SIX MONTHS IN A SCHOOL OF TELEGRAPHY.

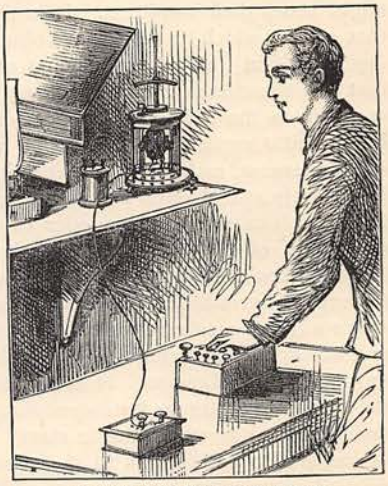
IN these days of keen competition and overcrowding in all the professions, most young men, above what is somewhat invidiously termed the "working class," must be prepared to accept but little, and when opportunity offers to do much, in order to find the work and position for which they may be fitted.

SENDING SUBMARINE MESSAGE.

Now amongst all the professions, telegraphy is that which is least overcrowded, and probably that which offers the greatest scope for ability and legitimate ambition, in the case of young men possessing the average education of gentlemen's sons. In submarine telegraphy, the demand for competent and qualified men is actually in excess of the supply, and is likely to increase with the extension of the present lines of telegraph.

Much has been said of the evils of favouritism in this as in other departments; but these evils have at length become so generally recognised, that we can place some confidence in the assurances we have received, that the advancement of officers will in future depend upon their merit and efficiency, and not upon the influence of "friends at court." Assuming this to be the case, there are several important considerations which point to this profession as an eligible opening for a considerable section of the class to which we have referred. In the first place, the expenditure of time and money necessary to become qualified for the profession of telegraphy is very small indeed, in comparison with that which is required in the case of any other profession.

It has been amply demonstrated that, with due application and with the advantages afforded at a good School of Telegraphy, a man possessing the average education of a gentleman's son may in six months obtain a practical knowledge of, and fair proficiency in, all the systems of signalling generally employed. Moreover, in the same period he may obtain also a fair grasp of the higher branches of the professional training of a scientific telegraphist and electrician, and a general theoretical knowledge equal to that of men who have been in the service, and even on the electrical staff, for many years. Of course, the ability to do promptly and perfectly much of the practical work required of members of this staff can come only through the experience and practice which time will give him. In the meanwhile he can be working intelligently, instead of mechanically and by "rule of thumb," and can be perfecting the foundations of his future advancement and success.



TESTING FOR FAULTS IN CABLE.

There is another advantage—albeit it may be only of a probable and prospective character—which is almost peculiar to telegraphy considered as a scientific profession. It is a *new* profession, a growing one, not only extending its own boundaries year by year, but capable of giving to its votaries, now and then, a new world, an entirely fresh field of endeavour.

RECEIVING SUBMARINE MESSAGE.

There are already many applications of electricity besides telegraphy, and some of these are of considerable importance. We seem to be on the verge of others—the nature of which may be gathered from the inaugural address of the president for this year of the Society of Telegraph Engineers—which could give employment to many hundreds of trained men. From many points of view, it appears certain that the applications of electricity will become vastly extended. And in this connection it may afford a valuable hint to some amongst the readers of this article, to point out that a duly instructed telegraphist should be prepared, and can be enabled, to turn his hand, if necessary, to any application of electricity which may become commercially developed and grow into importance.

From what has been said, the importance to the

telegraphist of a fair scientific knowledge of his profession is sufficiently obvious. We speak advisedly when we say that the mere capacity to transmit and receive a certain number of words per minute will of itself alone no longer be a sufficient qualification even for the "manipulating staff" of our great submarine companies. There will no longer be a hard and fast line between the "electrical staff" and that which we have just mentioned. We believe that nearly all the companies are now anxious to afford aid and encouragement to their officers in their endeavours to perfect themselves in the knowledge of their profession. Some of them, we know, have even gone to the expense of giving special instruction to certain of their *employés*, in order to fit them for a post in which they might better their condition. It is the want even of that culture which he might have obtained by qualifying himself in the higher branches of his profession, that has sometimes caused the young telegraphist to succumb to the indolent influences of station-life in hot latitudes, or to seek his pleasure in public places of amusement, rather than in the cultivation of the best society of the country in which he happens to be located. The study, often under very advantageous conditions, of his own beautiful science, electricity, might otherwise have been a preventive of *ennui*, and a source of never-failing interest to him.

We will suppose the student to enter a really efficient and well-appointed School of Telegraphy, such as may now be found in London. Here he will at once join the elementary class for "manipulation," or signalling, and also an elementary science class. In the former he has first to be initiated in the use of the "single-needle" instrument, by means of which he becomes acquainted and familiar with the alphabetical, numerical, and punctuation signals, the rules for spacing, and the technicalities used in signalling, which are essentially the same in all systems of transmission by hand. At this stage the signals are such as would be obtained through a short overland line. His next step is with the "Morse recorder," in which system the "dot" or "dash," imprinted upon a paper strip, corresponds to the "left" or "right" deflection of the "needle." Here the knowledge he has already gained is of course of great service to him. Considerable care is necessary to insure his adopting at once what lengthened experience has proved to be the best style of handling or fingering the transmitting instruments or "keys" used for these systems of signalling; and it is an advantage to have nothing to *unlearn* in this direction. In a period of time varying from four to six weeks, according to the natural aptitude of the learner, he finds himself at one of the "stations" of a "cable circuit," sending messages to, and receiving others from, his instructor or another learner. The progress he makes is ascertained and recorded from day to day, and the length of the "cable" through which the signals are sent and received is gradually increased. Ultimately he joins the advanced manipulation class, in which he obtains a practical knowledge of the difficulties in signalling, and of the peculiar character of the signals in the case of very long lines. Here also he becomes acquainted with the "mirror" receiver, the beautiful "syphon recorder" of Professor Sir W. Thomson, the "automatic transmitter" of the late Professor Sir C. Wheatstone, and the arrangements for the "duplex" working of lines.

The word "cable," which we have used, requires some explanation. In order to reproduce exactly the electrical conditions which prevail in long submarine lines, a very expensive piece of apparatus—viz., an "artificial cable"—is absolutely necessary for efficient instruction in submarine signalling, and is invariably employed in the best of the London Schools of Telegraphy. The apparatus in question was devised by Mr. Cromwell F. Varley, the Atlantic cable electrician, who has testified that the signals obtained by its means exactly correspond to those actually obtained through the Atlantic, the Eastern, the Brazilian, and other long cables, according to the mode of its adjustment. Sir W. Thomson, also, states that the signals and "speeds of signalling" obtained with the artificial cable are altogether similar to those of the great submarine cables. This apparatus is as necessary for the instruction of the learner in the various methods of *testing* cables, as it is in familiarising him with the signals he will be expected to read and transmit when appointed to a station on a submarine line.

We have now to refer to the scientific portion of the course of instruction, including these processes of testing, in which considerable skill, as well as accurate electrical knowledge, is frequently requisite. In the school to which we have referred, great pains have been taken to perfect the principles and the routine adopted in this branch of the training. The problem to be solved was by no means an easy one. Given a dozen or two of young men having the average education of gentlemen's sons, it is required to give them, in six months, a fair grasp of general physics, elementary chemistry, and that *modern* science of electricity—the electricity of the telegraph engineer. But of no less importance is it to give these students the habit of study—a foundation upon which they can build securely—and a love for the science which it is their business to apply. Amongst those who are qualified by their acquirements to give the requisite instruction, a small fraction only, we think, would be found to have the gift of teaching—of making difficult things seem easy. In a school of the kind to which we refer, anything like "cramming" is scrupulously avoided, even at those periods immediately preceding the periodical examinations. The great error of making a good memory the sole criterion of proficiency—of placing at a disadvantage the man who may not remember figures, but who understands principles—is avoided by allowing the students to consult in these examinations a small note-book, in which they are encouraged carefully to enter the arithmetical "constants" of formulæ, and in some cases the formulæ themselves. As mentioned above, the pupil—unless his previous studies enable him to pass a certain preliminary examination—first enters the elementary science class; and here he becomes acquainted, generally for the first time, with the two

great discoveries—including so many minor discoveries of the last and of the present centuries—viz., the "conservation of matter" and the "conservation of energy." The student commences with mechanical dynamics—the "doctrine of motion"—which, as Maclaurin says, "has been justly called the key of nature;" and, throughout his initiation in electro-chemistry, and in the laws of the inductive and conductive circuits, the dynamical principles that "work" is done, and "potential energy" stored up, in the separation of masses or molecules, and in electrical separation, and that "kinetic energy" and heat become developed when masses or molecules are allowed to fall together, and when electrical recombination occurs, are constantly insisted upon. The beneficial result of thus appealing to the intelligence of the pupil, and of directing it to grand general principles rather than to details at the earliest period, is in most cases abundantly shown in the later periods of the course.

The fundamental law of current variation, first formulated by Ohm, and verified by Pouillet, requires to be very fully elucidated, and leads directly to various processes for measuring the resistance and the electromotive force of batteries, in which the student may commence to acquire some skill in "testing." He should be well exercised in the various formulæ relating to wires; and, as an example of the proficiency attained in this direction, it may be mentioned that one of the practical problems he is frequently required to solve, in the school we have referred to, is the determination of the exact weight and length of a wire made up into a coil, of which the ends only are accessible. A clue to the *modus operandi* may be found in the fact that the diameter of the wire in question, and its electrical resistance, are data obtainable by measurement.

The principle and the use of Wheatstone's balance, the electrometer, and the galvanometer, with the mode of taking their "constants," and the measurement of very high resistances by the "fall of charge" in a condenser, next engage attention, and by degrees the student is led on to the more complicated tests for determining the nature and the distance of "faults" in cables, and to various other work pertaining to the advanced science class.

In conclusion—recognising the importance of the mental culture that science can give, and the fact that the ability to do well some useful work requiring special training and acquirements is one of the best accomplishments a man can possess—we may observe that there are many gentlemen's sons who, even without any present necessity for or intention of joining the telegraph service, might do well to spend six months in a really good School of Telegraphy.

THE CHINESE AND CIVILISATION.

IT is pretty generally known that the vast influx of Chinese labour into the Pacific States has year by year become a subject of increasing perplexity to American statesmen, and most people have probably some general notion of the main outlines of the difficulty; but probably very few have a clear idea of how very serious a problem it is, much less of how closely it may be possibly approaching to our own doors. The inimitable "Heathen Chinee" of Bret Harte has done much to make people think that the American jealousy of "Chinese cheap labour" is *solely* (as beyond doubt it really is very largely) a trades-union feeling founded on the usual trades-union grounds, and to hide the real significance of facts which furnish just occasion for considerable anxiety. In this anxiety England herself may feel some share; for, as already hinted, the question is threatening to become more than an American one. Not only has a Committee of Congress formally requested the President to open correspondence with our British Government upon the subject of Chinese immigration—a fact which alone has brought the subject within the range of British foreign politics—but British colonies in Australia are beginning to feel the pressure of the same difficulty. More even than this: proposals have recently been made in English newspapers to meet both the scarcity of domestic servants and other labour difficulties in England itself by the importation of Chinese, and in some quarters the proposal has been received with marked favour. Under these circumstances it is really of importance to form some clear idea of what the "Chinese difficulty" when fully developed really is, and what are so far the ascertained effects of that contact of the Chinese *en masse* with civilisation, which some amongst ourselves are disposed to bring about.

The first side of the question which naturally strikes an Englishman is, of course, the purely economic one, and on this head we have what appears to be trustworthy evidence—much of it gathered from Chinese witnesses—in the shape of reports from a Committee appointed by the Senate of California to investigate the subject, and a previous joint Committee of Congress appointed in 1876 for the same purposes. From these documents it appears that out of a total population in California variously estimated at from seven to eight hundred thousand, at least one hundred and twenty-five thousand are Chinese, a more probable estimate being one hundred and fifty thousand, while some place it at two hundred thousand. This vast population lives at an average expense of about sixpence per day, and can hence afford to work at such extremely low wages as to drive out of the State all other labour of the same kind, even negroes being unable to compete with them. This alone would be a serious thing enough to the working classes, though