SIMPLE LAMP SOCKET AND RHEOSTAT.

BY GEO. M. HOPKINS.

In the annexed engravings, Fig. 1 represents a simple and efficient electric lamp socket, designed for use in experimental work and in places where an ornamental socket is not required. It consists simply of a small wooden cylinder in which is inserted the end of a brass wire, the projecting portion of which is bent to form a helical coil which fits the thread of the base of an Edison incandescent lamp. In the wooden cylinder is inserted another brass wire of the same size, which is annealed, flattened, and bent over the end of the block as shown, to form the second connection of the lamp.

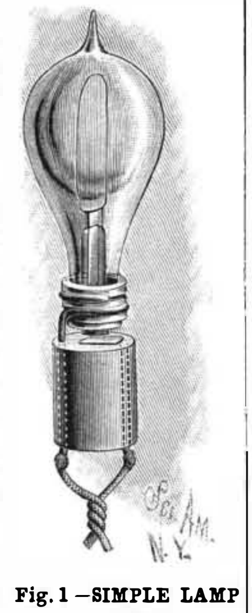


Fig. 1.—SIMPLE LAMP SOCKET.

To the ends of the wires projecting below the wooden cylinder are soldered the ends of the flexible cord which conveys the current to the lamp. By screwing the lamp down in the socket, the button at the bottom is brought into contact with the flattened wire and the circuit is completed. By unscrewing the lamp, the circuit is broken.

A convenient rheostat for experimental purposes is shown in Fig. 2. A number of coiled wire sockets are attached to a board and connected with a wire leading to one of the binding posts at the end of the board. A corresponding number of flat copper strips are secured to the board and soldered to a wire leading to the other binding post. Any one or all of the lamps may be screwed down in their sockets so as to throw them into the circuit. Lamps of any resistance may be used, so that the rheostat can be adapted to the current to be controlled.

With one lamp in the circuit, the resistance thrown in will of course be that of the lamp; with two lamps of the same resistance, half that amount; with three lamps, one-third, and so on, *i. e.*, each lamp thrown in in parallel will increase the conductivity and diminish the resistance of the rheostat.

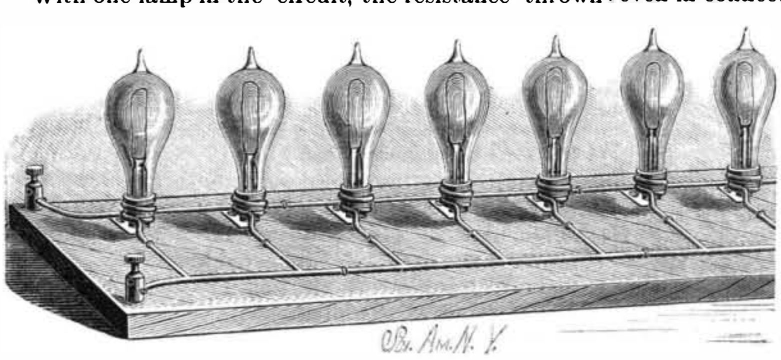


Fig. 2.—RHEOSTAT FORMED OF LAMPS.

It is not essential that all of the lamps should be of the same resistance. When lamps of different resistances are used, their joint conductivity is ascertained by adding the reciprocals of their resistances together. The reciprocal of this equals the joint resistance in ohms. For example take three lamps or combinations of lamps having resistances of 50, 150, and 200 ohms respectively. The reciprocals of these numbers are 1-50, 1-150, and 1-200, the sum of which is 19-600. The reciprocal of this is 600-19; joint resistance of the three lamps in parallel will therefore be 31.6 ohms. Where resistance greater than that of one lamp is required, two or more lamps may be connected in series.

Boiler Plates.

The methods employed by Messrs. Cramp in the building of large modern boilers, with thick plates for high pressures, are thus described:

The plates are, in the first place, pickled in a wooden bath containing a 5 per cent solution of sulphuric or hydrochloric acid. After remaining in the bath for about six hours, they are removed and thoroughly scrubbed with hickory brooms, while a strong stream of fresh water is played upon them. They are then immersed in a bath of lime water to neutralize any remaining acid, and again washed with clean water. All holes are drilled, and the edges of the plates are planed and beveled for calking. The shell plating is bent cold to the proper curvature in the rolls. The flanging is done by a Tweddle hydraulic flanger, the plate being heated to a bright cherry-red. A length of about 8 ft. can be flanged at each heat. Furnace mouth plates are flanged in cast iron dies at a single heat.

After the flanging of tube plates, etc., is completed, they are reheated, and the plates are straightened on a cast iron surface plate, and finally they are annealed by cooling in the open air from a cherry-red heat.

The riveting is performed by a Tweddle hydraulic riveter, using a pressure of 1,500 lb. per square inch on the flange, which gives a stress of about 90 tons on the rivet. The stay tubes are screwed into both tube plates and expanded, the ends in the combustion chamber being beaded over.

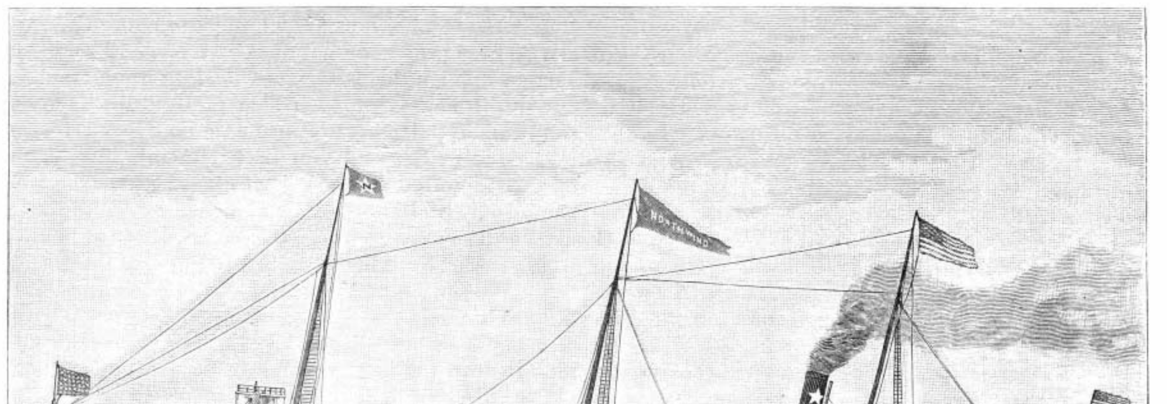
A Warning to Dog Owners.

Possessors of canine pets will do well to take warning from certain recently reported observations of Professor Nothnagel. These go to prove that the development of cysticerci in the human subject is in some cases to be attributed to contact with the saliva of lapdogs which have been allowed to lick the faces and mouths of their owners. The explanation is a feasible one, and adds a noteworthy contribution to our knowledge of morbid etiology. The tænia echinococcus, as is well known, inhabits the small intestine of the dog, and it is highly probable that the ova occasionally find their way into the animal's mouth; for example, in vomiting. There are various æsthetic reasons why the kiss of even the most cleanly and most friendly pug or terrier should be dispensed with. We have now, thanks to the Viennese observer, a still stronger argument to urge against this practice. It may, indeed, like the others, fail to daunt the too-devoted master or mistress, but we cannot do less than avail ourselves of this opportunity to forestall if possible, by a timely warning, the sharper teaching of experience.—*Lancet.*

THE STEAMSHIP NORTH WIND—THE BUSINESS BOAT OF THE LAKES.

The North Wind is one of a fleet of six steel steamships, owned by the Northern Steamship Company, the lake line of the Great Northern Railway Company, between the head of Lake Superior and seaboard connections at Buffalo. As this fleet carried between the opening and close of navigation 500,000 tons of freight, including 1,300,000 barrels of floor, they may well be classed among the money makers, and the immense tonnage credited to them shows the extent of the lake trade outside of the millions of tons in the coal and ore business. But they are unable to meet requirements even in connection with the railway, and preparations are being made for increasing the fleet in the near future by an addition of four steamers, two of which will, in all probability, be passenger steamers, elegantly equipped and so arranged that they can be used for freight traffic when the passenger season is over, carrying 3,500 tons of freight through the Sault canal.

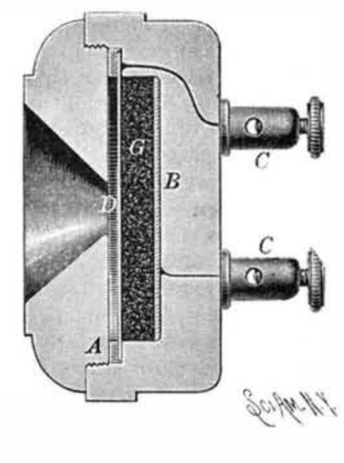
The North Wind, alike to the other boats of this fleet—they are duplicates in every respect and were built by the Globe Iron Works Company—cost her owners $223,000. She is 292 feet keel, 312 feet over all, 40 feet beam and 24½ feet moulded depth. Her triple expansion engines are 24, 38 and 61 by 42, and she has two boilers 14×12½ feet. She has four gangways on either side and six hatches for the handling of freight. A line shaft with two drums to each hatch enables the boat to handle ninety-six barrels of flour at one time, as each of the drums handles eight barrels. The boats are capable of carrying about 2,500 net tons on 15 feet of water through the Sault canal. The boats are thoroughly equipped in every way, the Northern Wave being fitted with an Edison electric light plant, and the entire fleet have Providence windlasses. Electric plants will be placed on all of the other boats of the line during the winter.—*Marine Review.*



NEW LAKE STEAMSHIP THE NORTH WIND.

LONG DISTANCE TELEPHONY.

The difference between the ordinary and the long distance telephone systems lies not so much in the instruments used for transmitting and receiving speech as in the lines. The fundamental thing in the long distance telephone is a metallic circuit, *i. e.*, a line in which the current returns through a wire instead of the ground. Another important difference is that the wire used in the construction of the line is of very high conductivity. By the employment of the metallic circuit the effects of induction are *nil;* the induction in both wires being equal and in opposite directions in the receiving instrument, exactly neutralize each other.



Where the long distance line is in a cable containing other lines, the two wires are usually twisted, to subject them both to exactly the same inductive influence.

These are important points, and it is of course necessary to employ an efficient transmitter. The one commonly used on long distance telephone circuits is known as the "Hunning transmitter," shown in section in annexed engraving, for which we are indebted to Prescott's "Electric Telephone." The diaphragm cell is made of insulating material, and arranged to clamp a diaphragm, D, of thin platinum foil or ferrotype plate, the diaphragm being held in place in the cell by a ring, A. In the cell is arranged a back plate, B, of brass, the space intervening between the back plate, B, and the diaphragm, D, being filled with a body, G, of loose, finely divided conducting material, preferably finely granulated coke, sifted so as to remove all fine dust. Oven-made engine coke is recommended for this purpose. The binding screws, C, C, are placed in connection with the diaphragm, D, and back plate, B.

This transmitter may be used in a circuit with a battery and Bell receiver, or the transmitter and battery may be arranged in circuit with the primary wire of an induction coil, the secondary wire being connected with the line wires extending to a distant point, and there provided with a Bell receiver. This transmitter has been tested by Prof. Cross along with the Edison and Blake transmitters, with the following results: The average strength of the current flowing with the Edison transmitter was 0·100 milliampere; with the Blake transmitter, 0·138 milliampere; and with the Hunning transmitter, 0·560 milliampere.

Fat in Milk.

The Dairy Association of Kiel offers a prize of £150 (3000 marks), for an improved method for determining the fatty matter in new milk, skimmed milk, and butter milk, without the use of a chemical balance as accurately as by the gravimetric process. It must be free from danger, cheap, and so simple in execution as to allow of comparative determinations of the fat in the milk of individual cows; and it must be distinctly preferable to all the methods now in use. Applications marked with a motto and accompanied with a sealed envelope containing the name and address of the sender, and with the apparatus required, may be addressed to Herr C. Boysen, Kiel, up to October 1, 1891.

New York Tunnel Schemes.

For over twenty years New York City has been the center of tunnel schemes. The first attempt of any importance and upon which any real work was done was the underground road starting at the corner of Broadway and Warren Street, and intended to run under Broadway. This was initiated by and all the work done was after plans designed by A. E. Beach, editor of the SCIENTIFIC AMERICAN. It was in this work that the first use of a shield propelled by hydraulic jacks was practically tested. The shields which have since been used, notably the one employed under the St. Clair River in the tunnel recently completed, and in the Hudson River tunnel, work on which is now progressing favorably, are modifications of this idea, the principle of construction and the method of operation remaining unchanged. It is fair to assume that in this project Mr. Beach was in advance of the times, since although in the construction of 200 or 300 feet of tunnel he demonstrated the feasibility of his plans, the city was not then in such a condition as regarded the uptown distribution of its inhabitants to look favorably upon a scheme of this character. Afterward the completion of the elevated roads was thought to fully solve the problem of transportation of passengers up and down town. Following this there have been many plans for underground railroads in New York, particularly one which proposed to use the entire surface of Broadway, providing for quick and slow traffic by means of four tracks. Numerous other plans have been brought forward, but none has as yet advanced further than paper.

THE HUDSON RIVER TUNNEL.

The next undertaking which advanced further than the drawings was brought foward by Col. D. C. Haskin to tunnel the Hudson River. Work was begun some thirteen years ago, and since then has been carried forward more or less erratically, according to the financial condition of the company. Some months since, English engineers and capitalists, at whose head were Sir Benjamin Baker and Sir John Fowler, took hold of the undertaking, and since their advent the work has been progressing most satisfactorily. The first work here done was of the utmost importance, since it introduced and proved the practicability of running a subaqueous horizontal tunnel through soft material by means of compressed air. The most important fact demonstrated was that the soft silt forming the bed of the Hudson River had sufficient tenacity in itself to act as a wall dividing the air from the water.

The first work done has been so frequently described that it is unnecessary to enter into details. A shaft was first sunk on the New Jersey shore to the depth of about 56 feet below high tide, and from the center of the river wall of this shaft an opening was made, and a temporary tunnel started. The temporary tunnel at the shaft terminated in an air lock similar to those now employed in the bulkheads, and gradually flared in steps so that its longitudinal section was cone shaped until its outer diameter was 22 feet. From the end of the cone or temporary tunnel the two main brick tunnels were begun. Afterward this work was removed and two tunnels continued to the shaft.

In carrying forward the work the heading was formed into steps or terraces in which the men stood, and the excavation was carried on at all points of the face. As fast as the heading advanced, iron plates, one-fourth inch thick and bent to correspond with the curve of the tunnel and flanged upon the four edges, were inserted to form rings, and as soon as a section of 8 or 10 feet had been lined, it was bricked. In this work no attempt whatever was made to protect the silt heading by means of bracing. It was found, as stated above, to be sufficiently tenacious and homogeneous to prevent the escape of air or the entrance of water. The air pressure was kept about equal to the hydrostatic head, and of course was increased as the tunnel advanced under the river. It was a most difficult matter to keep the tunnel to grade, owing to the fact that it was impossible to exactly calculate the amount of settlement that would take place in a section after the masonry work had been completed, slight changes in the density of the silt influencing the amount of settlement, and as this could not be calculated with any degree of certainty, it was impossible to provide for it.

In order, therefore, to keep the tunnel to grade, and as a secondary consideration to ascertain the character of the material in advance of the heading, the so-called pilot tunnel was introduced by John F. Anderson. This pilot tunnel was 6 feet in diameter, and made up of interchangeable plates, flanged so that they could be bolted together, and formed a central hub which extended a few feet into the silt in advance of the face, and also a few feet into the completed masonry of the tunnel. Being supported rigidly at both ends, the central portion of this pilot acted as a foundation upon which struts to support the plates could be placed. It was found that this pilot answered every purpose, and that its use permitted the keeping of the tunnel to the proper line.

THE AIR LOCKS.

Placed at intervals along the tunnel, as the work was completed, were brick bulkheads, in which about a third from the top were inserted air locks 15 feet long, 6 feet in diameter, and provided at each end with a 3 by 4 foot door, of course opening toward the heading. The use of these air locks has been continued until the present time. They are placed about 300 feet apart, the rear one being taken away and advanced as the work advanced. There are now in use three locks, the further one being over 2,000 feet from shore. Any one entering the tunnel passes into the air lock, when the rear door is closed. Air is then admitted, and after the pressure in the lock has become equal to that on the heading side of the lock, the inside door is opened and the visitor passes into the first section of the tunnel, being then under a pressure of about 15 pounds to the square inch. The next lock, at about 1,800 feet from the shaft, is then entered and a slightly increased pressure found in the second section of the work. The third lock is then passed through, and the visitor finds himself in the heading section under a pressure of about 35 pounds to the inch.

THE SHIELD.

If a tube, say 4 inches in diameter and 1 foot long, be made of pasteboard and one end closed with a pasteboard cap and the other end closed with a sheet of tissue paper, it is evident that this cylinder can be submerged in water to any depth, provided a pressure be maintained in the interior equal to the hydrostatic head. In other words, the tissue paper diaphragm, as long as an equilibrium is maintained between the air and water pressure, will serve every purpose of a dividing or separating wall equally as well as the stronger pasteboard diaphragm at the other end. It was this principle which was utilized in the first work of the tunnel. If, now, in place of the tissue paper diaphragm a cap be substituted which is free to move longitudinally over the outside end of the cylinder, and which is about 2 inches in length, a good representation is obtained of the steel shield which is now used in advancing the head. Presuming the joint between this pasteboard cap and the pasteboard cylinder to be airtight, it is evident that the cap can be moved forward or away from the cylinder a short distance without interfering with its duties as a cap.

The steel shield in the tunnel is 20 feet in diameter, 10 feet long, divided in the center by a steel diaphragm, provided with nine openings about 2 feet square. This shield corresponds to the pasteboard cap on the cylinder. It is pushed forward by sixteen 20-ton hydraulic jacks, the cylinders of which are secured in the rim of the shield and the plungers of which find a bearing against the completed work of the tunnel. As the shield is forced forward by the jacks the silt squeezes through each of the nine openings, falls to the bottom of the excavation, is loaded upon a car, run back a short distance, elevated about 12 feet by means of a hydraulic elevator, and then run on tracks up the tunnel, through the locks to the shaft, when it is raised by a second elevator to the surface and carried to the dumping ground.

INSERTING THE PLATES.

After a shield has advanced a space sufficient to permit of the erection of a ring of plates it is stopped and a ring inserted. The ring consists of heavy cast iron flanged plates, 20 inches wide, and varying in weight from 1,100 to 75 pounds, the key plate being the smallest. These plates are handled by means of an erector carried upon a bridge beam traveling upon tracks secured to brackets at each side of the tunnel, so that the beam and its erector arm can be moved forward and back as the occasion may demand. The erector arm is mounted upon a shaft placed at the center of the bridge, and also has, by means of hydraulic cylinders, a motion at right angles to the shaft. It is, therefore, evident that the grasping end of the erector arm can be brought down and made to take hold of the plate lying on the bottom; can then be raised, turned on its shaft so as to bring the plate in position, and to hold it until it has been securely bolted to the ring of plates already in place. It will be seen that this method varies materially from that formerly proposed. In the fi.st place, thin plates were used, which were afterward lined with masonry. In this case heavy cast iron flanged plates are used, which, it is expected, will not be lined except at the bottom, and for a certain distance, probably half way up the sides, the strength of the cast iron plates being calculated to be sufficient to stand the pressure which will come upon them when the air is removed. The work has progressed most satisfactorily, and the heading of the north tunnel is now about 2,400 feet from the shaft on the New Jersey side, or nearly half way across, the whole distance being 5,600 feet. The south tunnel, which of course runs parallel with the northern tunnel, and a few feet from it, is finished for a distance of about 600 feet. At the New York end, instead of sinking a shaft a caisson was sunk, and from the river side of this the two tunnels started. No work has as yet been done on the New York side since the new management took hold, although a shield is now ready to be put in place, and the work is in such condition that it can be resumed at any time. The south tunnel here has been extended about 20 feet and the north tunnel about 180 feet.

PROJECTED EAST RIVER TUNNEL.

Another tunnel scheme which, it seems probable, will be carried through is that by the New York and Long Island Railroad Company, who intend building a tunnel under the East River from Long Island City to New York. All legal difficulties have been overcome and nothing now remains to interfere with the project. The terminus of the tunnel on this side is to be at West Forty-second Street and Tenth Avenue, and at Thompson Avenue, near Dutch Kills, in Long Island City. At the first named point there will be a connection with the freight tracks of the New York Central, and at the other point with the Long Island Railroad. Other branches will probably extend to other points in the city. It is believed, because of the results of borings made along the line of the tunnel, that all the work can be prosecuted in solid rock, and that at all points sufficient head room can be found, so as to do away with the requirement of any masonry work. The length of the tunnel under the river will be nearly half a mile. It is expected that this tunnel, when completed, will do away with the trouble now experienced in crossing the East River, and that other advantages may be looked forward to if the shipping interest at Montauk, the upper end of Long Island, ever develops.—*Iron Age.*

Death of Dr. Henry Schliemann.

Dr. Schliemann was the son of a Lutheran minister. He was born in Aukershagen, Mecklenburg, in 1822. His father was a great student of Greek, and his son early received a strong bent toward the same line of study, and it is said that when a mere boy he determined to discover Troy. After five years of exhausting and distasteful employment with a grocer, which he was forced to engage in from poverty, he got a position as correspondent and bookkeeper with an Amsterdam mercantile house. In 1846 the firm sent him to St. Petersburg as their agent. His business prospered, and he eventually acquired a fortune. He traveled a great deal in the next few years, and learned many modern languages. His knowledge of ancient and modern Greek was thorough.

His archæological work now began. He was the possessor of a fortune. He devoted the rest of his life to investigations among the ruins of Greece and Asia Minor. His first important work on archæology was published in 1869 in French, and was entitled "Ithaque, le Péloponnèss, Troie; Recherche Archæologique." Five years later, in 1874, appeared his "Troy and its Remains," giving the results of his excavations on the site of ancient Troy and the Trojan Plain. He obtained permission in this year from the Greek authorities to prosecute his researches at Mycenæ. Here he made the singularly interesting discovery of five ancient tombs, which he identified as the ones pointed out to Pausanias, the ancient historian of Greece, as those of Agamemnon and his companions, buried by Ægisthus. When it is remembered that these tombs were subjects of local tradition in the days of Pausanias, an idea can be acquired of the insight into the past given by Dr. Schliemann's researches. His discoveries of objects of art in the precious metals were very numerous. A collection of them was exhibited in London in 1877 at the South Kensington museum. He has sold many collections to the different art museums of the world.

His home life was influenced by his classic tastes. His wife was a Grecian, the daughter of an Athenian. Greek was the language of his household, even his servants receiving Greek names. His two children were named respectively Agamemnon and Andromache. In the course of his wanderings he found himself in California when that State was admitted to the Union. He became himself a United States citizen.

Only last year he was commencing new explorations in Asia Minor, under a firman of the Turkish government. His published works were extensive and numerous. His income enabled him to prosecute a work that gave him world-wide fame.

His relations with America were many. It was in the early days of California that he there laid the foundations of his fortune, which he increased during the Crimean war while established in St. Petersburg. His death was announced on December 27. It occurred at Naples, Italy. Few lives have been more fruitful of usefulness.

A CRACK in a piece of metal is prevented from extending further by the well known means of drilling a hole where the rent ends; but when the hole is not bored on just that spot, the crack is apt to continue beyond the hole. To facilitate the search for the exact point, *Revue Industrielle* recommends moistening the cracked surface with petroleum, then wiping it, and immediately rubbing it with chalk. The oil that has penetrated into the crack exudes and thus indicates with precision where the crack stops.