How the Telegraph is Kept in Order.

Every one has seen a "line man" walk up a telegraph pole as readily as if he were going up a flight of stairs. With a quick, nervous jerk of the foot he drives the spurs into the wood, and takes a firm hold every time. This dexterity comes from practice. It looks dangerous when a man is near the top of the pole, but that there is really little danger is proved by the fact that accidents very rarely occur. The men become accustomed to working at a great height, and mind it no more than sailors on a ship. An experienced man looks out for rotten poles and rotten cross beams, and once confident of these, he feels no further alarm. He hangs on by his legs as cleverly as a monkey by its tail, and thus has the free use of his arms and hands.

The spurs are of steel, and consist of a flat bar with a bend, which passes under the instep. A sharp point projects diagonally downward so as to bear a heavy weight from above. The greater the weight the deeper the point sinks, and the wood would have to be very rotten for it to slip. It leaves behind on the pole those queer little holes, which so much resemble the work of a woodpecker on a tree.

The line men are divided into two classes, climbers and ground men. The latter rank little higher than ordinary laborers, but in time, if they are ambitious to learn, they graduate into climbers. Climbers are paid from $40 to $75 a month, and at present are in great demand owing to the large amount of telegraph construction going on throughout the country. Ground men dig holes, plant poles, carry wire, and do whatever other labor is necessary.

The climber is provided with a pair of pliers, a hand vise, and a strap. He catches up the broken ends of wire, draws them together with the vise and strap, and splices them with the pliers. Care is taken to leave a certain slack, so as to allow for contraction by cold in winter. In large cities a number of climbers are kept constantly on duty at the central office, so as to be sent out at a moment's notice to repair a break. If a pole falls prompt action is taken. The fallen portion is chopped into sections and dragged out of the way of traffic. The stump is dug out. If a hole is to be dug, it is bored with a great earth auger, which does its work more neatly and quickly than spades.

There are different ways of raising the poles. If it is a very long pole—say seventy feet—a short pole is temporarily inserted and used as a guide. These long poles are becoming common in the city, for the reason that they raise the wires above the great mass of wires that covers the streets with a network of iron. Smaller poles are raised with pikes. A slanting ditch is dug from the surface of the ground to the bottom of the hole. The pole is laid in this, and this raises the upper end from the ground. Eight or ten men with pikes get under it. These pikes are long, smooth poles, with a sharp spike in the end. The men drive the spikes into the under part of the pole, and raise all together. They stand in such a way that the center of gravity of the pole falls among them, and there is no danger of its toppling to either side. Of the ten men eight will retain the advantage gained by the lift. The other two loosen their pikes, and, going in front of the others, insert their spikes lower down. Another lift is given, and this process is continued until the pole is raised to a perpendicular. The earth is then firmly wedged in about it, and it is ready to receive the wires.

The wires used are generally of size No. 8. For very long circuits Nos. 6 and 4 are used. The Western Union Telegraph Company has two No. 4 wires running to Chicago. The telephone companies use smaller wires, generally No. 12. This accounts for the greater damage done them by a sleet storm such as that of the 21st of January last.

The insulators are of glass, and cost from three to four cents apiece. Very many other devices and various kinds of material—stone, porcelain, rubber, etc.—have been used as insulators, but glass has been found to be the best and cheapest.

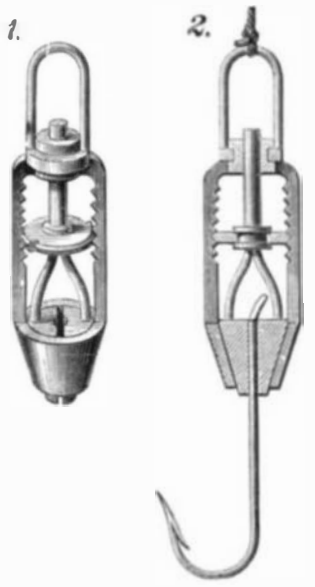
The chief operators of the offices in the large cities have charge of repairs for a wide circuit about them. At the American Union office, in this city, the chief operator has control to Philadelphia, to Hartford, and to Albany. At various stations along the lines between these points are test offices. The operators in these are required to be on duty at seven o'clock every morning. The chief operator in New York at that time calls up Philadelphia. Receiving a response, he tries every wire to Philadelphia. If all work properly it is all right. If a wire fails to work, the chief operator calls the test office nearest Philadelphia. If he again receives no response, he continues calling the successive test offices until he receives an answer. He thus locates the place of trouble, and then orders out the line men who are in waiting at the test stations on either side, who go along the line until they discover what is wrong. Another method is to call the test officers, beginning at New York, and cause each to ground its wire, until the point of damage is located.

It is easy to locate a break in the city where line men are constantly on the lookout, but in the country it is a different thing. Line men, who are necessarily climbers, are engaged by the month, and have each a certain tract of line assigned to their care. If the lines run along a railroad a man has control of an average of fifty miles. In case of a break he travels on a baggage or hand car to the place of trouble. These line men are under the control of certain head offices, and can be concentrated at any serious point of damage. In many instances the operators at unimportant stations also act as line men, and this is a part of their regular duty. Where the operator works on commission, he is paid extra for his line work. If the line runs on a turnpike away from a railroad, the line man has only fifteen miles under his care. He is obliged to live within call of the nearest station, and to be ready to go out at any time. Night or day, hot or cold, he must be prepared to start for the scene of trouble. The lines often run through desolate places, on the sides of mountains, and in wide prairies. The line man on horseback dashes from pole to pole, following the wires with his practiced eye. He often camps out all night, for he must not stop until the work is completed. In the winter some of these men travel on snow shoes, and lately, out West they have had the strange experience of digging down to the wires, where the snow was so deep as to cover the poles. It is a rule that the line man must go over the line once a week, to see that the poles are in order and to replace broken insulators. His hours of toil are often repaid by days of ease. He is alert for duty, but may have nothing to do for a long time. His pay continues just the same, and as long as he keeps within call he can do what he pleases.

The telegraph companies would like to run their wires under ground, but they find it won't work. They have been unable to insulate the wires so that they will work properly for any length of time. This compels the use of poles, which are generally of two kinds, cedar or chestnut. Cedar is the lightest, trimmest, and best looking, but chestnut lasts longer. Wires last from six to eight years. Rust is their great enemy, and smoke is another foe. Neither wires nor poles are expensive. Labor is the great item in making repairs, and in times when there is universal disaster to lines the companies have to pay high wages.—*N. Y. Sun.*

IMPROVED SWIVEL-HOLDER FOR FISH-HOOKS.

The engraving shows a simple and effective holder for fish-hooks of different sizes. The housing or head has at the top a cylindrical sleeve, to which is attached a swivel



HYMERS' SWIVEL-HOLDER FOR FISH-HOOKS.

loop for receiving the line. The bottom of the housing is connected with a conical sleeve for receiving conical jaws attached to a forked rod extending upward through the cylindrical sleeve. This forked rod carries a double cam, which engages notches in opposite sides of the housing, and holds the conical jaws in any desired position. The device is adapted to hooks of different sizes by inserting the conical jaws to a greater or less distance into the conical sleeve and fastening them by means of the cam.

This device facilitates the removal and replacement of broken fish-hooks, and admits of using on a line, hooks of a size suitable for any purpose. It answers as a sinker, and may be made small enough for catching minnows or large enough for the largest lines in use. It is a perfect swivel and a reliable holder. The inventor applies the same holder to rods, wire rope, etc.

This device was recently patented by Mr. C. Hymers, of 1601 Monroe street, St. Louis, Mo., who may be addressed for further information.

A Great Crucible Steel Casting.

Messrs. Jessop & Sons, Brightside Steel Works, Sheffield, have recently cast the largest crucible steel casting yet produced. It is a spur ring 28 feet in diameter, machine-moulded, and cast whole. To cast it 270 pots were used, each pot holding 80 lb. weight of molten steel. When the steel had been poured into the three large ladles, the plugs were removed, and it ran into the mould, the weight when cast being about 10 tons. In its finished state the weight will be about 8½ tons. It is, without doubt, by far the largest crucible cast steel casting of its kind that has ever been produced. Messrs. Jessop & Sons anticipate that this will be the beginning of an important trade with Lancashire mill owners, as they discover how much more durable steel wheels are than the cast iron wheels at present in general use. The firm have previously cast wheels 13 feet and 14 feet in diameter, but to 28 feet was a great leap. Now, however, they are prepared to undertake castings up to 34 feet. The operation of casting occupied 8½ minutes.

NEW INVENTIONS.

Mr. Henry B. Burin, of New York city, has patented a machine for threading bolts and tapping nuts, so constructed that when one tap or die is forced forward to do its work another die or tap will be withdrawn from its work. Thus the machine works continuously, and no time is lost in withdrawing the die or tap.

Mr. Major Thorp, of French Creek, West Va., has patented a cattle shed for use as temporary shelter in open pastures or fields. It consists of a roof pivoted to an upright support in combination with a windwheel and connecting devices, whereby the roof is turned so as to afford shelter from the wind coming from any quarter.

Mr. Elmer P. Newman, of Dimondale, Mich., has patented a copy holder for writing-books ruled parallel with the binding edge. The copy holder is formed of metal or other suitable material, having the ends bent under to form grooved flanges, which embrace the edges of the pages, and the upper longitudinal edge is bent over forward on the upper side to form a longitudinal flange for holding the copy, which is also held by the bent prongs on the lower edge of the holder.

Mr. Matthias Naumier, of Port Byron, N. Y., has patented an improvement in grain cradles, which relates to cradles made with either straight or bent snaths, and has for its object to give increased strength to the implement, and which consists in a novel system of bracing, which strengthens the snath, post, and fingers.

Mr. James E. Gowen, of Peabody, Kansas, has patented a self-adjusting weather strip for doors. It consists of a wood or metal strip, which, by means of springs, is caused to fit tightly against the casing of the door when the latter is closed.

Mr. Robert I. Draughon, of Perdue Hill, Ala., has patented a cotton chopper, which can be easily guided along a row of plants, whether straight or crooked, and around stumps or other obstructions, which will chop the plants to a stand without throwing the soil out of place, and which will allow the horse to walk at the side of the row

Mr. James H. Brown, of Boston, Mass., has patented an improved machine for sawing kindling wood, which automatically feeds the sticks to the saw. The principal feature of the machine is a wheel with radial arms and spring clamps, by which the sticks are presented to either a circular or reciprocating saw, and devices for thrusting the sticks longitudinally to insure the cutting of definite lengths.

Mr. Carl L. Præger, of Philadelphia, and Hubert F. Praeger, of South Bethlehem, Pa., have patented a self-adjusting wrench for bolts and nuts. The invention consists in a curved handle, one end of which serves as a lower jaw, and which is socketed and chambered to receive the shank and operating mechanism of the upper jaw. By means of a spring, slotted wedge, and lever, the upper jaw is adjusted and held. Some modifications of these devices are shown in the patent, but the principal features are as stated.

Mr. Arthur S. Pierson, of Harvard, N. Y., has patented a jointer for circular saws, so constructed that it can be readily adjusted to operate on saws of different diameters, and which will bring all the teeth to a uniform length. It is an ingenious, simple, and effective device.

Mr. George W. Miller, of Fawn Grove, Pa., has patented a rein holder for holding reins high enough above the dash-board of a vehicle to keep them out of reach of the horse's tail. It consists of a wire frame hooked on to the upper edge of the dash-board, a rectangular loop of the same material extending down in front to rigidly hold the frame, this loop being fastened to the front end of the box.

Mr. James A. Raney, of Cross Cut, Pa., has patented a sieve for middlings purifiers, so constructed that all parts of the sieve cloth will be covered by the middlings, thus preventing the air blast from passing through any uncovered portion of the sieve and the consequent waste of fine middlings.

Mr. Godfried Laube, of Wausau, Wis., has patented a car heater and ventilator, so constructed as to constantly reheat the air contained in the car, which allows a supply of fresh air to be introduced into the car when desired, which allows the hot air to be moistened before its introduction into the car, and which can be advantageously used for heating rooms and buildings.

Messrs. Herman H. Beckman, Claumer H. Beckman, and Christ Beckman, of Clayton, Iowa, have patented an improved windmill, so constructed that it turns more or less toward the wind according to the velocity with which the wind blows, and always remains in balance on its supports.

Mr. Richard Poindexter, of Bethania, N. C., has patented a tire shrinker, which is a cheap, simple, and effective device for holding a tire upon the anvil while it is being operated upon to shrink it, or upset it by hand forging.

Mr. William B. Van Hutton, of La Bahia Prairie (Burton P. O.), Texas, has patented a folding crate for the transportation of poultry, small animals, fruit, vegetables, etc, which is firm, strong, and durable, and may be folded so as to occupy little room in reshipment.

Mr. William J. Suttie, of New York city, has patented a nose piece for eye-glasses for holding the glasses and supporting the spring. The nose piece has several points of attachment to the lens or bow, and a socket for the end of the spring.

Mr. John Flanagan, of Newburg, N. Y., has patented an improvement in submerged pumps, which consists of a double cylindered pump provided with pistons composed of elastic diaphragms secured at their edges in the sides of the

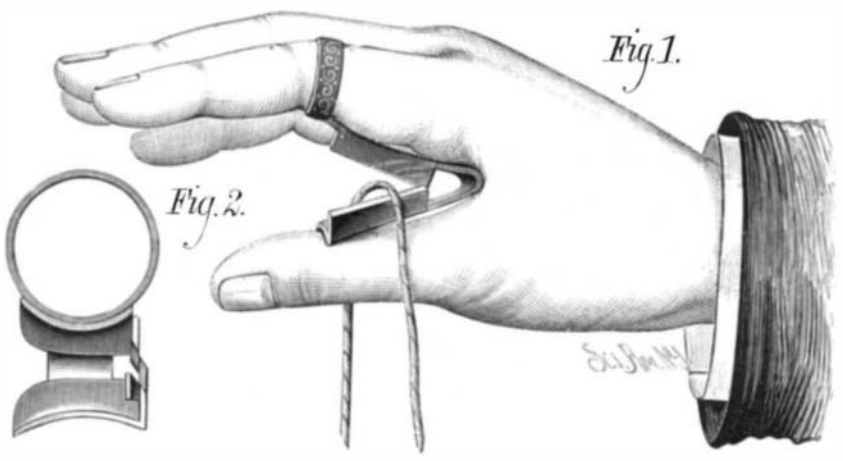
cylinders, and centrally in arched and perforated valve boxes, that are provided with ordinary hinged lift valves, said cylinders having open and cup-shaped bottoms forming suitable seats for ball valves, and having egress ports above the elastic diaphragm, the design being to submerge the pump and operate it by means of a rocking lever to lift and force water.

NOVEL SCISSORS.

The engraving shows a scissors attachment to the hand for cutting twine, tape, thin fabrics, etc. It is intended as a substitute for the shears or scissors ordinarily employed, and it consists of two short cutting blades attached to a V-shaped spring, one end of which is secured to a ring worn on the index finger. The spring is provided with suitable bearing plates for the thumb and finger, and the device is held as indicated in the engraving.

Scissors of this construction are always ready for use, and are not in the way when out of use.

This novel device is the invention of Mr. O. C. Haward, of Washington, D. C.



SCISSORS ATTACHMENT.

Hudson River Tunnel.

According to the *Railway News* the Hudson River Tunnel is advancing satisfactorily toward the New York shore at the rate of five feet a day. Two hundred men are employed digging out the dirt and putting in the iron and brick work. The tunnel is finished as they go along, and the work is much safer than under the old plan, which resulted so disastrously. A small tunnel, about six feet in diameter, is run ahead of the larger tunnel, which follows and incloses it; warning is thus given of the nature of the soil. The work is now in the south tunnel, which is now completed 290 feet from the shaft, and will soon be out as far as the north tunnel, which has been cleaned out, but not extended, since the accident. Both tunnels will then be carried along together. A caisson is in course of construction for beginning the work on the New York side.

NEW TELEPHONE TRANSMITTER.

BY GEO. M. HOPKINS.

The microphone, with pendants, figured and described by the writer in the SCIENTIFIC AMERICAN of Nov. 16, 1878, was among the earliest of telephone transmitters, and although the device was crude in appearance and exceedingly simple in its construction, it contained the germ of a successful instrument, and was favorably noticed in the scientific papers of Europe.

The transmitter shown in the annexed engraving is based upon the same principle, and, so far as the devices for varying the currents go, it is even simpler than the original microphone. Fig. 1 shows the exterior of the instrument, Fig. 2 the interior, Fig. 3 a detail of the transmitter proper, Fig. 4 a sectional view of the receiver, and Fig. 5 is a diagram showing the battery and line connections. Everything, excepting the battery, bell, and receiver, is contained in the box. In the center of the cover is formed the mouthpiece, behind which is placed the diaphragm, consisting of ordinary Russia iron of the thickness commonly used in stovepipe. It is 2¾ inches in diameter, and is held in position in a circular cast iron frame by two springs attached to the frame and pressing the diaphragm. The edge of the diaphragm is bound with soft rubber or felt. This arrangement, however, is not essential to the successful working of this instrument, as equally good results may be obtained when the diaphragm is clamped tightly at the edges between two rings fastened with screws to the front of the box.

To the center of the diaphragm *a* (see Fig. 3) is attached a metal clamp, *b*, which supports, in a horizontal position, a cylindrical pencil of hard electric-light carbon, ¼ inch in diameter and 1 inch long. A disk, C, of battery carbon 1¼ inches in diameter and ¼ inch thick, is grooved around the edge and wound with fine copper wire, which terminates in a flexible spiral connected with the upper hinge of the box. The carbon disk is suspended by a silk thread from a spool formed on the inner end of a screw extending through the box cover, and capable of being turned so as to raise or lower the carbon disk, as may be required. The disk is slightly inclined from the perpendicular, and the line of contact between it and the carbon pencil is a little above the center of gravity of the disk. This arrangement of the two carbons prevents any marked break in the local circuit, as the disk tends to rock on the carbon pencil rather than fly from it when the diaphragm is set in vibration. The carbon disk has been saturated with melted paraffine in some instances with beneficial results.

The clamp which holds the carbon pencil is electrically connected with the lower hinge of the box. From the hinges the connections may be more easily traced in Fig. 5 than in the perspective views.

This diagram shows all of the connections for one end of the line, both ends being alike. The connections are shown in condition to call or receive a call. When a call is received the current passes from the line through the switch, E, button 2, key, bottom or outer contact of the key, bell-magnet, and ground wire, A, to the ground. When the key is depressed to call a distant station, the key touches the inner or top contact, on the battery wire, B, sending the current through the button 2, switch, E, and line to the bell and ground of the distant station. The current returns by the ground and wire, A, to the battery. After calling, the switch, E, is moved to button 1, and the switch, F being connected with the switch, E, by an insulating connection, is at the same time moved to button 3, as shown in dotted lines. Now the line connection is through the switch, E, button 1, wire, G, secondary wire of the induction coil, and receiver to the ground. The switch, F, when turned as described, completes the local circuit, the current passing from one cell of the battery through the wire, D, switch, F, button 3, transmitter, primary of the induction coil, ground wire, A, and wire, C. The connections are now correct for talking. The diagram shows the connections adapted to the class of transmitters employing but a single battery element, and to a line requiring several cells of battery to call. If a single cell of battery is sufficient to call, the posts of the wires, B D, will be connected together.

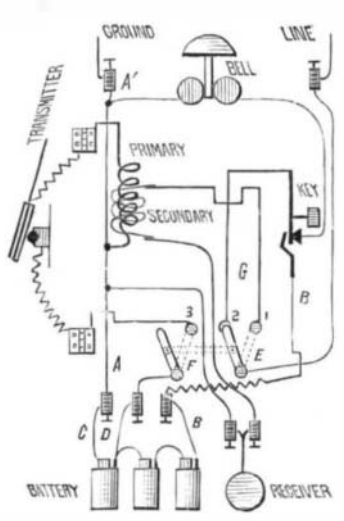


Fig. 5.- Telephone Connections.

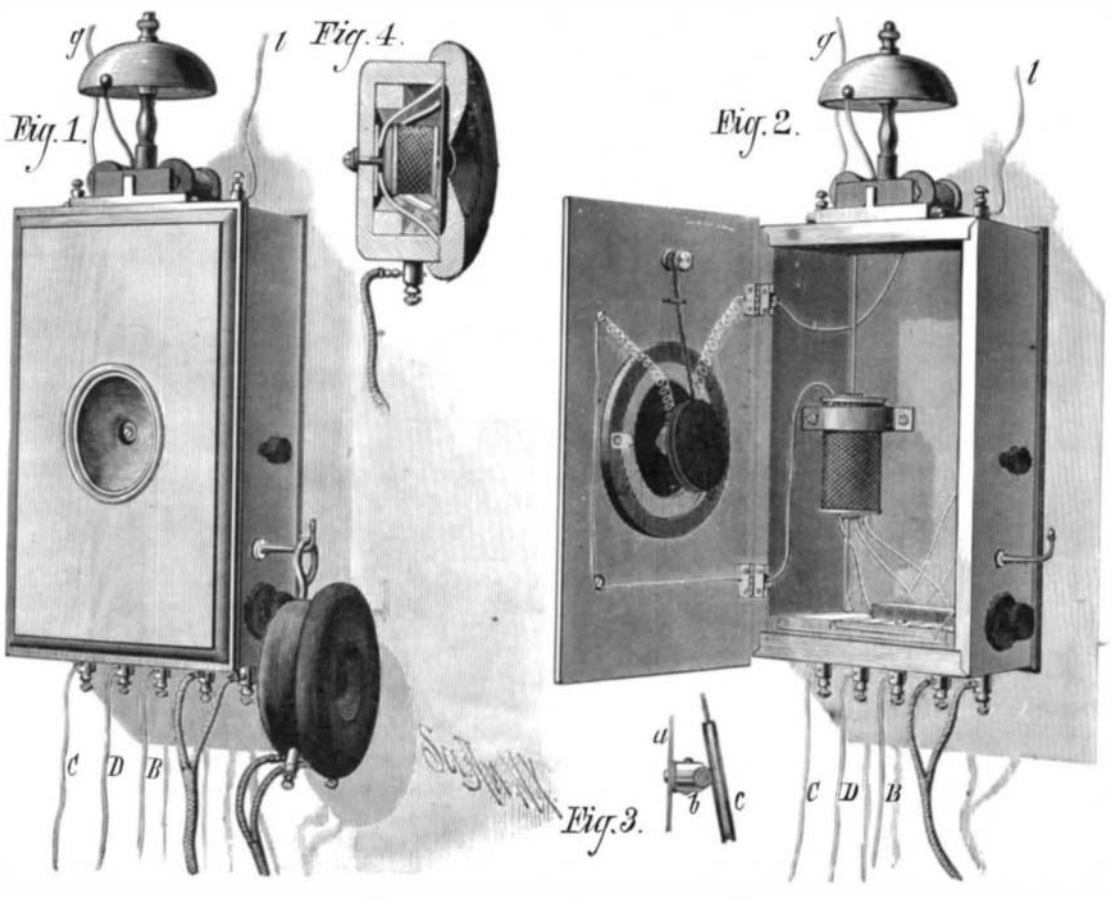
The button which moves the switch extends through the side of the box below the hook upon which the receiving instrument is hung. This arrangement insures the readjustment of the switch after talking, as the receiver cannot be hung up until the switch button is pushed in.

Three layers of No. 18 silk covered wire form the primary of the induction coil, and the secondary consists of some ten or twelve layers of No. 36 silk covered wire.

The receiver, shown in section in Fig. 4, has a diaphragm of the usual size mounted in a hard rubber case 2½ inches in internal diameter and 1 inch deep. The bobbin of the usual style is placed on a soft iron core having a large convex head, and held in place by a screw extending through the bottom of the case. A soft rubber button is placed between the casing and the convex end of the core, and eight curved permanent magnets, one-eighth inch thick and one-quarter inch wide, touch the convex end of the bobbin core and are pressed upward into contact with the diaphragm by a rubber ring at the bottom of the case. The diaphragm at its points of contact with the magnets is freed from japan or oxide, and the ends of the magnets are let into notches cut in the case, so that when they press upon the diaphragm the latter is backed by the mouthpiece.

This receiver is very compact and light, and as to efficiency it is all that can be desired.

The transmitter works well, is perfectly simple, requires no particular care in its manufacture, and never gets out of adjustment.



SIMPLE TELEPHONE TRANSMITTER.

Telephonic Electric Condensers.

In order to make a condenser sing it is merely needful to connect its armatures with the extremities of the secondary helix of an induction coil, interposing in the primary helix a battery and a microphone analogous to the transmitter of Reiss. If thus arranged the apparatus merely reproduces musical sounds. The author interposed a battery in the secondary helix of the coil; *i. e.*, he connected one extremity of the induced wire with one of the poles of a battery, the other pole communicating with one armature of the condenser, the second armature being attached to the other extremity of the induced wire. Articulate sounds are then reproduced with perfect distinctness. M. Th. du Moncel observed that this fact confirms his ideas on the origin of sounds in the telephone.—*A. Dunand.*

A Reception of Professor Bell.

A grand reception has been recently given by the Mayor and Corporation of Brantford, England, to Professor Bell. The reception was attended by about 300 people. After the presentations the Mayor presented on address to Professor Bell, to which the latter made a suitable reply. An address was then presented by the Board of Trade, to which a reply to the following effect was made:

It might not be uninteresting to them, although not connected specially with trade, if he were to make some remarks upon his recent discovery of the photophone. He described it as at present rather a contribution to science than to the world's utilities, but he looked forward to important practical applications. Among them be specified communication between passing ships at sea, lighthouses and the shore, and in case of war communication with distant places could be received without the necessity of an intervening wire. He then described the apparatus and experiments, and added that he had spoken for a distance of 800 or 900 yards, and had sent the musical sound a mile and a quarter, but he saw no reason to anticipate any difficulty but that of the convexity of the earth in transmitting articulate speech by light to any distance.