gave a description and engraving in the last number of the SCIENTIFIC AMERICAN, with an extract from the emphatic testimonial of the Examining Board to its efficiency, has been adopted by the U. S. Government, and an order for one hundred of the deadly machines for the army, is now being filled at Colt's Armory, Hartford.

PLANING CURVED SURFACES.—Hitherto, it has been found impossible to adapt the ordinary planing machines for curvilinear planing, but at length this problem has been solved by Mr. Middleton, the head of the machinery department in Chatham dockyard, who has succeeded in planing the whole of the curves and angular surfaces of the iron stem-piece for the *Monarch*, with no other appliances than the common planing machine.—*Engineer.*

[Links for locomotive valve gear have been planed for years in our machine shops on common planers, and by half a dozen different methods. It is no trouble at all. A common way is to take the vertical screw out of the tool holder, and attach a rod to the slide, with the bottom of said rod working in a curve of the required radius formed in a piece bolted to the bed of the planer.—EDS.

THE shop is getting to be only a primary school for mechanics. Time was when to be a first-class workman—capable of handling the file, or running the lathe or planer, or better still "doing a job"—was the hight of a mechanic's aspirations. All is changed. The mechanic, to be worthy of the name, must be more than a mechanical workman. He must understand the principles of his business and must be capable of not only doing a job, but preparing it and directing it. The world needs scientific mechanics as well as mechanical mechanics.

LIGHTING CIGARS.—The pyrophorus used for lighting cigars is a highly combustible powder, requiring only exposure to air and slight warmth to ignite. It is preserved in a small tin case with a narrow orifice, from which a little is dropped on the end of the cigar, and ignited by the aid of the breath. It seems to be even more dangerous to property than he cigar itself.

LAUNDRY GLOSS.—The beautiful finish of linen got up for sale is imparted by pressure and friction upon curved surfaces of hard pasteboard. Try a true cylinder, or convex table, veneered with the best quality of press board, such as printers use, instead of the usual domestic "ironing sheet."

HOT AND COLD BLAST.—An inquiry instituted by the British Association has determined the ratio of strength in hot-blast iron as 1,024.8, and of power to sustain impact as 1,226.3, to 1,000 in cold-blast iron.

SYRACUSE papers say, that the water in the fire engines of that city is kept constantly hot by jets of gas which are brought into contact with the boilers. It is said that gas costs in Syracuse only a dollar per thousand.

MR. SPILLER, of the Woolwich arsenal, has remarked that the barrels of the rifles used by the volunteers there are strongly magnetic. The range at which they are fired is situated due north and south.

A COSMOPOLITAN bank, whose checks will be everywhere at par or premium is to be established at London, with branches in the leading cities of the world. This will do away with bills of exchange.

A LOCOMOTIVE exploded lately at Rochester under a pressure of ninety pounds, and was thrown across the street into a saloon without doing much damage.

AN excellent bronze for small castings may be made by fusing together in a closed crucible ninety-five parts of copper by weight, and thirty-six parts of tin.

FORTY tons of rust were taken out of the Menai tubular bridge at one thorough cleaning.

IT has been calculated that 96,000 pounds of candles are used weekly in the mines of Cornwall.

M. PISANI proved the presence of soluble hyposulphates in the aerolite which fell at Orgueil.