Francisco as near as Cleveland, compared with the best wires now in use.

The company is now finishing the line from Cleveland to Chicago, and in a few days we shall probably be able to chronicle the wonderful fact that telephonic communication between New York and Chicago—distance about 1,000 miles—is established.

This remarkable conductor is made by Wallace & Sons, of Ansonia, Conn. The process of manufacture is peculiar. The steel wire, arranged in the form of spirals, is slowly screwed forward through the electro-plating batteries, by which the copper, to the above thickness, is deposited on the wire. We understand that no less than twenty large electrical dynamo-machines are employed to effect the deposition of the metal.

We believe that Professor Moses G. Farmer was the original inventor of the compound steel and copper wire. This was in 1869. Its introduction has been retarded for lack of proper means for its successful manufacture. The copper was originally proposed to be wound around the steel in the form of a ribbon; afterwards the attempt was made to draw the copper upon the steel by rolling; but neither of these methods proved satisfactory. The plan adopted by Messrs. Wallace has been crowned with success, enabling them to cover the wire with copper to any desired thickness, while it is so tenacious that the wire may be tied into a close knot without disturbing the copper.

EARLY STEAM ENGINES AND BOILERS.

In a recent paper read by Mr. John Whitelaw before the Civil Engineers' Club, of Cleveland, O., he gave some interesting information about the performances of steam engines as made about a hundred years ago.

In this country the duty of a pumping engine is estimated by the number of pounds of water raised one foot high on a consumption of one hundred pounds of coal. Thus the record of the pumping engines at Lynn, Mass., is stated to be in round numbers 104,000,000 pounds of water raised one foot high for each 100 pounds of coal burned.

These results show remarkable gains over the old-time engines. In 1770 Jonathan Hornblower and John Nancarrow were the most noted builders of pumping engines. The best average duty which they were able to get from 100 pounds of coal was, in round numbers, 6,000,000 foot pounds; so the Lynn engine does more than sixteen times as much work for the same fuel as the old style of machines. These were vacuum engines. Steam was only used to make a vacuum, and thus generating power. James Watt's improvements followed, and in 1793 he had so far improved the steam engine that his best machine made an average duty of 27,000,000 foot pounds per 100 pounds of coal. The Lynn engine does about four times better than that. Watt at this time pronounced his engine perfect, and said that no further improvement could be expected.

In 1814 Arthur Woolf made engines that showed a duty of thirty-four millions of foot pounds; and in one example a duty of seventy millions was reported.

In 1828 Capt. Grose made improvements on his engine, and the duty was found to be a little over eighty-seven millions.

In 1834 William West produced an engine that yielded a duty of close on to ninety-nine millions of pounds.

In 1840 Hocking and Loam extended the expansion principle, and in 1842 one of their engines showed a duty of one hundred and seven millions of pounds—a result that is hard to beat at the present time.

The boiler engineering and firing of the old time was very peculiar. Instead of increasing the number of boilers when more steam was required, they used to have one boiler of gigantic dimensions, with correspondingly enlarged fireplace. They also placed the fire bars eight or ten feet below the bottom of the boiler, and then filled up the space with coal. They thought the more coal they burned the more steam they would get. A boiler at Dalcoath mine was 24 feet in diameter and 24 feet high. The furnace was 7 feet below the bottom of the boiler, was 9 feet wide, and extended from one side of the boiler to the other. Trevithick said the fire in this boiler was 7 feet thick, and had in it 30 tons of burning coal.

Engineers have learned a thing or two about steam and boilers during the past hundred years; but there is doubtless a vast amount of knowledge on the subject yet to be acquired.

THE LEFFEL TURBINE.

We lately had the pleasure of inspecting a magnificent specimen of this motor, recently constructed by James Leffel & Company, of Springfield, Ohio, to order of the Smithsonian Institution, Washington, D. C. The wheel in question is very strong, having been built for a high head of water; its mechanical execution is perfect, and its finish resplendent. All the parts are highly polished, and heavily plated with gold and silver. This wheel is intended for the permanent museum of the institution, and was selected as the representative of standard excellence among American made water wheels—a fact which is of course highly gratifying to the manufacturers, as well as thousands of manufacturers who use this effective and reliable machine. The Leffel is a double action wheel, being in fact two wheels combined on one shaft; is fitted with adjustable gates, and contains the latest improvements.

SANITARY PRECAUTIONS AFTER FLOODS.

The following instructions emanate from the *Comité Consultatif d'Hygiène Publique*, dated June 12, 1856, and from the *Conseil d'Hygiène Publique, etc., de Salubrité du Departement de la Seine*, dated January 5, 1883, both of France. They are of peculiar interest to us at the present time on account of the Western floods.

Sanitation of Houses.—Habitations which have been invaded by the waters should receive special care, so that those whom the flood has expelled should not occupy them before they have been made sufficiently healthy for habitation.

They should first be cleaned out as quickly and thoroughly as possible, and freed from all dirt and *débris* deposited in their different parts by the water.

Continuous aeration and the most active ventilation are the best and most energetic agents of sanitation for houses.

To increase these as much as possible, where it can be done, a large fire should be maintained on the hearth, and the doors and windows opened, so that the light and heat of the sun may contribute their part to purifying the air.

At the same time care must be taken to dig a ditch 10 to 15 inches deep around each house, whose interior is in many cases below the level of the ground, which proceeding realizes one of the simplest and most active sewage systems.

It will also be well, after having torn down all plastering, which will be in a bad condition, to scrape to their bottom all joints in the walls, and to replaster them in the parts of the house most injured, and where bad deposits have principally accumulated. The floors, where such exist, should be carefully attended to, and the soil under them covered with a disinfecting substance, such as pounded charcoal, or sand, or else with an impermeable material, such as flagging, paving blocks, cement, etc. Where the house is several stories high, the top stories should be the first occupied.

Great precautions should also be followed in the treatment of certain articles of furniture, such as beds and mattresses, which must be renovated or replaced, and which should never on any account be used until thoroughly dried.

Sanitary treatment, such as adopted for houses, should be applied with no less vigilance to stables and barns to prevent epizootics, whose deplorable consequences there is no need to allude to here.

One peculiar feature it is important to note, though it can only be accidentally produced: it is the possible alteration of the water of wells and springs of potable water, in whose neighborhood matter in a state of decomposition may have been deposited, or piles of excrementitious and organic *débris*, or which sources of water supply may have been contaminated by the contents of privy vaults. Attention should be directed to this danger.

To disinfect cellars into which, by agency of the inundations, the contents of privy vaults may have penetrated, commercial sulphate of zinc may be used, either by sprinkling it in powder in the cellar, or by watering the ground when the water has gone down with a concentrated solution of this salt.

For the same purpose the solution of chloride of zinc, a disinfectant known as "St. Luke's Water," may be employed. It is in daily use in the civil hospitals.

The concentrated solution of sulphate of iron does well, but the disinfection is not so complete as with salts of zinc; it is, however, cheaper.

The last consideration is of little importance, because two kilogrammes (nearly five pounds) of zinc salt, costing less than one franc, are enough. T. S.

Rarefied Air as a Conductor of Electricity.

Edlund continues his researches upon this subject. A number of experiments are described to show that the phenomena of the opposition to the passage of sparks from terminal to terminal in rarefied air cannot be explained by the theory that a vacuum does not conduct electricity. He carefully discusses the question of the contrary electro motive force which is developed at the terminals. "It is not the resistance of the gas but this electro-motive force, increasing with the rarefaction and connected with the electrodes, that presents an obstacle to the passage of the current. Everything is in favor of the hypothesis that vacuum opposes a very feeble resistance to the propagation of electricity." Without the employment of electrodes, one can excite an induction current in a Geissler tube, which is sufficient to produce light. This would be impossible if the highly rarefied gas or vacuum were an insulator.—*Phil. Mag.*

Simple Cure for Cold Feet.

The following remedy for cold feet is recommended by the *Fireman's Journal* for sedentary sufferers, as well as policemen, car drivers, and others who are exposed to the cold: All that is necessary is to stand erect and very gradually to lift one's self up upon the tips of the toes, so as to put all the tendons of the foot at full strain. This is not to hop or jump up and down, but simply to rise—the slower the better—upon tiptoe, and to remain standing on the point of the toes as long as possible, then gradually coming to the natural position. Repeat this several times, and, by the amount of work the tips of the toes are made to do in sustaining the body's weight, a sufficient and lively circulation is set up. A heavy pair of woolen stockings drawn over thin cotton ones is also a recommendation for keeping the feet warm, and at the same time preventing their becoming tender and sore.

Solid and Hollow Iron Columns.

A confusion of ideas is sometimes found among practical men respecting the comparative strength of solid and hollow pillars. One hears it often said, for instance, says the *Building News*, that a hollow pillar is stronger than a solid one. Now this is, as one able authority has pointed out, not absolutely the case; it is perfectly true, that, comparing the strengths of two pillars of the same height and diameter, one solid and the other hollow, the latter has the advantage of being economically stronger. The fact is, the solid column is stronger than the hollow of the same external diameter; but the lesser area is more effective than the greater, because the central portions of the solid pillar are less useful in resisting the bending force than the metal in the circumference of the hollow pillar. But if the quantity of material in both the solid and hollow pillar of equal height is the same, the hollow pillar is by far the stronger. A simple geometrical construction will enable any one to understand this fact, by enabling us to proportion a hollow column of the same area as that of a solid one, by one of the diameters being given.

It is shown, in fact, that hollow columns of the same area of metal as a solid one may be made to any larger diameter, their strengths increasing proportionately till a limit is reached by the shell of the metal becoming too thin to insure a sound casting. Taking an example from Downing's work, a hollow pillar 9 inches in external diameter, having an internal diameter of 8·062 inches, and a thickness of metal of 0·47 inch, or about ½ inch, is 5½ times stronger than a solid pillar with the same quantity of metal. A thickness of ½ inch may be regarded as a practical limit in manufacture.

The Material for Good Superintendents.

The *Northwestern Lumberman* mentions a conversation had with a gentleman largely interested in the lumber trade at the West, when he said that there are grand chances for young men, of the right stamp, to find employment in the lumber business. The gentleman further remarked that it was almost impossible for him to find the right kind of men to superintend the different branches of his business. They must have a quick and sound judgment, and know the business from the stump up. He advertised for men, and out of seventy applicants there were but two that he dared to give a trial. There are plenty of men who are willing to step in as managers, but they want to begin at the top. If anything goes wrong under them, they are ignorant as to the way to correct it. The boys who began work moneyless and friendless have succeeded best. They began at the bottom round of the ladder, did not know more than their superiors, were willing to work and learn, were temperate, and now some of them are filling positions of trust and profit, while others are doing a good business for themselves.

It is not in the lumber trade alone where the boy commencing on the bottom round of the ladder has made his way upward and been crowned with success. But it is a fact, patent to all observers, that the successful men in all branches of business are generally those that commenced on the bottom round, and by their own unaided exertions worked their way upward, some to the top of the ladder, others to various heights; but most all who possess those qualifications our contemporary suggests as requisite for a manager in the lumber business to have, are sure of a fair degree of success at almost any business they may undertake.

Bleaching by Electricity.

Dr. Dobbie and Mr. J. Hutcheson, of Glasgow, in the course of certain experiments on the action of electric currents upon a solution of common salt, found that there is a formation of hypochlorite of soda—*i. e.*, bleaching soda. If the solution is neutral, there is an escape of chlorine during the action of the electric current, while a certain quantity of hypochlorite remains in the liquid. If the solution is kept alkaline, all the salt is converted into hypochlorite. If it is made acid, all the chlorine escapes, and no hypochlorite remains in the solution. Experiments on the subject are now in progress in a Scottish bleach works on a large scale. The yarn or cloth to be bleached is saturated with brine, and passed between two rollers, each of which is in connection with one of the poles of a galvanic battery. The current passes through the moist goods and produces hypochlorite of soda (bleaching soda), or free chlorine, according as the solution of salt was alkaline or acid.

In the former case the goods must be taken through sours to complete the bleaching; in the latter case this is not necessary. Discharge styles upon cotton goods can be produced with rollers, which are partly covered with non-conducting materials. The current then passes only through the parts left uncovered. An advantage of the new process for bleaching is that in many cases it will supersede the previous bowking and washing, as the electric current has a decomposing action upon the resinous impurities.

A Medal of Honor.

The Pratt & Whitney Company Hartford, Conn., have just been awarded by the city of Philadelphia, on recommendation of the Franklin Institute, the John Scott Legacy Medal: "To the most deserving." The engraved award on the medal reads: "To the Pratt & Whitney Co., Hartford, Conn., for their standard gauges, taps, and dies; on the recommendation of the Franklin Institute." The medal is of bronze, four inches diameter, and is a fine specimen of the die-maker's art.