in the effort to compete with foreign raisins is the cost of labor. The Spanish vineyardists can get all the laborers they need for from 15 to 25 cents per day, while the California producers must pay at least $1 per day. The very much greater productiveness of the soil, however, will do much to offset this disadvantage.

AMATEUR MECHANICS.

CENTERING AND STEADYING.

To center a cylindrical piece of metal readily and accurately is a very simple matter when the workman is provided with tools especially designed for the purpose, and it is not difficult when an engine lathe or even an engine rest is available; but to do it easily and properly in an ordinary plain foot lathe may puzzle some of the amateur mechanicians.

Although some of these methods are well known they will nevertheless be described for the benefit of some who may require the information.

The method of centering shown in Fig. 1 is one of the most common where the lathe is provided with an engine rest. A forked tool, A, is clamped in the tool post in such a position that a line drawn from the point of the tail center will bisect the angle of the fork. A square pointed center, G, is inserted in the tail spindle and moved against the end of the rod being centered with a slight pressure, the tool, A, being at the same time moved forward by the screw of the engine rest until the rod turns smoothly in the fork and the square pointed center has found the center of the rod; the tail spindle is then moved forward until the cavity is sufficiently deep to permit of starting the center drill. The angle of square center, G, for very hard material, should be a little more obtuse than that shown in Fig. 4. In any case, it should be of good material and well tempered.

In Fig 2 is shown a centering tool which is designed to take the place of the engine rest and fork in Fig. 1. The part B is fitted in place of the ordinary tool rest, and the jaw, C, which has in it a V-shaped notch, is hinged to the part B at D. A screw, E, passes through the upper end of the part B, and bears against the jaw, C. After what has already been said in connection with the engine rest, the manner of using this contrivance will be readily understood.

In Fig. 3 the hand tool, F, is employed for steadying the shaft and bringing it to a center. This tool is bent to form a right-angled notch for receiving the shaft, and when in use it is supported by the tool rest after the manner of an ordinary hand turning tool.

Work that is too large to be readily centered in this manner is often centered approximately by means of the universal square, as shown in Fig. 5. A diametrical line is drawn along the tongue of the square, the work is then turned through a quarter of a revolution, and another line is drawn. The intersection of these lines will be the center, at least approximately.

This point may now be marked with a center punch, and the work may be tested in a lathe. If it is found to revolve truly on the centers it may be drilled, otherwise the center must be corrected with the center punch, and the work again tested in the lathe.

After centering by any of these methods, the center must be drilled and countersunk with a suitable tool, so that it will fit the lathe center, as shown in Fig. 6. The angle of the lathe centers should be sixty degrees. To insure uniformity in everything pertaining to the centers, the center gauge, shown in Fig. 7, should be used for getting the required angle on the lathe centers and on the drills used in centering.

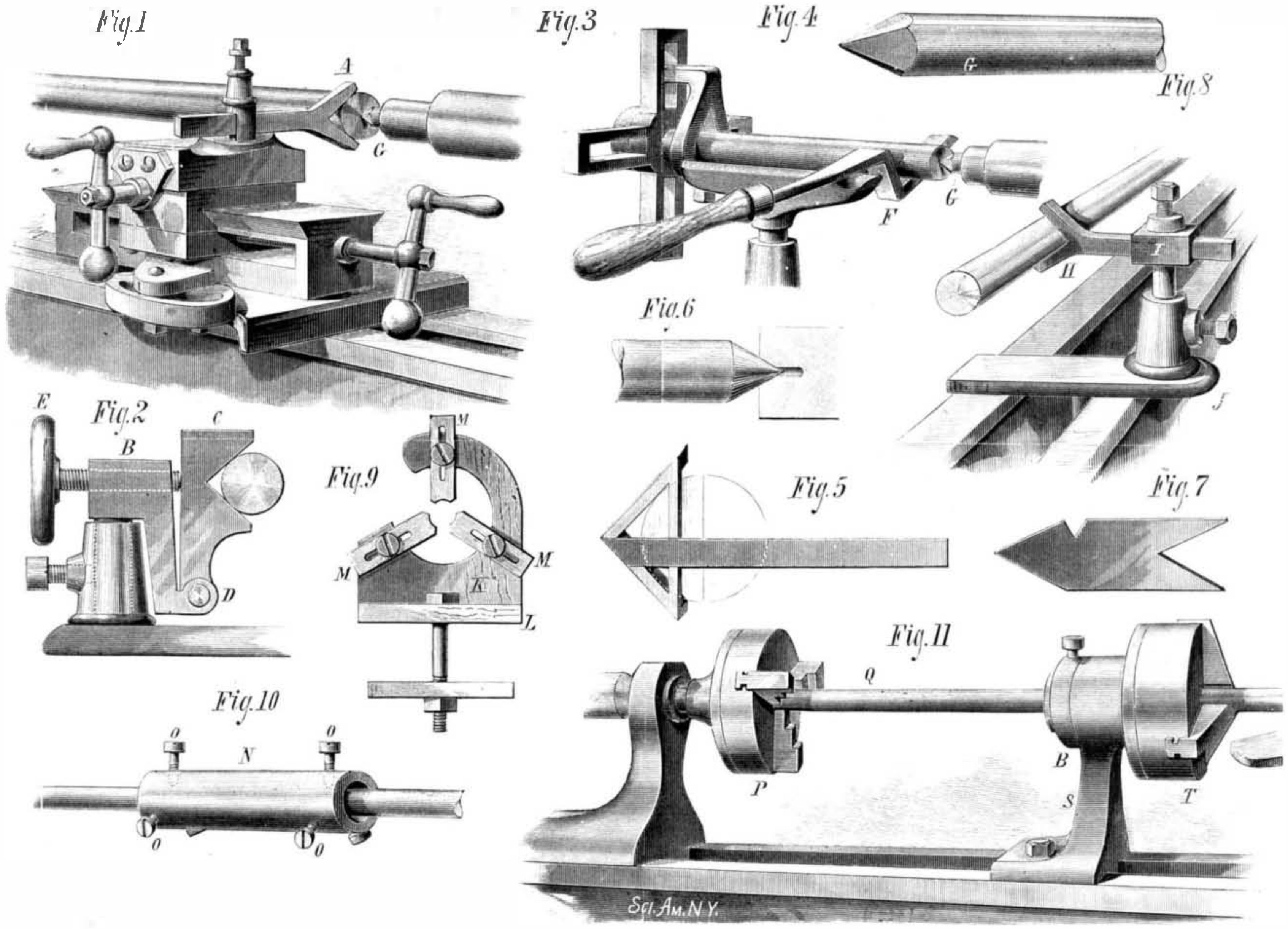
The matter of steadying long, slender rods while being turned in the lathe is often perplexing.

In some cases it may be done tolerably well in the manner illustrated in Fig. 8. The fork, H, is supported by the standard, I, which is inserted in the socket of the rest support, J. The device shown in Fig. 2, may be used in a similar way.

Fig. 9, represents a steady rest, the construction of which will hardly need explanation. For light work it may be made of wood; the upright being secured to the cross piece, L, which rests upon the lathe bed. The slotted pieces, M, are adjustable lengthwise to accommodate the size and position of the shaft. When it is required to support a bar which is not round, the sleeve, N, shown in Fig. 10, is employed. It slips over the shaft and revolves in the steady rest. The bar is centered by the screws, O.

The device shown in Fig. 11, is used where a hollow mandrel lathe is not at hand. A piece of gas pipe, Q, is held by the chuck, P, and is secured by a set screw in the sleeve, B, which is journaled in the standard, S, and carries the chuck, T.

This arrangement may also be employed for turning the ends of long rods where it is not desirable to put them regularly on the centers of the lathe. M.



CENTERING AND STEADYING TOOLS.

THE MANUFACTURE OF SEWING AND FLOSS SILK.

Twenty years ago the manufacture of silk goods in the United States was confined to so few firms and limited to such small amounts, that it was hardly to be classed among the industries of the country. Since about 1860 we have been brought into closer commercial relations with China and Japan, and other silk producing countries of the world, which has given silk manufacture a powerful impetus. American manufacturers discovered that their goods could rival those of European production in quality as well as price, and consumers found it to their advantage to patronize the home industry. Statistics could be given which would show the immense increase of American silk stuffs and the corresponding decrease of imported silks, but as the purpose of this article is to describe the process of manufacturing, they must be omitted.

The raw silk is imported in bales, each containing twenty bundles or "books." These weigh from five to eight pounds each, and are made up of a number of skeins. They are broken open and the skeins assorted according to the fineness of fiber; this is done entirely by touch and very rapidly. Ordinary grades of silk contain three sizes; the finer qualities only two. The fiber is exceedingly fine, translucent, of a white or yellow color, and very tough.

After the skeins are sorted they are soaked for three hours in a tank of soap and hot water, to remove the natural gum and the adulterating substances which are added to increase the weight. This adulteration is sometimes equal to one fourth of the entire weight. The silk is dried in a centrifugal drier without rinsing, as it is found that the presence of a small quantity of soap facilitates the handling of the material. It now goes to the reeling machine. Each of these contains thirty spools and reels. The skeins are placed upon the latter and rapidly spooled. Each machine has a single attendant who, after long practice, shows wonderful dexterity in untangling and tying the delicate fiber.

To a casual observer, raw silk appears to be regular and to possess a perfectly smooth surface; this is, however, not the case; it is uneven and contains many scales and projecting lumps, which must be removed before the silk can be twisted. This important process of cleaning consists simply in running the fiber through a pair of sharp and nicely adjusted semicircular knives. It is now ready to be combined to form the thread. Three or more fibers, the number varying with the size of thread desired, are reeled together on a spool, which, in another machine, is rapidly revolved as the silk is wound off; this process twists it loosely together. The operation of combining and twisting is repeated, and the thread is now made, though several processes are still necessary to finish it. The first of these is stretching, an operation which elongates and tightens the twist, at the same time squeezing out the soap, which had been left till this stage. The stretching machine consists of a pair of large wooden rolls placed over a tank of pure water. The silk is wet and reeled from one to the other.

It now undergoes the most delicate operation in the entire process of manufacture—that of dyeing. Those who delight in artistically combining the soft tints of floss silk into beautiful embroideries, little think of the wonderful skill and care which is necessary to produce those tints. Primary colors must be combined, the most delicate shades must be perfectly matched, and the faultless gradations of color, which blend so harmoniously in the same skein, must be most carefully chosen with reference to the general effect. The beautiful anilines are largely used, and the skeins of silk, hung upon long wooden rods, are suspended in the hot dye. A large amount of the liquid is next extracted in the centrifugal drier, and the remainder in the drying room. The dye contained in the thread makes it stiff and harsh, and to restore its natural softness and pliability it must be "wrung." A sturdy operative hangs the skein upon a strong projecting bar of lignum vitæ, inserts a similar bar and twists the thread, turning it until all parts have been subjected to the strain.

After picking out the loose bits it is wound on large spools, and is now ready for the spooling room. The spool, already labeled by a method which will be described hereafter, is placed on a spindle, the thread wound on a few turns, and it is then set in rapid revolution. As the silk runs on the spool it passes through a guide in the end of a sliding arm, which is moved regularly back and forth by a revolving screw; this screw has the same pitch as the tightly wound thread upon the spool, due allowance being made for the difference in speeds, and the silk is consequently run on with unfailing accuracy and smoothness. When filled the spool is stopped and the thread cut and fastened. The entire operation takes but a few seconds. The spools are now weighed separately, and also in lots of one dozen, in order to correct any inaccuracy in amount. All that remains is to place them in neat paper boxes, and they are ready for shipping.

The larger part of the spools used are labeled by stamping directly on their ends, in one or more colors. This, besides causing a large saving in expense over the paper label, insures the preservation of the label. The spools are fed between a pair of inked metal rolls with reversed dies upon them, which print the design a sixty-fourth of an inch below the surface. When two colors are used a second pair of rolls become necessary.

Galileo's Museum, Florence.

In the January number of the *Pharmacist and Chemist*, published by the Chicago College of Pharmacy, we find an interesting letter from H. D. Garrison, Florence, Italy, describing incidents in the life of Galileo, which we are sure will be read with interest by many, and by those especially who have visited Florence and Pisa, which are the central cities of the physical sciences of Europe, and have seen the trophies of Galileo so carefully preserved there, and which the writer describes in connection with incidents in the life of their author. The extracts we give cannot help but revive pleasant memories. It will be remembered that not only Galileo, but Leonardo da Vinci, the philosopher, artist, and statesman, the renowned Torricelli, Michael Angelo, the painter, sculptor, architect, civil and military engineer, and diplomatist, and the powerful Medici family, honored Florence by making it the arena of their most memorable exploits in scientific research. Truly, says the writer, this is classic ground. Having been the home of Galileo during the principal part of his eventful life, this city is possessed of surpassing interest to those scientifically inclined. This great philosopher was born in a very humble, not to say hard looking, two story stone house, situated on a little crooked street in the old city of Pisa, located about sixty-five miles west of here, near the mouth of the Arno.

When young Galileo attended church, instead of looking at the saints and crucifixes, or even at the pretty girls, he watched the swinging chandelier and reinvented the pendulum clock. No wonder he watched this chandelier, for it is a remarkable one, from the fact that the rope by which it is suspended is about one hundred feet long. I gave the chandelier a push, as any rather tall person may do, and during my stay in the cathedral it continued to vibrate without apparent retardation. He observed, what few will now admit without the demonstration, that the vibrations of a pendulum, whether large or small, are performed in equal times. While quite young, Galileo arrived at the conclusion that large and small bodies fall with equal velocity. To the learned men of Pisa, chiefly priests, this doctrine appeared extremely absurd. To test it, an experiment was performed by dropping bodies of different sizes from the famous leaning tower, 180 feet high. To the utter astonishment and discomfiture of Galileo's opponents, the bodies, large and small, projected simultaneously, kept close company until at the same instant all reached the earth. On account of these experiments Galileo was compelled to leave Pisa, and took refuge in the rival city, Florence.

At the latter city, called throughout Italy "Firenze," Galileo, quite unmolested, busied himself in the study of mathematics, physics, and chemistry until the year 1610, when, having heard that a Dutchman, Lippershey, had constructed a telescope, he, without having seen it, contrived and manufactured one for himself of such power that he was enabled to count forty stars in the constellation of Pleiades, where before but seven had been seen. The mountains of the moon were discerned, the phases of Venus recognized, and the satellites of Jupiter discovered in quick succession. Thus, in a few months, the doctrine of Copernicus, then regarded as heretical in the highest degree, was completely confirmed. But the Church, then unused to reverses, and unskilled in explaining away scientific contradictions, saw no way to meet the issue successfully but by physical force. The priests were directed to oppose the doctrine, and did so at once from every pulpit in Florence. The arguments used by them generally ran about as follows:

All things were made for man, and nothing was made in vain. But the satellites of Jupiter, not being visible, are useless, and therefore do not exist. Galileo was promptly arrested on the charge, then a fearful indictment, of heresy. In vain did the old philosopher explain and beg them to look for themselves. His adversaries, well illustrating the adage that "none are so blind as those who will not see," would listen to nothing but renunciation and denial of the alleged discoveries, presenting at the same time the alternative of indefinite imprisonment, probably ending in death.

Remembering the fate of the beautiful Athenian woman, Hypatia, who was torn into shreds by the monks under St. Cyril at Alexandria, for teaching the heretical philosophy of Plato and mathematics; and remembering also the fate of poor Bruno, who but a little while before had been driven from England, Germany, and Switzerland, in succession, and who, having taken refuge in Venice, was there kept in solitary confinement six years, then removed to Rome and kept two years longer in a dungeon, and finally slowly burnt to death, so slowly that he begged for more wood, or any means to end his suffering—and all this for having simply *argued* in favor of the probability of the Copernican doctrine, Galileo, concluded, very wisely, to appease the wrath of the Inquisition by the required denial. The Vatican Council supplemented this trial by formally denouncing the Copernican theory of the universe as "false, and utterly at variance with the Holy Scriptures."

Several years later, under the reign of a new pope, whom Galileo thought more liberal and generous, he ventured again to publish his discoveries and opinions, and was again promptly arrested and tried by the Inquisition for heresy. Again a public denial was required as a condition for mitigating his sentence, and again Galileo consented to make it. This time, besides his denial before the pope and Inquisition, he was required to publicly renounce the doctrine and deny his discoveries before his friends in the Santa Croce Cathedral of Florence.

Lest his friends should not all attend and profit by his recantation, they were compelled to be present. Then on bended knee, after kissing the Bible, he solemnly pronounced himself a liar and dupe, but on departing, as tradition has it, whispered to one of his friends, "nevertheless it (the earth) moves." Not content with this the Church felt bound to inflict mild, exemplary punishment, and hence detained him as a prisoner for life. Although his prison was his own house at Arcetri, a few miles out of Florence, still he was not permitted to leave it, even to attend church or to secure medical advice at Florence, nor was he even permitted to see his friends until after he became blind, when this permission was graciously accorded him.

At his death he was refused burial in consecrated ground, and his right to make a will was disputed. Now, in the same old cathedral which witnessed his public recantation, stands an elegant marble tomb, erected to his memory by his favorite pupil, Giovanni, and ever and anon the priests declaim, in glittering generalities, of the wonderful support their doctrines received from astronomy!

In the Natural History Museum, a beautiful room called the "Tribuna de Galileo," covered by a dome elegantly frescoed with scenes illustrative of his checkered life, is devoted to the exhibition of a magnificent statue of the old philosopher, his telescope and other philosophical instruments.

The telescope is astonishingly small and simple. It consists of an ash-gray colored tube, about four feet nine inches long, by two inches in diameter. The object glass, now cracked and shown separately, mounted in brass, is about 1¼ inches in diameter. The eye-glass, apparently a simple plano-convex lens, about three quarters inch diameter, is still *in situ*, apparently mounted in a wax like cement. The whole instrument being in a locked glass case, placed in a niche about ten feet above the floor, I was unable to make more accurate measurements. By the side of the telescope is shown another instrument of similar form and size, with which he at a later period discovered the spots on the sun. He also invented several other instruments, as a goniometer, dynamometer, and various mathematical instruments. He also invented the compound microscope, the original instrument made by him being still preserved in the old stone tower situated on a hill overlooking the city of Florence and valley of the Arno river, where he made his celebrated discoveries in astronomy. This instrument consists of a wooden tube about eight inches long, having small convex lenses about one quarter inch diameter, for both object and eye glasses. These were mounted in hard wax. The eye-glass was capable of slight adjustment, by being set in a wooden cap, which was screwed upon the wooden tube. The stage was simply a slip of glass, but it was illuminated by a little mirror placed below it, precisely as may be seen in our cheap microscopes. I wanted very much to peep through the microscope, and also through the telescope, but saw no possible means of doing so. The tower used by Galileo was apparently an old castle or watch tower used by the Florentines in their perpetual wars with adjoining provinces, during the two or three preceding centuries. Near the top of the tower is a square room which Galileo used as his studio and laboratory. It is said to appear now just as when used by the great master, from which I judge that he was not very fastidious.

PATENTS are now printed and prepared for issue so that they may be mailed on the day of issue, thereby bringing the patentee into possession of his patent some two weeks earlier than under the old rule. Owing to this change, there will be no patent lists bearing date Dec. 24 and Dec. 31, 1878; the list following that of December 17th is that of Jan. 7, 1879, which appears in the present number of this journal.

WE are indebted to Mr. Lewis J. Miller, Clerk of the Albany, N. Y., Fire Department, for a copy of the annual report.

Correspondence.

Isolation by Gutta Percha.

To the Editor of the Scientific American:

With reference to the artice "Isolation by Gutta Percha," in No. 25 (December 21, 1878), a few words may not be out of place, though they come from a different quarter.

The writer of the article mentioned breaks a lance for the late lamented Paymaster U.S.A., Mr. Simpson, and exhibits undoubtedly great zeal for his protégé, but the facts hereafter to be stated will probably set at rest the doubts in regard to the priority of the invention, as far as Mr. Simpson is concerned.

"Gutta percha was first imported," our informant says, "from the East Indies into England in 1845." According to all available sources, the best of which shall be immediately named, the first importation of that article was effected by the assistant surgeon, Dr. Montgommerie (or Montgomery, as some have it), from Singapore, in 1843. *Vide* Moigno, "Traité de Télégraphie Electrique," 2d ed., Paris, 1852, p. 294; Du Moncel, "Exposé," 3d ed., 2, 456; *Dingler's Journal*, 97, 237; "The Atlantic Telegraph," London, 1866, p. 108; Poggendorff, *Annalen*, 74, 157. The *Mechanics' Magazine*, 1847, 46, 474, gives the name of the first importer of gutta percha as Joze d'Almerida, but agrees about the year with the rest of the authorities enumerated above.

Our informant further says "that the first publication in England regarding the isolating qualities of gutta percha was made in March, 1848, by Professor Faraday."

Now there is but a slight mistake in this, but a mistake it certainly is. In citing dates one should be scrupulously exact. That first publication took place on the 9th of February, 1848, full one year and a half after the discovery of the isolating qualities of gutta percha was made by a Prussian officer, who since is ranked among the first telegraph engineers of the age. Werner Siemens, then lieutenant of Prussian artillery, had been trying since the fall of 1846 to isolate subterranean wires by gutta percha. In the spring of 1847 he had succeeded so far as to be able to lay before the Board of Commissioners, convened for the purpose of establishing telegraph lines in Prussia, the project of isolating subterranean wires by gutta percha. The Commissioners, well aware of the advantages which subterranean lines presented over those of any other kind, did not hesitate to have two such lines laid, both of which were executed by Siemens in the summer of 1847.

The correctness of this statement may be ascertained by the perusal of the *Philosophical Magazine*, 3d series, 32, 165; of the *Journal of the Society of Telegraph Engineers*, vol. 5, London, 1876, p. 82; and of the *Telegraphic Journal*, 4, 106.

It appears from all this that when Mr. Simpson, in his application to the Patent Office, November 22d, 1847, claimed the isolation of telegraph wires by gutta percha as his invention, he was rather behindhand, and Mr. Siemens had had considerably the start of him.

It may as well be added that Mr. Siemens, together with his partner and co-operator, Mr. Halske, constructed, as early as 1847, the first press by the means of which the telegraph wires were enveloped by the gutta percha, the envelope not showing any longitudinal seam.

It is indeed surprising that Mr. Simpson's name is nowhere mentioned as having had anything to do with the isolation of wires by gutta percha, as it is a well known fact, even on this side of the Atlantic, that Samuel T. Armstrong established at Brooklyn, in the year 1847, a manufactory "of gutta percha for the isolation of telegraph wires," and that the experiment made in 1848 to lay a wire isolated by gutta percha through the Hudson river met with such a signal success that Armstrong, elated by that event, proposed the laying of a gutta percha cable between Europe and America. (Shaffner's "Telegraph Manual," p. 254.)

Where was Mr. Simpson at that time, and why did not he step forth and assert his rights?

We, therefore, cannot accede to our informant's opinion, that Mr. Simpson's rights have been impaired through a misconception of the duties of the Patent Commissioner, but are led to believe that the Patent Commissioner concerned was rather cautious about issuing a patent, and judiciously refused what, to the best of his knowledge and belief, he could not grant.

Even the favorable report of Congress, in 1862, "on the originality and novelty of Mr. Simpson's invention," and the patent granted him rather late in 1867, "as the originator of the first practical method to lay a telegraph line through the ocean," are couched in rather cautious terms; and as for the decision of the Circuit Court of New York, we must await what the Supreme Court will have to say about the case.

F. HENNICKE.

Reproduction of Eels.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of January 4th you state that "the mystery which has hitherto attended the propagation of eels has at last been cleared up by the discovery of ripe ovaries by Professor Baird."

In the "Medical Repository," of 1806, of which I have a copy, I find the following, given by Dr. Mitchill: "On the 5th of September, 1806, being on a shooting and fishing party with some friends at Flatland, on Long Island, one of the inhabitants brought from the adjoining bay a basket of uncommonly large salt water eels. He soon began to skin and gut them in our presence; the eels abounded with fat. . . . I examined about a dozen of the eels as they were displayed