GLASS TUBING.

The manufacture of glass tubing is surprisingly simple. The glass blower takes a small quantity of melted glass from the pot with his blowing tube, rolls it slightly on a marble slab to give it a cylindrical form, he then adds a small quantity of glass from the same pot, and blows the enlarged mass while rolling it, taking great pains to keep the shape cylindrical. If tubes of large caliber are required, the inside diameter of the cylinder is enlarged, and the glass is allowed to cool slightly before drawing. For tubes of very small caliber, such as thermometer tubes and other capillary tubes, the internal diameter of the cylinder is decreased and the glass is used very warm.

In making a piece of glass tubing the assistant places a ball of glass against the end of the glass cylinder by aid of his blowing tube. Now the men, each holding an end of the glass cylinder by means of their blowing tubes, begin to separate, walking backward. The cylinder is thus lengthened, and at the same time made smaller in diameter, and the diameter, of course, depends upon how much the tube is drawn out.

When the tube has attained the right size it is generally too warm and soft to admit of laying it down without destroying its shape; it is therefore cooled by means of a fan, as shown in Fig. 1. When it becomes sufficiently cool it is laid upon a series of equidistant parallel wooden blocks of uniform height, where it remains until it becomes cold. It is then cut into lengths with a diamond or a file. If the tubes are to resist great pressure or changes of temperature, they are annealed with great care. They are sometimes plunged into boiling linseed oil and slowly cooled.

FIG. 1.—COOLING GLASS TUBES.

Reading Room of the British Museum.

The dome of the British Museum reading room, in which the electric light is now used, is 140 feet in diameter and 106 feet high. In this dimension of diameter it is only inferior to the Pantheon of Rome by 2 feet; St. Peter's being only 139; Sta. Maria, in Florence, 139; the capitol at Washington, 135½; the tomb of Mahomet, Bejapore, 135; St. Paul's, 112; St. Sophia, Constantinople, 107, and the Church at Darmstadt, 105.

The new reading room contains 1,250,000 cubic feet of space; its "suburbs," or surrounding libraries, 750,000. The building is constructed principally of iron, with brick arches between the main ribs, supported by twenty iron piers, having a sectional area of 10 superficial feet to each, including the brick casing, or 200 feet in all. This saving of space by the use of iron is remarkable, the piers of support on which the dome rests only thus occupying 200 feet, whereas the piers of the Pantheon of Rome fill 7,477 feet of area, and those of the tomb of Mahomet 5,593 feet. Upwards of 2,000 tons of iron have been employed in the construction. The weight of the materials used in the dome is about 4,200 tons, namely, upwards of 200 tons on each pier.

The uprights or standards of the bookcases in the British Museum reading room are formed of wrought iron, galvanized and framed together, having fillets of beech inserted between the iron to receive the brass pins upon which the shelves rest. The framework of the bookcases forms the support for the iron perforated floors of the gallery avenues, and which are generally 8 feet wide, the central 6 feet being appropriated to the perforated floor, and the remainder being a clear space between the back of the books and the flooring, by which contrivance the light from the skylights (in all cases extending to the full width of the avenues) is thrown down the back of the books on each story, so that the lettering may be easily discerned throughout the book ranges. The shelves are formed of iron galvanized plates, edged with wainscot and covered with russet hide leather, and having a book fall attached. They are fitted at each end wih galvanized iron leather, covered, and wadded pads placed next the skeleton bookcase framing, to prevent injury to the binding when the books are taken out or replaced. Between these pads the skeleton framing of the cases forms an aperture by which a current of air may pass and ventilation be kept up throughout. The shelves rest upon brass pins, the holes for which are pierced at three quarters of an inch apart from center to center; but by a contrivance in cranking the shaft of the pin, which may be turned upward or downward, this interval is practically halved, and the position of the shelves may be altered three-eighths of an inch at a time.

The reading room contains three miles lineal o f bookcases, eight feet high; assuming them all to be spaced for the averaged octavo book size, the entire ranges form twenty-five miles of shelves. Assuming the shelves to be filled with books, of paper of average thickness, the leaves placed edge to edge would extend about 25,000 miles, or more than three times the diameter of the globe!

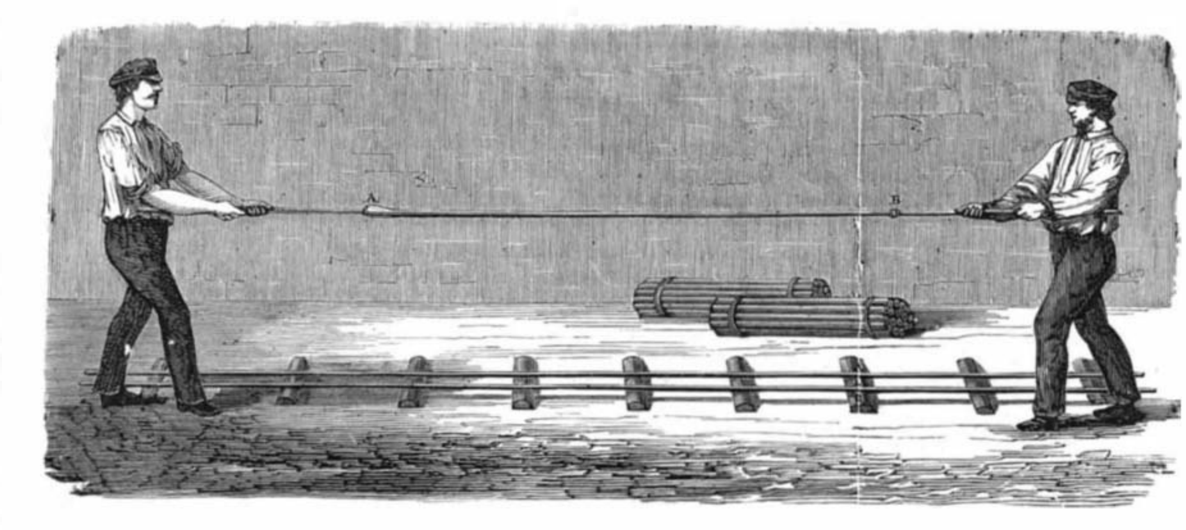

FIG. 2.—DRAWING GLASS TUBES.

Slag Boiler Covering.

Mr. Franz Buttgenbach, the well known metallurgist, gives the following method for the utilization of blast furnace cinder as an insulator for steam pipes, etc.: Mix 150 parts of cinder dust, 35 parts by weight of fine coal dust, 250 parts of fire clay, and 300 parts flue dust, with 10 parts of cow's hair, add 600 parts of water into which 10 to 15 parts of raw sulphuric acid has been poured, and make a stiff dough of the whole. This is thrown in small amounts upon the warmed pipe, hardening rapidly. Upon this rough coat a second, third, etc., is laid, according to the thickness which is to be used. By the action of sulphuric acid gypsum is formed, and the silica, rendered free, hardens. The mass becomes as hard as porcelain, and is still porous. It adheres firmly, and never cracks. Mr. Buttgenbach states that he has tested its merits by ten years' use, and has found it to meet all requirements.

AGRICULTURAL INVENTIONS.

An improvement in sulky-plows has been patented by Mr. William J. Meharry, of State Line, Indiana (Sheldon, Illinois, P. O). The object of this invention is to furnish an improved sulky attachment for plows, which shall be simple in construction, may be readily attached to any ordinary plow, will materially lighten the draught, and will allow the plow to be readily controlled.

Messrs. John J. Howell and Osnel H. Wienges, of Fort Motte, S. C., have invented an improved handle, which is so constructed that it may be applied to hoes, rakes, and other similar garden and farm implements, and which may be easily and quickly detached from one implement and attached to another, and when attached will hold the implement firmly and securely.

An improved farm gate has been patented by Mr. George Johnson, of Waucousta, Wis. This is an improvement in the class of horizontally swinging farm-gates, which have suitable attachments for holding them at different elevations for the purpose of avoiding snow or other obstruction, while being opened or closed. The invention relates to the construction of the attachments or devices which hold the gate in different vertical adjustments.

NEARSIGHTEDNESS AND THE COLOR OF THE EYES.—M. Nicaté stated, at the meeting of the French Society for the Advancement of Science, that as one of the results of his examination of 3,434 eyes in relation to myopia, at Marseilles, this defect was observed far more frequently in light than in dark eyes, blue and gray eyes furnishing 18 per cent, and black and brown eyes only 11·27 per cent.

Purifying Gelatine.

Impurities in gelatine may be classified under two heads—mechanical and chemical—the latter being far more difficult to remove than the former, inasmuch as they are more or less in combination with the material itself. Fortunately they do not appear to exert the same injurious action on the emulsion as the mechanical, which, although simply in a state of suspension, are yet exceedingly difficult to remove by simple filtration, especially after the emulsion is formed, as many of them are in quite as fine a state of division as the bromide itself; hence it is clear that any means which may be adopted to remove the one will also remove the other.

The mechanical impurities in gelatine principally consist of lime in the form either of the sulphates, carbonates, and phosphates, fat or grease, sometimes animal fiber, and always that very indefinite compound "dust." This latter impurity is generally present in considerable quantity owing to the sheets or flakes, while in the jellied form, being exposed on nets of string or wire in a strong current of air to dry, when, as a matter of course, any dust that comes in contact with them adheres and dries into the gelatine. In some of the English manufactories wire nets are employed, but on the continent those made of string are principally in use, and fibers of that material adhere to and are detached with the gelatine. It is said that these nets are greased to prevent the flakes from sticking. If this be the case it will account for some of the fat generally present in gelatine. We are told that it is the custom with some of the continental manufacturers to wash the surface of the sheets of their finest kinds with warm water after they are dry so as to remove the extraneous surface matter.

Although, as we have said, it is almost impossible to remove the insoluble matter by mere filtration, owing to the viscousness of the solution, yet it may be entirely eliminated by adopting the process commonly employed in the culinary art for clarifying jellies. This consists of mixing with the solution of gelatine some albumen of white of egg, and then raising the temperature sufficiently high to coagulate the albumen, which in coagulating imprisons the insoluble particles. The whole is then put into a flannel bag, and suspended in front of a fire, when the solution passes through perfectly clear and transparent, even if an opaque sample of gelatine have been used, and at the same time all fatty particles will be retained by the coagulated albumen. In practice, however, it will be found very difficult to treat successfully thick solutions in this way, as they will not pass through the strainer in the same manner as thin ones, such as are used for jellies, and also that strong solutions set much quicker and at a higher temperature than weak ones, so that some other plan must be adopted to avoid the necessity of filtering the solution if a strong one require purification.

The method we have employed with perfect success does not require filtration at all, yet the solution is rendered perfectly bright and transparent, and free from all solid particles as well as fatty matters. For this purpose the gelatine to be purified is placed in cold water until it has become swollen. It is then transferred to a beaker placed in a water bath heated to a temperature of 110° Fah.—not higher—until it is dissolved; then some well-whisked white of egg is stirred in. The proportion we have used has been two ounces of albumen to each four or five ounces of dry gelatine. Now, with a whisk, or, better still, one of the American egg beaters, convert the whole into froth. To do this easily it may be necessary to heat the solution somewhat, so as to render it more limpid; but care must be taken that it does not rise beyond 120° Fah., otherwise the albumen will be coagulated before its time. After the whole is converted into froth the temperature of the water bath must be quickly raised to nearly boiling point, and then allowed to remain undisturbed for some time.

As the albumen coagulates it will rise to the surface of the solution, carrying with it all the solid impurities, leaving the lower part quite clear. This may take some little time, according to the strength of the solution; but the temperature must be maintained until it is clear. It may then be allowed to cool, and the whole turned out (which may be easily done by placing the beaker in water for a few seconds and then inverting it), and the top part cut off and rejected. The other part may then be used direct for the emulsion, or it may be cut into thin slices and dried in an atmosphere free from dust, and preserved for future use. The drying may be much facilitated by digesting the thin slices in strong alcohol, so as to displace the greater part of the water before commencing to dry, and by this means the chances of its becoming contaminated with dust will be much reduced.

The object of converting the greater part of the solution into froth is this: If the albumen was simply stirred in and then coagulated it would remain in suspension, owing to the density of the solution; but, when the whole is converted into froth, the air bubbles as they rise to the surface carry the coagulated albumen, together with its imprisoned impurities, before it. As an example of the efficacy of this method of purification we may mention that we once mixed some gelatine with a solution of Indian ink which had been passed through filtering paper, and then treated it in the manner described, the result being that the whole of the coloring matter was removed with the albumen, which floated on the top like soot, while the lower portion was not only transparent, but perfectly devoid of color.

This experiment not only proves the efficiency of the process, but also shows that it is impracticable to purify the emulsion with albumen after it is made, as has been suggested, for the purpose of removing the coarser particles of bromide, because the whole would be removed in the same manner as the coloring matter of the Indian ink was.—*British Journal of Photography.*

Letters Patent.—How and in What Manner they can be Taken Out.

In this age of improvements and inventions the subject of patents is of great interest. The laws which govern patents are among the most important on the statute books looking to the protection of industries, as they grant inventors, their heirs and assigns, the exclusive right for a specified period to new discoveries and inventions of a novel and useful character. Every invention or discovery to be patentable must possess the merit of either novelty or utility. A patent will not be granted to an applicant for an article discovered and invented by another, but inventors will not prejudice their rights by allowing the public sale of that invention for two years before applying for a patent, and a valid patent will not be issued in case this use extends over a longer period. A "prior invention" does not hold good, if the party has simply conceived the idea of the thing patented; it is necessary that it should be reduced to a practical form or complete invention before a claim can be established. Whoever restores an abandoned or lost art or invention may obtain a patent for it.

An invention patented in a foreign country can receive a patent in the United States, if it has not been in public use two years prior to the application, but the American patent will not continue beyond the time granted by the foreign patent. In determining

WHETHER AN INVENTION IS NEW,

it is only necessary to ascertain if it is different from anything previously patented. In deciding the question of novelty it is necessary to decide whether an invention is really novel, or whether it consists in a double or analogous use of something already known. For instance, a patent will not be issued to a person who first applies to railroad cars a kind of a wheel previously used for other conveyances. Neither can the discovery of a principle, a natural law, scientific truth, or property of matter be a subject of a patent. But whoever makes a new and useful application of any of these things by embodying the principle of the law in mechanism, or describing a new process by which the discovery may be of practical utility, may obtain a patent for his invention, which consists not in the abstract principle, but in its practical application.

Persons wishing to obtain letters patent usually apply to a solicitor of patents or attorney, and furnish him with a model of the invention desired to be patented, except in cases of designs, compositions, and processes. The petitioner takes oath that he believes himself to be the original and first inventor of the invention, and that, to his knowledge, it has not been known or used before. Accompanying this petition and oath must be a model of the invention if the case will admit of it, with drawings and specifications. The application must be signed by the inventor unless he is dead, when it must be signed by his executor or administrator. The specification is a full description of the invention, in writing, and the manner and process of making and using it. The description is followed by the claim, in which the applicant must particularly specify the part, improvement, or combination which he claims as his own invention and discovery. Where there are drawings the specification must refer by letters and figures to the different parts. In the case of the composition of matter, specimens of the composition and of the ingredients sufficient in quantity for the purpose of experiment must accompany the application.

THE CHIEF OBJECTS OF THE SPECIFICATIONS

Are to make known the precise nature of the invention, and to enable the public from the specification itself to practice the invention after the expiration of the patent. The object of the claim is to fix with accuracy the extent of what is claimed as new. It is sometimes fatal to a claim to call an invention a machine when it is a process, and it is of the utmost importance to the inventors that the specifications are plain. The petition, oath, model, specification, drawing, etc., are forwarded to the Patent Office at Washington by the solicitor or attorney. The Patent Office, as those who have seen it are well aware, is one of the most notable buildings in the nation's capital, as it is one of the most important. Here are preserved all records, books, models, drawings, specifications, etc., pertaining to patents. The office is under the supervision of the Secretary of the Interior, but the Commissioner of Patents is the chief in charge of the office. The officers consist of a commissioner, assistant commissioner, and three examiners-in-chief, besides one chief clerk and examiner in charge of interferences, and a host of primary examiners. These primary examiners are men versed in some special department of mechanics, etc., and models, drawings, specifications, etc., are given to them for examination, with due reference to their special qualifications.

If an applicant is dissatisfied with a decision, he can be heard by the board of examiners-in-chief, and then, if still dissatisfied, before the Commissioner on appeal. Appeals from the Commissioner can be taken in all cases, except interferences, to the Supreme Court. Where an inventor is not ready to file a complete specification, and desires further time, but wishes to secure his right, he can file a caveat, which will be placed in the secret archives of the Patent Office; and if there be any application within a year for anything which appears to interfere with his claim, he shall have notice, and may appear and prove priority; and by a second caveat he may renew it for another year. Patents can be procured in foreign countries, and a great many are taken out in England, Canada, France, Belgium, and Germany.

THE PATENT OFFICE IN WASHINGTON

Is more than self-supporting, and to-day is said to have at least $1,000,000 to its credit. Last year there were 20,260 applicants for patents, and 12,354 patents were granted, besides 1,455 trade marks and 492 labels. Of the patents, 832 were held for the final payment of dues. The cost of obtaining a patent is usually about $60, $25 of this amount being the fee of the solicitor and the balance is paid at the Patent Office. The State receiving the largest number of patents per capita last year was Nevada, but usually the order is as follows: Massachusetts, Connecticut, Rhode Island, New York, and the District of Columbia. It is to be expected that Massachusetts and Connecticut will stand at the head of the list. The intuitive ingenuity of the Yankee is constantly designing something new and exploring the labyrinths of science and art in its efforts to lighten the labor of man, and it will be a long time before he can be ousted from his position at the head of designers and inventors.—*Boston Globe.*

Fire Losses.

The statistics of fires for the month of September show that the losses by fires reported in the United States amounted to $5,349,300, and in Canada to $264,800. Of the United States loss, the insurance companies paid $2,298,200, and of the Canadian loss $165,000, or less than one half. The loss for the corresponding month of last year was $790,500 less than the aggregate amount above given. This total loss of $5,349,300 was distributed, says the *Fireman's Journal*, generally throughout the States and Territories, New York State suffering the most severely, her loss being $767,700; Illinois comes next, with a loss of $439,600; Iowa lost $322,500, and Massachusetts $281,600. Dakota had an exceptional fire at Deadwood, where the loss was $1,070,000, which is not included in the classification of average losses. For the nine months ending with September, the recorded losses of the United States amounted to $61,150.100, and in Canada to $6,014,800—an aggregate of $67,164,900. The aggregate losses for the same period last year were $50,626,-500, showing a gain for 1879 of $16,538,400. Should the last three months of the year only equal for each the loss of September, the recorded loss for the year will be $84,007,200. But it is estimated that one third of the actual losses are not recorded, so that the estimate heretofore made that the annual loss by fire is $100,000,000 is not far out of the way.

The statistics for the past ten years show, excepting great conflagrations, a yearly increase in the fire losses of the country. This is positive demonstration that the means for controlling fires have not kept pace with the building operations of the country. Including the great conflagrations, the fact becomes apparent that improvement in fire extinguishing machinery has not kept pace with the latest methods of construction. As a matter of fact, the means for fighting fires in the seven, eight, or nine story buildings of modern times, constructed of the most inflammable material, are no better than they were twenty years ago, before the era of tall buildings, and when better methods of construction prevailed. The steam fire engine is the only real advance in fire extinguishing machinery that has been made within the present generation, and the capacity of these has not been increased to accord with the modern style of architecture. Machinery that is equal to fighting a fire in a three story building is wholly ineffectual when the flames are raging a hundred or more feet above the street level. That our engines have not greater capacity is not the fault of the manufacturers. The demand has been for light engines that could be quickly drawn to a fire, rather than for those of great capacity in throwing water. As a matter of fact, the light engines are more serviceable three times out of five. It is only in those cities where tall buildings are numerous that more powerful engines are required, and in those greater importance is laid upon the ability of the lighter ones to get quickly to a fire and put it out before it gets headway, than upon great volumes of water to suppress one that is well agoing. Preventions of conflagrations, rather than their extinction, is relied upon. This would be all well enough if it could always be trusted. But conflagrations will come in spite of every precaution, and, in such an emergency, the engine that can throw the greatest volume of water steadily for all the time required is the best one.

But to return to the statistics, which show an annual waste of $100,000,000 of property every year. This amount of actual values, the product of the people's industry, is thrown away yearly. There is no return for it in any shape. Insurance companies may make good individual losses, but the money must come from the pockets of other individuals, and, eventually, is paid by the producing classes. It would be far better if we could take $100,000,000 a year in new, crisp, greenbacks from the National Treasury and burn them up, if by that means we could save for business purposes the property destroyed by fire. But suppose Congress should appropriate this sum of money to be burned up every year —what a howl of indignation would be raised by the tax-payers of the country! How they would denounce the wastefulness of our legislators, and how quickly they would relegate them to private life. But would it be any worse for Congress to thus squander the substance of the nation than it is for the careless and wasteful taxpayers to do it? The waste is the same, and careful and prudent tax-payers are forced to contribute to make up the losses of those who are neither the one nor the other. What we want is better legislation to control the erection of buildings, and legislation to prevent insurance companies from encouraging incendiarism by paying more for property that is destroyed by fire than it was worth while standing. In other words, the payment of losses by insurance companies should be restricted to two-thirds the value of the property destroyed. With such a law in force, property owners would be compelled to carry one-third of the risk themselves, and this would destroy all motive to incendiarism, and induce prudence and care in the management of property. Such a law enforced rigidly in every State would reduce our fire losses more than fifty per cent the first year.

Telegraphy in France.

By the end of the present year, of 87 chief towns of departments, only 26 will not be provided with direct telegraphic communication with Paris. These 26 towns communicate through intermediate offices. The total number of direct wires from the French capital to provincial centers is 113, and several of these centers have more than one such wire. Thus, Amiens has 2; Bordeaux, 3; Marseilles, 4; Montpellier, 2; Nantes, 2; Toulouse, 2; Trouville, 2; and Versailles, 39. Twenty-five of these lines are subterranean. As regards direct wires to foreign centers, Paris has one to Amsterdam, one to Antwerp, one to Basle, three to Berlin, one to Berne, one to Bergeux, three to Brussels, one to Cologne, one to Florence, one to Geneva, nine to London, one to Metz-Hamburg, one to Milan, one to Mülhausen, one to Rome, one to Strasbourg, one to Turin, and two to Vienna. There is also a direct submarine wire from Marseilles to London.

The Telegraphic System of the World.

The system of telegraphs in Europe comprised, at the end of 1877, 268,809 miles of lines, and 769,768 miles of wires. There were 19,627 government telegraph stations, and 12,708 railway and special stations. The number of employés amounted to 61,984, and the number of instruments to 41,708. The number of paid messages was, in round numbers, 86,000,000, of which 20,000,000 were international dispatches. The number of other telegrams forwarded amounted to about 7,000,000. M. Newman Spallart gives the following statistics for the other parts of the world. In America (1875 to 1877), 114,157 miles of wires; 8,756 stations; 23,-000,000 telegrams. In Asia (1875 to 1876), 24,521 miles of wires; 489 stations; 2,300,000 telegrams. Australia (1875), 23,582 miles of wires; 689 stations; 2,500,000 telegrams. Africa (1874 to 1876), 8,148 miles of wires; 196 stations; 1,200,000 telegrams.

A New Colorado Mining Tunnel.

The Boulder *News and Courier* says: "A tunnel has recently been started at the base of Seaton Mountain, about one mile from Idaho Springs, having a course north 24° east. It cuts at right angles all the lodes, and some of them at a depth of 2,300 feet. Thirty-seven already discovered will be cut by this tunnel, many of them well and favorably known by their rich and abundant production of ores. Of these, the projector of the enterprise has secured thirty-four lodes, and arranged for the purchase of the balance when desirable, thus wisely avoiding any possibility of dispute over titles, surface claims, or side lines in the long hereafter. This tunnel, christened the 'Idaho,' is considered in many respects the largest and best constructed tunnel in the country for mining uses. Bed rock was reached at a distance of 48 feet, at which point the first lode was cut, the vein matter assaying well. Very strong and promising mineral veins have been cut within each successive 25 feet since reaching solid rock. This tunnel, if continued on its course, will reach Black Hawk at a distance of three and a half miles."