537·3 : 55·038 : 681 (547)

Effect of electric current on the Magnetic instruments at Alibag Observatory

V. V. SOHONI, S. K. PRAMANIK, S. L. MALURKAR
and S. P. VENKITESHWARAN

India Meteorological Department

(*Received 1 October 1952*)

Introduction

1. The Colaba Observatory was established by the Government of Bombay in 1823. Magnetic observations commenced there from 1841. The Observatory was taken over by the Government of India in 1899. When the question of the electrification of Bombay came up, a magnetic observatory was installed at Alibag, the headquarters of the Colaba district, situated on the coast, 18 miles to the south of Bombay (Fig. 1–plate facing p. 46). Magnetic observations commenced at Alibag from 1904 and were linked up with those of Colaba by means of two years' comparative observations. We thus have a long continuous series of observations for over 100 years at Colaba and Alibag.

2. In those days Alibag was a small town with a population of a couple of thousands only, with agricultural and fishing population sparsely distributed in the adjacent areas. It was then thought that the Alibag Magnetic Observatory would be safe from any electricity in its neighbourhood at least for a century. But the development of this area was more rapid than was expected. Within less than 25 years, in 1923, a private company applied to the Government of Bombay for a licence for the supply of electricity in the Colaba district. The India Meteorological Department had to consider what would be the best means to protect the Alibag magnetic records from artificial magnetic disturbances consequent on the introduction of electricity in the Colaba district. The magnetic authorities in Britain were consulted. Their experience in the matter of the protection of the Greenwich Observatory had not been satisfactory. The India Meteorological Department felt that clauses like those drawn up for the protection of the Greenwich Observatory would not be sufficient in the case of Alibag. They did not prohibit the erection of electric systems near the observatory, but empowered the Admiralty to inspect the systems and demand such alterations as necessary for the protection of the magnetic instruments. The India Meteorological Department felt that if they were to demand alterations in the methods of installation, on the ground that the instruments were being affected, the onus of proof that the demands had not been complied with would lie on the India Meteorological Department and there might be endless trouble, perhaps with litigation until the requirements were met. Before 1914, there were five magnetic observatories in the then Indian Empire against whose absolute readings all the field survey values in the Indian Sub-continent were reduced : corresponding to the locality where the survey was made the values of one set or other of standard observations were used (*vide*, Records of the Survey of India, Vol. 19, 1901-1920). (1) Bombay-Alibag ; *(2) Dehra Dun ; (3) Barrackpore-Calcutta ; (4) Kodaikanal ; and (5) Toungoo (Burma). With the start of the first world war, the magnetic observatory at Barrackpore was closed down. At the time of the Inchcape Committee retrenchment, about 1932, the magnetic observatories at Toungoo and

*The magnetic observatory at Dehra Dun maintained by the Survey of India Department was getting disturbed by local influences and was closed down about 1943. It is learnt that a magnetic observatory would be restarted at some distance from Dehra Dun in the near future.

Kodaikanal seem to have been closed down. The question being important in as much as it entailed protecting the only Magnetic Observatory in this part of the world with a long series of standard observations, the India Meteorological Department suggested the inclusion in the licence of a clause prohibiting completely the transmission of electric energy within certain specified distances of the Alibag Observatory. The Government of Bombay, at the instance of Government of India, agreed to include such a clause, and when the licence was issued it contained a clause prohibiting the transmission of electrical energy within a radius of 18 miles of the Alibag Observatory in the case of direct current of any kind, and within a radius of 5 miles in the case of alternating current.

3. The first objection to such restrictions was received in 1925. That year a Consulting Engineer applied to the Government of Bombay for permission for two of his clients to generate about 5 K.W. of electricity in Alibag. The Government of Bombay thereupon wrote to the Government of India suggesting that the restrictions enforced at Alibag appeared unnecessarily rigorous in view of the fact that the Greenwich Observatory was close to some large generating stations apparently with no ill-effects. At the instance of the India Meteorological Department, however, Government of India wrote back stating that the request should not be agreed to for the following reasons —

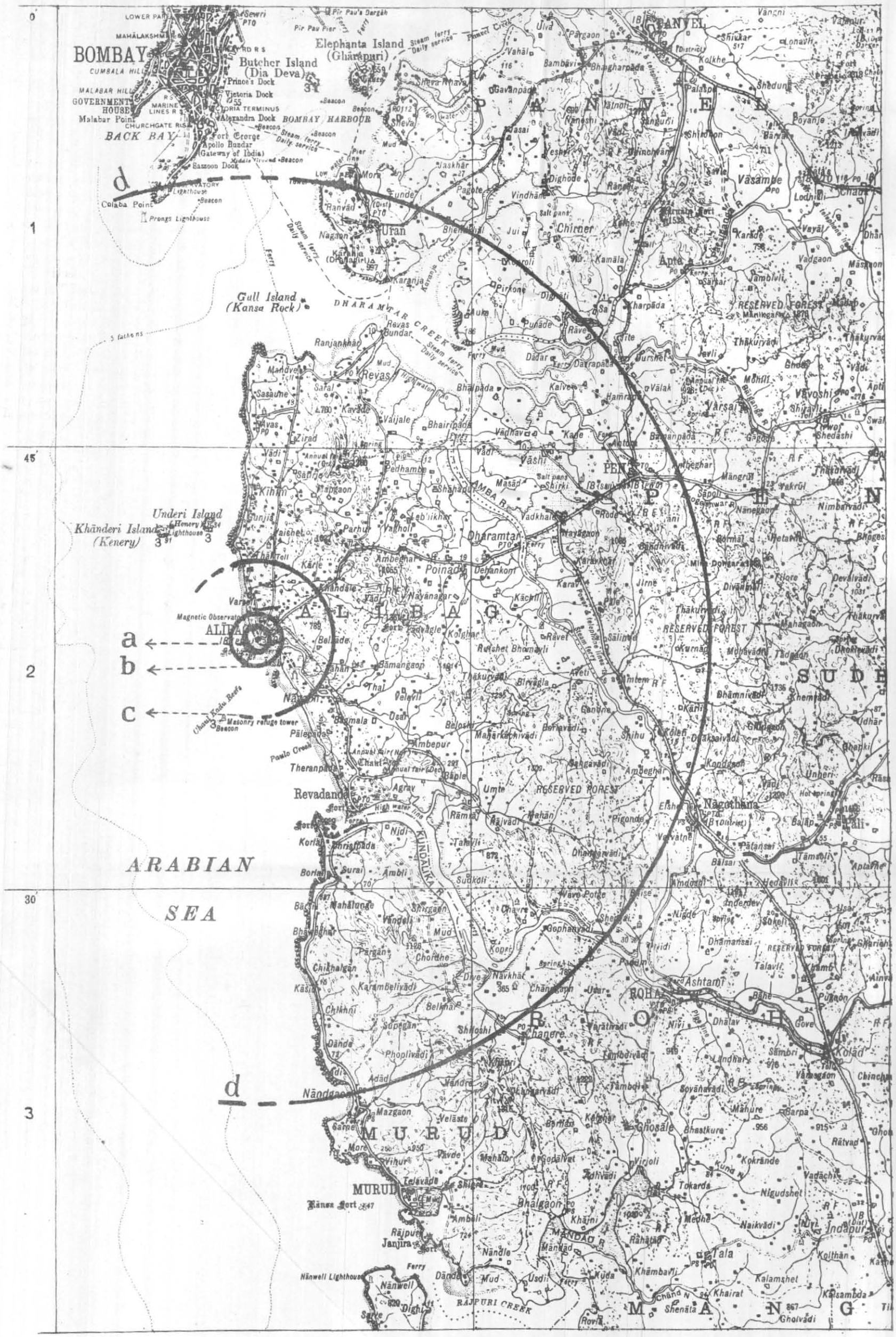
(*i*) The Magnetic Observatory at Greenwich had to be shifted to a distance of 25 miles in consequence of such local disturbances as had led in India to the removal of the Magnetic Observatory from Colaba to Alibag. Before this removal from Greenwich was decided upon, costly protective measures had been tried, but found to be insufficient. Also in the U. K. the safety of the leading Magnetic Observatory of Kew had been maintained by shifting it to a well protected location, far from any public electric system, to Easkdalemuir in Scotland.

(*ii*) The Alibag Observatory being the only institution in India doing work in terrestrial magnetism in a rigorously scientific manner, and being the senior institution of the kind in the East, and one of the important magnetic observatories in the world, the data of which are regarded by magneticians throughout the world as fundamental, it was necessary to ensure the accuracy of the observations from the suspicion of interference by artificial magnetic disturbances.

4. In the years 1929-1930 several requests were again received from hospital authorities, cinema companies and private individuals, for the installation of small electric generators near the Alibag Observatory. In 1934 the President of the Alibag Municipality began to press for the removal of the restrictions, again on the ground that there were electric installations in the neighbourhood of Magnetic Observatories in the United Kingdom. All such requests were however opposed, as it was felt that if we agreed to any such request, numerous applications for electrical installations near the observatory were likely to be received. There would be no easy means of checking that the current generated was not allowed to leak into the earth and doubt would arise as to the correctness of the magnetic records of the Alibag Observatory. With a view to secure necessary legal authority to oppose such demands, the question was at this time taken up with the Government of India, whether it would be advisable to frame rules under Section 37(2) (h) of the Electricity Act for the protection of the Magnetic Observatory. After detailed consideration by the Government of India, it was, however, decided that this was not necessary, and it was left to the goodwill of the Bombay Government to enforce the necessary restrictions.

5. In 1938 one firm, on the same grounds as mentioned above, again approached the Bombay Government for modification of the restrictions on the use of electricity in and around Alibag, but the Government of India in consultation with the Bombay Government decided not to relax them.

6. During the years 1938-1940, the President of the Alibag Municipality, on the basis of data regarding electric installations around Magnetic Observatories collected from several different countries, sent many



Restrictions on use of Electric current at Alibag.

(1) Inside Circle (a) (radius ½ mile), only Alternating Current, 3 phase, minimum 50 cycles allowed. No Alternating Current thermal generator or step-down transformer shall be located inside Circle (a).

(2) Within the area between Circle (a) and Circle (b) (radius 1 mile), same as within Circle (a), but step-down transformers allowed.

(3) Within the area between Circle (b) and Circle (c) (radius 3 miles), same as between Circles (a) and (b), but alternating current thermal generator and small conversion of A.C. into D.C. or generation of D.C. up to a maximum of 2 K.W. in all, allowed.

(4) Within the area between Circle (c) and Circle (d) (radius 18 miles), use of both A.C. and D.C. other than for traction allowed.

(5) Outside Circle (d), no restriction on use of electricity including electric traction.

FIG. I.

G. P. Z. P. Poona, 1952.

representations both to the Government of India and the Government of Bombay for modification of the stringent restrictions enforced on the use of electricity around Alibag. At the instance of the Government of India, the Director General of Observatories discussed the matter with representatives of the Bombay Government. In these discussions it was emphasised that it would become necessary to shift the magnetic observatory from Alibag to some other locality before allowing the use of electricity in the town, and that on the analogy that part of cost towards shifting the observatory from Colaba to Alibag was paid by the Bombay Electric Supply Co., compensation would also have to be paid towards shifting the observatory from Alibag to another site. The question was not pursued during the war.

7. In 1946 after the war was over, the demand from the public of Alibag for the electrification of their town became more persistent, and the Government of Bombay wrote to the Government of India stating that the demand for the removal or relaxation of the restrictions at Alibag could no longer be resisted. The matter was discussed with the Electricity Commissioner with the Government of Bombay on 3 April 1947, and the preliminary conclusion arrived at was, that an alternative site should be selected pending any decision on the removal of the restrictions at Alibag. The new site should be linked up with Alibag by means of comparative observations for 2 years. Thereafter, electricity might be allowed into Alibag town subject to restrictions essential for the protection of the magnetic records. If it was found later that the Alibag observations were vitiated inspite of the precautions imposed, the plan was to shift the Alibag Observatory to the alternate site.

8. Surveys were made of the region south of Alibag to locate such a site and a spot about 7 miles south of Alibag was located. But it was understood that a survey of the Alibag district which had been carried out by the Electrical Commissioner with the Government of Bombay showed that the demand for electricity for agricultural purposes, such as working of irrigation pumps, in the villages south of Alibag was perhaps greater than the demand at Alibag town itself. As the high tension transmission line was expected to pass along the main road from Alibag to Revdanda and further south, it was very likely that in the next few years all those villages would become electrified. It became, therefore, apparent that no suitable alternative site could be located within a short distance of Alibag.

9. Fresh discussions were held with the Government of Bombay authorities on 1 August 1947, and it was agreed that, in the circumstances, the Meteorological Department would be agreeable to allow the electrification of Alibag subject to some restrictions essential for the safety of the magnetic records, provided a field station, subsidiary to the main observatory, was set up in a suitable place within a reserved forest or in the middle of grazing ground. The plan was that restrictions imposed regarding insulation of wires and ban on direct current would be sufficient to ensure that the large-scale changes in the magnetic records at Alibag would not be significantly affected by the effects of electric current, and thus the continuity of the long series of the Colaba-Alibag magnetic records would be maintained unimpaired. The study of short-period fluctuations which might be affected by the effects of electricity would be undertaken from the records of the field station.

10. Detailed surveys of the region round about Alibag were made in 1947-48, by parties led by the first author, and a site was selected in the neighbourhood of Amtem-Nigadi on the eastern bank of the river Amba, about 17 miles to the east of Alibag, for the projected field station. It was, however, found that the setting up of the field station away from human habitation would prove very costly and involve difficult arrangements for the stay of the observing staff.

11. It had been suggested in 1938 and in 1947 that experiments should be carried out on the effect of electric current on the magnetographs. In May 1950, it was decided to undertake experiments to find out

that effects of electric currents on the magnetic instruments, to determine what restrictions on the use of electricity in Alibag were necessary, and also to ascertain whether it was possible, to so safeguard the Alibag Observatory as to make it unnecessary to have a field station at Amtem-Nigadi, as contemplated.

The Experiments at Alibag

12. It was planned to have 4 series of experiments in the different seasons with varying conductivity of the soil, one towards the end of monsoon, one in winter, one in summer and one during strong monsoon, when the land would be thoroughly soaked and moisture laden. The object was to observe the effects of leakage into earth and passage of electric current, on the magnetic instruments. The four series were conducted in September 1950, November 1950, February 1951 and July 1951.

13. The equipment for generating electricity for these experiments consisted of :

(1) D. C. generator—maximum capacity 30 amp. on 220 volts

(2) A. C. generator—maximum capacity 3 amp. on 230 volts, single phase, approximately 50 cycles

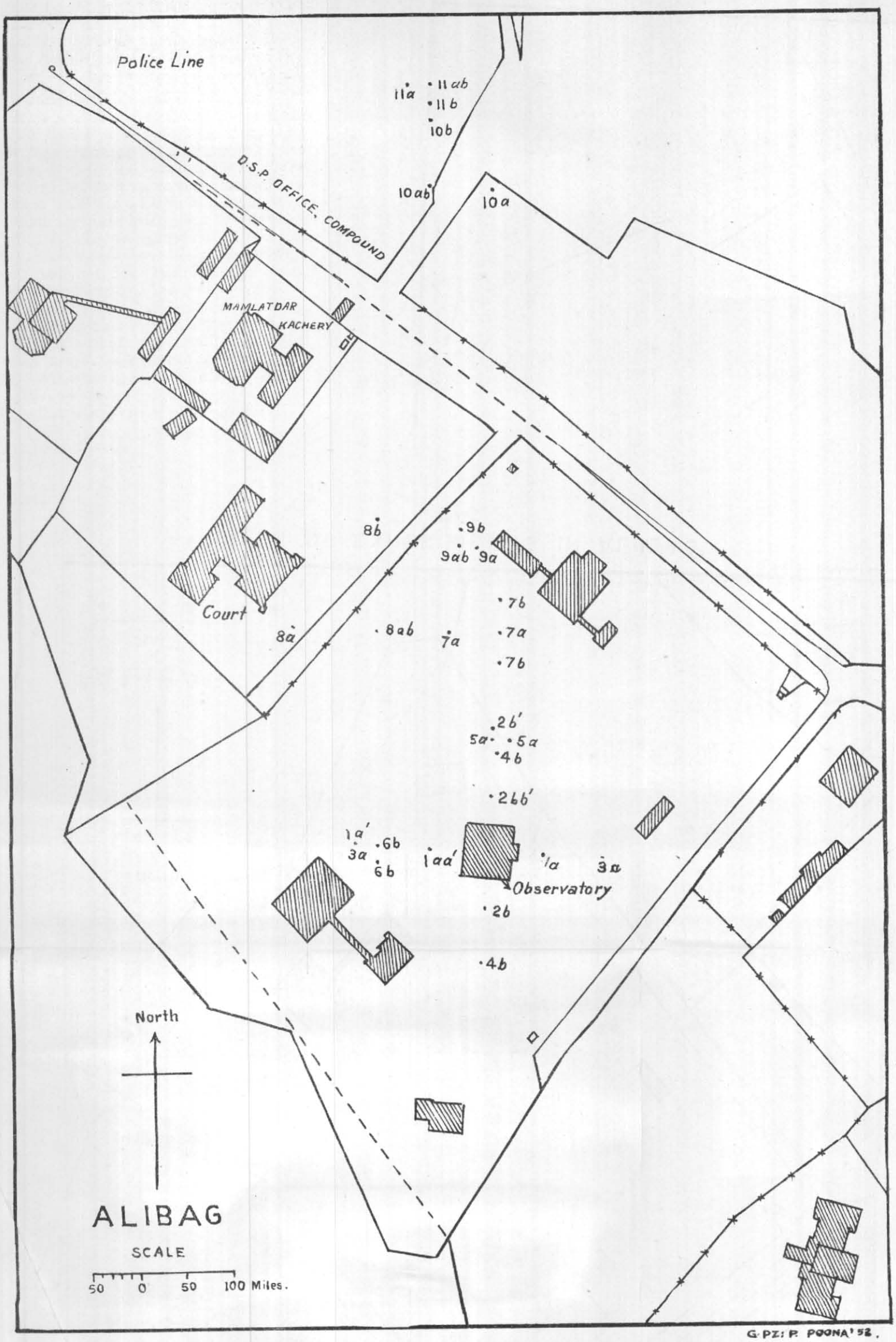
(3) A. C. generator—maximum capacity 15 amp. on 110 volts, single phase, approximately 50 cycles.

These generators were mounted on a 5-ton truck* along with the special switch board and commutating arrangement, which enabled the use of current from any of the generators and also enabled the interruption of the A.C. and reversal of the D.C. The requisite ampere and volt meters also formed part of the equipment. For the experiments, the truck with the generators and the accessories used to be taken from Poona by road to Alibag which is about 85 miles away. The road crosses the Ghats between Khandala and Khapoli and involves a crossing of a river by ferry at Dharamtar* 13 miles from Alibag. The ferrying of the truck was difficult and during the monsoon rather risky.

14. Sites were chosen in the beginning at distances 1/8, 1/4, 1/2, 1 and 2 miles from the observatory, with the help of a large scale map of Alibag, towards the north, as there was a good road that side, and the truck with the generating sets and other equipment could easily proceed along it. When it was found that no appreciable effect was noticeable even when current was leaked into the ground about 1/8 mile away, sites were chosen nearer the observatory and then inside the observatory compound, and finally close to the magnetograph room. Current was leaked into the ground with the help of 2 electrodes (copper plates 2 ft × 2½ ft × 22 SWG) buried into it some distance apart in an E–W or N–S direction determined with the help of a prismatic compass. The electrodes were put in a horizontal position in pits 6″ to 9″ deep and covered with earth, water being poured to get good contact when the earth was not wet. The distance between the electrodes was of the order of 100 ft during the first series of experiments, and about 15 ft during the other three series, except when the electrodes were on opposite sides of the observatory room. A pair of points in the ground at which the two electrodes were buried for leaking current constituted one site, *e.g.*, the two points 10ab, 10a constituted one site. The sites are given in column 2 of Tables 1 to 4 and also shown upto site 11 in Fig. 2 (*vide* plate facing this page). The pairs of points are either in a East-West or North-South direction ; in the former case ' a ' is given in the figures of both the points and in the latter case ' b ' is given, *i.e.*, 10ab, 10a indicate a pair of points in E–W direction and 10ab, 10b in the N–S direction.

15. To find out whether a moist ditch, copper tube or copper plates round the observatory afforded any protection to the magnetic instruments, current was leaked with two electrodes on opposite sides of the magnetograph room outside with (*a*) a ditch about 2 feet deep dug round the observatory and filled with water from a nearby well with

* For pictures of (1) Generator truck in the field and (2) Ferrying the truck across Dharamtar creek, see page 106.



SITES OF EXPERIMENTS IN ALIBAG.
FIG.2.

a petrol driven pump during the dry season of February 1951 to wet the earth, (*b*) a closed ring of copper tubes buried into the ground at a depth of 6″ and the earth wetted, (*c*) copper plates 2 ft high buried into the ground vertically and connected together to form a closed ring and the earth near the plates wetted.

16. To find out the effect of current passing through a wire on the magnetographs at different distances from them, current was passed through big loops of wire, the portion nearest to the observatory being in a straight line either in N–S or E–W direction. Current was also passed through a loop round the magnetograph room, and through twisted wires at different distances from the magnetographs.

17. *Current*—(*a*) Both D.C. and A.C. were leaked at the different sites. D.C. was leaked generally for 2 to 4 minutes in one direction, and then the current was reversed and passed for a similar period in the opposite direction. In the case of A.C., the current was interrupted a few times during the period of 3 to 5 minutes during which it was leaked.

(*b*) During the first series of experiments it was found that no effect of leakage of D.C. was noticeable on the magnetographs at sites distant 1/8 mile or more from the observatory even when the experiments were repeated a number of times. During the next three series of experiments sites beyond 1/8 mile were not, therefore, occupied, and current was leaked at that distance, and at the sites within the observatory compound. Sites in the observatory and close to the magnetograph room were repeatedly occupied in the different seasons. During the first two series both D.C. & A.C. were leaked into the ground and passed through wires, but it was found that A.C. produced no effect on the magnetographs, and so during the next two series practically only D.C. was used.

18. *Effect on Magnetographs*—The watch in the truck used to time the leaking or passing of current was compared with the watch with which the magnetographs were set to enable a proper examination of the records of the magnetographs, and to avoid the possibility of natural fluctuations being attributed to the effects of the current. Whenever current was passed or leaked the time with particulars of current was noted down, and a watch was also kept on magnetographs to note if any visual effects were produced, particularly to guard against large deflections when the current was leaked or passed close to the observatory. When the current was leaked outside the observatory compound and further away contact was kept with the observatory through a Walkie-Talkie set, one unit of which was kept close to the observatory and the other in the truck, and thus the visual effect, if any, on the magnetographs in these cases also could be watched. The following magnetographs were functioning in the observatory—

1. Watson Horizontal Force
2. Watson Vertical Force
3. Watson Declination (Comparatively Insensitive)
4. La Cour Horizontal Force
5. La Cour Vertical Force
6. La Cour Declination.

The Watson magnetographs had " quick-run " arrangements also, and the instruments were adjusted to " quick-run " when the experiments were carried out.

Results and Conclusions

19. The particulars, date, time, site, the distance between and direction of the electrodes, the amount and nature (A.C. or D.C.) of current of the experiments, and the effect on the two sets (Watson and La Cour) of magnetographs measured from the photographic records as well as the visual estimates of displacements shown by magnetographs are given in the accompanying tables.

20. It will be seen from the tables that A.C. produced no effect on the magnetographs even when a series of lamps were burned in the observatory room or the current was leaked in the ground close to the observatory with the electrodes on opposite side of it.

21. The main results from the four series of experiments are as follows—

A.C.

(1) Current leaked at varying distances, even close to the magnetograph room

produced no noticeable effect on the magnetic instruments.

(2) Passing of current through insulated wires close to the magnetograph room did not produce any noticeable effect on the magnetic instruments.

(3) The lighting of many bulbs with current within the two walls of the magnetograph room produced no noticeable effect on any of the magnetic instruments.

(4) Passing of current through twisted insulated wires taken very close to the magnetic instruments did not produce any noticeable effect on them.

D.C.

(1) (*a*)—Leakage of current up to 5 amp. 220 volts (maximum that could be produced with the generator) with electrodes 15 ft apart, at a distance of about 100 yards or more from the magnetograph room did not produce any noticeable effect on the magnetic instruments.

(*b*)—Leakage of current at varying distances up to about 70 yards from the magnetograph room produced noticeable effect on the magnetic instruments, the effect increasing with decrease in distance. The effect was more marked if the electrodes were on opposite sides of the magnetograph room.

(2) Passage of current up to 20 amp. through twisted insulated wire in N–S and E–W direction even at 10 ft from the magnetograph room did not produce any noticeable effect on the magnetic instruments.

(3) (*a*)—Passage of current up to 20 amp. through single insulated wire in N–S and E–W directions at a distance of 200 ft from the magnetograph room did not produce any noticeable effect on the magnetic instruments

(*b*)—Passage of current 5 to 15 amp. through single insulated wire in N–S and E–W directions at distances of 100 ft and less from the magnetograph room affected the instruments, the effect being quite large at short distances.

(4) A ring of copper tube 6″ ($\frac{1}{4}$″ diameter) below the surface or a ring of copper plates (2 ft deep) buried in the ground, or a ditch ($1\frac{1}{2}$ ft deep) filled with water and wet earth, round the magnetograph room, did not appear to afford any protection to the magnetic instruments from the effect of leakage of Direct Current.

22. The results of the experiments show that it is possible to allow electricity in Alibag with suitable restrictions, and that if these restrictions are observed it would be possible to safeguard the magnetic observations at Alibag against the effects of electric current, and further that the once-contemplated magnetic field station at Amtem-Nigadi, is not necessary.

23. The question of suitable restrictions has been discussed with the Electricity Officers of the Bombay Government and it has been agreed, keeping in view the requisite protection for the possible introduction of more sensitive magnetographs in future and also an adequate factor of safety, that the following restrictions should be imposed on the use of electricity at Alibag to ensure that the Alibag magnetic observations are not vitiated by the effect of electric current (also see Map, Fig. 1).

(1) Only Alternating Current, three-phase, minimum fifty cycles, shall be allowed in the town.

(2) No Alternating Current thermal generator shall be located within one mile of the observatory and no Alternating Current step-down transformer within half a mile of the observatory.

(3) Direct Current shall not be allowed within three miles of the observatory it being provided, however, that, within this range but beyond one mile from the observatory, small conversion of Alternating Current into Direct Current or generation of Direct Current up to a maximum of two kilowatts in all may be allowed.

(4) No electric traction shall be allowed within 18 miles of the observatory.

Acknowledgements

24. The authors are thankful to the band of workers who co-operated whole-heartedly in the series of experiments. In this connection particular mention may be made of Messrs. A. S. Chaubal, B. B. Huddar, D. K. Deshmukh and D. M. Pagare, who rendered very valuable assistance.

Effect of electric current on Magnetographs at Alibag

TABLE 1

Series I—September 1950

Time (IST)	Site (see Fig. 2)	Distance from magnetographs	Electrodes: Distance apart (ft)	Electrodes: Direction	Current: Nature	Current: Volts	Current: Amperes	Recorded effects on magnetographs: Watson H (gamma)	Watson V (gamma)	La Cour H (gamma)	La Cour V (gamma)	La Cour D (Tenth of a minute of arc)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
19 September 1950													
0928-40	14ab, 14a	½ m	100	E-W	AC	110	2	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Site near forking of road
0942-50	14ab, 14b	½ m	100	E-W	DC	220	4·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
0956-1002	14ab, 14b	½ m	98	N-S	AC	110	2·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1005-08	14ab, 14b	½ m	98	N-S	DC	220	4·6	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1043-47	12ab, 12b	¼ m	66	N-S	ACI	110	4·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Site north of tank
1049-54	12ab, 12b	¼ m	66	N-S	DCI	210	8·3	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1100-02	12ab, 12a	¼ m	74	E-W	AC	105	4·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1103-05	12ab, 12a	¼ m	74	E-W	DC	210	8·0	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1136-38	10ab, 10b	600′	96	N-S	AC	110	3·0	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Police compound
1143-45	10ab, 10b	600′	96	N-S	DC	220	5·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1151-54	10ab, 10a	600′	85	E-W	AC	110	2·0	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Police and adjoining compounds
1207-10	10ab, 10a	600′	85	E-W	DC	220	3·8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1246-49	8ab, 8b	260′	118	N-S	AC	110	1·8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Observatory and adjoining compound
1251-53	8ab, 8b	260′	118	N-S	DC	220	3·0	2	*Nil*	3	1	1·5	Do.
1258-60	8ab, 8a	260′	88	E-W	AC	110	1·0	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1301-03	8ab, 8a	260′	88	E-W	DC	220	2·0	*Nil*	*Nil*	*Nil*	1	*Nil*	Do.
1625-30	7b, 7b	200′	65	N-S	AC	110	1·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Observatory compound
1635-40	7b, 7b	200′	65	N-S	DC	220	3·0	4 at 1636	1	5	1	1	Do.
1647-50	7a, 7a	230′	62	E-W	AC	110	1·4	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1655-58	7a, 7a	230′	62	E-W	DC (also R)	220	2·5	*Nil*	1	*Nil*	1	·5	Do.
1718-23	12ab, 12b	¼ m	66	N-S	AC	110	3·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	North of lake
1727-32	12ab, 12b	¼ m	66	N-S	DC (also R)	210	7·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1736-42	12ab, 12a	¼ m	74	E-W	AC	110	3·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.

DC—Direct Current DCR—Direct Current reversed DC (also R)—Direct Current also reversed
AC—Alternating Current ACI—Alternating Current interrupted

TABLE 1 *(contd)*

Time (IST)	Site (see Fig. 2)	Distance from magnetographs	Electrodes		Current			Recorded effects on magnetographs					Remarks
								Watson		La Cour			
			Distance apart (*ft*)	Direction	Nature	Volts	Amperes	H (gamma)	V (gamma)	H (gamma)	V (gamma)	D (Tenth of a minute of arc)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	13)	(14)
19 September 1950—*contd*													
1748-54	12ab, 12a	¼ m	74	E-W	DC (also R)	210	6·5 to 7·0	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	North of lake
1810-16	14ab, 14a	½ m	98	N-S	ACI	110	2·0	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Site near forking of road
1823-29	14ab, 14a	½ m	98	N-S	DC (also R)	220	3·5 3·6	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1832-37	14ab, 14a	½ m	100	E-W	ACI	110	2·0	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1841-48	14ab, 14a	½ m	100	E-W	DC (also R)	220	3·6 to 3·9	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
20 September 1950													
0857-0902	15ab, 15b	1 m	103	N-S	ACI	110	4·0	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Near temple on Versoli road
0906-09	15ab, 15b	1 m	103	N-S	DC	220	7·3	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
0909-12	15ab, 15b	1 m	103	N-S	DCR	220	7·3	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
0916-19	15ab, 15a	1 m	100	E-W	DC	200	12·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
0919-22	15ab, 15a	1 m	100	E-W	DCR	200	12·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
0926-31	15ab, 15a	1 m	100	E-W	ACI	105	6·8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1437-39	12ab, 12b	¼ m	66	N-S	ACI	110	7·2	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	North of tank
1441-44	12ab, 12b	¼ m	66	N-S	DCR	180	14	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1446-50	12ab, 12a	¼ m	74	E-W	DCR	200	12	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1451-54	12ab, 12a	¼ m	74	E-W	ACI	105	6	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1509-12	14ab, 14b	½ m	98	N-S	ACI	110	3	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Site near forking of road
1515-19	14ab, 14b	½ m	98	N-S	DC	220	5·4	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1522-26	14ab, 14a	½ m	100	E-W	DCR	220	5·6 5·8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1529-32	14ab, 14a	½ m	100	E-W	ACI	110	3·2	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1549-52	15ab, 15a	1 m	103	N-S	ACI	105	4·3	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Near temple on Versoli road
1552-59	15ab, 15a	1 m	103	N-S	DC	220	8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1601-06	15ab, 15b	1 m	100	E-W	DCR	200	10·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1608-11	15ab, 15b	1 m	100	E-W	AC	110	5·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.

DC—Direct Current DCR—Direct Current reversed DC (also R)—Direct Current also reversed
AC—Alternating Current ACI—Alternating Current interrupted

TABLE 1 (*contd*)

Time (IST)	Site (see Fig. 2)	Distance from magnetographs	Electrodes		Current			Recorded effects on magnetographs					Remarks
								Watson		La Cour			
			Distance apart (*ft*)	Direction	Nature	Volts	Amperes	H (gamma)	V (gamma)	H (gamma)	V (gamma)	D (Tenth of a minute of arc)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
20 September 1950—*contd*													
1647-51	16ab, 16b	2 m	84	N-S	ACI	110	3·2	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	On Rewas road
1653-57	16ab, 16b	2 m	84	N-S	DC (also R)	220	6·2	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1701-05	16ab, 16a	2 m	80	E-W	DC (also R)	170	15·0	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1707-10	16ab, 16a	2 m	80	E-W	ACI	100	9·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1734-38	10ab, 10b	600′	96	N-S	ACI	110	4·3	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Police compound
1740-45	10ab, 10b	600′	96	N-S	DC (also R)	220	7·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1750-55	10ab, 10a	600′	85	E-W	DC (also R)	220	4·6	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Police and adjoining compounds
1757-1801	10ab, 10a	600′	85	E-W	ACI	110	2·8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1819-22	8ab, 8b	260′	118	N-S	ACI	110	2·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Observatory and adjoining compounds
1824-28	8ab, 8b	260′	118	N-S	DC (also R)	220	4·3	3	1	3	1	2	Do.
1832-36	8ab, 8a	260′	88	E-W	DC (also R)	220	2·7	3	1	*Nil*	1	2	Do.
1837-41	8ab, 8a	260′	88	E-W	ACI	110	1·8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1859-1903	7b, 7b	200′	65	N-S	ACI	110	2·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Observatory compound
1905-09	7b, 7b	200′	65	N-S	DC (also R)	220	4·3	2	2	1	1	1	Do.
1912-19	7a, 7a	230′	62	E-W	DC (also R)	220	4·0	1·7	2	1	1	1	Do.
1919-23	7a, 7a	230′	62	E-W	ACI	110	2·4	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1951-56	3a, 3a	115′	240	E-W	ACI	110	1·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Observatory compound (across observatory room)
1958-2003	3a, 3a	115′	240	E-W	DC	190	2·2	3	Not recorded	10 to 14	1·5	2	Do. Main deflection may be covered by time mark

DC—Direct Current DCR—Direct Current reversed DC (also R)—Direct Current also reversed
AC—Alternating Current ACI—Alternating Current interrupted

Effect of electric current on Magnetographs at Alibag

TABLE 2

Series II—November 1950

Time (IST)	Site (see Fig. 2)	Distance from magnetographs	Electrodes		Current			Recorded effects on magnetographs					Remarks
								Watson		La Cour			
			Distance apart (*ft*)	Direction	Nature	Volts	Amperes	H (gamma)	V (gamma)	H (gamma)	V (gamma)	D (Tenth of a minute of arc)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
18 November 1950													
0954-58	3a, 3a	115′	240	E-W	AC	120	0·8	1	*Nil*	Blacked out	Blacked out	*Nil*	Observatory compound (across observatory room)
1004-08	3a, 3a	115′	240	E-W	AC	220	2·4	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1012	3a, 3a	115′	240	E-W	DC	250	1·9	11	39	3	26	2	Do.
1035-37	3a, 3a	115′	240	E-W	DC	250	1·9	11	Not recorded	3	26	2	Do.
1057-59	3a, 3a	115′	240	E-W	DC	250	1·9	13	37	4	26	2	Do.
1106-09	3a, 3a	115′	240	E-W	DC	250	1·9	13	37	4	26	2	Do.
1109-11	3a, 3a	115′	240	E-W	DCR	250	1·9	13	37	4	26	2	Do.
1119-22	1aa′, 1a′	50′	110	E-W	AC	120	1·1 to 1·3	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1123-26	1aa′, 1a′	50′	110	E-W	AC	220	2·4	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1135-38	2bb′, 2b′	60′	120	N-S	AC	120	0·4	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1141-44	2bb′, 2b′	60′	120	N-S	AC	220	1·2	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1203-06	4b, 4b	115′	230	N-S	AC	120	0·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1211-14	4b, 4b	115′	230	N-S	AC	220	1·2	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1217-20	4b, 4b	115′	230	N-S	DC	250	0·8	2	25	*Nil*	12	1	Do.
1220-23	4b, 4b	115′	230	N-S	DCR	250	0·8	2	25	*Nil*	12	1	Do.
1540-43	5a, 5a	115′	15	E-W	AC	120	0·3	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Observatory compound
1546-49	5a, 5a	115′	15	E-W	AC	220	0·8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1552-55	5a, 5a	115′	15	E-W	DC	250	0·4	5	*Nil*	*Nil*	*Nil*	*Nil*	Do.

DC—Direct Current DCR—Direct Current reversed DC (also R)—Direct Current also reversed
AC—Alternating Current ACI—Alternating Current interrupted

TABLE 2 *(contd)*

Time (IST)	Site (see Fig. 2)	Distance from magnetographs	Electrodes: Distance apart (ft)	Electrodes: Direction	Current: Nature	Current: Volts	Current: Amperes	Recorded effects on magnetographs: Watson H (mma)	Watson V (amma)	La Cour H (gamma)	La Cour V (gamma)	La Cour D (Tenth of a minute of arc)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
18 November 1950—*contd*													
1555-58	5a, 5a	115′	15	E-W	DCR	250	0·4	4	*Nil*	*Nil*	*Nil*	*Nil*	Observatory compound
1610-13	6a, 6a	115′	15	N-S	AC	120	1·2	1	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1615-18	6a, 6a	115′	15	N-S	AC	220	2·4	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1620-23	6a, 6a	115′	15	N-S	DC	250	1·8	3	2	*Nil*	1	*Nil*	Do.
1623-26	6a, 6a	115′	15	N-S	DCR	250	1·8	3	4	*Nil*	1	*Nil*	Do.
1648-51	9ab, 9a	350′	15	E-W	AC	118	2·4	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1654-57	9ab, 9a	350′	15	E-W	AC	220	4·0	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1659-1702	9ab, 9a	350′	15	E-W	DC	250	3·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1702-05	9ab, 9a	350′	15	E-W	DCR	250	3·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1717-20	11ab, 11a	700′	15	E-W	AC	120	2·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Police compound
1723-26	11ab, 11a	700′	15	E-W	AC	220	3·6	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1733-36	11ab, 11a	700′	15	E-W	DC	250	3·6	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1736-39	11ab, 11a	700′	15	E-W	DCR	250	3·6	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1848-1902					AC	105 to 115	8 to 14	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Observatory compound. Current carried in a loop, nearer side close (10 ft) to observatory in N-S direction. The current was circulated through electrodes dipped in a basin of salt water
1904-08					DC	240	8 to 10	1	84	1	25	4	Do.
1920-24					AC	115	5 to 8·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Same way as above but wire 10 ft away in an E-W direction

DC—Direct Current DCR—Direct Current reversed DC (also R)—Direct Current also reversed
AC—Alternating Current ACI—Alternating Current interrupted

TABLE 2 *(contd)*

Time (IST)	Site (see Fig. 2)	Distance from magnetographs	Electrodes		Current			Recorded effects on magnetographs					Remarks
								Watson		La Cour			
			Distance apart (*ft*)	Direction	Nature	Volts	Amperes	H (gamma)	V (gamma)	H (gamma)	V (Gamma)	D (Tenth of a minute of arc)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
18 November 1950—*contd*													
1925-28					DC	240	10 to 14	41	73	6	46	11	Same way as above but wire 10 ft away in an E-W direction
2000-07					DC (also R)	220 to 240	8 to 20	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Twisted wire with current and return current —E-W position
2011-17					DC (also R)	230	14 to 17	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Twisted wire with current and return current but N-S position
19 November 1950													
1120-23	3a, 3a	115′	240	E-W	DC	250	2·7	10	26	9	18	15	Observatory compound. A ring of copper tube round observatory about 50 ft radius put about 6″ below ground
1123-26	3a, 3a	115′	240	E-W	DCR	250	2·7	10	26	9	17	1·5	
1146-49	3a, 3a	115′	240	E-W	DC	250	2·7	10	24	7	17	1·5	Observatory compound. After testing resistance of copper tube to see good contact
1149-52	3a, 3a	115′	240	E-W	DCR	250	2·7	10	24	7	17	1·5	
1206-09	3a, 3a	115′	240	E-W	DC	250	2·7	10	25	10	18	1·3	Observatory compound. After removal of copper tube
1209-18	3a, 3a	115′	240	E-W	DCR	250	2·7	10	25	10	18	1·3	
1247-50	13ab, 13a	¼ m	15	E-W	DC	245	8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Site north of tank
1250-53	13ab, 13a	¼ m	15	E-W	DCR	245	8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1259-1302	13ab, 13b	¼ m	15	N-S	DC	240	7·9	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1302-05	13ab, 13b	¼ m	15	N-S	DCR	240	7·9	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1720-45								74	11	39	9	5·4	Truck about 6 ft north of magnetograph room
1756-59					AC	100 to 110	4 to 15	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Twisted wire taken into the magnetograph room with end between the instruments

DC—Direct Current DCR—Direct Current reversed DC (also R)—Direct Current also reversed
AC—Alternating Current ACI—Alternating Current interrupted

Effect of electric current on Magnetographs at Alibag

TABLE 8

Series III— February 1951

Time (IST)	Site (see Fig. 2)	Distance from magnetographs (ft)	Electrodes: Distance apart (ft)	Electrodes: Direction	Current: Nature	Current: Volts	Current: Amperes	Recorded effects on magnetographs: Watson H (gamma)	Watson V (gamma)	La Cour H (gamma)	La Cour V (gamma)	La Cour D (Tenth of a minute of arc)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
14 February 1951													
0842-44	3a, 3a	115	240	E-W	DC	240	1·4	1·7	19·6	3·7	16	1	Obsy. compound. (Dry ditch 2 ft deep, 50 ft radius round obsy.)
0844-47	3a, 3a	115	240	E-W	DCR	240	1·4	1·7	19·6	3·7	16	1	Do.
0902-04	1aa′, 1a′	50	110	E-W	DC	240	0·6	3·1	8·5	5·2	7	*Nil*	Do.
0904-06	1aa′, 1a′	50	110	E-W	DCR	240	0·6	3·1	8·5	5·4	7	*Nil*	Do.
0911-13	1aa′, 1a′	50	110	E-W	AC	240	0·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
0934-36	1aa′, 1a′	50	110	E-W	DC	240	0·7	4·8	11·0	5·4	9	*Nil*	Dry ditch and copper tube round obsy.
0936-38	1aa′, 1a′	50	110	E-W	DCR	240	0·8	3·1	11·0	6·7	9	*Nil*	Do.
1532-35	1aa′, 1a′	50	110	E-W	DC	240	1·2	4·4	17·0	7·4	13	15*	Dry ditch and copper plates round obsy.
1535-38	1aa′, 1a′	50	110	E-W	DCR	240	1·2	3·9	15·7	6·7	13	15*	Do. *Doubtful
1600-02	9ab, 9a	350	15	E-W	DC	240	1·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Obsy. compound (Dry ditch)
1602-04	9ab, 9a	350	15	E-W	DCR	240	1·5	..	..	..	..	*Nil*	Do.
1621-23	11ab, 11a	700	15	E-W	DC	240	1·4	..	..	..	..	*Nil*	Police compound (Dry ditch)
1623-25	11ab, 11a	700	15	E-W	DCR	240	1·4	..	..	..	..	*Nil*	Do.
1654-58					DC	220 to 280	5 to 15	1·3	3·9 to 9·8	*Nil*	3·1 to 6·5	*Nil*	Current carried in a big loop the nearer portion being in a E-W direction 85 ft north of obsy. room

DC—Direct Current DCR—Direct Current reversed DC (also R)—Direct Current also reversed
AC—Alternating Current ACI—Alternating Current interrupted

TABLE 3 *(contd)*

Time (IST)	Site (see Fig. 2)	Distance from magnetographs (ft)	Electrodes: Distance apart (ft)	Electrodes: Direction	Current: Nature	Current: Volts	Current: Amperes	Recorded effects on magnetographs: Watson H (gamma)	Watson V (gamma)	La Cour H (gamma)	La Cour V (gamma)	La Cour D (Tenth of a minute of arc)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
14 February 1951—*contd*													
1658-1705					DCR	220 to 280	8 to 17	1·3	4·1 to 11·3	*Nil*	3·4 to 7·1	*Nil*	Current carried in a big loop the nearer portion being in a E-W direction 85 ft north of obsy. room
1718-25					DC	240	4 to 12	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Loop nearer side 220 ft north of obsy. room
1725-26					DCR	230 to 240	5 to 16	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1925								*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Twisted wires carrying current between the two walls of the obsy. building and six 40-watt bulbs burning in western and northern passages
2148-51	Iaa′, Ia′	50	110	E-W	DC	240	0·7	3·9	8·9	4·8	8·7	*Nil*	Ditch filled with water and moist earth
2151-53	Iaa′, Ia′	50	110	E-W	DCR	240	0·7	3·9	9·6	5·4	8·7	*Nil*	Do.
15 February 1951													
1105					DC	240	3 to 6	Partially gone in the hourly break	*	11 to 15	*	About 8 to 10	Current in wire round obsy. radius 55 ft * Went out of field
1110-12	Iaa′, Ia′	50	110	E-W	DC	240	0·9	3·5	12·4	8·5	9·7	1	Ditch filled with water and moist earth
1112-14	Iaa′, Ia′	50	110	E-W	DCR	240	0·9	3·9	11·6	5·9	9·7	1	Do.

DC—Direct Current DCR—Direct Current reversed DC (also R)—Direct Current also reversed
AC—Alternating Current ACI—Alternating Current interrupted

Effect of electric current on Magnetographs at Alibag

TABLE 4

Series IV—July 1951

Time (IST)	Site (see Fig. 2)	Distance from magnetographs (ft)	Electrodes: Distance apart (ft)	Electrodes: Direction	Current: Nature	Current: Volts	Current: Amperes	Recorded effects on magnetographs: Watson H (gamma)	Watson V (gamma)	La Cour H (gamma)	La Cour V (gamma)	La Cour D (Tenth of a minute of arc)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
					25 July 1951								
0853-55	3a, 3a	115	240	E-W	DC	250	2	10	42	6	*	1·6	Obsy. compound (across obsy. room) *Merged in base line of H
0855-57	3a, 3a	115	240	E-W	DC	250	2·4	11	42	6	*	1·5	Do.
0903-05	3a, 3a	115	240	E-W	AC	110	1·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
0917-19	3a, 3a	115	240	E-W	DC	250	2·2	8	20	9	15	1·6	Obsy. compound (in a big loop across obsy. room)
0919-21	3a, 3a	115	240	E-W	DC	250	2·4	9	20	9	16	1·5	Do.
0931-33	6b, 6b	115	15	N-S	DC	250	4·3	*Nil*	3	*Nil*	1	1·8	Obsy. compound
0933-35	6b, 6b	115	15	N-S	DC	250	4·4	*Nil*	2	*Nil*	1	1·8	Do.
0938-40	1aa′, 1a	50	55	E-W	DC	245	5·3	16	0·9	11	1	3·1	Do.
0940-42	1aa′, 1a	50	55	E-W	DC	245	5·3	16	1	13	1	3·1	Do.
0955-57	2bb′, 2b	60	55	N-S	DC	250	2·3	1	4	4	1·5	2·7	Do.
0957-59	2bb′, 2b	60	55	N-S	DC	250	2·3	1	4	3	1·7	2·2	Do.
1000-05	2bb′, 2b	60	55	N-S	AC	110	1·7	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1005-08	2bb′, 2b	60	55	N-S	AC	220	2·2	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1021-23	5a, 5a	115	15	E-W	DC	250	2·0	2	0·7	1	0·3	1	Do.
1023-25	5a, 5a	115	15	E-W	DC	250	2·2	2	0·7	1	0·3	1	Do.
1026-28	5a, 5a	115	15	E-W	AC	220	2·1	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1035-37	2bb′, 2b′	60	120	N-S	AC	210	2·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1041-43	2bb′, 2b′	60	120	N-S	AC	210	2·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1100-02	1aa′, 1a′	50	110	E-W	AC	210	2·6	Hourly gap		*Nil*	*Nil*	*Nil*	Do.
1523-25	3a, 3a	115	240	E-W	DC	250	2·5	9	24	10	18	1	With copper tube round obsy.
1525-27	3a, 3a	115	240	E-W	DC	250	2·5	9	25	7	18	1·6	Do.
1551-53	9ab, 9a	350	15	E-W	DC	250	3·3	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1553-56	9ab, 9a	350	15	E-W	DC	250	3·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.

DC—Direct Current DCR—Direct Current reversed DC (also R)—Direct Current also reversed
AC—Alternating Current ACI—Alternating Current interrupted

TABLE 4 *(contd)*

Time (IST)	Site (see Fig. 2)	Distance from mag neto-graphs (ft)	Electrodes: Distance apart (ft)	Electrodes: Direction	Current: Nature	Current: Volts	Current: Amperes	Recorded effects on magnetographs: Watson H (gamma)	Watson V (gamma)	La Cour H (gamma)	La Cour V (gamma)	La Cour D (Tenth of a minute of arc)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
25 July 1951 — *contd*													
1601-03	9ab, 9b	350	15	N-S	DC	250	4·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	With copper tube round obsy.
1603-05	9ab, 9b	350	15	N-S	DC	250	4·4	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1621-23	11ab, 11a	700	15	E-W	DC	245	5·3	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1623-25	11ab, 11a	700	15	E-W	DCR	245	5·3	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1627-29	11ab, 11b	700	15	N-S	DC	245	4·5	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1629-31	11ab, 11b	700	15	N-S	DCR	245	4·8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
26 July 1951													
0953-55	9ab, 9b	350	15	N-S	DC	245	4·8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Obsy. compound
0955-57	9ab, 9b	350	15	N-S	DCR	245	4·8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1000-02	9ab, 9b	350	15	E-W	DC	250	4·6	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1002-04	9ab, 9b	350	15	E-W	DCR	250	4·6	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1004-06	9ab, 9b	350	15	E-W	DCR	250	4·6	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1034-39					DC	180-250	4-19	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	Obsy. compound current carried in a big loop, the nearer portion being in E-W direction 200 ft north of magnetograph room, the electrodes dipping in a basin of salt water
1039-42					DCR	About 200	10-19						Do.
1054-58					DC	200-240	10-19	8-7	12	*	9	1·1	*Not clear Current carried in loop 100 ft north of magnetograph room
1058-1105					DCR	200-230	10-18	1-3 (Hourly gap)	Hourly gap	*	9	1·1	Do.
1107-12					DCR	220-230	10-14	2	11	1	7	*Nil*	Same as above with wire raised above ground
1136-39					DC	240-250	7-15	7 (fluctuating)	23	4	12	0·5	Current carried in a loop 50 ft north of magnetograph room
1139-41					DCR	220-250	8-15	7 (fluctuating)	20	3	12	0·5	Do.

DC—Direct Current DCR—Direct Current reversed DC (also R)—Direct Current also reversed
AC—Alternating Current ACI—Alternating Current interrupted

TABLE 4 *(contd)*

Time (IST)	Site (see Fig. 2)	Distance from magnetographs	Electrodes		Current			Recorded effects on magnetographs					Remarks
								Watson		La Cour			
			Distance apart	Direction	Nature	Volts	Amperes	H (gamma)	V (gamma)	H (gamma)	V (gamma)	D (Tenth of a minute of arc)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
26 July 1951—*contd*													
1141-43					DCR	220-240	10-15	7 (fluctuating)	20	3	12	0·5	Same as above with wire held up
1514-17					DC	220-240	5-18	*Nil*	28-48	3	12		Obsy. compound. Current carried in a big loop the nearer point being in N-S direction 50 ft west of magnetograph room
1517-19					DCR	220-240	12-19	1-2	34	3	12	**	Do.
1521-23					DC	210-240	10-18	2	50	4	19	**	**Merged in base line Same as above but wire held up
1531-34					DC	200-245	5-18	*Nil*	6-12	*Nil*	5	**	Current carried in loop 100 ft west
1534-36					DCR	220-240	12-17	*Nil*	9-10	*Nil*	4	**	Do.
1537-39					DC	230-240	11-15	*Nil*	7-9	*Nil*	1-2	**	Same as above ; wire held up
1602-05					DC	210-245	8-16	*Nil*	4	*Nil*	5	**	Current carried in loop 200 ft west of magnetograph room
1605-07					DCR	210-235	11-18	*Nil*	4	*Nil*	2	**	Do.
1735-37					DC	210-240	10-17	*Nil*	1	*Nil*	0·7	*Nil*	Do.
1737-40					DCR	175-240	10-20	*Nil*	1	*Nil*	0·7	*Nil*	Do.
1808-10					DC	235-240	7-11	..	*Nil*	*Nil*	*Nil*	*Nil*	Current carried in twisted wires in E-W direction 25 ft north of magnetograph room
1810-12					DCR	240-250	7-12	..	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1817-20					DC	240-250	4-13	..	*Nil*	*Nil*	*Nil*	*Nil*	As above ; twisted wire 10 ft north of magnetograph room
1820					DCR	240-245	7-10	..	*Nil*	*Nil*	*Nil*	*Nil*	Do.
1823-25					DC	235-245	8-11	..	*Nil*	*Nil*	*Nil*	*Nil*	Same as above with wire held up
1910-14					DC	220-230	10-18		*Nil*	*Nil*	*Nil*	*Nil*	Current carried in twisted wire in a N-S direction 25 ft west of magnetograph room
1914-16					DCR	190-230	16-19		*Nil*	*Nil*	*Nil*	*Nil*	Do.
1919-23					DCR	180-240	10-20		*Nil*	*Nil*	*Nil*	*Nil*	Current in twisted wire 10 ft west of magnetograph room
1923-25					DCR	180-240	10-18		*Nil*	*Nil*	*Nil*	*Nil*	Do.

DC—Direct Current DCR—Direct Current reversed DC (also R)—Direct Current also reversed
AC—Alternating Current ACI—Alternating Current interrupted