

Casting Metals, Glass, etc.

Letters patent have been taken out in France for improvements in casting metals, glass, and other materials. We give an illustrated description of the apparatus employed. An air-tight vessel is formed of a hollow cylindrical vessel of cast iron, closed at its lower end, and strengthened on the exterior by rings of wrought iron shrunk upon it. The vessel is closed air-tight at its upper end by a hemispherical cover, between which and a flange around the upper edge of the vessel is placed a washer of soft metal; the lid when closed is pressed firmly down upon the washer by a screw working through a head or nut which is held down to the vessel by three descending arms, formed at their lower ends with lugs to hook on to other lugs which pass below the flange on the top of the vessel. When the head or nut is thus held the lid can be forced down by turning the screw which works through the nut. In case where it is desirable to apply the heat to the material during the time it is solidifying, as, for example, when casting ingots of steel, the mold into which the steel is to be cast is surrounded with a casting of thin metal, and placed within the air-tight vessel. Between the thin metal case and the sides of the vessel, pieces of charcoal are roughly broken up, and are so placed that air may penetrate readily through the charcoal; when the melted metal is poured into the mold the charcoal is thereby brought to a red heat and ignited, and by this means the metal is kept heated. As soon as the metal has been poured into the mold, a thin plate is placed upon the top of the metal in fusion, and a thick plate of fire-clay is placed over the top of the mold; the lid of the outer vessel is then put on, and the joint is made air tight by forcing it down by a screw, as above described. Compressed air is afterwards admitted into the vessel from a suitable reservoir; the communication between the reservoir and vessel can then be closed by a cock, so that the pressure in the vessel may be increased by the expansion of the air as it becomes heated.

Fig. 1 of our illustration shows a vertical section of an apparatus constructed as described, the apparatus is more especially suitable for making castings of steel, but similar means may be employed when making castings of glass or other fluid substances.

A is a strong vessel of cast iron, strengthened exteriorly with wrought-iron rings, *a*, shrunk upon it; B, a lid for closing the vessel air tight; S, the screw for pressing down the lid or cover on top of the vessel, A; the screw works through the nut, *n*, which, when the lid is to be closed, is held down to the vessel, A, by three arms formed at their lower ends with lugs, *c*, which are passed under other lugs, *o*, the stems, P, of which are fixed to the upper strengthening ring, *a*, of the vessel, A.

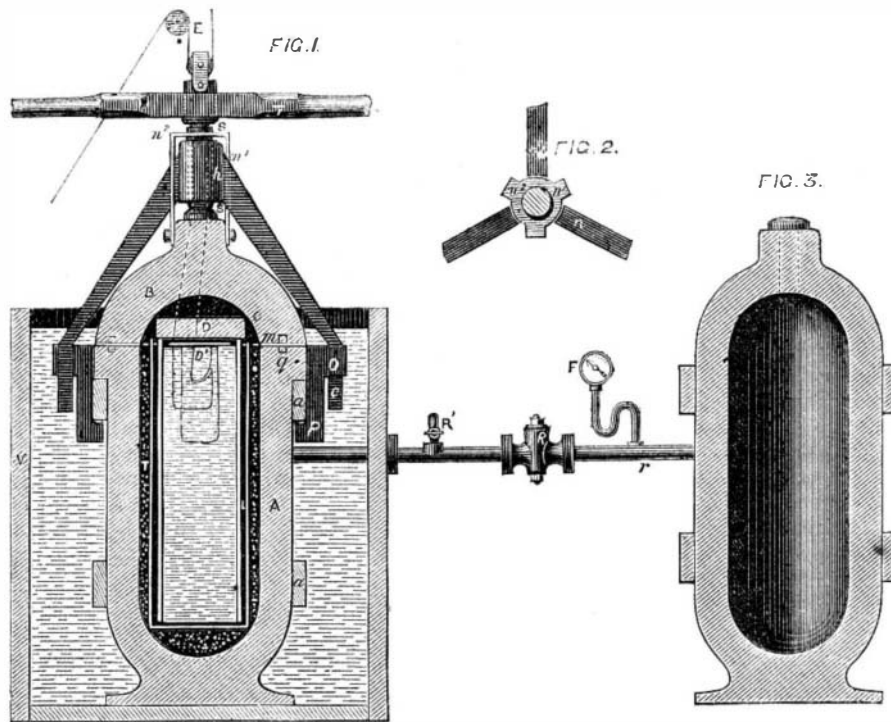
The screw and nut are connected to the top of the lid, B, by three other arms *n*1, descending from a ring, *n*2, through which the screw passes freely. The construction of these parts is clearly seen in the cross section shown at Fig. 2. At the top of the screw is carried a pulley, over which is passed a cord, E, by which the screw and with it the lid, B, can be raised or lowered when the lid is disconnected from the vessel. *q*, *q* are steady pins to keep the lid concentric with the top of the vessel, A, and *m*, is a soft-metal washer for making the joint between the vessel, A, and lid, B, air tight. In the interior of the vessel, A, is placed an iron ingot mold, L, into which the melted metal is to be poured; the lower end of the mold is closed by an iron bottom, as shown, and the top of the mold is covered over with a slab of fire tile, marked D, the ingot mold is surrounded by a casing, T, of thin sheet iron, and between this casing and the sides of the vessel, A, is placed charcoal broken into small pieces so that the air may pass freely amongst it. At Fig. 3 is represented a reservoir of compressed air communicating with the vessel, A, by a pipe, *r*, on to which is fitted a pressure gage, F, to indicate the pressure of air in the reservoir. The passage of air through the pipe, *r*, from the reservoir to the vessel, A, is controlled by a cock, R, the pipe, *r*, also carries a tap, R1, by opening which the pressure of air may be reduced when desired.

The apparatus is used in the following manner: Supposing the air reservoir to be filled with air at a pressure of about 10 atmospheres and that the melted steel is ready to be run into the ingot mold, the metal is poured into the ingot mold, L, the small disk of sheet metal, D1 is placed on the top of the fluid metal, and the whole is covered over with the disk of fire tile, D, as shown in the illustration, the fire tile having been previously heated to a white heat.

As the ingot mold becomes heated by the metal poured into it the heat is radiated from it across the small air space between the mold and the thin metal case by which it is surrounded, heats this casing to a red heat, and ignites the charcoal by which it is surrounded. The lid, B, is closed and fixed securely on the top of the apparatus, the lower end of the screw being forced down on the circular washer, *u*, on the top of the lid, B, by turning the screw of the lever arms, T1, upon it; the apparatus being closed, the tap, R, is opened, the compressed air passes into the apparatus, so making the pressure in the vessel, A, equal to the pressure in the air reservoir, the air becoming quickly heated, in the vessel, A, the pressure rises, and if the tap, R, is then closed, the pressure in the vessel, A, will rise above that in the air reservoir.

It will thus be seen that the pressure in the vessel, A, can readily be regulated by means of the taps in the pipe, *r*. We

must here remark that the quantity of air which passes from the air reservoir into the vessel, A, is relatively very small, as the vessel, A, is almost entirely filled with the ingot mold, the casing, and the charcoal with which it is surrounded. This is very advantageous for economizing the compressed air employed, but more especially for concentrating the heat in a small space, so that the metal in the ingot mold may cool slowly and as regularly as possible, the exterior of the vessel, A, is surrounded by water contained in a bath or vessel, V, so as to keep it cool, as shown by our illustration. Steel thus cast into molds and subjected to pressure, is under the most favorable conditions for solidifying into a homogeneous mass, for as regards pressure it is compressed with a force which is considerable, as a pressure of ten atmospheres corresponds to a column of melted metal of about forty-five feet high; if this

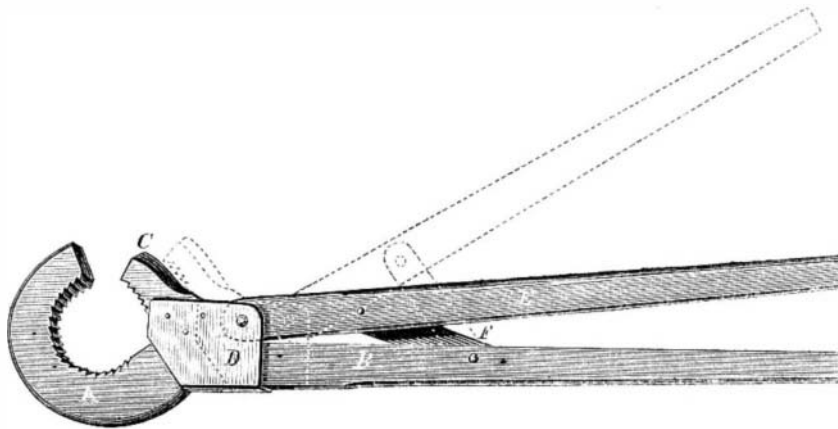


APPARATUS FOR CASTING METALS, GLASS, Etc.

is compared with the height of the head or get of metal usually employed by founders it will be seen how greatly superior is the process of casting above described to that usually employed. A pressure of ten atmospheres has been taken as an example, but there is nothing to prevent a pressure of twenty thirty or forty atmospheres being employed, as this may be done without danger. By the process above described a dense and homogeneous ingot is obtained, as the metal is not only subject to pressure while in a fluid state, but also as it passes through the pasty into the solid state. By the combined use of a concentrated heat and great pressure a highly malleable steel is obtained, and also a steel which when tempered becomes extremely hard, these being the two most valuable qualities in steel.

Improvement in Pipe Tongs.

This is an implement which is of great importance in gas fitting and plumbing, and presents decided advantages over the old style of pipe tongs. By its use the pipe may be more firmly grasped with less liability to injury, while it is equally convenient in use. In the engraving, A, is a curved jaw comprising about, or a little less than three fourths of a circle,



CRAIN'S PATENT PIPE TONGS.

and is forged with the handle, B, in one continuous piece. C is also a curved jaw about, or a little less than one fourth of a circle in extent, and is riveted to a bent plate, D, passing over the back of B. The other handle, E, is pivoted to D, and the two handles are connected by a link, F, so that when the handle E, is opened to the position shown by the dotted outline, the jaw, C, is withdrawn to the position shown by its dotted outline. This allows the pipe to enter between the jaws.

When the handles are pressed together, the jaw, C, approaches the other with great force through the action of the toggle formed by the handle, E, and the link, F; but as the pipe is grasped on all sides there is no danger of crushing it. The jaws are toothed internally in the usual manner, and for the same purpose. Patented, through the Scientific American Patent Agency, Aug. 3, 1869, by R. Crain of Shaffer Farm Dennison Post Office, Pa., who may be addressed.

SOMETHING NEW IN MECHANICS.

Under this head the *Independent Democrat*, of Concord, N. H., gives us a long description of what the editor supposes to be a new way of transmitting power, specially useful in cities as a substitute for steam, the invention of Horace Call, of that city.

By means of water wheels and pumps, air is to be compressed at the river bank and conducted in pipes to the city shops. Here the air discharges into the bottom of a tank, and bubbles up like a boiling caldron. Within the tank is a bucketed wheel, so arranged that the buckets will receive the ascending current of air, the force of which will turn the wheel and drive the machinery of the shop.

"The philosophy of the power," says the *Democrat*, "is simple.

The air displaces the water in an upward current, equal to the weight of water down. It is so simple that it is a wonder that it has never been applied before.

"The possibilities of this invention afford a wide field for speculation, and one which we will not enter upon to-day. When we consider that it probably costs \$50,000 a year to operate the stationary engines in this city, while a river with 10,000-horse power runs through it, unused, the magnitude of an invention which proposes to make it available at a comparatively small expense, is one which challenges the attention of mechanics and scientific persons."

There appears to us nothing in the above invention which warrants the great expectations expressed by our New Hampshire cotemporary. The practice of driving machinery by compressed air is very old. Ordinarily it is wanting in economy as compared with the direct employment of water or steam. But in inaccessible locations, in mines, and tunnels, it is used to advantage, serving for ventilation as well as power. In the Hoosac and Mont Cenis tunnels the drilling machines are driven by air, which is compressed by water power and carried long distances in pipes to the drills.

The only novelty in Mr. Call's improvement lies in his tank and air wheel; but this form of air engine can hardly be as effective as the ordinary machines. The resistance of the wheel revolving in the water, and the friction of the rising air will about equal, we should think, the friction of a well-constructed piston engine.

The Ponsard Process of Smelting Iron Ore.

This is a French improvement, if indeed it shall prove to be in practice a real improvement. The chief feature of the Ponsard process, is that the ore is pulverized and mixed with pure coal or carbon, and then placed into tubular crucibles, heated from the outside. By thus protecting the ore from the direct action of the fuel employed for heating the crucibles, inferior combustible matter can be used and a certain economy thereby effected. By an arrangement of the furnace, gray or white iron, or even steel, can be produced at will. The furnaces can easily be converted into puddling furnaces into which the metal can enter at one side and run out at the other, prepared for being submitted to the rolling mill.

Suit for a Million.

Andrew Whiteley, who for a long time has been contending with the Commissioner of Patents for certain reissues, has

finally entered suit against that official. In his declaration he sets forth that, in various patent cases in which he was assignee of Gage, Weeks, Haines, and others, for improvements in harvesters, etc., he obtained certain orders of Judge Fisher, of the Supreme Court of the District of Columbia, directing the Commissioner of Patents to take certain evidence as to novelty, to reissue certain patents, and to ante-date others; that, in consequence of these proceedings, he has been compelled to lose time, opportunities of making money, and to employ counsel, by reason of which he is a large loser. He therefore

brings suit, laying his damages at one million dollars.

If Mr. Whiteley should succeed in getting judgment for the amount of damages claimed, we imagine that it might go hard with Commissioner Fisher to raise the funds.

Carvalho's Painting of the Grand Canyon of the Colorado River.

Mr. S. N. Carvalho, patentee of a very excellent steam super-treating device and an artist of considerable merit, gave a private exhibition of a new painting of his, on Friday evening, September 3d, at his studio, 765 Broadway. The subject is a view of the Grand Canyon of the Colorado River, and is of interest from the fact that the sketches were taken by Mr. Carvalho on the spot and while attached to the Fremont expedition as photographic artist. The stern and impressive grandeur of its everlasting rocks made such an impression on Mr. Carvalho that he took sketches of them

from various points of view with great trouble and at much personal risk.

The picture represents the canyon at the head of Diamond Creek, where the vast rocky walls rise abruptly to the height of from 3,000 to 6,000 feet. At the bottom of this gloomy and terrible abyss flows a stream of dark water, flecked here and there with foam. In the background is a line of lofty bluffs, many of them crowned with masses of rock of enormous size and fantastic shapes, in which domes, towers, spires, and minarets are faintly outlined.

REAR-HORSES.

General Engelmann, of Illinois, has found by experience, that the best way to get rid of the grasshoppers in a vineyard is to raise rear-horses there, which are also known as devil's horses, *alias* praying nuns, *alias* intelligence bugs, *alias* devil's riding-horses, but the correct English name of which is "camel cricket."

Fig. 1 gives a very good view of the sexes of this insect, *b* representing the male, which is of a brown color, and *a* the female, which is of a green color. The female has such short wings that she is incapable of flight; but the male flies as readily and as strongly as an ordinary grasshopper. The General's mode of colonizing this insect in his vineyard, is to collect the masses of eggs in the dead of the year and place them upon his grape vines. Fig. 2 will enable the reader to recognize these singular egg masses whenever he may happen to meet with them. Persons are very generally ignorant of their real nature, and on the principle that "everything that is unknown must be something hateful and destructive," are apt to cut them off and throw them into the fire. They should, under no circumstances, be destroyed. As a general rule camel crickets are only found in the central and southern parts of Missouri, in the southern part of Illinois, and in other southerly regions. But Mr. D. B. Wier is domesticating them at Lacon, on the Illinois river; and on one occasion one of their egg masses was found as far north as Lee county, Northern Illinois. We are inclined to believe that, with a little care and attention they may be acclimated at points further north than these.—*American Entomologist.*

TRANSMISSION OF POWER.

BY WILLIAM S. AUCHINCLOSS, HONORARY COMMISSIONER TO THE PAIS EXPOSITION 1867.

LEATHER BELTING.

An examination of the different leather departments, and the varieties of belting in actual use, reveal a tendency on the part of manufacturers to improve the quality of wide belts by securing 2-inch strips along their edges. Specimens of this character are exhibited by Messrs. Webb & Son, Stowmarket, England; Mr. William Ruland, of Bonn, Prussia; H. Lemaistre & Co., Brussels, Belgium; Placide Peltereau, 32 Rue d'Hauteville, Paris; Poullain Brothers, 99 Rue de Flandre, Paris; and others of less note. The material forming these strips is (with a single exception) leather of the same quality as the belt. The methods of attachment are variable, as laces, threads, rivets, eyelets, and brass screws. The English use the threads, Prussians the laces, and the French all the varieties enumerated. Mr. P. Peltereau, proprietor of one of the largest houses in France, makes a remarkable display, not only of belts and their mountings, but of different kinds of leather; such as tanned elephant hide, varying in thickness from one fourth to one half an inch, and hippopotamus hide, from one inch to one and a half inches in thickness. His 8-inch and 10-inch belts have leather facings two inches wide on their edges. Each of these facings is attached by two leather laces, whose stitches have three fourths of an inch span, and run in parallel lines, separated by one and one fourth inch.

The "inextensible belt," for which, at a previous exposition, he received a gold medal, has steel instead of leather edging strips. These strips, for a 10-inch belt, are two inches wide by one sixty-fourth of an inch in thickness, and attached by two riveted rows of copper tacks. These tacks are one eighth of an inch in diameter, and placed three and one half inches between centers.

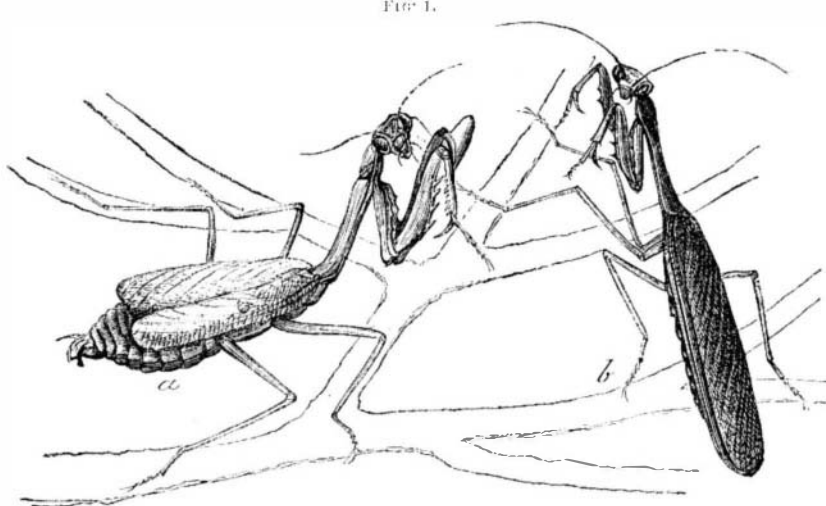
Messrs. Poullain Brothers join their single, and compound their double belts with headless one eighth of an inch brass screws. This is accomplished with a very ingenious machine, of which there are several types in the French department. It carries a coil of plain brass wire, which, while being fed to the work, passes through a die of twenty-eight threads to the inch. The screw thus formed enters the belt at a point closely clamped by a foot-lever, and, having passed through, is cut off. Finally, the belt being placed on a surface plate, the points of all the screws are slightly riveted. The most compact and expeditious of these machines is the invention of Mr. Cabourg, 74 Rue St. Honoré, Paris.

Mr. E. Scellos, of 74 Boulevard du Prince Eugene, exhibits what he terms a "homogeneous belt," for 150-horse power. This belt is nineteen and one half inches wide by three fourths of an inch in thickness. It is composed of 104 leather strips three fourths of an inch in width, laid longitudinally with reference to the belt, and laced transversely; the distance between laces is one and one fourth inch, and dia-

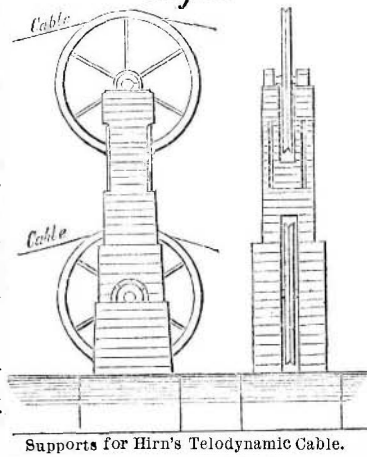
meter of lace equals three sixteenths of an inch. The advantage of edge-bound wide belts, where frequent shipping is an essential, we think will be readily conceded; and to what extent they can supplant double belts, is a subject worthy of experimental inquiry. The use of very wide belts is seldom resorted to in the machinery department. One of the stationaries has two central ribbed pulley rims bolted to the arms of its fly wheel; on these run four belts six inches in width; another has two 12-inch edged belts, and so on—the inclination was always to increase the number rather than the width of the belts.

TRANSMISSION OF POWER TO GREAT DISTANCES.

For the transmission of power to great distances, leather and rubber belts are rendered useless by their extreme elasticity, and the expensive character of their intermediate supports; while shafting with bevel gears consumes the applied



power in excessive friction, elasticity, etc. These difficulties were studiously met and successfully solved by Mr. C. F. Hirn, of Colmar, Haut Rhin, in the year 1860; the practical working of his invention was partially displayed at the exhibition of 1862. In the park of the present Exposition, his system is clearly shown by the operation of a centrifugal pump, deriving its power from a stationary engine, working on the opposite side of the artificial lake, and distant some 500 ft. from the pump. This so-called "telodynamic system" is based on the substitution of a high velocity wheel



Supports for Hirn's Telodynamic Cable.

opened in a small mass, for its converse; namely, large mass moving with small velocity. The power conductor is simply a light wire rope, passing over pulleys of large diameter, and upheld at intervals of about four hundred feet by support-pulleys. The construction of these pulleys, and their supports, is shown by the accompanying figures, 1 and 2, giving a side view and end view, and a section of the rim of the pulley.

The two extreme pulleys, or those which receive and distribute the power, are rotated at speeds having a circumferential velocity of 1,800 to 4,800 feet per minute. It has been the practice to make these of cast iron, but steel is recommended where higher velocities are necessary. The face of the pulley is channeled by a deep V-groove, while the bottom of the latter has a filling of gutta-percha which adapts itself more and more perfectly to the rope and entirely prevents slip and wear. Fig. 2 is a section of the rim of the support pulley, showing the cable A, resting upon the gutta-percha cushion, B. Herein lies the secret of its practical success; a result only attained after most discouraging experiments upon pulleys constructed successively of copper, wood, cast iron, etc., with facings of leather, india-rubber, horn, lignumvita, and boxwood. Experience has proved that the loss of power by the telodynamic system is quite trifling, and arises mainly from the resistance of the air to the arms of the pulleys, the friction of their axles, as well as the rigidity of the rope in its passage over the pulleys.

It has been found that two pulleys, twelve feet in diameter, making 100 revolutions per minute, with a cable of seven sixteenths of an inch diameter, can, by means of a circumferential velocity of 4,000 feet per minute, transmit 120-horse power (to distances less than 400 feet) without sustaining a loss of more than two and one half per cent. If this limit is exceeded, it will become necessary to introduce support pulleys of seven feet diameter, and for these there should be estimated a mechanical loss of about one per cent per 3,300 feet of distance traveled. The pecuniary expense, independent of the ground rent, amounted to \$1,000 (gold) per 3,300 feet, plus \$600 for the receiving and distributing pulleys, with their respective shafts and supports. It is evident that

this system cannot be limited in its application by rectilinear transmission, but is susceptible of all the changes in direction which inclined pulleys can command. There are already between 400 and 500 instances of its employment in connection with the manufacturing interests of the continent. Its advantages in respect to our own country can hardly be over-estimated.

CADMIUM AND ITS USES.

BY PROF. C. A. JOY, OF COLUMBIA COLLEGE.

Seven cities dispute the right of having given birth to the immortal Homer, and seven men claim the honor of having discovered cadmium. A learned German has tried to show that Homer was a myth. Cadmium was named after the mythical *caecilia*, but is, nevertheless, a reality.



It was in 1818, just fifty years ago, that the attention of chemists was called to some samples of zinc that were sold for medicinal purposes; they gave, when in solution, a suspiciously yellow color with sulphureted hydrogen, and hence were condemned as containing arsenic. A number of chemists were furnished with specimens for examination, and several of them got on track of a new metal at the same time.

Frederick Stromeyer, who was born in Gettingen, in 1778, and was for many years professor of chemistry at the University in his native city, until his death in 1835, was the first to publish a full account of investigations into the properties of the new substance in September, 1818, and he gave to the metal the name of cadmium.

Karsten simultaneously proposed to call it melinium, from the quince-yellow color of one of its compounds; Gilbert gave it the name of junonium, from the planet Juno, and John christened it klaprothium, after a famous chemist; but all of these strange appellations have been eliminated from our nomenclature, and cadmium is the only one recognized in modern times.

The discovery of cadmium forms an era in the line of scientific research. It was the first metal found in a compound and not in an ore, and it could not have been detected until chemical analysis had reached an advanced state of accuracy. Traces of it were soon found in zinc ores, but it was not until after the lapse of twenty years from the time of Stromeyer's publication, that an ore of cadmium was discovered. Lord Greenock, at that time, described a mineral which had been picked up on his estate, and which proved to be a cadmium blende, analogous to zinc blende, or to galena. The new ore was called greenockite, and since that time it has been found in various localities; it is, however, a very rare mineral.

For commercial purposes, we obtain the metal from zinc ores and furnace deposits. By subjecting zinc to downward distillation, the first portions that come over often contain cadmium. The pure metal is obtained by dissolving the regulus in sulphuric acid, and converting it into a sulphide, by means of sulphureted hydrogen, then re-dissolving and re-precipitating, by carbonate of ammonia, and reducing with a proper flux. As thus obtained, it is a white, soft, malleable, ductile metal, eight and one half times heavier than water. It leaves a mark upon paper the same as lead, and when bent gives out a creaking sound, similar to that known as the "tin cry." It can be distilled the same as zinc, but unlike zinc, when it is set on fire and burns, it gives a brown oxide. It sometimes happens that zinc-white is contaminated by this brown powder and rendered worthless as a paint. Cadmium melts at about 440° Fah., and when alloyed with other metals, causes them to fuse at a lower temperature; a very little of it renders copper very brittle. Seventy-eight parts of cadmium, and twenty-two parts of mercury, was, for a long time, used for plugging teeth, but, as the amalgam oxidizes easily and turns yellow, and the mercury proves injurious to health, this application is pretty much abandoned. Mr. Abel has proposed an alloy for jewelers' use, which is said to be very malleable and ductile, and to possess a fine color. It is composed of 750 parts of gold, 166 parts of silver, and 84 parts of cadmium. We had occasion, when giving an account of the properties of bismuth, to speak of the very fusible alloys composed of bismuth, tin, lead, and cadmium; they melt at a point much lower than cadmium itself.

It is as a yellow paint that cadmium compounds are the most highly prized. By mixing a solution of gum arabic, chloride of cadmium and hyposulphite of soda together, we obtain a fine yellow paint, which is one of the most durable known to artists. There are other ways of making it, and the purity of color depends very much upon the absence of metals that turn black when mixed with sulphur, and the care with which it is dried. The very property that led to the condemnation of zinc-white, and which ultimately brought about its discovery, is the yellow color, now most frequently turned to valuable account.

The keeping properties of the colloid, made sensitive by the iodide and bromide of cadmium, have made these salts great favorites with photographers, and a new use for cadmium has sprung up of late years in this direction.

Manufacturers are getting more into the habit of saving the furnace and flue dust of zinc works, and of separating the cadmium from them, and in this way the supply of the metal is increasing. Salts of cadmium find application in medicine. The sulphate is applied to the eyes to remove specks from the cornea, the nitrate produces violent vomiting and purging, and, in general, when taken internally, the