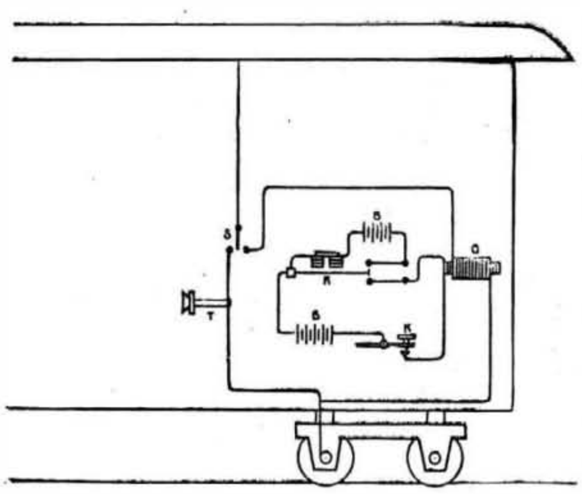
THE EDISON SYSTEM OF RAILWAY TELEGRAPHY.

The announcement made last summer that Mr. Thomas A. Edison was working out the details of a system of inductive telegraphy for sending and receiving messages on moving trains prepared the public for taking a very lively interest in the week's practical trial of the system, recently made on the Staten Island Railway. The necessary apparatus was applied to a car on one of the regular afternoon trains running from Clifton to Tottenville. The experiments were made personally interesting by having each member of the party leave a written message, sealed

FIG. 1.



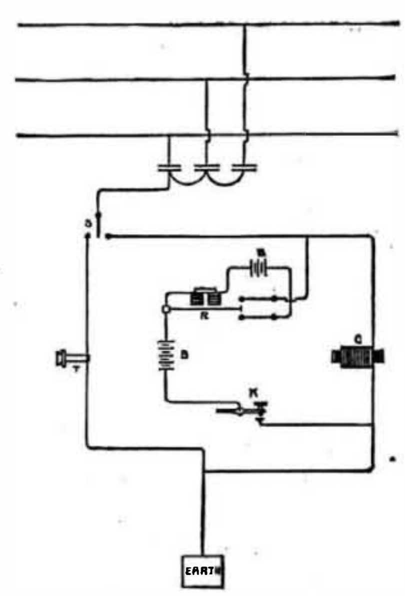
and directed to himself, with the operator at Clifton. During the trip, these messages were received on board the moving train, and each writer had the satisfaction of having his words correctly returned to him.

The main feature of the system, that of using the ordinary telegraph wires strung on the poles along the track, in place of a specially laid wire, as in the Phelps system, was invented and patented by Mr. William Wiley Smith in the fall of 1881, and he and Mr. E. T. Gilliland have been associated with Mr. Edison in the development of this idea.

The apparatus on board the train is all attached to a compact operator's desk, occupying no more room than an ordinary car seat. This desk may be placed in any part of the car desired, and may be moved from one car to another in a few minutes' time. The apparatus consists of an ordinary Morse key, phonetic receivers, an electro-magnet, a vibrating reed, an induction coil, and a battery. Similar apparatus is in use at the fixed stations. With the assistance of our diagrammatic illustrations, the reader will be able to understand the disposition of the instruments, and follow the current on its journey from the key on the train to the receiver at the fixed station, or *vice versa*. The car roofs are covered with tin and connected electrically by copper wire. During the experimental run at Staten Island, four cars were used. As the induction takes place between the telegraph wires and the tin roof, it is desirable to have as large a metallic surface as possible. Under favorable conditions, one roof will suffice, but it is better to have several. An insulated wire runs from the roof of the telegraphing car to a switch, S, at the operator's desk. This is shown open in Fig. 1. When a message is to be received on the car, the switch is turned to connect with a wire running to the phonetic receiver, T, and thence to the ground. The receiver may be either an ordinary telephone, or a pair may be used and held to the ears, somewhat after the manner of ear muffs. After coming from receiver, the wire is carried under the car and connected with a strip of copper, which is pressed against a copper cylinder on one of the axles by means of a spring, thus giving a ground connection by the axle and wheel.

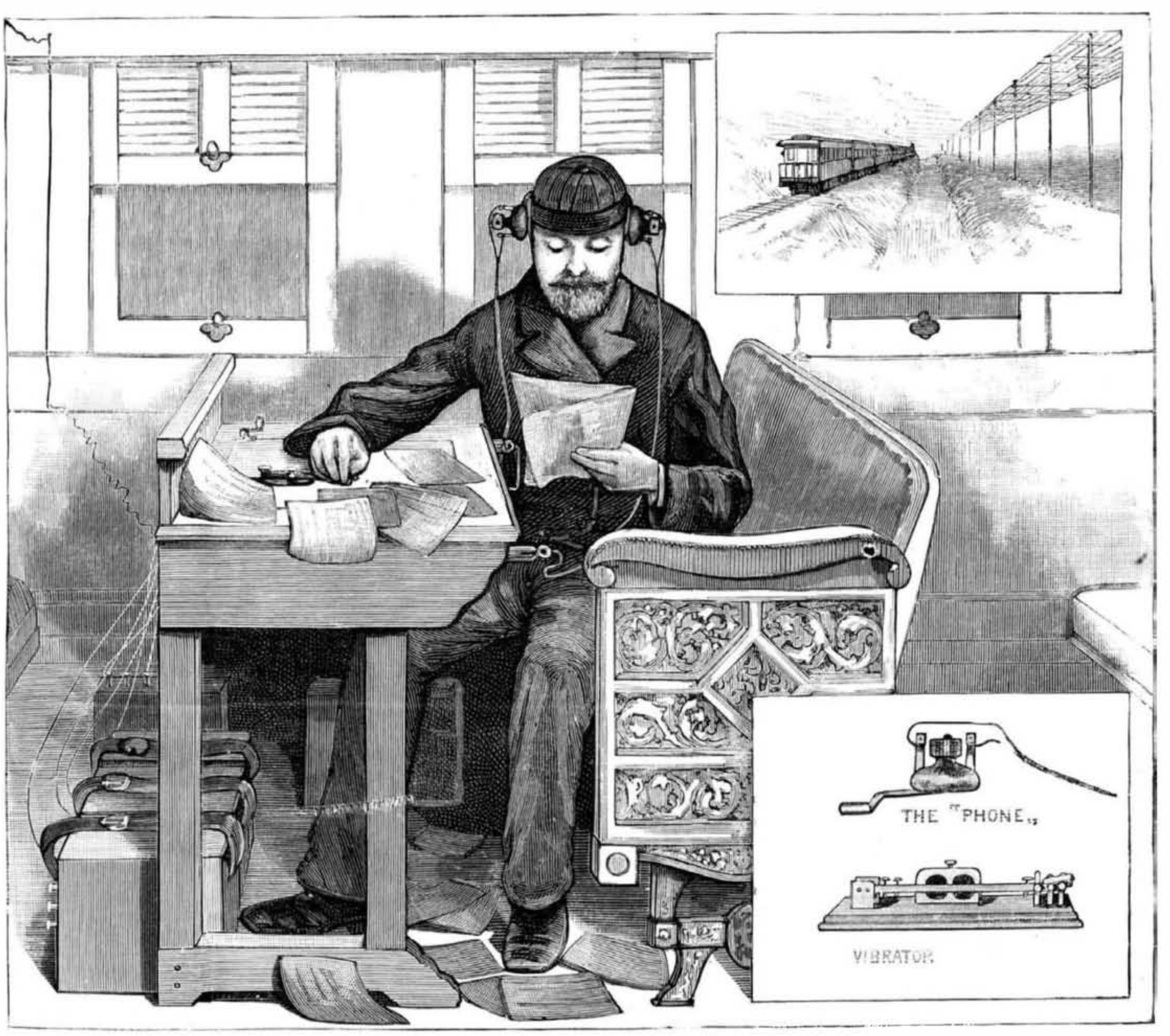
When, however, a message is to be transmitted from the car, the switch is connected with a wire leading to one end of a secondary coil at C, the other end of which is connected with the ground wire just described. Inside of this secondary coil, and separated from it by a layer of paper, is the primary coil, which is within the short electrical circuit represented by the diagram. A ten cell Fuller battery is placed underneath the desk. One pole of the battery is connected with the Morse key, K, which in turn is connected with one end of the primary coil as shown. The other pole of the battery is connected with a metallic reed, R, which is made to vibrate 500 times a second by means of a small independent battery. These vibrations produce a sharp, clear musical note, which is very audible at short distances from the operator's desk. The free end of the reed at each vibration strikes against a metallic button, connected by a wire with the other end of the primary coil. This being the arrangement of the apparatus on the train, we will suppose that the message is actually being transmitted. The Morse alphabet of dash and dot is employed, and consequently any operator can work the system. When the key is pressed down to form a letter, the short circuit is closed and the current passes through the primary coil. But the vibrating reed breaks the current each second into five hundred waves, and these electrical waves induce corresponding ones in the secondary coil. The function of this induction coil is to transform the intermittent current into one of high electrical tension. From the coil the waves pass to the roof, and by a sharp, quick discharge traverse the intervening air and reach the telegraph wires. It will be noticed that the word "discharge" is employed in spite of the fact that the action between the roof and wires is nevertheless, in strict elec-

FIG. 2.



trical parlance, one of induction. This constitutes the point of the invention.

Mr. Edison believes that he has made a new discovery in physics. He finds that bodies hitherto considered non-conductors, such as air, are really so only after an appreciable period of time. At the first instant of discharge, the air offers no resistance to the passage of a current, but becomes almost immediately polarized, and the communication becomes permanently interrupted. The idea, therefore, in these very short waves of high tension is to permit them to cross to the wires before the air has time to offer any opposition. A sufficient period, however, intervenes between them to permit the air to return to its normal condition, and consequently allow the succeeding waves to pass. Mr. Edison illustrated this point to the writer by drawing a series of dots about an inch apart. The dots represent the waves and the spaces the interven-



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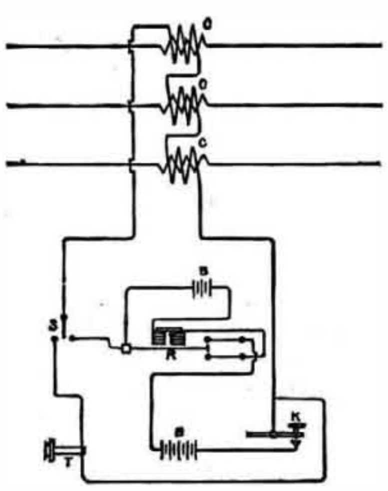
ing air. The polarization of the air attendant upon the passage of the waves is neutralized before the arrival of the wave following. The series of waves, having been communicated to the telegraph wires, are transmitted to every station on the line and to every train having suitable apparatus. If the key were held down continuously, simply a musical note, corresponding to that produced by the vibrating reed, would be heard in all the receivers. It is the breaking up of this note into dots and dashes, by means of the key, that transmits the telegram.

Though the apparatus at the fixed stations is similar to that on board the trains, the manner of throwing the waves on or off the telegraph wires is naturally different. Two arrangements are possible. In the one shown in Fig. 2, condensers are used. These are simply a series of circular metallic plates, equal in number to the number of telegraph wires used. One plate is connected with each wire, and is brought opposite, but not touching, a similar plate connected

FIG. 3.

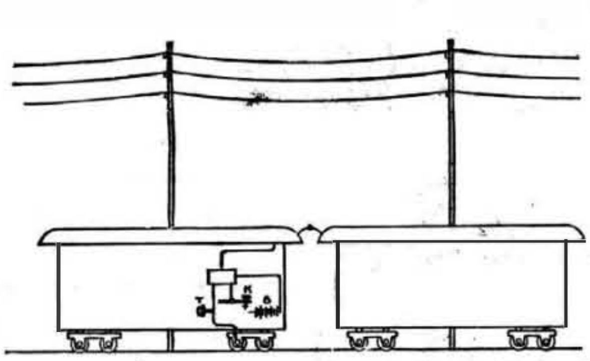


with the switch, S, in the station. The electrical waves pass to the condensers, spring across the intervening space to those opposite, and so pass on to the receivers.

In the second arrangement, shown in Fig. 3, no condensers are used, but the telegraph wires themselves are formed into a primary coil, and the wires from the office switch form the secondary coil. This is shown at C. In this case no further induction coil is needed in the office. The number of wires necessary for the transmission of the waves will depend upon circumstances. In case the sound becomes too faint for convenient translation into words, a greater number of wires should be employed. At Staten Island four were used, and gave very satisfactory results. The distance from the car roof to the wires was from 15 to 20 feet. In experiments made at Menlo Park, Mr. Edison succeeded in transmitting a message through the air over a distance of 580 feet. It will be observed that the circuit connecting the operator's key and the receiver is three times broken by the air, once at the induction coil, once at the roof, and again at the fixed station, either at the condensers or at the line coil.

As one of the chief merits of this system is its inexpensiveness, it may be of interest to state just what the cost is. The apparatus on board the train and that at the fixed stations cost about $50 each. The annual royalty for the use of the system varies from $7 per mile on roads of five to six thousand miles to $15 per mile on roads of a hundred miles or less. The president of the company, Dr. Crowell, informs us that it is

FIG. 4.



about to be introduced on the line of the Chicago, Milwaukee, and St. Paul Railway. Of its usefulness in averting accidents, by keeping each train informed of the whereabouts of the one immediately ahead or following it, in intercepting criminals, and in promoting general social and commercial intercourse, it will be unnecessary to speak.

We are indebted to *Frank Leslie's Illustrated Newspaper* for the use of the large cut.

IT is common practice, when employing chloride of calcium, to dry the air surrounding an instrument, to place the capsule on the bottom of the case. Experiment has clearly shown that desiccation is far more rapid and thorough if the salt be placed near the top.

Firing without Flame in Coal Mines.

It is announced in the *Bulletin de la Societe de l'Industrie Minerale* that some trials recently concluded at the experimental mine gallery at Neukirchen have abundantly justified the suggestion made by Mr. Galloway for the water tamping of blasting charges in fiery mines. Mr. Galloway offered the suggestion as a possible method of preventing the flame from shot firing entering the air of a mine, and causing an explosion with the fire damp and coal dust that might at the moment be present. The trials made at Neukirchen were designed to prove the value of this suggestion under the most trying conditions. A blast-hole was charged with gunpowder and tamped with water, this latter being contained in animal bladder. It was fired in an atmosphere containing five per cent of fire damp, with coal dust spread over a length of ten meters of the gallery floor, without producing the slightest flame or consequent explosion.

A similar shot fired under analogous conditions with a different tamping produced a very violent explosion. The experiments were repeated with the same results. It was proved also that water tamping is quite as efficacious for practical purposes as any other; for a heavy block of bed rock was completely broken up by this means. The experiments are to be continued and varied; but this preliminary announcement has been published by the society which is carrying on the investigation, to show that a means of robbing coal mining of half its terrors, without at the same time causing the miner to work under irksome restraints and disadvantages, has at length been put into practice. There is no reason to suppose that this system of blasting—the credit for suggesting which it is pleasant to see accorded to Mr. Galloway even by the foreign society—will be one whit more troublesome than the old; and the additional expense, if any, must be insignificant.

New Facts Concerning the Venous Circulation in the Fingers.

The separate injection of minute venous radicals is a matter of difficulty, owing to the resistance offered by the valves. M. Bouceret adopts the following method: The part to be injected is kept in a warm bath, 104° to 113° Fah., for five or six hours. The arteries are then injected with a colorless fluid; as soon as the subcutaneous veins appear to be well defined, but before they are distended, the injection is stopped. A cannula is inserted by means of a trocar into the largest of the superficial veins. A simultaneous injection is next made of the artery with red fluid, and of the vein with blue fluid. Each fluid penetrates to the capillaries, and the color of the part is pretty much that which is seen in life. It is supposed that the colorless fluid either makes the valves of the veins incompetent by distention, or else that it actually forces the valves against the sides of the vessels. This method has brought to light what appears to be a discovery, which is no less than the existence of a special collateral circulation in the fingers perfectly distinct from that which nourishes the tissues. The branches which are given off from the collateral arteries are very few and thin, so that the trunk vessels are hardly reduced in size where they terminate in an arch at about the middle of the palmar aspect of the last phalanx. From the arch many arterial tufts are given off, and divide in the pulp of the finger. These vessels have no venæ comites. Practically, the tufts are like the glomeruli of the kidney. They are found in abundance about the arch before mentioned and under the upper two-thirds of the nail, as well as over the thenar and hypothenar eminences. The ordinary mode of vascularization is found side by side with this special form. The large size of the digital vessels at their termination is in great contrast with the comparatively slight nutritive wants of these parts, and M. Bouceret believes that the object of the special kind of circulation is to afford more nourishment and warmth; but there seems more probability in M. Poirer's suggestion that it is related to the exquisite sensibility of the localities concerned.—*Lancet.*

Bring up Young Men.

Some three years ago, in an editorial, we advised our manufacturers to select one or more boys from good and tried families—boys that bid well to become staid, energetic, business men. Send them to some institute where they can get the training you desire to fit them for your work. Open an account with them; when you send them away, charge the expense to them as you pay it out; and when they graduate, and you put them in the mill, give them to understand that if they prove themselves worthy of the trust, you will make them sharers of the profits. You will get a blank once in a while, but as a rule you will get young men who will help to carry your burden, while you do the thinking. And your business secrets will be kept. Besides, to have half a dozen young men coming up in this way will elevate the tone of your works. Instead of one owner going through the mill once or twice a day, there will be an owner in sight somewhere all the time. You can then use your skill and experience where it will produce the most money.—*Wade's Fibre and Fabric.*

BICYCLE LEG.

The annexed engraving shows a simple device—the invention of Mr. John F. Morgan, of 82 Munroe Street, Lynn, Mass.—for holding the bicycle erect when it is at a standstill. On each shank of the fork is secured a tubular casing, Figs. 2 and 3, closed at the top by a loose cap. At the outer side part of each casing is a longitudinal slot, having a notch at its lower end extending toward the rear, as indicated in Fig. 4. Within the casing is a sliding tubular leg extension, formed with a lug projecting through the slot. A square rod projects from the cap down through the center of the casing and through a square aperture

MORGAN'S BICYCLE LEG.

in the top of the sliding leg. Surrounding the rod is a spring which usually keeps the leg raised within the casing. When the bicycle is to be supported, the legs are forced down by pressing upon the lugs, which are then turned to pass into the notches, thereby locking the legs in place. As the legs rest upon the ground, they prevent the bicycle from falling, and the rider can mount easily. Before starting the bicycle, he pushes the lugs out of the notches by turning the caps, when the springs draw the legs into the casings. In dismounting, the bicycle will stand by simply extending that leg on the side the rider dismounts from. Extending both legs of course supports the machine more securely.

IMPROVED BOTTLE AND STOPPER.

The bottle and stopper here shown are for the purpose of containing poisons, and are so constructed that a certain and more than ordinary amount of manipulation will be required before the stopper or cover can be removed. The bottle is formed with a number of horizontal and vertical grooves, as plainly shown in Fig. 1; near the lower edge of the cover is a lug. The cover is placed upon the bottle so that its lug will enter the highest vertical groove and pass

HOWELL'S IMPROVED BOTTLE AND STOPPER.

into the end of the upper horizontal groove. The cover is then turned to carry the lug along through this groove to the middle vertical one, and so on to the closed end of the lowest groove. With a poison bottle arranged in this way, it will be impossible for the drug clerk to make mistakes by dispensing drugs from the wrong flask, as his attention will be at once called to the character of the drug contained in the bottle when he attempts to remove the stopper. The cover is also formed with a series of points about its upper edge, as shown in Fig. 2.

This invention has been patented by Mr. J. H. B. Howell, of Newton, N. J.