drawing and distributing of specific wires from the manhole as a center. Hand-holes, shown at bottom of Fig. 7, are used for distribution from a single cable only. The transit ducts included in the conduits, as described, are supplemented by external lines of pipe, laid above the creosoted plank work, directly in the earth, which are termed distributing ducts. These are to provide for local service, and at intervals they have hand-holes, which are hollow castings similar to the lower box in Fig. 7, giving access to the wires, to which castings pipes are connected leading into the separate buildings or to the different lamp posts. These last named pipes are termed service pipes.

For private house distribution, the house top or back yard system is adopted. For the first named as many leads of cable or wire as requisite are taken out of the manhole and carried up the front wall of a building to its roof and thence distributed where needed. The back yard system, shown in the cut, Fig. 8, involves the erection within the block of a single distributing pole. The cable is brought to it from the manhole, preferably by an underground and cellar route, and carried up to a distribution box shown in the same cut. Entering this box the cable is opened and its wires distributed and carried to the cross arms of the pole and thence to the houses requiring the service.

The kinds of current to be provided for resolve themselves into two—high and low tension. The low tension represents telephone and telegraph service; the high tension, the electric power and light leads. When it is necessary to have both kinds of current in the same street, two main conduits are laid, one for each type of service, and they are placed on opposite sides of the street. Furthermore, the rules of the Board of Electrical Control do not permit the use of wires in the same cable which differ in potential from each other more than 500 volts.

Other forms of subway are in use. The Dorset conduit,* made entirely of asphalt concrete without iron ducts, was one of the earliest forms laid. This presents the peculiarity of insulating the cable covering. The regular conduit grounds it, through all that lies within the ducts. The Johnstone subway, seen in Figs. 1 and 2, made of sectional iron castings for conduits and manholes, has also been used, and is approved of by the commissioners. It grounds the cable coverings. Wooden pipes have also been used in the concrete ducts instead of iron ones. On account of the recent gas explosions the manholes will probably be ventilated, so as to permit any accumulation of gas to escape into the air through a pipe reaching well above the street attached to an electric light pole.

These conduits have been laid by a construction company, as the Board of Electrical Control and their predecessors have had no authority to spend money for such purposes. The construction company, for its return on the investment and general expenses, relies on the revenue received for the use of these ducts. The rental has been based on the use of a single duct per annum and per mile. It will be clear that as each duct can carry six electric light wires, when each wire is in a separate lead-covered cable, and that when the wires are in a single cable eight wires can be contained in a 2½ inch duct, a fairly remunerative rental will not be extravagant. As regards telephone service connection, the cable introduced containing some fifty double wires arranged to provide for through metallic circuits, it follows that on a ground system 100 telephone wires can be provided for by a single duct. The entrance of the telephone cables from the subway ducts into the central station building in Cortlandt Street is shown in the SCIENTIFIC AMERICAN of March 30, 1889.

To give an idea of the extent of work, the figures from the report of the Board for the past year may be quoted:

* See SCIENTIFIC AMERICAN, October 9, 1886.

240,155 feet of trench have been excavated, giving 2,287,880 feet of single duct transit and distributing and central station connections. Allowing 80 wires to the duct, this gives a capacity for telephone and

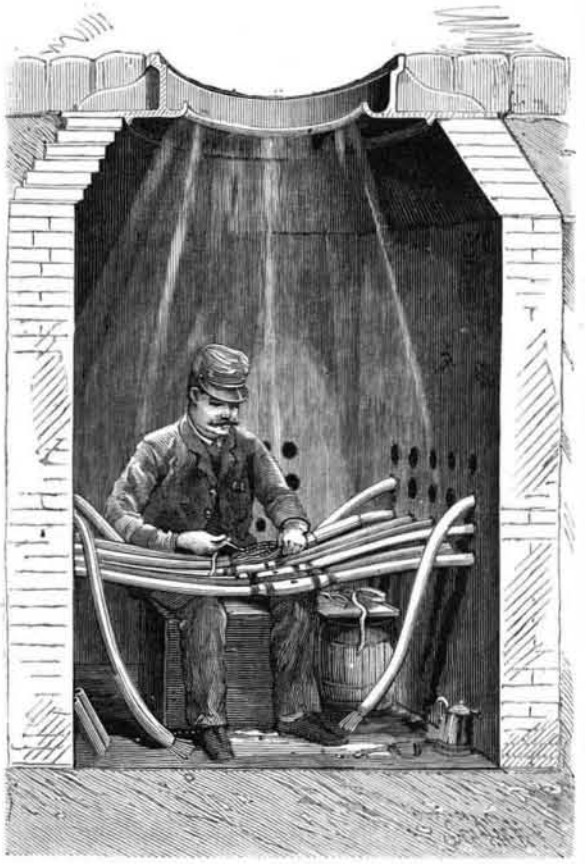
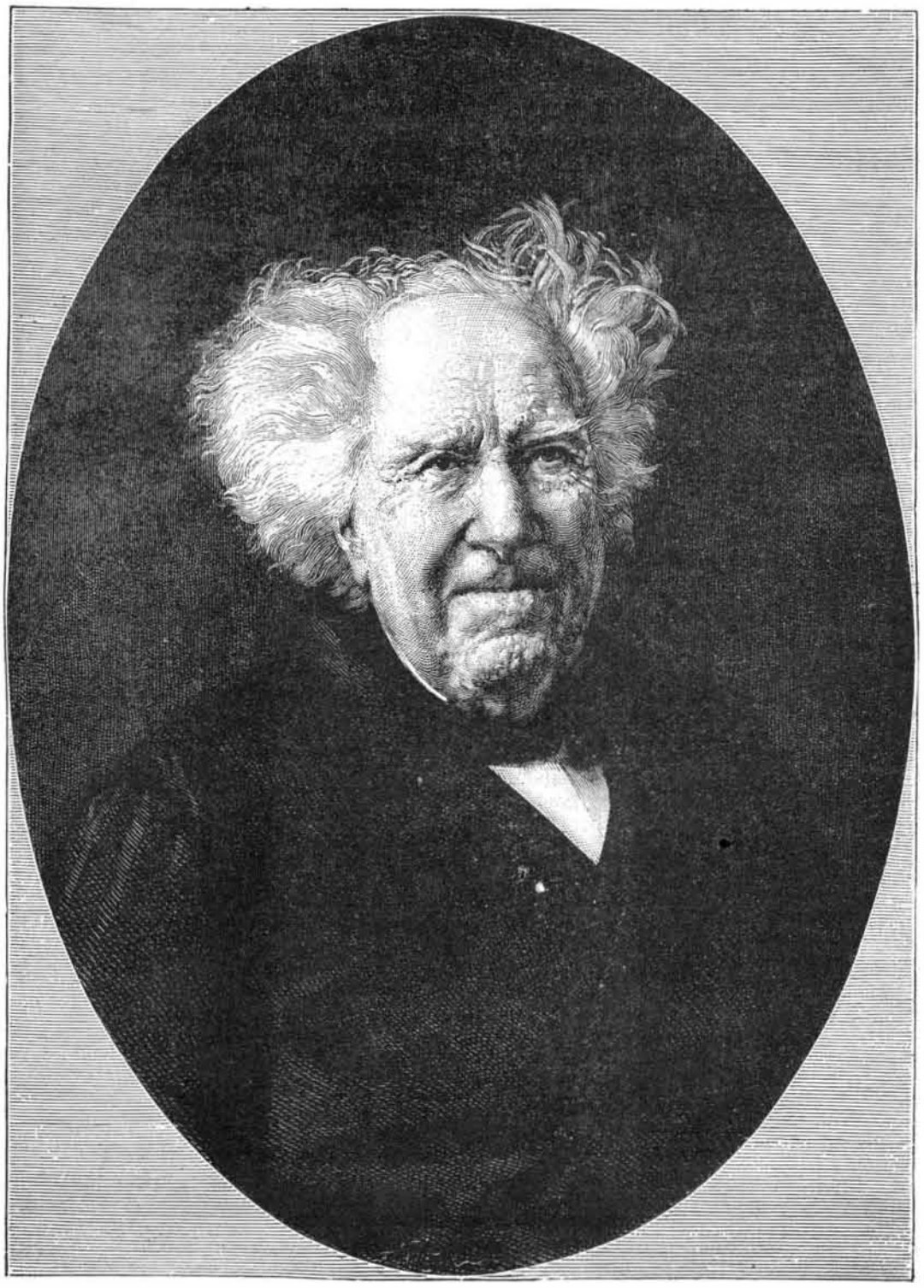


Fig. 9.—SPLICING WIRES AND CONNECTING CABLES.

telegraph service of nearly 35,000 miles of wire, long enough to go nearly one and a half times round the earth. For lighting and power service, 316,796 feet of single duct, with a capacity of 600 miles of wire, had been laid by the end of 1888. The Edison incandescent conduit is separate, and represented 338,376 feet, with over a million feet of conductors.



MICHEL EUGENE CHEVREUL.

MICHEL EUGENE CHEVREUL.

This distinguished French chemist died in Paris on Tuesday, April 9, at the great age of 102 years 7 months and 9 days. His strength had been failing for some months, but his friends had not been without hope that he would live till the 31st of August next, to celebrate the completion of his 103d year. His son, Henri Chevreul, died a few weeks ago, 70 years of age.

The date and place of M. Chevreul's birth are well authenticated. He was born at No. 11 Deux Haies Street, Angers, an old city of France, at 8 o'clock in the evening of August 31, 1786, the record bearing the attestation of many witnesses. The parents were both persons of some distinction, the father being a physician and a professor, and living to the age of 91 years. The mother died at 93 years of age. M. Chevreul's memory of his early life was also remarkable, and he used to relate having been the witness of the guillotining of two persons in 1793, when he was but seven years old.

M. Chevreul studied at a central school in Angers from the age of 12 to 17 years, thence going to Paris, where, in 1797, he was admitted to Vaquelin's laboratory, taking his place among several students who were afterward to win a high place as chemists. At the same time Chevreul was giving instruction in another college, and four years afterward became preparator at the Museum. At the age of 30 he was appointed director of the dyeworks and special professor of chemistry at the Gobelins. In 1814 he demonstrated that oils and fats were formed of a mixture of several peculiar principles, including margarine, oleine, and stearine, the latter furnishing stearic acid, and giving rise to the industry of making stearine candles. M. Chevreul's further labors upon fatty bodies and saponification aided also in creating other new industries, besides much enlarging the field of organic chemistry.

In 1842 M. Chevreul assumed charge of the dyeing operations at the Gobelins and Beauvais establishments belonging to the government, and his researches and valuable discoveries touching colors have been almost continuous from that time to this. He has shown that the harmonies of colors are submitted to immutable laws, which may be demonstrated by calculation. His laboratory was a vast room surrounded by show cases, in which were kept specimens of his work, and numerous parcels sent him by various industries, with closets containing various specimens of coloring matters, test tubes, graduates, glass rods, balances, etc. It is not too much to say that there was but little work of much importance, during the past half century, touching the dyeing industries, which his researches did not cover in the extraction, fixation, and observation of colors.

He was examiner for many years at the Polytechnic School, and had always been president of the National Agricultural Society. Up to 1855 he had been a member of the jury of every French exhibition. A member of the Legion of Honor, commander in 1844, grand officer in 1865, grand cross in 1875, he has had all the grades that any scientist could be covetous of. The foreign decorations that he received would cover his entire breast. But honors never elated the indefatigable worker, who was ever studying, and remained more than ever, at the age of over one hundred, the dean of the students of France and of the entire world. The life of the centenarian was passed between the Museum of Natural History, the Gobelins, and the Institute of France. He never failed to be present at the Monday sessions of the Academy. The number of memoirs that he presented to his colleagues is almost incredible. He was never desirous of being a politician, but during the Franco-Prussian war (1870–71), at the age of eighty-six, he willingly endured the pri-

vations of the siege, and did not leave the confines of Paris. He lived at the Museum while more than eighty Prussian bombs were shattering the glasses and breaking the cases.

Of his works several have been translated into English, German, and other languages. The best known are: "Lectures on Chemistry Applied to Dyeing" (2 vols., 1828–31); "On the Law of the Simultaneous Contrast of Colors and the Distribution of Colored Objects Considered in Relation to Painting" (1839), accompanied by a splendid atlas; "On Colors and Their Applications to the Industrial Arts by Means of Chromatic Circles" (1864); and a "History of Chemical Research," begun in 1856. He also wrote on sanitary subjects, on organic analysis (1824), on the optical effects of silken textures (1848), on the divining rod and table tipping (1854), on scientific method (1855), and on the prescription of drugs in medicine (1865). He wrote all the articles on chemistry in the "Dictionnaire des Sciences Naturelles," and edited with comments the "Photographic Researches" of Niepce de St. Victor (1855). It was at his suggestion the practice of charring the interior of water casks was adopted.

M. Chevreul is reported to have left a large fortune. He was tall of stature and well formed, having a vigorous and healthy constitution, which, under his methodical way of life, although he was always an energetic worker, preserved him for a vigorous and healthy activity throughout all his long years.

The Tiffany Exhibit of American Jewel Minerals.

Tiffany & Co., of this city, have prepared an exhibit of minerals to accompany their collection of jewel and art work to the Paris Exposition. It is designed to cover the field of American jewel minerals only, and the endeavor has been to keep it as compact as possible by only including remarkable and unique specimens. Among the specimens of native gold is some of John Marshall's "find" of 1849 at Souter's Mill, the first gold found in California. Native silver is shown in some very beautiful specimens, in one associated with native copper. The last is of special interest, it having been pronounced fraudulent by some English authorities, although really authentic. The first sapphire found in the United States, from Jenks mine, Franklin, Macon Co., N. C., and the first sapphire ever found in its matrix are included.

Beryls, blue, green, and colorless, are shown, including a cut specimen (aquamarine) of 133 karats, from Stoneham, Maine, and emerald crystals from 1 to 8¾ oz. weight. The latter are of greater value as crystals than could be anticipated from them if they were cut. Garnets are present in perfection. Ruby garnets from Fort Defiance, Arizona, and Navaho Reservation, New Mexico; the first samples of cut spessarite garnet, and the great 14 lb. crystal with all faces perfect—a slightly distorted or elongated dodecahedron—and a two inch garnet cup are typical of the character of this mineral as shown. Red, green, and colorless tourmalines from Maine localities are extremely beautiful, and are both cut and in natural crystals.

A number of very beautiful associated malachite and azurite specimens are shown, embodying Ruskin's idea of the green of the earth and the blue of the heavens. It would be hard to find in all mineralogy a more exquisite combination of colors.

Among the quartz minerals are a quantity of crystals, curious on account of their minute size and perfection, there being 7,500 to the ounce.

Crystals of amethysts, smoky and rose quartz and rock crystal, and quartz, jasper, and other arrowheads, some unique, are included. Some of the rose quartz is cut into cups, spheres, and other shapes, and a mass of rock crystal is considered one of the finest shown. An interesting exhibit is olivene from meteorites, two being cut into jewels (chrysolite), forming gems of true celestial origin. An Oregon opal is the first found in the United States. A superb block of amber is shown which is dichroitic or fluorescent, and a massive piece of jet is near it, both illustrating organic jewel material. Pearls from different sources are included; some from Indian mounds, others from the clam, common oyster, and other mollusks. Mottled and black obsidian and the first samples of pectolite and wollastonite ever cut are of interest. The exhibit, which is in part a loan collection, is in charge of Mr. Geo. F. Kunz, who is to accompany it to Paris. By the time this reaches our readers it will probably be on its way across the ocean.

Cure for Roaring.

It may interest owners of horses to know that the mare ridden by Colonel Edwards in the Old Berks Hunt Club race, and who finished second, was a very bad roarer (hence her name "Aroara"), but was operated upon by Mr. Jones, of Leicester, who inserted a tracheotomy tube. Considering the length of the course, a long four miles, the pace, the holding ground and big fences, her performance was a wonderful testimony to the efficiency of Mr. Jones' operation. The tube which is inserted in the trachea of the throat is certainly a wonderful thing. The time occupied in the race was nineteen minutes.—*Land and Water.*

THE REV. J. G. WOOD.

The Rev. John George Wood, who did more to popularize the study of natural history than any writer of the present age, was the son of a surgeon who was at one time chemical lecturer at the Middlesex Hospital. He was born in London in 1827, and was educated at Ashbourne grammar school and at Merton College, Oxford. After being attached for two years to the Anatomical Museum at Christ Church, Oxford, he was ordained in 1852 as chaplain to the Boatmen's Floating Chapel. This post he held for four years, and in 1856 he was appointed assistant chaplain to St. Bartholomew's Hospital. This post he resigned in 1862, and from 1868 to 1876 he held the post of Precentor of the Canterbury Diocesan Church Union. Want of space forbids us to mention more than a few of Mr. Wood's numerous works on natural history. Among them are "Common Objects of the Seashore," "Homes without Hands," "The Natural History of Man," "Our Garden Friends and Foes," and his larger "Natural History," in three volumes, enriched by excellent illustrations from animal painters of the highest rank. He also for some time edited the *Boy's Own Magazine.* In 1879 he projected a series of "Sketch Lectures" on zoology, illustrating them himself by drawings in colored pastels on a large canvas. These lectures have been delivered in all the principal institutes of England and Scotland. His last lecture—on ants—was given in London only a few days before his death, which took place on March 3, at Coventry, from an attack of peritonitis. Sad to say, despite his energy and

THE REV. J. G. WOOD, NATURALIST.
Born 1827. Died March 3, 1889.

industry, Mr. Wood was unable to make any provision for his family, and he has left a widow in very ill health, with six children, absolutely destitute. Donations on their behalf will be received by the Rev. Alfred Whitehead, Vicar of St. Peter's, Kent, and Rural Dean of Westbere.—*The Graphic.*

Curious Facts as to Wheels.

The product of the cycle manufacturers for 1889 exhibits little departure in types of bicycles, tricycles, and safeties, but a number of quite noticeable improvements in details, in the direction of strength and lightness, simplicity, and ease of use. As usual, the old New England makers have the lead in the finer machines.

The cycling industry is still comparatively young on both sides of the metropolis. It began at Hartford about eleven years ago, and took root in other places two or three years later. From the first the New England bicycles were built for men's use, first class mechanically and first class in price.

Whether it is impossible or inconsistent to make both high and low grades of bicycles in the same factory, or whether there is some other local or trade reason for it, the fact is the costlier and finer grades never appear from the same factory with the cheaper and inferior grades.

It may be worth observing, in connection with the fact that the high grade bicycles continue to be made by the two or three leading makers of the East, that there is a difference in the average grades of workmen, often quite apparent. Talent and skill are not only cumulative in the same factory by years of practice, but also go somewhat from generation to generation. Skill, ingenuity, and steady industry, which contribute so much to the productive power represented on any pay roll, are found at a higher average in our older manufacturing centers. Articles and machinery of accuracy or delicacy, or complexity or difficulty of construction, like bicycles, guns, and watches, require in their production just this sort of superskilled labor and steadiness of force, especially in the finer grades. Manufacturers of experience take this into account in locating.

The difference in grade and construction of machines made has no necessary relation to the character of machines that are used in the different sections. The sale of fine grades in all sections is very large and increasing. While the East may not lose its excellence or prestige in cycle making, it is quite likely that the West will gain, until its marks may be as good as a Boston, Hartford, or Chicopee Falls mark. It took Birmingham some time to equal Sheffield, and then some time longer to overcome the "Brumagem" reputation; but it got there, and, as every one knows, is now a center for really fine manufactures.

Of course not all that is made in the East in this line is best, since wherever a successful business is founded imitators spring up; but generally speaking in design of machines, in material used, in workmanship and finish, in substantial improvements over last year's productions, in all that goes to make up the best bicycle, tricycle, or safety, the old New England makers still hold the lead.

The Tobin Bronze.

The Tobin bronze is a metal recently placed on the market by the Ansonia Brass and Copper Company, of 19 and 21 Cliff Street, New York. It possesses many remarkable characteristics. Among its leading qualities are great torsional and tensile strength, with corresponding high elastic limits, as will be observed in the recorded tests by N. O. Olson, Esq., engineer of the department of tests for Fairbanks & Co.

Source		Ansonia Brass and Copper Company.		
Material		Hot rolled Tobin bronze.		
Mark		1	2	3
Test No.		6,491	6,492	6,493
Shape, original, 1 in. round bars.				
Dimensions, Final. Original.	Length, inches	8 in.	8 in.	8 in.
	Diameter, inches	0·645	0·641	0·645
	Area, square inches	0·327	0·323	0·327
	Length, inches	9·36	9·30	9·12
	Diameter, inches	0·518	0·500	0·509
	Area, square inches	0·211	0·198	0·204
	Per cent elongation	17·00	16·25	14·00
	" reduction	35·47	38·70	37·61
Stress in lb. Tension. On Speci.	Elastic limit	17,000	18,000	18,000
	Maximum	26,060	25,720	25,850
Per sq. in.	Elastic limit	51,990	55,730	55,050
	Maximum	79,700	79,630	78,900
	Fracture	Very good.		

Mr. Olson says it is far superior in point of strength to any bronze or metal of that kind he has ever tested.

Chief Engineer Hine, U. S. Navy, after making tests, found the metal to withstand the action of certain acids with a loss that was infinitesimal. It can be forged into bolts with great facility, and is used in large quantities for this purpose in several of the naval steamers now in course of construction for the navy, and for various other purposes, such as dye house and sugar machinery. It has been used successfully for cylinder linings and pump rods by some of the leading pump makers of the country. Owing to its non-corrosibility and high torsional elastic limit, which is equal to that of the toughest grade of machinery steel made in this country, it is being generally used for steam launch and yacht propeller shafting. Another important feature is that it can be drop-forged in the same manner as steel, making it essentially valuable where strong and intricate bronze pieces are required that cannot be obtained by casting. It has been carefully tested, and found to withstand the action of sea water in such a manner as to commend it to favorable notice for sheathing ships and spiles. The ingot metal is adapted for railroad car journal boxes and bearings of all kinds, for land and marine machinery, and, in point of endurance and anti-frictional properties, has given results equal to the best in use.

The company's pamphlet, just issued, contains testimonials from many of the leading firms of the country.

Hanging Doors and Blinds.

In hanging a number of doors which are of the same size, the time expended upon measuring the correct position of the hinges may be, according to the *California Architect and Builders' News,* saved in a very simple manner, which is as follows: Take a lath and mark upon the top and bottom the exact position where the hinges should come. drive in at these marks sharp-pointed brads, and you have a gauge which may be used in hanging all doors of the samesize. In using it, all that is necessary is to place it against the edge of the door with the top of the lath on the level with the top of the door, give it a sharp tap of the hand, when the brads will mark the exact position of the hinges. The same gauge lath may be used in marking out the position of the hinges of the stile of the door frame, excepting that a nail should be driven in the bottom of it, so that there may be sufficient room left at the bottom to allow proper play of the door. The use of a gauge lath in the case referred to is an example of its use. It is of equal utility in hanging many other pieces, such, for instance, as inside and outside blinds, shutters, etc.

MR. I. P. ALLIS, the head of the Reliance Iron Work at Milwaukee, one of the largest foundries and machine shops in the country, died very suddenly April 1. He was a man of cultivated tastes, a liberal patron of the arts, and had amassed a large fortune.