forms or figures, and in such conditions used as a substitute for stone, for building, architectural or other ornamental purposes.

[See some accounts of this invention in another column.]

MACHINES FOR BORING CYLINDERS.—Marvin S. Otis, (assignee to Charles Rumley,) of Rochester, N. Y.: I claim the arrangement of the parts substantially, as described, so as to produce an alternating transverse motion of cylinder in combination with a rotating movement of the cutter, or vice versa, substantially as set forth.

MAKING NUTS.—Isaac H. Steer, of Winchester, Va. (assignee to Henry Carter of Pittsburgh, Pa.) Ante-Dated December 19 1854: I claim, first, making a nut at a single operation, from a heated bar or plate of metal, by cutting off the blank from the bar, punching a hole or eye through it, and swaging it into shape, substantially as set forth.

Second, punching the eye of the nut, in a die or press-box by which it is surrounded and firmly supported, and thus prevented from straining or bursting during the operation, substantially as set forth.

Third, shaping nuts by subjecting them while hot to powerful and sudden compression on the punch, and in the punching die substantially as set forth, whereby they are finished with such a degree of smoothness regularity and precision, that in the condition in which they come from the machine, they are fit to use in the construction of most kinds of machinery, and are at the same time sounder and stronger than unpressed nuts, made by machinery.

RE-ISSUE.

NUT AND WASHER MACHINE.—Henry Carter and James Rees, of Pittsburgh, Pa. Original Patent dated August 26, 1851: We are aware that Isaac H Steer about the Year 1840, proposed to make nuts by the process we have here described: but never completed a machine which would do this automatically, therefore we do not claim this process in itself and irrespective of machinery, but, being the first to construct a machine capable of making nuts by this process, without any other manipulation than is required for feeding in the bar iron.

We claim the machines substantially as described, for making nuts, by cutting the blank from a heated bar of iron, punching its eye in a closed die-box, pressing it into shape while in the die-box and on the punch, and then discharging it as specified.

[FOURTEEN of the patents in the above list were secured through this office.

(For the Scientific American.)

Variation of the Magnetic Needle.

A few days ago, I had the pleasure of a glance at one of the volumes of Bache's Report of the United States Coast Survey, and thought a few remarks might not be uninteresting to many of your readers. The following table will show the variation of the needle at several points:—

Cape Flattery, Washington Territory, variation	20½ East
Santa Barbara, Cal.	13½
San Luis Pass, Texas	9
Galveston,	8¾
Ship Island Shoal, La.	8
Pascagonla River. Miss.	7½
St. George's, Tuna, Florida	6¾
St, John's Harbor "	3¾
North Edisto River	3
Cape Roman Shoals, S. C.,	3
Cape Fear River, N. C.,	½
Pungoteague Creek, Va.,	2½ West
New York Bay	6
Nantucket,	9½
Alden's Rock, Portland, Me.	10½

From this it appears that there is 30¾ degrees difference in the variation, between the most western and eastern points of the U. S. The line of variation passes through the State of North Carolina. Can any one tell where it passes through the States north of that? I have heard it said that it passes near Pittsburg.

The magnetic pole, as marked on Mitchell's Atlas, is on the 70th parallel of north latitude; and on the 10th meridian of longitude, west from Washington. Is there more than one magnetic pole? Is the magnetic pole stationary or movable? Is the line of no variation straight or crooked—and where located? It is said that the variation of the needle changes from east to west, in a given number of years. Is this so—and if so, how accounted for?

An answer to the questions propounded above, would be very interesting to surveyors in general. The law of Pennsylvania, which has been in operation for the last three years, requires surveyors to adjust their compasses to an established meredian, to be established at or near the county seat of each county, and entered in a book, kept for that purpose, the variation of the needle from said meridian. At some future time, I will give you the result of the entries made for the last three years. Suffice it to say, at present, that the variation is on the increase westward. GEORGE P. DAVIS.

Kennett's Square, Pa., June 18, 1855.

Venus, one of the brightest of the planets, is now visible with the naked eye in the day time, and for two or three months to come it will be increasing in brilliancy, and may be seen every afternoon.

The waters of Lake Erie are continually rising. They are now three feet higher than they were four years ago.

European Inventions, Discoveries, &c.

NEW COMPOUND OF GOLD AND MERCURY.—When gold is treated with mercury in large excess, a definite compound is formed, which remains dissolved in the mercury, from which, however, it often separates in a crystalline form, and from which it may be almost entirely separated by mechanical means, such as pressure through chamois leather. This solid amalgam crystallizes in four-sided prisms, and contains six parts of gold to one of mercury, and fuses on elevating the temperature (Gmelin, vol. iii.) The mercury, however, which has passed through the chamois-leather, always contains gold, in proportion varying from a minute trace to 10 grs. in the pound. In the metallurgical processes for extracting gold, it becomes important to estimate the amount of gold remaining in the fluid part of the mercury, and it was during some experiments made with the view of ascertaining the best method of doing so that this new amalgam was discovered.

This substance is best obtained by dissolving gold in mercury in the proportion of 1 part of gold to 1000 of mercury, about 7 grs. to the pound avoirdupois, squeezing the solution through chamois-leather, and dissolving the mercury in dilute nitric acid with gentle heat. The compound is left in the form of four-sided prisms, of the most brilliant metallic luster, which may be boiled in nitric acid without decomposition, and exposed to the atmosphere for months without becoming tarnished. On exposure to heat they do not fuse, but afford a sublimate of metallic mercury, amounting in my experiments to rather less than 12 per cent.; the form of the crystals remained unaltered, their luster was little affected, and the residue consisted of pure gold. This would correspond to a compound of four atoms of gold to one of mercury:—

Au	197 × 4 =	788	or 88 74
Hg	100	100 "	11 26
Total		888	100.00

[By T. H. Henry, F. R. S., in the London *Mining Journal*.]

IMPROVED TUYERE FOR SMITH'S HEARTHS.—A paper was recently read before the Birmingham Institution of Mechanical Engineers (England,) on improvements in Tuyeres, by John Fernie, which clearly demonstrated the advantages of a large water space around the tuyere to prevent their burning out.—Mr. Fernie having observed the defects in the common water tuyeres, which in large fires were sometimes burnt out in a day, found that, from the smallness of the water space, steam was formed at the end, which drove the water back into the cistern, and it struck him, as an improvement, to make the space sufficiently large to allow a free circulation of the fluid, and thus prevent the formation of steam. The entire annular space round the nozzle of the blast pipe, instead of being supplied with water from a tube only, is placed in communication with a large body of fluid by opening direct into the water cistern, which insures in all cases a good supply of water, and as that portion nearest the fire gets hot, it circulates, and prevents the metal getting too high a temperature. The first one on this principle was put to work in 1846, and proved eminently successful; it was a single casting, with the inner pipe for the blast, carried straight through to the back of the water reservoir. A modification was suggested by a brother to the author of the paper, in which the tuyere was cast in two pieces—the one nearest the heat being fixed on by a conical joint with bolts and nuts, which can thus be removed when burnt out, and a new one supplied. In the Brittannia Carriage and Wagon Works, near Birmingham, 35 of these tuyeres are in use, most of which have been four or five months in wear, and have proved so satisfactory, that 35 more fires have been fitted with them. At the Brittannia Foundry, Derby, they had been in constant use, and not one had required renewal; there is no disadvantage of making them of cast-iron.

ELECTRICITY—CONDUCTION.—The following is the substance of a lecture, recently delivered by Prof. Faraday. before the Royal Society, on a disputed question of electrical conduction:—

"The point in dispute is, whether electricity can be transmitted through fluid bodies without decomposing them. In explaining and illustrating the subject, Prof. Faraday introduced a number of experiments, to show the relative powers of different substances of conducting frictional and voltaic electricity. The conduction of frictional electricity by wires, by the hand, and by a solid piece of niter, when applied to a charged electrometer, are supposed to be produced without any chemical action, and is called "conduction proper;" but when liquids are the media through which electricity is conducted, decomposition takes place, and many experiments seem to confirm the opinion, which by some electricians is considered an established law, the amount of decomposition has a definite relation to the quantity of electricity transmitted. Faraday's researches have established the fact, that when an electric current is passing through a fluid and decomposing it, the process of decomposition takes place instantaneously in each particle of the fluid that serves to conduct the electricity, and that a train of decompositions and recompositions is thus set in action. Whether any portion of electricity passes by "conduction proper" beyond that which thus decomposes the fluid, is the question that remains to be determined, and on which Prof. Faraday expressed himself still doubtful, though it might be gathered from his observations that his opinion leans towards the hypothesis of partial "conduction proper" through fluids. To give an idea of the vast quantities of electricity that are excited by chemical action, and the difficulty of estimating the amount transmitted, he kept a galvanometer deflected for a few moments by the excitement of electricity in a small pair of platinum and zinc plates applied to his tongue, and observed that in that short space of time a greater quantity of electricity had been called into action by those small plates than is contained in several thunder-storms. From this it might be inferred that a quantity of voltaic electricity, inappreciable by the instruments employed in ordinary experiments, might be conducted unobserved without decomposing action, which quantity, however, if it had been in the state of intensity of frictional electricity, would exhibit powerful effects.

Professor Faraday noticed the experiments of electricians on the Continent, which appeared to confirm the notion, that even frictional electricity cannot be conducted through water without decomposing it, and in opposition to that hypothesis, he exhibited others, which he said it is difficult to explain, except on the supposition that water conducts directly, in the same manner as solid conductors. Two wet muslin bags, blown out, to resemble in effect two large soap bubbles, were held in the electric field, between the electrical machine and a conductor connected with the earth, without being so near as to receive any charge. When removed together, and applied to the electrometer, there was no indication of electricity; but when one bag was separated from the other whilst under the influence of electrical induction, they then exhibited electrical conditions, one being negative and the other positive, in the same manner as two metallic balls would. The evaporation of spirits of wine without decomposition, by the heat of two immersed conducting plates from a voltaic battery, was also noticed, as evidence of "conduction proper" by a fluid. Prof. Faraday, in conclusion, expressed his ignorance of the nature of the mysterous power of electricity, and said, with respect to the special action of the force he had that evening noticed, his mind "is still in doubt."

Southern Copper Ore.

There are very rich mines of copper in Tennessee and Georgia. No less than 9,558,968 lbs. of it were carried over the Central Georgia Railroad last year, and exported from Savannah to England.

Report on Steam Boilers—Scales.

David Embree, Esq., Supervising Inspector, under the new steamboat law, for the district of St. Louis, has presented a report to the Secretary of the Treasury, on the subject of steam boilers. It embraces an account of experiments made for preventing the scale forming in steam boilers, and for testing the strength of iron of the exploded boiler of the steamers *Kate Kearney* and *Timour No.* 2.

The following are selections from the report, relating to the scales or incrustations in boilers, and next week, we will present the part of the report relating to the strength of steam boiler iron, which is very interesting and instructive:—

"By experience many years ago, I found that vegetable acids and vegetable alkalies would destroy and prevent such scales, when formed from the waters of the Ohio, they being principally composed of carbonate of lime; but from tests lately made, of the low water scales or coating, of the waters of the Missouri, they were found to contain from 46 to 48 per cent. of sulphate of lime; the appearance is different from those of the Ohio, and they adhere to iron like paint to wood. My first attempt was to ascertain what kind of acid would dissolve this deposit, and at the same time what effect such acid would have upon copper and iron. The following is the result:—

The Results of tests of Missouri lime scales, at the request of the Supervising Inspector.—A mixture of 1-2 oz. of muriatic acid, and 1 oz. of water, 1-2 oz. scales, 62 grs. copper, 32 grs. iron—dissolved one half of the scales, and had no effect on the copper or iron.

A mixture of 1 2 oz. sulphuric acid and 1 oz. of water, 1-4 oz. (1-4 oz, is equal to 112 grs.) scales, 90 grs. copper, 28 grs. iron—dissolved 10 grs. of scales, had no effect on the copper, dissolved 4 grs. of the iron.

A mixture of 1-2 oz. nitric acid and 1 oz. of water, 1-2 oz. scales, 90 grs. of copper, 32 grs. of iron—dissolved all of the scales, dissolved 8 grs. of copper and 9 grs. of iron.

A mixture of 1-2 oz. acetic acid and 1 oz. of water, 1-4 oz. of scales, 70 grs. copper, 30 grs. iron—dissolved 32 grs. of the scales, without any effect on the copper or iron.

J. J. T. COLMAN.

St. Louis, March 14, 1855.

The most promising of these was the muriatic acid; taking into consideration amongst other things, the cost of the article.

In these experiments the materials were cold. I afterwards repeated them with the muriatic acid, and found when cold one or two per cent. of the iron dissolved; but when gradually heated in a sand bath, to nearly the boiling point of water, the result was from 14 to 36 per cent. of iron dissolved, with but little effect on the scales of deposit.

I afterwards used muriatic acid, one part, and water, two parts, cold, on a flue of the steamer *Elvira*, and in short time dissolved the lime or coating; the rust or dark coating also came off, leaving the iron bright and apparently uninjured.

To the iron thus cleaned I applied "Sibbard's anti corrosive metalic compound."

On the first trip of the boat (having been out one week) there did not appear to be any deposit on this compound. On the second trip there appeared a thin skin of lime; afterwards it accumulated as fast as on any other part of the boiler; it however, separated from the iron by the use of a sharp instrument, more readily than it did in other places."

Coal of the Ohio Valley.

We learn by the *Railroad Record*, Cincinnati, that about 60,000,000 bushels of bituminous coal are raised and consumed in the Ohio Valley. The coal field of the Ohio Valley is the largest in the world; the coal surface amounting to 99,000 square miles. That of Great Britain only amounts to 12,000, and from it no less than 925,000,000 bushels are raised every year. It is the source of England's great wealth; without it her manufactures would be very insignificant. The Ohio Valley must be the great iron shop of the world some of these days.