

HAND REGULATION OF A HYDRO-ELECTRIC PLANT IN INDIA.

By J. W. MEARES.

IN these days of automatic regulation, distant control, and so forth, it may be of interest to readers of the *ELECTRICAL REVIEW* to hear of a water-driven power station which has for years been regulated entirely by hand, without governors.

The plant in question is at Darjeeling, the hill station of Bengal, and the summer headquarters of the Bengal Government. The original installation was laid down by the present writer in 1896, on behalf of Messrs. Kilburn and Co., in pursuance of an agreement with the municipality. It consisted of two 65-kw. Crompton-Brunton single-phase alternators, driven by Gunther Girard turbines. Soon after completion a disastrous flood caused a landslide which dammed up one of the two hill torrents which supplied the power, with the result that the power station was buried in mud over the top of the machines. They were excavated, however, washed and dried, and set to work again some few weeks later. These 2,300-volt generators are still working, and as an old Cromptonian I feel rather proud of them.

The present municipal engineer, Mr. G. P. Robertson,* M.I.E.E., M.I.Mech.E., took over charge in 1903, and under his able management this small plant has been extended from time to time, and has paid very well indeed. Incidentally, he adopted a "point-five" tariff for the winter heating load many years ago—earlier, I think, than our friends in Great Britain. From the very beginning, even before the mud episode, the hydraulic governors were very troublesome; they were not of a type calculated to assist in the parallel running of alternators, and they never recovered from the shock of being buried alive.

From this point I prefer Mr. Robertson's report, on the extension now contemplated, to speak for itself.

"The governors on the old machines gave so much trouble that they have been scrapped, and the machines are being controlled by hand. One of the difficulties was grit getting into the governor-controlled valves of the hydraulic gear. Oil-pressure gear was, therefore, specified for the new turbine, and the governor supplied acted splendidly for a time. One day, however, the machine started hunting so violently that it had to be shut down, but when opened out again it ran as smoothly as if nothing had happened.

"Some time afterwards I was in the power house when the same thing occurred again. I then thought that the effect was due to an electrical surge of such a nature as to set up mechanical pulsations, synchronising in some way with the surge, so that the machine was nearly hammered to pieces before it could be shut down.

"I made inquiries about this while at home this year, and heard of several similar cases, though very little is said about them. One man explained the case as being due to harmonics; he admitted that similar cases had occurred in Switzerland, and doubted if any governor would keep control in the circumstances. The governor may act like a charm for years at a time, taking care of all kinds of lighting and switchgear surges; but one day, for no apparent reason, the machine starts to hunt, sometimes with disastrous results.

"The machines at Sidrapong are now being run successfully without governors. A tachometer has been fitted to each machine, and a machine coolie stands by with his hand on the control wheel and his eye on the tachometer. His whole job for four hours at a stretch is to adjust the control wheel so that the tachometer pointer is always against a red line on the dial. He does this splendidly. An educated man would probably either smash up the machine or go to sleep before the end of the four hours, but the job neither worries nor bores the coolie. I propose to adopt this arrangement for the new plant."

I may add that we are fortunate in having no Trade Union to object to the employment of what may, perhaps, be called the "Coolie automatic voltage regulator," a type

which is not described in Mr. C. C. Garrard's recent paper on the subject. The cost of each regulator of this type is Rs. 10, or, say, 13s. 4d. per mensem, and no repairs are necessary—not even a "little bit of string" is required to prevent them being too sensitive.

INDIAN NOTES.

[FROM OUR SPECIAL CORRESPONDENT.]

Allahabad and Lucknow Electric Lighting Schemes.—"Residents of Lucknow and Allahabad," says the *Pioneer*, "have heard so much of electric schemes that have come to naught, that they might be excused perhaps for feeling somewhat sceptical on the subject of the possibilities of electric lighting for the two capitals. It appears that an important new development in the carrying out of the much canvassed scheme has recently taken place. The licensees, Messrs. Crompton & Co., have been given guarantees by the two municipalities concerned of $4\frac{1}{2}$ per cent. per annum on the paid-up capital required—a sum amounting to 15½ lacs of rupees (£100,000). The arrangement arrived at is that the municipalities are to share all the profits above the $4\frac{1}{2}$ per cent. guaranteed for the seven years' period of their guarantee—the licensees anticipating that the concerns will pay at least 8 per cent. after three years' working. If this anticipation is realised the municipalities should do well on the deal. It is proposed to form a limited liability company, under the Indian Companies' Act, with the well-known firm of Messrs. Martin & Co., of Calcutta, as managing agents, the capital to be raised in India, and residents of the two towns being given an opportunity of taking shares in what is expected to prove a profitable investment.

"It is also, it may be mentioned, anticipated that when the supply of electric power is available, an additional demand is more than likely to arise in the way of small industries, which are wont to spring up where electric power is obtainable. The ideas of the promoters of the present scheme are, we understand, not confined to meeting the wants of the wealthier classes only; arrangements are to be made to install lamps in bazaar shops, the tenants to be charged a flat rate of a few annas per lamp per month."

The above has been taken from a recent article in the *Allahabad Pioneer*, and it gives some idea as to how matters stand regarding the proposed supply of electricity for lighting and power for the two cities mentioned. With regard to Lucknow, the residents may well indeed be sceptical, as there have been at least half a dozen schemes drawn up and discussed within as many years. The authorities, both civil and military, must have shelves of estimates pigeon-holed somewhere appertaining to an electric supply; and, incidentally, the hotel-keepers of Lucknow must be a good deal in pocket, through the sums spent by the representatives of various contractors in Calcutta and Bombay who have been periodically invited, or, rather, seduced to Lucknow to draw up estimates, which, being sent to the authorities concerned, after much trouble and great expense, were not even acknowledged—a want of courtesy which, by the way, is characteristic of Indian methods.

It is reported that a wealthy Indian has promised to subscribe 7½ lacs (£50,000) for the Lucknow scheme if the municipality consent to give his name to the undertaking.

Calcutta Electric Supply Corporation, Ltd.—The consulting engineers of this prosperous company in London have recently given a contract to the British Thomson-Houston Co., of Rugby, for a 6,000-kw. set—the largest steam turbine set out East—for the new Calcutta power house, Calcutta.

The present plant consists of four 3,000-kw. Orlikon steam turbine sets, one 800-kw. ditto, and four 500-kw. Belliss sets; the supply is at 6,000 volts, 50 periods, transformed at several sub-stations to 450 volts direct-current three-wire, and covering an area of 109 square miles.

Darjeeling.—The death is reported through drowning of the popular and very able municipal electrical engineer, Mr.

*Mr. Robertson's regrettable decease is announced in the following article.—Eds. *ELEC. REV.*]

G. P. Robertson. He recently spent a period at home and on the Continent, inquiring into the most recent and modern improvements in long-distance hydro-electric transmission practice, and on his return to India was deputed to survey and develop a further scheme for the Darjeeling extension electric power system. It was while actively engaged in this operation that he recently met his end by his boat being capsized in the Rungeet River. He was an extremely able and energetic engineer, and a hard-headed Scotsman, whose advice and guidance will be sadly missed by the Darjeeling municipality. Besides being electrical engineer, he was in charge of the sanitary, drainage and buildings department of this flourishing municipality, and his work in each of the departments attest to his all-round capabilities.

CONDITIONS AFFECTING THE VARIATIONS IN STRENGTH OF WIRELESS SIGNALS.

THE paper read before the INSTITUTION OF ELECTRICAL ENGINEERS by PROF. E. W. MARCHANT, and abstracted in our last issue, was discussed in London on February 11th.

MR. W. DUDDELL, in opening the discussion, said the paper raised many questions, but he would confine himself to the problem of measurements, because insufficient results had been obtained to enable satisfactory conclusions to be arrived at as to the discrepancy between day and night signals. He referred to the necessity for organised observation over a wide area, pointing out that the programme discussed in Brussels for making such measurements, which had been abandoned owing to the war, showed the difficulty of keeping constant conditions of measurements in different places. He took issue with the author as to whether the Einthoven galvanometer was so sensitive as stated. Lately Abrahams had constructed an improved moving coil galvanometer in Paris, which was quite as sensitive as the Einthoven instrument, and it was evident that we were on the point of obtaining a sufficiently sensitive instrument to record long-distance measurements.

MR. VVYAN, who apologised for the absence of Mr. Marooni, mentioned that some long distance records of night signalling had been obtained from Melbourne, ship to shore and vice versa, covering 2,000 miles with a 1½-kw. set, which was the greatest distance obtained with such a set. It was difficult to come to any conclusions as to conditions, &c., without some organised system of collaboration, extending over a period, for making observations.

DR. W. H. ECCLES thought the most useful feature of the paper would be the details of the use of the Einthoven galvanometer, especially when organised measurements could be made. In the Pacific it was found that with a 2-kw. wireless set it was normally possible to communicate over 2,000 miles at night, and freak signalling in the summer had been established over 3,000 miles and 3,500 miles in the winter. In the day the possible range was only some 200 miles. Dr. Marchant was only getting one-tenth of the variation that was being obtained in Pacific work. For short distances the upper layers of the atmosphere probably had little influence on the result, but it was otherwise in long distances. In wet weather, the loss of insulation increased the damping effect, and might account for 20 to 30 per cent. difference in measurements.

MR. J. E. TAYLOR said as regarded the theoretical assumptions as to causes of varying strength of wireless signals, he had little belief in any of the speculative theories put forward, particularly in regard to ionised air, &c. He suggested that the antenna had superimposed on its own field another field due to the atmospheric potential grade, which had the effect of greatly increasing the field in an upward direction, and this gave rise to radiation at a high level much above the normal. As the range increased defraction due to low level radiation would sift out, but the high level radiation would persist.

ADMIRAL SIR H. B. JACKSON thought the Pacific would be an excellent area in which to experiment on account of its numerous small islands and long-distance transmission.

MR. CAMPBELL SWINTON expressed surprise at the uniform results said to have been obtained with the crystal detector, which was usually very variable. No other method of measurement was so sensitive as the galvanometer method, and it would be a great benefit if a method could be devised which eliminated rectifying the current.

DR. J. A. FLEMING, whose remarks were communicated, said that similar measurements had been carried out at University College on signals coming from the Eiffel Tower. The signals were received on an Einthoven galvanometer through the usual form of tuner. To calibrate the galvanometer they used two coils, the mutual inductance of which at various distances was known, so that by measuring the primary current by hot wire ammeter they could determine the value of the secondary current; the latter was made to take the place of the antenna current, and it was then possible to repeat the deflections of the Einthoven galvanometer produced by the Paris signals by a known current in an artificial antenna using the same frequency. The observations were made by Mr. Coursey; from the charts made it

appeared that the greatest falling off in signal strength occurred when it was clouded both in Paris and London. But before any valid conclusions could be drawn it would be necessary to have an antenna set up near Paris and an automatic record kept of signal strength close to the sending station; such an antenna should be in duplicate—earthed and non-earthed. He could not believe that the large variations of strength in only 200 miles observed in London were entirely due to ionisation of the air; in short-distance transmission there was a considerable degree of propagation through and over the earth's crust, and reception was not entirely due to a true space wave.

PROF. HOWE said he also had been making measurements of signals, &c., with a view to getting measurements of the actual field set up by the signals. He explained the difficulties of thermal galvanometer measurements, admitting the advantages of the Einthoven galvanometer method used by the author, which eliminated trouble due to other people sending signals. Basillie had showed that if the wave length was altered only a very little, great differences in results were obtained. He was very glad to hear a denunciation of the ionised atmosphere theory; it could be made to fit any desired condition at will.

PROF. MARCHANT, in replying, said he wished to stimulate observation of signals, and had put up theories with a view to their being demolished if necessary. It was extremely difficult to calibrate an aerial, and they were driven to calibrating the secondary. The Einthoven galvanometer was one of the best available. He agreed that the Pacific was a wonderful place for transmission, and that this result was due to local conditions, as such results had never been obtained anywhere else. The energy record was quite different from the distance record. He found it quite hopeless to try to take direct measurements of signals. The ionised air theory was excessively convenient as a medium of explanation, but he was bound to say he thought ionised air was a factor.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electric Heating and Ventilation.

THE CRENDEN CONDUITS CO., LTD., of Chester Street, Aston, Birmingham, after having spent a considerable time in experimenting and tests, have just placed on the market a system of heating and ventilating by electricity, and have now actually at work at the showrooms of their London agents (Messrs. Baxter and Custer, Ltd., 219, Tottenham Court Road), an installation giving very satisfactory results in an exceedingly difficult situation, which they invite anyone interested to call and inspect.

Some of the advantages claimed for this system are set out below:—

It ensures proper circulation, distribution and equalisation of temperature, which is essential to a proper heating system.

Immediate results are obtained as soon as the electric current is switched on, in all parts of the building, and the heat is not localised as is the case when separate radiators or fires are used.

The system is entirely automatic in its action and requires no attendant.

It requires no coal or water, as in the case of steam heating plant, and does away with all boilers, radiators, steam pipes, valves, traps and pumps.

It can be used for cooling the atmosphere in hot weather, and can be fitted with air filters and ozonisers, which makes it an ideal system for hospitals.

The system is considerably less expensive both to install and maintain than steam heating and other systems.

The system is so arranged that by switching on the full load the desired temperature of about 60° F. is obtained during the first hour, and the consumption of current can then be reduced to about a third, which would maintain this temperature.

The company are prepared to undertake the installation of their system in any building, and to advise and quote for any work. They also make up these plants in a portable form, which can be easily carried from room to room. They will be pleased to give full particulars as to the capacity and output of their various plants, with the cost of running per hour, to those interested.

An Electric Kitchen in Derby.

The accompanying illustration shows the electric kitchen of the Whitehall Café, St. James's Street, Derby, which has recently been equipped under the direction of Mr. T. H. Thorpe, Derby, the architect for this imposing building and the Kinema Hall adjoining the Café.

The electrical equipment, which was all supplied by the BRITISH ELECTRIC TRANSFORMER CO., LTD., London, at present comprises 34 standard "Tricity" hot-plates, all of which are operated from indicating control panels, with separate "on and off" switch and fuse, the hot-plates being interchangeable; 18 are for boiling purposes, and the remainder for operating two double ovens and four single ovens. There are, in addition, two 24 in. x 12 in. 6-kw. radiant grills, and a carving table 5 ft. x 2 ft. 3 in. x 2 ft. 10 in. high with hot cupboard, and two carving dishes with a maximum loading of 7 kw.

The general arrangement was set out by Mr. F. S. Grogan, of the British Electric Transformer Co., Ltd., in conjunction with the manageress of the Café, Mrs. A. Etheridge.