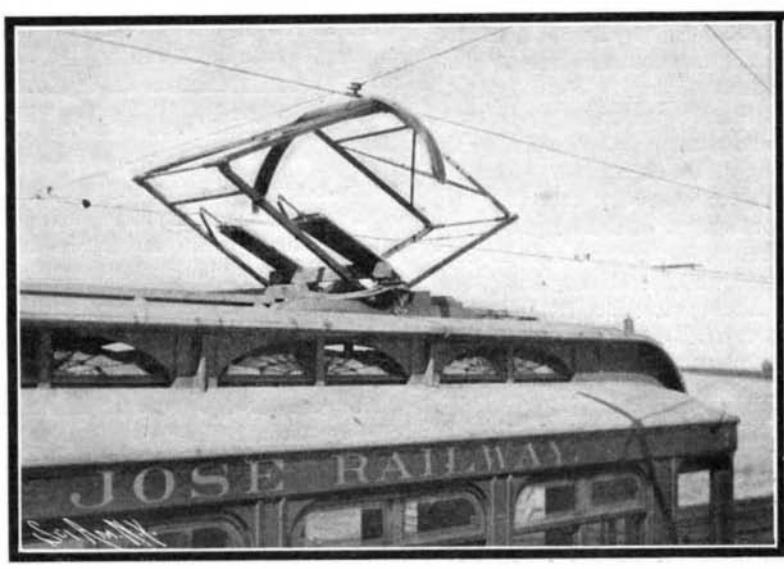
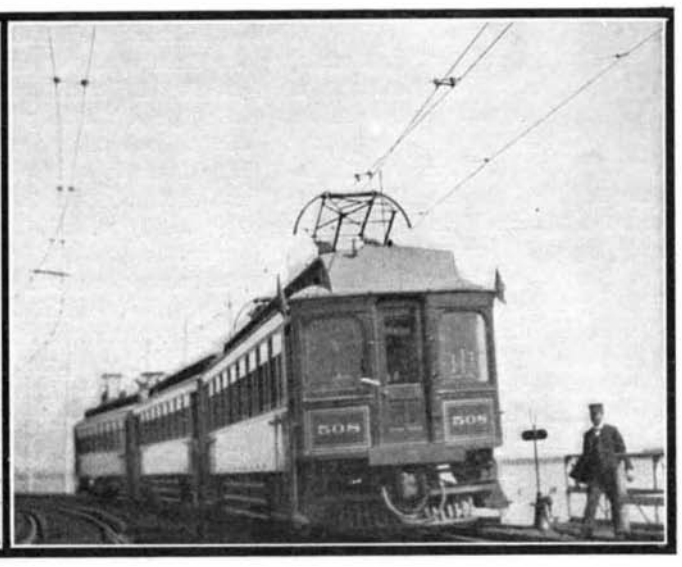
A TROLLEY FOR HEAVY MULTIPLE-UNIT ELECTRIC TRAINS.

BY HERBERT I. BENNETT.

Electric railroading on the Pacific coast has been progressing at a more rapid rate than in any other portion of the United States during the last two years. This advance has not been along the well-established practices for city lines alone, but much has been done in extra-heavy traffic for suburban service. The conditions met with have caused the engineers connected with these enterprises to do a great deal of original and pioneer work. Probably the most unique and absolutely successful device that has been developed is the trolley in use on the San Francisco, Oakland & San Jose Railway, commonly known as the Key route, which was designed and recently patented by Mr. John Q. Brown, the engineer in charge.



The Roller Trolley as Mounted on a Car.



Multiple-Unit Train Fitted With Roller Trolleys.

AN IMPROVED ROLLER TROLLEY FOR HEAVY ELECTRIC TRAINS.

The conditions met with were most exacting, some of which we will mention here. A third-rail system was out of the question, as part of the road passed through streets of various towns and cities, including Oakland and Berkeley, with a combined population of 100,000. The ordinary trolley pole and wheel was entirely unsuited for the work, because at high speed the wheel would leave the wire, the direction of trains could not be reversed, such as in switching, without serious delay in reversing the trolley poles, and most important of all, the heavy currents could not be collected without severe arcing at point of contact. This road operates eight-car trains, weighing, approximately, 350 tons, and at speeds as high as fifty miles per hour, which require at times, approximately, 2,500 to 3,000 amperes to be collected from the overhead conductor. A device was required that, in addition to meeting the above conditions, would operate at high speed on curves without leaving the wire in any direction. Also it must have a range of not less than six feet in height for passing through subways and over surface railroad crossings. These requirements have all been more than met in this device, as it has been operating perfectly for one year, and is a great success.

It has been found that it simplifies the overhead construction greatly, doing away with all trolley frogs and switches except at right-angle crossings, where a simple crossing of special design is used.

The wear on the trolley wire is less than that caused by the ordinary wheel, and the life of the roller which is used is not known, as the original rollers are still in service. These wear to a bright smooth surface, instead of being corrugated or pitted, as was expected.

The device is practically noiseless when operating at any speed, owing to the fact that the roller is packed with non-resonant matter to destroy the vibration.

In Fig. 1 the trolley is shown in its normal condition upon the car. As readily noted, it consists of a double diamond frame of angle iron made up of four conjoined frames. These are connected on each side by elongated joints to give stiffness, while at top and bottom the frames terminate in segmental gears. The gears at the bottom cause the side frames to move in unison, while the gears at the top keep the guards always in a vertical position, as shown. The roller is carried at the top on a shaft, the ends of which are fastened rigidly in a casting to which the guards are secured and on which pivot the segmental gears. The roller is made of 24 inches of 5-inch non-arcing metal tubing with hubs in each end, which have graphite bushings forming the bearing. These bearings are lubricated with oil carried in a cavity in the hub. The guards, which are essential to the satisfactory operation at branch-off wires, are made of sheet steel pressed into the required shape. The arrangement of the tension springs, which keep the roller in contact with the overhead conductor, is worthy of notice. The springs are in practically the same plane as one side of the bottom frame, and secured as shown. This arrangement gives practically a uniform upward pressure on the roller for all positions of the trolley wire, those now in use operating with a pressure of 24 pounds.

Fig. 2 shows a three-car train at a branch track, the trolley having picked up the branch-off wire. It also shows that two trolleys are used on each train of two or more cars, as such an arrangement always insures a continuous and low-resistance circuit to the motors.

The Key route has twenty-six of these trolleys in use, and one other road has arranged to install fourteen.

THE MALCOTTI TELECRYPTOGRAPH FOR TELEGRAPHING UPON TELEPHONE LINES.

BY EMILE GUARINI.

To develop the telegraph and put it within reach of everybody, to install private lines for the use of the public, of administrations, and of business houses, and even to create, by this method of communication, a valuable auxiliary to the telephone — in a word, to popularize it as well as the latter—is a question that seems to be the order of the day, to judge by the interest that the daily technical press is taking in the subject.

We know that one of the weak points of the telephone is that it leaves no trace of the communications exchanged, and is therefore incapable of receiving in the absence of the subscriber; and that another is that it in nowise assures the secrecy of such communications.

In England, Italy, and France, to speak of these countries alone, this inconvenience has given rise to frequent complaints, inquiries, and lawsuits.

But it seems that such difficulties have finally been obviated, since almost simultaneous announcements have been made of the advent of several apparatus of more or less recent invention, to which the journals attribute characters nearly in common, and the accounts of which would almost lead us to believe that they write or print communications simply spoken in the telephone. At Brussels it is the telecryptograph of Engineer Malcotti, at Berlin the teletype and the Heljes apparatus, and elsewhere the Gruhu telautograph, the teledactylograph, etc., without counting the new systems of telegraphy and telephony with which also the press has for some time been occupying itself. With this true chaos of new inventions confronting us, it will perhaps prove of interest if we present a summary of the true state of the question, of which the great importance must not be forgotten. If it is desired to extend the use of the telegraph, this can be done either by installing special private lines in the principal cities or else by using telegraphic apparatus in connection with the telephones upon telephone lines that already exist. These two problems are substantially different, for, although some regular telegraph system may be made to solve the first, this is not the case with regard to the second. The apparatus derived from the Hoffmann type, installed at Berlin by means of a special line having a central teletypic office, is an example of the first case, as is also the Heljes, a system derived from the Wheatstone and Hoffmann, and which an effort is now being made to introduce. This latter is a simpler apparatus than the preceding, and, since it operates by means of a magneto, it may prove very useful to the army as well as in the operation of railways, and for private telegraph lines. Large business houses and administrative offices may have need of a printing telegraph apparatus for communicating with each other; but it may be seen that such a necessity is rather relative, especially when we think of the prejudicial dualism that might occur between the

Fig. 1.—The Apparatus Complete in its Original Form.

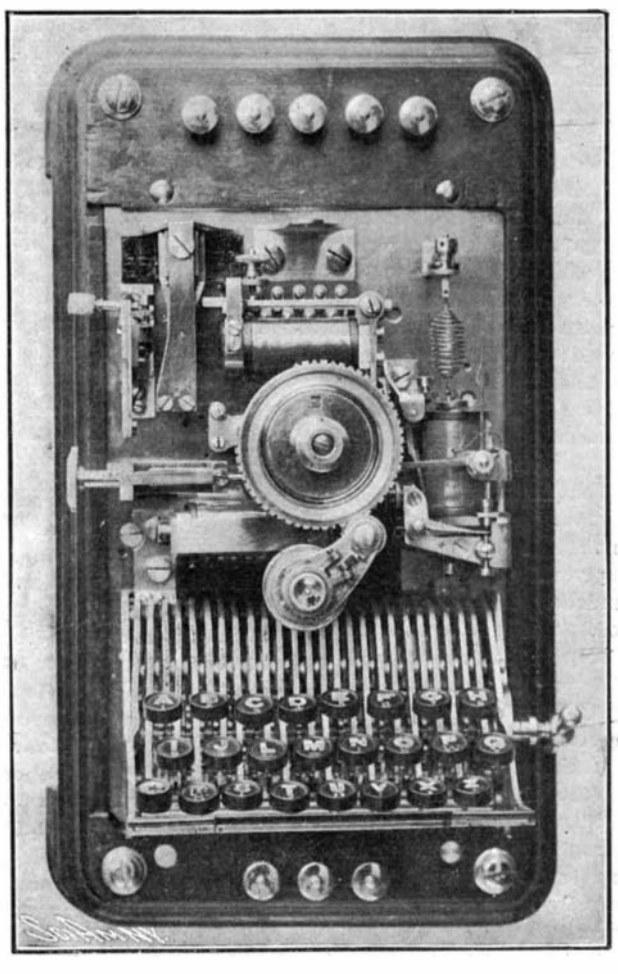


Fig. 2.—The Apparatus with Cover Removed, Showing Interior Mechanism.

THE MALCOTTI TELECRYPTOGRAPH FOR TELEGRAPHING ON TELEPHONE LINES.

To Secure Fulton's Birthplace.

An effort is being made to secure the house in which Robert Fulton was born, and in which he lived for a great many years, at Lancaster, Pa., that it may be preserved in its original condition. The house stands to-day just as it did when the inventor of the steamboat resided in it.

(two services if certain persons had the telegraph and others the telephone. This would make it necessary to have both and to pay a subscription to the two lines separately. This is why, without mentioning other objections, it would seem that private telegraphy by independent lines does not as yet represent the ideal from the viewpoint in question, aside, of course, from special applications such as railways, for war purposes, etc.

It is, therefore, from this point of view, pleasing to learn that an Italian electrician, M. Malcotti, of Rome, has been studying this question since 1901, but with the idea of devising a magnetic telegraph for use upon railways. This he finally succeeded in doing by means of the Hiljes apparatus above mentioned. But, subsequently, his attention became specially directed to a study of the application of the telegraph to telephone lines, which seemed to him to be of the most interest. After an examination of the question, he became convinced that it was necessary that the apparatus devised for this purpose should answer the following conditions: (1) That it should be applicable to any telephone installation whatever, even one with a central battery, without requiring any change or interfering with the service; (2) that it should nullify the danger of another apparatus interfering with the correspondence exchanged, and, at the same time, assure the secrecy of the latter; (3) that it should respond to the exigencies of an extensive exploitation, and that the net cost of installation should be small.

Is it possible for existing telegraphic apparatus to fulfill such conditions? It seems not, and the reason is that the telephone installations are based on two different systems, viz., that with individual microphone batteries at the residences of the subscriber and that with a central battery, which is known generally as the "common energy system."

In the first case, the important point is to so arrange conditions that the telegraphic currents shall have no influence upon the central exchange communicators which signal the termination of a conversation and which must be actuated solely by the call current. When the line consists of but a single wire, it is impossible to do this with any kind of telegraph apparatus. But if the line consists of the usual two wires, these can be used in parallel and the ground employed for the return. This is feasible if the central exchange is isolated. Does this system make necessary any alterations at the central exchange? A case where changes are necessary is exceptional. Besides, the common energy system with central batteries is obtaining a firmer footing every day because of the advantages that it presents. And how is it possible to install telegraphic apparatus like that mentioned upon one of these lines? It must be noted that an ideal apparatus should be capable of operating with any sort of installation, not only to make sure of an extensive exploitation, but also to permit of a modification of the latter in measure as the profits and needs of the service increase.

The problem remained unsolved until the apparatus devised by M. Malcotti, and called by him the "telecryptograph," made its appearance to surmount, it is claimed, all difficulties. This apparatus, which is said to have given satisfactory results during the course of some private experiments in Italy, and which is to be tested ere long upon the principal telephone lines of America and Europe, has, up to the present, been described in too incomplete a manner to allow of a very accurate idea being formed of it. It is, upon the whole, a secret printing telegraph, as its name indicates, and the distinguishing feature of the system is that it operates in the very same manner as the telephone, or by currents that do not disturb the central exchange, and which permit, therefore, of installing the apparatus independently of the telephone systems everywhere employed. The first condition mentioned above is thus entirely realized, as is also that of secrecy. In fact, it is possible to attune two apparatus to an agreed upon figure, or note, so to speak, so as to prevent any other apparatus from catching the communication exchanged. If a communication be transmitted in the absence of a subscriber, his apparatus not being attuned, the telegram will be received, but registered in an undecipherable manner. Upon his return, however, he can decipher the message automatically because he knows the cipher agreed upon. Transmitting in cipher, however, is merely optional, as it is possible to transmit, even in a legible manner, according to the usual process. It will be seen, then, that secrecy can be guaranteed while the communication is passing over the line wire to the receiving station, and that this guarantee is as perfect, even, as that offered by a closed letter.

It is not necessary for the central exchange to install the telegraphic apparatus, inasmuch as there is nothing to prevent two subscribers in correspondence from being called by "central." In a word, the apparatus does not interfere with the service. This is an important point.

The telecryptograph, therefore, would seem to solve the problem completely. But will it answer the practical exigencies of use with as much success as is asserted? This is yet to be seen, and it will prove of interest to know the details of the system, which we hope to illustrate some time in the near future. In the interim, we illustrate, in Fig. 1, the apparatus of the first type, which the inventor has greatly improved and transformed. It consists of a 5½x9½-inch box containing the entire transmitting and receiving mechanism. The apparatus prints on a paper ribbon and is actuated by means of a ratchet mechanism operated electrically, the necessary current being supplied by a small local battery. On the right of the apparatus (see Fig. 2 also), there is a sort of key that serves for attuning, as we have already explained.

The recent model is more practical. At the sides of the keyboard unwind two paper ribbons, upon each of which are printed in small and very legible characters the dispatches received and a copy of those sent, in such a manner that they can be distinguished from one another even should they be cut from the roller. The apparatus, which is very simple, is secured to the telephone. A spring that replaces the local battery sets in motion the apparatus, and it is possible to receive and transmit at the same time with or without secrecy.

Science Notes.

From experiments carried out the following conclusions are drawn by R. J. Strutt: (1) A radio-active gas or emanation can be obtained by drawing air over hot copper, or by bubbling it through hot or cold mercury. (2) By repeated circulation through mercury very considerable activity can be obtained, of quite a different order from that of metals as ordinarily observed. (3) The mercury emanation deposits radio-active matter on the walls of the vessel containing it. This deposit remains after blowing out the gas, and possesses at first perhaps one-sixth the activity of the latter. This induced activity falls to half value in 20 minutes. (4) The emanation itself decays in activity according to an exponential law, falling to half value in 3.18 days.

M. Blondlot now gives some additional information regarding the heavy emanation which he found to proceed from different bodies. This emanation possesses weight and falls downward by gravity. It acts almost like a stream of water proceeding from the substance. A silver coin is generally used, but if it is rubbed clean the emanation ceases entirely. It is then sufficient to heat it to 100 deg. C. in the air for a few minutes. When cold it now gives off the rays as before. The same holds good for pure silver, copper, mercury, iron, zinc, and bronze coins. Lead is an exception, and when freshly cleaned it gives off the emanation. On the contrary, after tarnishing, like lead pipe, it no longer acts. All the liquids he tried were active—water, salt water, pure sulphuric acid, glycerine, turpentine, alcohol, and in general all odoriferous liquids. The inactive bodies are platinum, iridium, palladium, gold, dry glass, fused sulphur, etc. M. Berthelot thinks that the emanation is not due to the metal itself (or other body) but to a very slight chemical action which is produced at the surface. The action of liquids, whose vapor tension is never absolutely zero, and of odoriferous bodies might be due to the formation of volatile compounds. It will thus be of interest to take up the question from a chemical point of view.

A cemetery belonging to a garrison of Longobards has been found near Ascoli on the Tronto at an important pass across the Apennines. The site of the fort is the top of an island of rock now occupied by a little hamlet called Castel Trosino. All the warriors were laid with their faces to the east. Near the head was found a comb made of horn or bone and a round shield with iron boss. On the right lay a long, straight iron sword in a scabbard of hide. Against the right shoulder was laid a long wooden spear and on the left a dagger in a highly ornamented sheath, decorated with gold, as well as a bow and arrows in a quiver. The buckle of a broad belt was generally present and often decorated appliqué for belt and scabbard, fashioned of gold, silver, or bronze. Small gold plates seem to have been sewed to the coat in the shape of a cross. One grave contained a heavy cuirass of plates bound together with iron wire. The horsemen had big shears for clipping manes and a large bronze feed trough with two movable handles; often bits, saddles, and harness were laid beside the dead. The women wore gold hairpins with rounded flat heads, gold earrings of different shapes, finger rings, and gold plates. One ring has the names Gerontius and Regina engraved on it. Crosses and necklaces of gold, and beads of glass, silver bracelets, pottery vases, and plates of glass, cups, combs, and other articles of the toilet accompany the remains of women. Gold coins of the Byzantine emperors cover the reigns tasius (491-518) and Mauritius Tiberius (582-602) the year 578 Faroald of Spoleto, Duke of the Lombards, conquered Ascoli. The cemetery is therefore attributed to a garrison which he placed at an important pass between the lands on the Adriatic and the country to the west. These graves have escaped the plunderer because no stones were placed above them. Most of the objects have been placed in the Museum of the Thermæ at Rome.

COFFEE AND COFFEE CULTURE.

BY C. B. HAYWARD.

The early history of coffee as an economic product is involved in considerable obscurity, fact and fable being blended to an extent which renders any exact knowledge of it previous to the fifteenth century almost impossible. It is said to have been known as early as 875 A. D., but a pamphlet published by an Arab sheik in 1566 seems to shed the first light upon its origin and early use. It is there stated that coffee was introduced into Arabia from Abyssinia about the opening of the fifteenth century, and that it had been known as a beverage in the latter country from the most remote period. Its peculiar properties were taken advantage of by the Mohammedans in connection with their prolonged religious ceremonies, but its use as a devotional antisoporific stirred up the fiercest opposition on the part of the orthodox element of the priests. Coffee was declared to be an intoxicant, and was accordingly prohibited in the Koran, but in spite of this the coffee-drinking habit spread rapidly. Coffee culture has become as inseparably associated with Arabia as tea with China.

For two centuries the world's supply of coffee was obtained from the province of Yemen in southern Arabia, where the well-known Mocha is still cultivated. Knowledge of the taste and value of coffee spread but slowly, so that it was not until the middle of the sixteenth century that it reached Constantinople. Here it also incited the bitter hostility of the priests. An excessive tax was imposed upon coffee houses, notwithstanding which they flourished and extended. After the lapse of another hundred years, coffee reached Great Britain, where it was introduced by a Mr. Edwards, a British merchant long resident in Turkey. The first coffee house in London was opened in St. Michael's Alley, Cornhill, by his Greek servant, Pasqua Rossie, in 1652, and, remarkable to relate, the introduction of the beverage into England met with the same opposition as in the East. In 1675 Charles the Second attempted to suppress coffee houses by royal edict, in which it was stated they were the resort of disaffected persons, "who spread abroad divers, false, malicious, and scandalous reports, to the defamation of His Majesty's government, and the disturbance of the peace and quiet of the nation." In England, as well as other countries, the most effective check on the consumption of the beverage was found to be a high duty, which led to much smuggling. Coffee is spoken of as being used in France between 1640 and 1660, and thereafter coffee drinking may be said to have become an established habit throughout the civilized world.

Up to 1690 the sole source of supply was Arabia, but in that year it was introduced into Java by the governor-general of the island, and the climate was found to be so well adapted to it, that cultivation was begun on a large scale. One of the first plants grown in Java was sent to the botanical gardens at Amsterdam, and seed from it was sent to Surinam, resulting in its introduction into that country in 1718. Ten years later it found its way to the West India islands, and from that time its cultivation has been general throughout the inhabited portions of the tropics.

The regions best adapted to its culture are well-watered mountain sdopes, varying from one to four thousand feet in altitude and between the parallels of 15 deg. north and 15 deg. south latitude, although it is cultivated from 25 deg. north latitude to 30 deg. south in situations where the temperature does not drop below 55 deg. Fah. According to the altitude at which it is grown, the bean varies in size and color, that from the highlands being small and light green, and nearer the coast of a yellow tinge and much larger; the wild trees of Liberia, which flourish in lowlands, producing the largest beans known, which are, however, inferior in quality, as is the case with the majority of the African product. Eastern coffee generally may be distinguished by its yellow color and large beans, as compared with the smaller green berries of Central and South American growth.

The tree in its wild state is slender, reaching a height of twelve to twenty feet, but under cultivation it is pruned to grow not more than six or eight feet high, for convenience in picking. The leaves resemble those of the laurel, though not so dry and thick, and are evergreen, while the flowers are somewhat like the jasmine. The trees are completely covered with blossoms, which perfume the whole countryside for