

Columbia Graphophone Company, Ltd. (London)

RECORDING EXPEDITION INSTRUCTIONS

GENERAL.

OBJECT OF INSTRUCTIONS.

1.—The following instructions and information are for the guidance of Electrical Engineers and Recording Operators on recording expeditions abroad; that is to say, recording which takes place away from main studios such as London, Paris, Milan, etc.

THEIR CONFIDENTIAL NATURE.

2.—The whole of the instructions and information contained herein is strictly secret and confidential, and must not be disclosed to any third party.

This booklet must not be loaned to others or be allowed to leave the employee's possession. It is the Company's property, and must be returned intact on leaving the service.

PRELIMINARY AUTHORITY.

3.—Electrical Engineers and Recording Operators will receive instructions from their respective Chiefs to undertake expeditions, and no expense is to be incurred until the necessary authority has been obtained.

TECHNICAL RESPONSIBILITY.

4.—They are responsible to London for their technical work, and no change in the technical arrangements is permitted without specific authority from Petty France. Agents have no technical responsibilities or duties whatever.

GEAR.

5.—Electrical Engineers and Recording Operators are responsible for collection, completeness, and pack-

ing of their apparatus before leaving Petty France; and, so far as practicable, its safe handling *en route*, so as to ensure arrival in good condition.

SPARES.

6.—For expeditions to remote parts of the world, or those planned to be of exceptionally long duration, arrangements will be made for extra supplies of spares to avoid the possibility of lengthy stoppages, and the staff must satisfy themselves that they have adequate spares before they leave.

EXPEDITION DETAILS.

7.—Electrical Engineers and Recording Operators should make themselves aware before they leave London of the exact name and address of the Agent to whom they are to report for the expedition; the number of titles to be recorded; the numbers of 10-in. and 12-in. blanks which have been shipped, together with particulars of their shipment, date of despatch, etc.; what equipment there is on the spot, such as generator, batteries, damping material, and heating cupboard; and generally make themselves independent of the Agent abroad for information on these points.

ANNOUNCEMENT OF ARRIVAL.

8.—On arrival of the expedition abroad a note should be sent to the Manager of the Recording Department, announcing safe arrival, and giving the address to which correspondence should be sent. Later, another note should be sent stating if the apparatus is O.K., and the date and time when recording commenced.

CORRESPONDENCE.

9.—All correspondence must be addressed to the Manager, Recording Department, Columbia Graphophone Co., Ltd., 73/75, Petty France, London, S.W.1, and all telegrams must be addressed to "Grafonola, London."

Letters or telegrams should not be addressed personally to anyone, so as to avoid delay in the case of absences unknown to the expeditionary staff.

CABLES.

10.—All cables must be carefully worded, and closely read over before despatch, to ensure being properly understood on receipt.

REPLIES TO CORRESPONDENCE.

11.—Prompt attention must be made to correspondence from Petty France, and letters and cables must be answered the same day as they are received.

CO-OPERATION OF STAFF.

12.—The Electrical Engineer and Recording Operator are expected, in addition to carrying out the work for which they are individually responsible, to render each other assistance and co-operate as much as possible.

PREPARATION FOR RECORDING.

13.—Recording staff must allow themselves one clear week-day before recording commences for the selection of studio, erection of apparatus, and making all ready for recording. In cases where more than a morning is taken up in the examination of possible recording rooms, and where the erection of apparatus cannot commence in the afternoon of that day, then more than one day must be allowed. The commencement of recording before the apparatus is in a condition to function properly must be avoided, otherwise poor work will result.

HOURS OF WORK.

14.—Generally speaking, two recording sessions of three hours each is regarded as a satisfactory day's work. This, together with the time necessary for testing apparatus, examining blanks, charging cupboards, heating up blanks, packing masters, entering up data, compiling reports, and so on, will generally mean that eight or nine hours' work per day will be required.

Occasional days having three sessions are not objected to, but if Agents attempt to run their recording

on the basis of 11 or 12 hours a day, then their attention should be drawn to the matter in writing—very tactfully worded—and it should be pointed out that it is not possible to give satisfactory service if these hours are repeatedly arranged. A copy of any such letter must be attached to the Weekly Report.

RECORDING SHEETS.

15.—The Agents' attention should be invariably drawn to the necessity for accurate recording sheets. Eighteen copies of these are required by London in every case, and if the Agents are not supplied with recording sheets they should get them printed immediately.

The headings required on recording sheets are as follows:—

Selection made on :— At..... Listed Record No. Size Matrix No. Is this " W " Recording? Category Title Artist Subject to Artist's Royalty Class	Language of Text Accompaniment Conductor Author { Name of Nationality of Composer { Name of Nationality of Copyright Status Country of First Publication Year of First Publication British Publisher Foreign Publisher
	Disposal

STANDARD OF RECORDING.

16.—The object of recording expeditions is to give the Columbia Agents and Representatives abroad the best possible recording service, and enable them to compete with other recording companies in the same market.

For this purpose the same care and attention must be paid to their recording as to the highest class work in London.

The standard of musical performance may be lower in some countries than in others, but this must not be allowed to influence in the slightest degree the standard of excellence required in the recording technique.

TYPE OF RECORDING.

17.—When in any doubt as to the type of record to be made, it is desirable to ask the Agent to produce records of similar artistes made by us, or alternatively by competing companies, in his territory, for listening to and examining before the recording commences. It is obviously of little value to judge from records made by London orchestras and London artistes what is wanted from local combinations.

NOTIFYING AGENTS OF DEFECTS.

18.—All cases where it is evident that the artistes being recorded are poor or have not been properly instructed, the orchestrations are unsatisfactory, the balance is faulty on account of weakness in various sections of the orchestra; or any other circumstances beyond the control of the recording staff which militate against the making of satisfactory records, should be carefully noted on the Weekly Reports. In addition, the Agent's attention should be drawn in writing to the matter, and this fact stated on the Weekly Report also. The object of drawing the Agent's attention to the matter is to give him the opportunity of rectifying the defects, the importance of which he may not realise, before it is too late. A copy of any such communication must be attached to the Weekly Report.

ATTITUDE TOWARDS AGENTS.

19.—Care must be taken to adopt a courteous and attentive attitude towards Agents, Conductors, and Artistes, on all occasions. Misunderstandings frequently arise due to language difficulties, and false

impressions may be inadvertently created owing to the susceptibilities of artistes and others.

DIFFERENCES OF OPINION.

20.—Any argument commencing with an Agent or others in connection with a recording should be terminated as quickly as possible compatible with politeness. In the case of Agents, Conductors, or Artistes, voicing obviously inaccurate statements or giving incorrect instructions, these may be merely noted, but care must be taken that no departure from current technical practice is permitted.

VOLUME ON RECORDS.

21.—In general, Continental recording is wanted louder than English, but care must be taken that records are not made so loud as to render them unsatisfactory from the point of view of wear, or make them blast on cheaper machines. The responsibility for bad wear will rest on the Recording Operator of the expedition.

It must be remembered that we are not making records for Columbia machines only.

AGENT'S INSISTENCE.

22.—In some cases an Agent may insist on certain records being made extraordinarily loud, or attempt in other ways to alter the technique, taking upon himself the responsibility of the finished record. In such cases the Agent should be required at the time to sign the Weekly Report to that effect.

WEEKLY REPORTS.

23.—The importance of proper clerical records of work done is emphasised. The Weekly Reports of the Electrical Engineer and Recording Operator are also valuable for reference and for clearing up points afterwards. These reports should include notes of all events or circumstances which tend to make the recording

difficult or prevent good records being made, so that any complaints arriving while the staff are away on another expedition may be settled without delay by reference to their written records. Reports must be promptly despatched.

REPRESENTATIVE MASTERS.

24.—On short expeditions the Recording Operator must take with him from London one case of blanks apart from those sent by Goods. This must be brought back with the apparatus, containing ten representative records of the various types of artistes recorded, so that we can get a prompt idea as to the success or otherwise of the recording expedition.

BRINGING BACK OF GEAR.

25.—All apparatus taken out by the Electrical Engineer and Recording Operator, including the case of blanks above referred to, must be brought back invariably by the Engineers. The handing over of gear for shipment by the Agents is strictly prohibited, and the Recording Staff are responsible for having their gear with them when they return to London, so that it can be cleared from the Customs at the railway station either the same day or the day following their arrival.

HANDING OVER GEAR.

26.—Immediately upon return of the expedition to London, the Electrical Engineer and Recording Operator must get their apparatus promptly cleared from Customs and delivered to Petty France. Tests and, if necessary, repairs will be put in hand at once to bring the apparatus into first class condition again.

DUBBING OF RECORDS.

27.—Though dubbing is now possible, it is not at all desirable. The number of records which have to be dubbed at the end of any recording expedition is a measure of the failure of the recording expedition.

EXPENSES.

AGENT'S RESPONSIBILITIES.

28.—Generally speaking, Agents bear the cost of sending waxes, the cost of their return, and all insur-

ance charges in connection therewith; the cost of employing artistes and the hire of the Recording Room, and the Recording Staff's travelling and living expenses.

TECHNICAL EXPENSES.

29.—All charges relating to anything of a technical nature, however, and all charges up to the production of the finished and accepted records are borne by the Columbia Graphophone Company.

RECOVERABLE OUTLAY BY AGENT.

30.—If the Agent in certain circumstances is asked to make any arrangement on our behalf which would saddle him with a charge of a technical nature, such as for example the hire of damping materials for the hall, or the hire of batteries and the like, arrangements should be made to pay this ourselves, or else the Agent should be given to understand that it is debitable to the Company.

KIT ALLOWANCES.

31.—For Continental travelling allowances for kit are not made, and the staff are expected to maintain their own kits. Prolonged expeditions to Persia, Japan or the East Indies, etc., are treated specially, and a kit allowance may be made, based on the merits of each case. Unless specially authorised, no one has authority to purchase kit chargeable to the Company.

FOREIGN RAILWAYS.

32.—First class railway fares are allowed on all foreign railways, with the following exception:—On all Luxe trains, for example, the Simplon Orient Express and similar trains, second class only is allowed. This provision applies to all cases on the Continent where trains of the Luxe class are run and second class accommodation is provided.

LIVING EXPENSES ABROAD.

33.—For the total number of days absent from Petty

France, including time spent travelling, living expenses are allowed up to a maximum of 30s. per day.

This figure includes the usual 10 per cent. tips at hotels abroad, and all meals and personal expenditure, both *en route* and during stay abroad.

Up to 30s. per day may be claimed for days occupied in travelling, except in the case of sea voyages of more than one day's duration. In such cases 30s. per day living expenses will not be allowed, as this expenditure is covered by the passage money. An amount not exceeding 10 per cent. of the passage money will be allowed for all incidental expenses encountered during the voyage.

NOTE.—The 30s. per day referred to above is intended to cover expenditure under the following headings:—

All meals, hotel bills (room, etc.), and tips in connection therewith. All expenses of a personal nature such as one bears out of salary at home.

COST OF LIVING.

34.—It may happen occasionally, on account of the high cost of living in any particular town, that 30s. per day does not adequately cover the actual expenses incurred, and in such a case the additional amount necessary to cover the cost should be claimed and the claim substantiated by attaching the hotel bills in question as evidence of the increased cost. In all such cases the authority of the Company's Agent in the territory concerned must be obtained in writing for any expenditure under the heading "living expenses" over and above 30s. per day.

PORTERAGE OF APPARATUS.

35.—Expenditure over and above the foregoing, such as, for example, portorage of apparatus, tips to Customs or other officials on account of apparatus, expenditure on electrical or mechanical items required for repair or replacement, and all other expenditure not

falling under paragraph 36 above, should be claimed by way of special entries giving particulars.

MONEY.

36.—In all cases where money is advanced by the Agents, a receipt in triplicate must be made out, the original handed to the Agents in question, a second copy attached to the expense sheet when it is returned to Petty France, the third copy remaining in the book provided for the purpose.

EXPENSE ACCOUNTS.

37.—On trips which extend from one territory to another separate expense sheets must be made out, so as to keep the various Agents' territories distinct. Statements of account should be posted to Petty France on leaving each territory, and any balance of cash in hand carried forward to the next territory. This is important, otherwise much time might elapse before the Agents' accounts can be debited with the expenses incurred. The payment of hotel bills by the Company's Agents abroad is not desirable.

ACCURACY OF DETAIL.

38.—Attention is particularly drawn to the importance of expense accounts being correct, in order to prevent unnecessary queries and loss of time in accounting afterwards; and detailed in order to enable the accountants to allocate the expenses to the proper cost accounts.

TECHNICAL.

SIZE OF STUDIO.

39.—The Studio should be approximately 35 ft. by 25 ft. by about 12 to 14 ft. high for best results with a combination of, say, 20 instruments or less. For more, larger sizes are required.

SHAPE OF STUDIO.

40.—Where there is a choice of studios, curve-shaped ceilings and walls should be avoided.

EXTERNAL NOISES.

41.—The Studio must be free from noises coming in from the street and elsewhere; if there is no other

choice, temporary exclusion of sounds may be obtained by battening windows.

HEATING AND LIGHTING.

42.—For satisfactory working, especially during the winter, the Studio should have adequate heating and ventilation. The temperature should be 60°F. (16°C.), or else the musicians' performance may suffer. The lighting should also be adequate.

STARTING SIGNALS.

43.—The starting light and buzzer must invariably be fixed up in the same manner as used for outside dates in London.

RECORDING ROOM.

44.—The Recording Machine Room should adjoin the Studio whenever possible, so as to avoid long runs of wiring, and also for rapidity and convenience of working.

ARTISTES IN RECORDING ROOM.

45.—Artistes must not be allowed in the Recording Machine Room, except when it is absolutely essential for conductors and leaders to hear their playbacks.

PROTECTION OF APPARATUS.

46.—All apparatus must be carefully covered at night, and the recording staff must not leave the place of recording until they have assured themselves that the apparatus will be safe, that all batteries have been properly disconnected, and that there is no danger of fire, or of damage to the apparatus through damp or leakage in the roof, etc.

Delicate apparatus, such as recorders, points, microphones, etc., must be locked up.

BREAKDOWNS AND REPAIRS.

47.—In the case of breakdown of any part of the apparatus, that part should immediately be replaced by spares. If this is not possible, temporary repairs should be made, provided the expedition can then carry on

satisfactorily. Failing that, Petty France should be communicated with by telegram, giving full particulars of the breakdown, and asking for instructions.

CHANGE IN PERSONNEL.

48.—In case of change in personnel for any reason the retiring man must wait for the new man and hand over the gear personally.

OPERATING.

WAXES.

49.—The Wax A1 is gradually being replaced by the Wax 363. Until complete replacement has taken place, a statement should be inserted in the Weekly Report giving a comparison between the conditions of the two kinds of waxes.

CONDITION OF BLANKS.

50.—On the first day of the recording expedition, samples of waxes should be unpacked from various cases to discover whether any accident has occurred likely to necessitate a further supply being cabled for.

UNPACKING AND REPACKING OF WAXES.

51.—Care should be used in unpacking blanks, so that the packing cases are available for the return journey with the least amount of damage. When repacking, two copies of Packing Slips must be sent to London addressed to:—

MANAGER,

Recording Department,

73/75, Petty France,

London, S.W.1.

DEFECTIVE BLANKS.

52.—Waxes which suffer from defects in surface, bloom, excessive warping, etc., should be put aside and used for tests, so as to conserve the use of good blanks for masters.

In no case may blanks which are defective from any cause be used for masters, even if it necessitates complete stoppage of recording.

In the event of a number of blanks opening out in poor condition, the Operator must examine the whole consignment and cable particulars with additional requirements.

In doubtful cases cable full particulars, and await instructions.

STORAGE OF WAXES.

53.—Careful arrangements must be made for the storage of the waxes during recording in a suitable cool, dry place; and for the putting aside of masters, tests, and store of blanks, so as to avoid mixing them up or damaging them.

HEATING CUPBOARD.

54.—Early arrangements should be made for the heating cupboard, so as to get blanks warmed up while the apparatus is being assembled.

IMPROVISED CUPBOARD.

55.—If no heating cupboard is available, one should be made, or a cupboard hired for the purpose, and carbon lamps used for heating elements. For a heating cupboard of the following dimensions, 5 ft. by 5 ft. by 18 in. inside, approximately 6 32-candle-power carbon lamps should be used for heating; a number of small-powered lamps is better than a few high-powered lamps.

DUST AND MOISTURE.

56.—Precaution should be taken that the heating cupboard is dry and free from dust. Any unpacking and dusting operation, or any other work involving movement of air, should not be undertaken when the heating cupboard doors are open. Frequently cupboards get damp during travelling. To test them, turn on the heat, and place one blank inside. If there is any moisture present, some will collect on the wax. To dry the cupboard keep the heat on and open the doors for a minute or two every five minutes or so to let out the damp air.

In the case of using a cupboard other than the standard one, care should be taken that it is free from holes at the top, where dust can penetrate on to the blanks.

LAY-OUT OF GEAR.

57.—Generally the lay-out of the gear should be the same as that used on an outside date in London, as this is found the most convenient method of assembly; that is to say, when one stands in front of the recording machine, the amplifier should be to the left and at right angles to the recording machine; the heating cupboard, if not used as the recording machine bench, at the back or to the right; and the suction plant as far away from the amplifier and its batteries as possible.

RECORDING BENCH.

58.—The rigidity of the recording bench is important, and, if necessary, this should be secured by staying it. Where we have our own heating cupboard it is used as the recording bench. Care should be taken that it is put on the flat part of the floor, and, if necessary, wedges should be used to secure rigidity.

GRAVITY MOTOR.

59.—All gears and bearings, and the governor pads, should be oiled well and often.

Weight, 100 lbs. (45 kilogrammes).

RECORDING MACHINE BELTS.

60.—Length of belt should be 5 ft. 4 in.

IMPROVISED BELT.

61.—In the case of absolute breakdown of all belts due to some untoward accident, a belt may be improvised in the following manner:—A reel of stout thread, such as is used for sewing on buttons, is procured. Two nails are inserted in a piece of wood, half the length of the belt apart, an end of the thread is fastened to one nail, and then the thread is wound round the two nails in a loop until the aggregate thickness of the strands of thread is approximately that of

the standard belt. Next the thread is wrapped around the combined threads, spaced about $\frac{1}{2}$ in. apart, and made fast to the loose end.

SPEED OF RECORDING MACHINE.

62.—During working care must be taken that the speed of the recording machine is exactly 78 revolutions per minute, and the speed should be tested before the commencement of every session, and several times during each session. If doubt is experienced at any other time as to the steady running of the machine, a test should be made to demonstrate that the machine is or is not running satisfactorily.

SPEED VARIATION.

63.—If it is not running satisfactorily the trouble may lie with the gravity motor or recording machine. In the former case it may be due to the gears being dry or sticky through old oil; the governor spindle being tight in its centres—this can easily happen by the top centre being knocked in transit; the governor pads being dry; or the governor springs or balls being loose. The gravity motor should run by the weight of the shackle alone when not belted to the recording machine.

If the trouble is with the recording machine itself it may be due to the turntable spindle being sticky; the feed screw being tight on the centres; or the feed nut being badly worn. The turntable, unbelted, should spin for about 15 seconds.

TEMPERATURE OF BLANKS.

64.—The working temperature of the blanks (both A1 and 363) should be 95°-100°F. (35°-38°C.).

HEATING OF BLANKS.

65.—Gradual and uniform heating of the blanks is what is required to bring them to the correct temperature without warping.

Quick heating or local heating will warp the blanks and make them useless for recording purposes.

UNIFORM HEATING.

66.—In order to get heated uniformly the blanks should be turned round on the shelves by hand from time to time.

A baffle board of cardboard or wood should be inserted between the heating elements and the bottom row of blanks, so as to avoid direct rays of heat reaching the underside of blanks, which would tend to heat them locally.

DEPTH OF CUT.

67.—The depth of cut on the wax must be carefully attended to, and the following rule observed:—

When the cuts are examined under a 10X glass the land between the cuts on the 99 thread should be 40 per cent. and the width of the top of the cut 60 per cent. of the total width of land and cut.

TRIAL CUT.

68.—When making the trial cut, the cutter should be carefully listened to for any audible swish. This indicates non-uniformity of material or temperature. Blanks that are uneven should be used only for tests.

EXAMINATION OF CUT.

69.—The cut should be examined under a 20X glass. The point of the cut should be exactly between the two sides. If this is not so, either the recorder is not upright, or the point is mounted incorrectly.

DEFECTIVE POINT.

70.—If the sides of the cut show reflected light of a non-uniform character, then records with noisy surface will result. In this case the point should be changed.

When a wax shaving comes away from the point in a curl about $\frac{1}{2}$ in. in diameter, it is usually a sign of a damaged point, provided the wax is at the correct temperature and uniformly heated.

IMPORTANCE OF EXAMINATION.

71.—This examination of cut for condition of the point should be made before every session in case some

74 (a).—Owing to shrinkage of the wax when it cools from recording temperature to ordinary (and processing) temperature, the starting diameters should be made as nearly as possible $\frac{3}{64}$ " larger (diameter) than $9\frac{1}{2}$ " for 10" and $11-\frac{7}{16}$ " for 12" records.

74 (b).—Records having a break in the cut due to lifting the point and starting again, or other departures from normal, must on no account be made unless specific authority has first been obtained from Petty France. Such blank spaces cause trouble with the automatic stops which are now fitted on all our machines.

accidental and unknown damage to the point has taken place.

PROTECTION OF RECORDERS.

72.—Recording points and recorders should be carefully locked away whenever the apparatus is left, even if only for an hour at meal times.

DIMENSIONS AND PLAYING TIMES.

73.—The table overleaf shows the dimensions and maximum playing times of different sizes of records.

ACCURACY OF DIMENSIONS.

74.—The exact starting diameters and “ rill-offs ” for all records are very important, in view of the large and growing number of automatic playing machines in many countries.

The starting on a record late, that is, making the starting diameter less, because the title happens to be short, is prohibited.

WEIGHT, ETC., OF BLANKS.

75.—A new 12-in. blank weighs approximately 5 lbs.

Case of ten 12-in. blanks :—

Approximate net weight 84 lbs.

„ gross weight 130 lbs.

Approximate dimensions, 31 in. by 19 in. by 19 in.

A new 10-in. blank weighs approximately 3½ lbs.

Case of ten 10-in. blanks :—

Approximate net weight 68 lbs.

„ gross weight 96 lbs.

Approximate dimensions, 28 in. by 16 in. by 16 in.

RECORDER.

76.—When travelling, the Recording Operator must carry the recorder in his personal baggage, and protect it as far as possible from falls, knocks, or heavy jolts likely to disturb its adjustment.

CONDITION OF RECORDER.

77.—Important recordings must not be carried on

DIMENSIONS AND PLAYING TIMES OF RECORDS.

RECORD SIZE		6"		8"		10"		12"	
Overall Diameter	—	6.1/16"	154.0 mm.	7.87"	200 mm.	10.7/32"	259.6 mm.	12.7/32"	310.4 mm.
Starting Diameter	—	5.3/4"	146.0 mm.	7.48"	190 mm.	9.1/2"	241.3 mm.	11.7/16"	290.5 mm.
Maximum Recording Space	—	1.1/2"	38.1 mm.	2.32"	59 mm.	2.13/16"	71.4 mm.	3.25/32"	96.0 mm.
Limit of Recording	—	2.3/4"	69.8 mm.	2.83"	72 mm.	3.7/8"	98.4 mm.	3.7/8"	98.4 mm.
Rill Diameter	—	2.1/2"	63.5 mm.	2.56"	65 mm.	3.5/8"	92.1 mm.	3.5/8"	92.1 mm.
Label Diameter	—	—	—	2.28"	58 mm.	3.3/8"	85.7 mm.	3.3/8"	85.7 mm.
LONGEST PLAYING TIMES at 78 revs. per minute.									
78 threads per inch	—	1m. 30s.		2m. 19s.		2m. 49s.		3m. 47s.	
87	—	1m. 40s.		2m. 36s.		3m. 8s.		4m. 13s.	
93	—	1m. 47s.		2m. 46s.		3m. 21s.		4m. 31s.	
99	—	1m. 54s.		2m. 57s.		3m. 34s.		4m. 48s.	
113.5	—	2m. 11s.		3m. 23s.		4m. 5s.		5m. 30s.	
126.5	—	2m. 26s.		3m. 46s.		4m. 34s.		6m. 8s.	
135.3	—	2m. 36s.		4m. 2s.		4m. 53s.		6m. 34s.	
144	—	2m. 46s.		4m. 17s.		5m. 11s.		6m. 59s.	

with a recorder which is in an unknown or untried condition.

ADJUSTMENT.

78.—If the stylus bar has been subjected to a knock with the blank or otherwise, a rough test for lack of balance may be made by examining the point under a 20X glass, switching the field current full on and full off repeatedly, and seeing if there is any movement when this happens. If the slightest movement is at all visible under a 20X glass, the recorder is definitely out of balance, and the spare recorder must be used.

MOUNTING.

79.—The recorder must be carefully mounted in its floater, and care taken that the floater bearings are not damaged or subjected to rough use.

EXAMINATION OF CONNECTIONS.

80.—The flexible wires from the recorder control box to the recorder should be carefully examined from time to time, to see that the insulation is perfect. Also the connection from these wires to the recorder itself must be tight. In the speech coil circuit of the recorder breakages of contacts or bad contacts are not noisy, but simply result in fading, or switching off and on without any noise.

ELECTRICAL.

RESPONSIBILITY.

81.—The Electrical Engineer is responsible for the electrical part of the apparatus, and for the delivery of recorder signals to the terminals of the recorder.

TRANSPORT OF MICROPHONES.

82.—Microphones must be carried with personal baggage, and care must be taken that they are not dropped or subjected to rough usage.

BATTERY ARRANGEMENTS.

83.—On arrival at the town in which the recording is to take place, the first duty of the Electrical Engineer

is to ascertain that the battery arrangements made in advance are satisfactory, and to arrange for the delivery of the batteries to the site of the recording.

BATTERY TESTING.

84.—Batteries must be tested with hydrometer and voltmeter to discover whether they are in satisfactory condition for recording, fully charged, etc.

MUD SPACE.

85.—Mud space in storage batteries should be examined wherever practicable (e.g., in glass-contained cells), to make sure that noise will not develop.

CHARGING ARRANGEMENTS.

86.—Arrangements must be made with the local battery agent for charging the batteries for the duration of the recording.

LAY-OUT OF APPARATUS.

87.—The electrical apparatus must be set up in the standard lay-out so far as practicable, and the amplifier, generator, and batteries kept as far away from the suction plant as possible.

WIRING.

88.—The external wiring of the apparatus must be neatly done, and in all cases shielded wire used for all speech circuits.

EARTH CONNECTION.

89.—A proper earth connection must be obtained, and suitable heavy copper wire run to it.

LOCATION OF GENERATOR.

90.—The motor generator must be located where the noise will not interfere with the recording operating, so that complaints will not arise afterwards from the studio managers, conductors, or artistes, that their playback was interfered with by the humming sound from the generator.

EXAMINATION OF GENERATOR.

91.—The generator should be examined from time to time during recording to see that it is not running hot, and that sparking of the commutators does not take place.

OIL IN BEARINGS.

92.—The generator must travel without oil in its bearings, as otherwise oil will get spilled on to the commutators and cause trouble. When packing it for a journey, therefore, the oil must be carefully emptied by the drain plugs supplied. Before the generator is used it must be carefully charged with oil to the proper level. The utmost importance must be attached to this instruction, as otherwise the generator will be useless on arrival, if it has travelled with oil in it, or else the bearing will be ruined, if it is run without oil.

TESTS BEFORE RECORDING.

93.—After the electrical apparatus has been set up and wired, before starting recording the tests provided for in the electrical "write up" must be carried out.

"WRITE UP."

94.—Electrical Engineers must take with them on all expeditions the wiring diagrams and "write up" supplied.

MATRIX NUMBERS.

95.—The following list gives the matrix prefixes for different countries:—

WAU	..	BRITISH	..	..	..	..	..	8"
WA	..	"	..	..	..	..	..	10"
WAX	..	"	..	..	..	..	..	12"
WARU	..	"	REGAL	..	..	..	..	8"
WAR	..	"	"	..	..	..	..	10"
WARX	..	"	"	..	..	..	..	12"
WBU	..	ITALY	..	..	..	..	..	8"
WB	..	"	..	..	..	..	..	10"
WBX	..	"	..	..	..	..	..	12"
WCU	..	DENMARK	..	..	..	..	..	8"
WC	..	"	..	..	..	..	..	10"
WCX	..	"	..	..	..	..	..	12"

WDU	} Vacant						
WD							
WDX							
WEAU	..	EXPORT	Afrikaan	..	..	..	8"
WEA	..	"	"	..	..	..	10"
WEAX	..	"	"	..	..	..	12"
WECU	..	"	Ceylon	..	..	..	8"
WEC	..	"	"	..	..	..	10"
WECX	..	"	"	..	..	..	12"
WEDU	..	"	Dixi	..	..	..	8"
WED	..	"	"	..	..	..	10"
WEDX	..	"	"	..	..	..	12"
WEIU	..	"	India	..	..	..	8"
WEI	..	"	"	..	..	..	10"
WEIX	..	"	"	..	..	..	12"
WEMU	..	"	Malay	..	..	..	8"
WEM	..	"	"	..	..	..	10"
WEMX	..	"	"	..	..	..	12"
WESU	..	"	Swahili	..	..	..	8"
WES	..	"	"	..	..	..	10"
WESX	..	"	"	..	..	..	12"
WFU	..	HOLLAND		..	..	..	8"
WF	..	"		..	..	..	10"
WFX	..	"		..	..	..	12"
WGU	..	GREECE		..	..	..	8"
WG	..	"		..	..	..	10"
WGX	..	"		..	..	..	12"
WHAU	..	AUSTRIA		..	..	..	8"
WHA	..	"		..	..	..	10"
WHAX	..	"		..	..	..	12"
WHBU	..	BULGARIA		..	..	..	8"
WHB	..	"		..	..	..	10"
WHBX	..	"		..	..	..	12"
WHCU	..	CZECHO-SLOVAKIA		..	..	..	8"
WHC	..	"		..	..	..	10"
WHCX	..	"		..	..	..	12"
WHU	..	HUNGARY		..	..	..	8"
WH	..	"		..	..	..	10"
WHX	..	"		..	..	..	12"
WHJU	..	JUGO-SLAVIA		..	..	..	8"
WHJ	..	"		..	..	..	10"
WHJX	..	"		..	..	..	12"
WHRU	..	ROUMANIA		..	..	..	8"
WHR	..	"		..	..	..	10"
WHRX	..	"		..	..	..	12"

WIU	..	INTERNATIONAL	..	..	..	8"
WI	..	"	..	..	..	10"
WIX	..	"	..	..	..	12"
WJU	..	BALTIC Poland	..	..	..	8"
WJ	..	" "	..	..	..	10"
WJX	..	" "	..	..	..	12"
WJEU	..	" Estonia	..	..	..	8"
WJE	..	" "	..	..	..	10"
WJEX	..	" "	..	..	..	12"
WJLU	..	" Lithuania	..	..	..	8"
WJL	..	" "	..	..	..	10"
WJLX	..	" "	..	..	..	12"
WJRU	..	" Russia	..	..	..	8"
WJR	..	" "	..	..	..	10"
WJRX	..	" "	..	..	..	12"
WJVU	..	" Latvia	..	..	..	8"
WJV	..	" "	..	..	..	10"
WJVX	..	" "	..	..	..	12"
WKU	..	SPAIN	..	..	..	8"
WK	..	"	..	..	..	10"
WKX	..	"	..	..	..	12"
WLU	..	FRANCE	..	..	..	8"
WL	..	"	..	..	..	10"
WLX	..	"	..	..	..	12"
WLAU	..	FRENCH Algiers	..	..	..	8"
WLA	..	" "	..	..	..	10"
WLAX	..	" "	..	..	..	12"
WLBU	..	BELGIUM	..	..	..	8"
WLB	..	"	..	..	..	10"
WLBX	..	"	..	..	..	12"
WLIU	..	FRENCH Indo-China	..	..	..	8"
WLI	..	" " "	..	..	..	10"
WLIX	..	" " "	..	..	..	12"
WLMU	..	" Madagascar	..	..	..	8"
WLM	..	" "	..	..	..	10"
WLMX	..	" "	..	..	..	12"
WLOU	..	" Morocco	..	..	..	8"
WLO	..	" "	..	..	..	10"
WLOX	..	" "	..	..	..	12"
WLTU	..	" Tunis	..	..	..	8"
WLT	..	" "	..	..	..	10"
WLTX	..	" "	..	..	..	12"
WMU	..	CONTINENTAL	..	..	..	8"
WM	..	"	..	..	..	10"
WMX	..	"	..	..	..	12"

WNU	..	NORWAY	..	..	..	..	..	8"
WN	..	"	..	..	..	..	..	10"
WNX	..	"	..	..	..	..	..	12"
WOU	..	PERSIA	..	..	..	..	..	8"
WO	..	"	..	..	..	..	..	10"
WOX	..	"	..	..	..	..	..	12"
WPU	..	PORTUGAL	..	..	..	..	..	8"
WP	..	"	..	..	..	..	..	10"
WPX	..	"	..	..	..	..	..	12"
WQU	..	ARABIA	..	..	..	..	..	8"
WQ	..	"	..	..	..	..	..	10"
WQX	..	"	..	..	..	..	..	12"
WRU	..	GERMANY	..	..	..	..	..	8"
WR	..	"	..	..	..	..	..	10"
WRX	..	"	..	..	..	..	..	12"
WSU	..	SWEDEN	..	..	..	..	..	8"
WS	..	"	..	..	..	..	..	10"
WSX	..	"	..	..	..	..	..	12"
WTU	..	TURKEY	..	..	..	..	..	8"
WT	..	"	..	..	..	..	..	10"
WTX	..	"	..	..	..	..	..	12"
WTAU	..	ALBANIA	..	..	..	..	..	8"
WTA	..	"	..	..	..	..	..	10"
WTAX	..	"	..	..	..	..	..	12"
WTSU	..	SYRIA	..	..	..	..	..	8"
WTS	..	"	..	..	..	..	..	10"
WTSX	..	"	..	..	..	..	..	12"
WVU	..	D. EAST INDIES	8"
WV	..	"	10"
WVX	..	"	12"
WYU	..	FINLAND	8"
WY	..	"	10"
WYX	..	"	12"
WZU	..	SWITZERLAND	8"
WZ	..	"	10"
WZX	..	"	12"

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