COMITE CONSULTATIF INTERNATIONAL TELEPHONIQUE

Xth PLENARY MEETING
Budapest, 3rd—10th September, 1934

VOLUMES I—V

ENGLISH EDITION

COMITE CONSULTATIF INTERNATIONAL TELEPHONIQUE

(C.C.I.F.)

PROCEEDINGS OF THE
Xth PLENARY MEETING
Budapest, 3rd—10th September, 1934

TRANSLATED INTO ENGLISH
BY
THE TECHNIGAL STAFF
OF
THE INTERNATIONAL STANDARD ELECTRIC CORPORATION

ENGLISH EDITION

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PREFACE TO THE ENGLISH EDITION.

This volume contains an unofficial translation of the official French text of the Proceedings of the COMITE CONSULTATIF INTERNATIONAL TELEPHONIQUE (C.C.I.F.) at its Plenary Session in Budapest, 3rd—10th September, 1934.

The English and French page numbers in the Contents pages and in the Index at the end of the book are printed in parallel columns so as to facilitate ready comparison between corresponding items in the English and French editions.

It should be noted that, whilst the French edition is published in five separately bound volumes, each with its individual page numbering, the English edition contains all five volumes within its covers. The pages in the English edition are numbered consecutively throughout the book.

INTERNATIONAL STANDARD ELECTRIC CORPORATION.

VOLUME I

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COMITE CONSULTATIF INTERNATIONAL TELEPHONIQUE

Xth Plenary Meeting, Budapest, 3rd–10th September, 1934.

LIST OF DELEGATES.

A.—DELEGATES FROM TELEPHONE ADMINISTRATIONS AND OPERATING COMPANIES.

1. Administrations or Operating Companies belonging to the C.C.I.F.

SOUTH AFRICA
(*Union of South Africa*) ... Mr. B. S. Cohen, of the British Post Office.

ALBANIA ... ... Not represented.

GERMANY ... ... Mr. K. Höpfner, Ministerial Director (*Chief Delegate*).
Dr. Jäger, Ministerial Councillor.
Mr. Dohmen, Chief of Division, Reichspostzentralamt.
Mr. Ehlers, Chief Councillor of Posts.
Mr. Gladenbeck, Councillor of Posts.

ARGENTINE
Compania Union Telefonica del Rio de la Plata.
Compania Telefonica Argentina.
Compania Internacional de Radio.
Sociedad Anonima Radio Argentina.
Mr. F. Gill (*Chief Delegate*).
Compania Telefonica Telegrafico del Plata.
Mr. B. Pohlmann.
Dr. H. F. Mayer.
Compania Internacional de Telefonos.
Mr. Max Langer.
Compania Transradio Internacional.
Not represented.

AUSTRIA ... ... Mr. Rudolf Heider, Ministerial Councillor (*Chief Delegate*).
Mr. Rudolf Oestreicher, Ministerial Councillor.

BELGIUM ... ... Mr. Van Ubbel, Engineer-in-Chief, Director of Telephones (*Chief Delegate*).
Mr. Fossion, Assistant Director.
Mr. Haemers, Chief Engineer.

CHILI
Chile Telephone Company.
Not represented.

CHINA ... ... Mr. Wupogfeng, Chief Engineer, Ministry of Communications,

CUBA

Cuban Telephone Company.

Mr. P. E. Erikson, Assistant Vice-President (*Chief Delegate*).
Mr. Van Hasselt, Engineer.

DENMARK ... ... Mr. M. J. Gredsted, Chief of the International Operating Service (*Chief Delegate*).
Mr. N. Holmblad, Engineer, Technical Section of Telegraphs and Telephones.
Mr. L. Saltoft, Chief Engineer of the Copenhagen Telephone Company.

DANZIG (*Free City of*) ... Not represented.

SPAIN

Compania Telefonica Nacional de Espana.

Mr. J. M. Clara, Director of the International Service (*Chief Delegate*).
Mr. Del Riego Salazar, Chief of Section.

ESTHONIA ... ... Not represented.

UNITED STATES OF AMERICA

American Telephone and Telegraph Company.

Mr. H. E. Shreeve, Technical Representative of the A. T. & T. Company in Europe.

FINLAND ... ... Mr. J. Rosberg, Engineer.

FRANCE ... ... Mr. Lange, Director of the Telephone Service (*Chief Delegate*).
Mr. Drouët, Inspector-General.
Mr. Aguillon, Chief Engineer.
Mr. Le Corbeiller, Chief Engineer.
Mr. Collet, Chief Engineer.
Mr. Malezieux, Chief Engineer.
Mr. Belus, Engineer.
Mr. Parmentier, Engineer.
Mr. Chavasse, Engineer.
Mr. Godfrin, Engineer.
Mr. Debry, Department Chief.
Mr. Rigollet, Deputy Department Chief.

GREAT BRITAIN ... ... Col. A. G. Lee, The Engineer-in-Chief, British Post Office (*Chief Delegate*).
Mr. W. H. Weightman, Principal in charge of International Telephone Service, British Post Office.
Mr. G. W. Gomm, Inspector of Telegraph and Telephone Traffic, British Post Office.
Mr. S. T. Keyte, Staff Officer, Accountant General's Department, British Post Office.
Mr. B. S. Cohen, Staff Engineer, Director of Research, British Post Office.
Mr. J. G. Hines, Staff Engineer, British Post Office.

GREAT BRITAIN (*cont*).

Mr. A. J. Gill, Staff Engineer, British Post Office.
Mr. P. B. Frost, Assistant Staff Engineer, British Post Office.
Mr. B. J. Stevenson, Executive Engineer, British Post Office.
Mr. F. E. A. Manning, Executive Engineer, British Post Office.

HUNGARY

(A) *Delegates from the Hungarian Administration.*

Baron G. Szalay, Secretary of State, Director-General of Posts (*Chief Delegate*).
Dr. P. de Hollan, Director-in-Chief.
Dr. P. Hajos, Director-in-Chief.
Dr. F. Havas, Director.
Dr. F. Kende, Under-Secretary.
Dr. F. Teész, Under-Secretary.
Mr. D. Véghely, Chief Technical Director.
Mr. G. Ujj, Chief Technical Director.
Mr. A. Lédeczy, Chief Technical Director.
Dr. R. Telbisz, Chief Engineer.
Dr. I. Tomits, Technical Councillor.

(B) *Reception Committee.*

Dr. P. de Hollan, Director-in-Chief (*Chairman*).
Dr. F. Havas, Director.
Dr. A. Racz, Director.
Dr. J. Albrecht, Councillor.
Dr. F. Teész, Under-Secretary.
Mr. E. Fritz, Technical Director.
Mr. A. Eglmayer, Technical Councillor.
Mr. E. Kisfalvz, Technical Councillor.
Mr. J. Erdöss, Technical Councillor.
Mr. T. Alkér, Engineer.

DUTCH INDIES ... ... Not represented.

ICELAND ... ... Not represented.

ITALY ... ... Mr. Cesare Albanese, Head of Department, Experimental Institute of Communications, P.T.T. Section (*Chief Delegate*).
Mr. A. Baldini, Section Head, Experimental Institute of Communications, P.T.T. Section.
Mr. F. Pepe, Engineer, Inspector, State Telephone Service.
Mr. D. Achilli, Department Head, State Telephone Service.
Mr. Elvio Soleri, Professor of the Engineering College at Turin, Member of the Council of the Turin Telephone Service Co.

JAPAN ... ... Mr. Yataro Nakamura, Engineer in the Ministry of Communications (*Chief Delegate*).
Mr. Takashi Ono, Engineer in the Ministry of Communications.

LETTONIA ... ... Not represented.

LITHUANIA ... ... Not represented.

LUXEMBOURG ... ... Not represented.

MEXICO

(A) *Empresa de Telefonos Ericsson S.A.*

Mr. Mauritz Vos, D.Sc. (*Chief Delegate*).
Mr. F. Markman, Engineer.
Mr. G. Segerström, Engineer.

(B) *Mexican Telephone and Telegraph Company.*

Not represented.

MOZAMBIQUE ... ... Not represented.

NORWAY ... ... Mr. Martin Wahl, Chief of Department, Telegraph Administration (*Chief Delegate*).
Mr. S. Rynning-Tönnessen, Engineer, Telegraph Administration.

HOLLAND ... ... Mr. H. J. Boetje, Engineer-in-Chief, Technical Director of Telegraphs and Telephones (*Chief Delegate*).
Mr. H. C. Felser, Inspector-General of Posts and Telegraphs.
Mr. Th. W. L. M. de Winter, Inspector of Posts, Telegraphs and Telephones.
Mr. J. Winkel, Chief Engineer of Telegraphs and Telephones.
Mr. J. Tj. Visser, Engineer of Telegraphs and Telephones.
Mr. H. C. A. Boom, Engineer, Director of the Municipal Telephone Service at Rotterdam.

POLAND ... ... Mr. Stanislas Debicki, Chief of the Telegraph and Telephone Operating Department in the Ministry of Posts, Telegraphs and Telephones (*Chief Delegate*).
Mr. Henry Pomirski, Chief of the Cable Department in the Ministry of the P.T.T.
Mr. Constant Dobrski, Chief of Section in the National Institute of Telecommunications.
Mr. Czeslaw Rajski, Chief of the Laboratory of State tele- and radio-communication service.

PORTUGAL ... ... Not represented.

RUMANIA

Societatea Anonima Romana de Telefoane.

Mr. J. Miclescu Prajescu, General Secretary (*Chief Delegate*).
Mr. B. H. McCurdy, Director of Long Lines and Transmission.
Mr. J. J. Parsons, Traffic Director.

SWEDEN ... ... Mr. A. Holmgren, Department Chief of the Telegraph Administration (*Chief Delegate*).
Mr. E. Halling, Director of Telephones, Stockholm.
Mr. A. Lignell, formerly Director of Telephones, Stockholm.
Mr. S. Nordström, Chief Engineer, Telegraph Administration.
Mr. G. Svedenborg, Section Engineer.

SWITZERLAND	Mr. A. Muri, Head of Technical Division (*Chief Delegate*). Mr. A. Möckli, Chief of Telephone Section. Mr. A. Keller, Chief of Test Section.
CZECHO-SLOVAKIA	Mr. St. Chocholin, Ministerial Councillor (*Chief Delegate*). Mr. Fr. Matous, Ministerial Councillor. Mr. J. Michalek, Councillor.
UNION OF SOVIET SOCIALIST REPUBLICS.	Mr. C. Koulbatski, of the Technical Research Institute, People's Commissariat of Posts, Telegraphs and Telephones (*Chief Delegate*). Mr. Balachov, Engineer, Chief of the Central Long-distance Department at Moscow.
URUGUAY	Not represented.
YUGOSLAVIA	Not represented.

2. **Representatives of Organisations co-operating with the C.C.I.F.**

(A) *Comité Consultatif International Télégraphique :*

Represented by the Hungarian Administration at the request of the Czecho-Slovakian Administration, directing the C.C.I.T.

(B) *Comité Consultatif International des Radiocommunications :*

Represented by the German Administration at the request of the Portuguese Administration, directing the C.C.I.R.

Bureau of the International Union of Telecommunications :

Mr. Boulanger, Vice-Director.

B.—DELEGATES FROM ELECTRO-TECHNICAL ASSOCIATIONS.

1. **International Union of Railways.**

Mr. Abeloos, Engineer in the Technical Service of Roads and Operation in the P.O. and Midi Systems.

Mr. Hellenthal, Director of the German Railways.

2. **International Conference of large High Tension Electric Networks.**

Mr. Wilczek, Consulting Engineer at Budapest.

3. **International Broadcasting Union.**

Mr. R. Braillard, President of the Technical Commission and Director of the Control Centre of the Union at Brussels.

Mr. Bernetti, Engineer of E.I.A.R. Company, Turin.

Dr. Nestel, Chief Engineer of the Reichs-Rundfunk Gesellschaft, Berlin.

Mr. E. L. E. Pawley, Engineer, British Broadcasting Corporation, London.

MINUTES OF THE OPENING SESSION

(3rd September, 1934).

The meeting opened at 10.00 a.m.

His Excellency Mr. Tihamér Fabinyi, Minister of Commerce : I have pleasure in greeting you in the name of the Royal Hungarian Government and in extending to you a cordial welcome.

The Hungarian Government is proud and indeed grateful to you for having accepted its invitation to hold this Plenary Meeting in Budapest, in the year when we are celebrating the 10th anniversary of the founding of the C.C.I.F., which makes this meeting a highly significant and solemn occasion.

The Hungarian Government wished, by its invitation, to express its great appreciation of the work done by this Committee during the past ten years, well aware that this work has always been inspired by the idea of developing—within the limits of possibility and in accordance with scientific progress—the networks, installations and the regulation of international telephone service, and to support these endeavours which tend to promote the development of civilisation and to bring the nations closer together.

I would like to emphasize that this development is of particular importance to Hungary, which, situated in the valley of the Danube and the Tisza, is the connecting link between western and northern Europe and the east and the south. Due to her position as an intermediary country, Hungary has always played an important part with regard to communications.

Conscious of her part, Hungary is, as in the past, striving now and for the future to maintain this tradition. Acting on this idea the Hungarian Administration has constructed the long-distance telephone cable, which connects Budapest with Vienna and Bratislava in one direction, and Szeged, a town situated near the Jugo-Slavian and Roumanian frontier, in the other direction. Hungary has thus established a large number of telephone circuits which can carry European and extra-European traffic under the best conditions. The modern cord-circuit repeater installation in the Budapest interurban exchange, increases the importance of the Hungarian telephone system.

I would ask you, as representatives of the Administrations and Telephone Companies, during your stay in Budapest, to be good enough to study not only the questions on your agenda, but also the telecommunication installations in Hungary. When, in the immediate future, you are planning the routes of the world telephone traffic, please remember that in Hungary the cables and telephone installations are always available in excellent condition for this traffic.

Inspired by these ideas I declare the Xth Plenary Meeting of the C.C.I.F. open and welcome you warmly.

Once more I bid you welcome and may the highest success crown your efforts ! (Loud applause.)

To my great regret I am now obliged to leave this illustrious assembly as other official duties call me. I would therefore ask the Secretary of State and Director General of the Hungarian Royal Administration of Posts to be good enough to take my place and continue to preside over this meeting. (Loud and prolonged applause.)

Baron Gabriel Szalay, Secretary of State and Director General of Posts : Following the remarks made by His Excellency, the Minister of Commerce, I, for my part, as Head of the Administration which has had the pleasure of inviting you here, also wish to tender you a very hearty welcome on behalf of the Royal Postal Administration of Hungary, which is greatly honoured to see the eminent representatives of so many telephone administrations and undertakings gathered in our capital.

We hope that the work of this Plenary Meeting will contribute materially to the continued development of telephony.

Before we begin our work, may I remind you that ten years have elapsed since the inception of the C.C.I.F.

The tremendous progress in telephony during these last years, the possibility of telephoning over almost unlimited distances by means of long-distance cables and radio-telephony, made it necessary to create an international organisation, able to arrange for and maintain the best conditions for these communications.

It is for this reason that the C.C.I.F. has been created, which by its recommendations, which have been adopted by nearly all the Administrations, has rendered inestimable services to the Union Internationale des Télécommunications.

The leading representatives of the nineteen administrations who have for ten years been intimately connected with the founding and development of our committee have done good work, and we remember them with gratitude. I am very happy to be able to welcome here several of the founders of the C.C.I.F., notably Mr. Lignell, former Telephone Director in Stockholm, now retired as a result of the number rather than the weight of years; forty-nine years in the Swedish telephone service, during which time he held what might be termed all the leading posts.

He has participated with the greatest interest in the work of the C.C.I.F. and, in stating how valuable he is, I will only say that he has had the pleasure of seeing all the proposals he brought forward at the Constitutive Assembly of 1924, put into effect in the international telephone services.

I hope—and I am certain that I am expressing the sentiments of all the members of the C.C.I.F. —that he may, in perfect health and for many years to come, further the development of the telephone. (Applause.)

The other founders also, whom we may call the pioneers in long-distance telephony, have not ceased to contribute to the work of the Committee which has been so rich in result.

I do not wish to take your time by going over the long series of questions dealt with by the Committee or by telling how its advice and recommendations, which have been adopted by the Administrations, have improved the telephone service, thereby accelerating the traffic. This will be the grateful task of the historian.

I would merely emphasize that the importance of the Committee has increased with each Plenary Meeting. Nor must we forget the conscientious work done by the various Commissions of Rapporteurs which succeeded the Permanent Commission (established until 1926), and which may be said to have had to deal with the greater part of the work, and last, but not least, the General Secretariat with which Mr. Valensi's name is so closely associated that it is difficult to imagine the one without the other.

It is a sad fate that he should not be here to-day on account of illness. Although absent, I would, however, thank him, as also all the members of the Committee—prominent and competent officers of the different Administrations, Companies and Organisations—for all their earnest and careful work for the benefit of the understanding and progress of humanity. (Applause.)

One thing that should not be passed over in silence is that, for the purpose of rendering our work even more efficient, our Committee has, since 1927, collaborated with the Comité Mixte Internationale, and that since its origin it has kept in touch with numerous international organisations. I have the pleasure of welcoming amongst us eminent representatives of the Conference

Internationale des Grands Reseaux Eléctriques à Haute Tension, those of the Union Internationale de Radiodiffusion and the Union Internationale des Chemins de Fer. I must certainly not forget M. Boulanger who represents amongst us the Bureau de l'Union Internationale des Télécommunications.

I confidently hope that the second decade of our work will be as fruitful and appreciated as the first.

I have pleasure in announcing that China and Japan have just become official members of the C.C.I.F. as from July of last year. I would take this opportunity of welcoming cordially the delegates of these two Administrations, as I feel sure that their participation in our work can only increase the remarkable results which we have achieved in the improvement of the international telephone service. (Applause.)

I now have the sad duty of recalling to your memories those of our colleagues who will never return.

(The delegates rise.)

Mr. Barillau, who died in February, 1933, and who participated for several years with greatly appreciated efficiency in the work of the 6th and 7th Commissions of Rapporteurs.

Mr. Stegmann, who has been a member of the German Delegation since the inception of the C.C.I.F., and whose participations in the Technical Commissions have been very profitable for telephony, died in August, 1933.

Mr. Robinson, who left us in November, 1933, after having participated in the work of the Plenary Meetings every year with a devotion appreciated by all his colleagues.

Professor di Pirro, who was amongst the founder-members of the C.C.I.F. An eminent electro-technician of universal reputation, he died in February, 1934, shortly after his retirement.

Finally, **Dr. Breisig,** who died in April of the present year, and who was also one of the most active founder-members of the C.C.I.F., and whose valuable advice will certainly be missed.

Gentlemen, I would ask you to observe a silence of one minute to honour their memory.

(One minute's silence.)

Now, Gentlemen, I would invite you to elect the President of the Plenary Meeting.

Mr. Höpfner : I think that I am speaking for everybody in proposing that the Secretary of State and Director General of the Royal Posts of Hungary, should be the President of the Plenary Meeting of 1934. (Loud applause.)

Baron Szalay : In thanking Mr. Höpfner for his kind remarks, I abide by your vote and accept the office of President. I am greatly touched by this mark of your confidence, and the honour which you have done me and which I also interpret as a mark of your sympathy towards Hungary, my dear country.

I need hardly add that I shall do my utmost to direct our labours to the best of my ability.

We have now to elect the three Vice-Presidents who will have to direct the work of the Commision.

May I propose to you that Colonel Lee be elected for questions of transmission, Mr. Albanese for questions of protection, and Mr. Muri for questions of traffic, exploitation and tariffs. (Applause.)

I note that these proposals are unanimously accepted.

Mr. Lignell : There is an old proverb which says that " Union is strength," and this applies so well to the work of the C.C.I.F.

When, on the initiative of the French Government, this Committee was established in 1924, it was clear to all the world that, in order to realise long distance telephone communication between countries, it was necessary not only to overcome difficulties of a purely technical nature, but also, and in particular, to establish uniformity in regard to the organisation of international lines and the methods for their utilisation. It became the task of the C.C.I.F. to carry out this unification, and it is recognised to-day that the C.C.I.F. has admirably fulfilled this task. This has only been made possible by the collaboration of the eminent experts of the different countries, aided by the man who holds the office of the General Secretary and, finally, by the lively interest which all the countries have taken in the important problems which had to be solved. The result of the work of our Committee—the establishment of a world telephone network—has practically been achieved in less than ten years.

The kind remarks which have just been addressed to me have touched me very much. I am happy if, for my humble part, I have been able to contribute to the great work of the C.C.I.F. I shall always continue to devote my interest and experience to telephone questions. I rejoice at the opportunity which has been given me to take part once more, although I have retired from the Service, in the Plenary Meeting of the C.C.I.F. in this lovely country of Hungary, and I would take this opportunity of thanking you, my dear colleagues on the Committee, most heartily for the friendship, cordiality and indulgence which you have always accorded me.

In closing I would express the hope that the unity which has given the C.C.I.F. the power to solve some of the greatest problems of our century with regard to communication shall not cease to prevail.

Baron Szalay : I have to inform you that M. Valensi, our highly esteemed General Secretary, is kept in bed by arthritis. He has written to me as follows :—

" MR. PRESIDENT,

" A severe form of arthritis, which attacked me shortly before my intended departure for Budapest, unfortunately persists and, greatly to my regret, prevents me from taking part in the opening session of the Xth Plenary Meeting of our Committee.

" I have already had the pleasure of writing to tell you how much I was looking forward to a visit to Hungary. My dear friends and colleagues on the Committee know the great intellectual and personal pleasure it always gives me to collaborate with them and how happy I have been to put all my effort at their disposal during the course of the first nine Assemblies. You will therefore understand that to me it is more than a misfortune—I may say a real tragedy—that my body should be chained here by illness, whilst my thoughts are with your meeting in the Houses of Parliament in Budapest.

" I would ask you to be good enough to express to all my dear colleagues my very sincere wishes for the success of their work as well as my feelings of great friendship and profound regret. I should, in particular, like them to know that my thoughts will be with them when they are meditating on the memory of those of our colleagues and friends who have recently passed away."

We very much regret the absence of our General Secretary, which deprives us not only of one of the moving spirits of the Committee, but also of a charming colleague who is the friend of us all.

I feel sure that I shall have your unanimous approval in proposing to write him a letter, thanking him for his good wishes with respect to the satisfactory progress of our labours, expressing our very deep regret at his absence and wishing him a quick recovery. (Loud and prolonged applause.)

Mr. Valensi at the same time submitted the following proposal to the Meeting :—

" That the functions of the General Secretary may be entrusted, in so far as technical questions are concerned to Mr. Le Corbeiller, Chief Rapporteur of the 5th C.R., who will be assisted by Mr. Ollier in regard to questions of protection (1st and 2nd C.R.'s) ; Mr. Bigorgne for questions of transmission (3rd C.R.), and by Mr. Parmentier in regard to questions of maintenance.

" With regard to questions of exploitation, the functions of the General Secretary may be confided to Mr. Mahé, Secretary of the 6th and 7th C.R.'s, Mr. Mahé being also the Secretary of the ' Commission des Voies de secours.' "

Does this proposal meet with your approval ? (Applause.)

I see that it does, and accordingly have pleasure in welcoming Mr. Le Corbeiller and Mr. Mahé, as also Messrs. Ollier, Bigorgne, Labrousse and Parmentier in their respective offices, being assured that the choice of the Meeting has fallen upon worthy substitutes for Mr. Valensi.

Mr. Le Corbeiller : The two secretaries you have just appointed thank you for the honour which you have done them and for your confidence in them. They are, however, conscious that they have not between them the total experience of Mr. Valensi with regard to the Meeting and the details of its deliberations. They will, however, endeavour to equal his devotion, and it is with pleasure that they put themselves at your entire disposal, as also all the Staff of the General Secretariat, to help you in your work so far as it lies within their power. (Loud applause.)

Baron Szalay : I regret to inform you that Mr. de Tersztyanszky, Directeur Supérieur Technique of the Hungarian Delegation, was taken ill at the beginning of this month, and has had convalescent sick-leave which he is spending by the sea. As he is thus prevented from taking part in our work, he will be replaced by Mr. de Veghely, Directeur Supérieur Technique. (Applause.)

Further, the Technical Director Aigner, another member of the Hungarian Delegation, having lost his mother a few days ago, regrets that he is unable to be with us. Mr. Raphael Telbisz, Technical Adviser, has been called to replace him.

I will read the letter that Mr. de Tersztyanszky has sent to me :—

" To the Secretary of State,

" Being on convalescent sick leave after my illness, I have had to leave Budapest to come here to recuperate. This, to my great regret, prevents me from being able to take part in the work of the Xth Plenary Meeting of the C.C.I.F., at Budapest.

" In asking you to be good enough to excuse my absence, I would express my best wishes for the success of the work of the Assembly."

I am sure that I have the approval of the Assembly in sending him a telegram, expressing our best wishes for his complete recovery and thanking him for his sincere wishes for the success of our work. I am also sure that Mr. Aigner will have the sympathy of all the members in his sad loss.

In conclusion, I would ask Mr. Mahé to give necessary information with regard to the dossier, distributed to the chief delegates.

Mr. Mahé : Gentlemen, you have received a dossier, containing the following documents :—

(1) A draft programme of the work of the Xth Plenary Meeting. (This Draft is not final.)

(2) A list of the questions, submitted for the examination of the Xth Plenary Meeting.

(3) A Form No. 1, on which the chief delegates are asked to enter the names and official titles of the members of their delegation.

(4) A Form No. 2, on which the chief delegates are asked to state the names of the members of their delegations who will take part in the different meetings of the following Commissions : Meeting of the " Commission des Voies de secours " in the European Telephone Service ; Meeting of the Symbols Commission ; Meeting of the Commission for the Maintenance Programmes of European Circuits.

(5) A supplementary list of documents preparatory to the Xth Plenary Meeting of the C.C.I.F. ; Management Report, 1934—Report on the Budget, 1934—Documents entitled respectively " C.C.I.F., 1934—2nd C.R.—Document No. 5."

Further, a document entitled " The first ten years of the Comité Consultatif International Telephonique " with six supplements.

Finally, an article published in the Review " L'Economie Internationale," by the International Chamber of Commerce, entitled : " International Telephony—Ten years of continuous progress," by J. S. Edström.

Mr. Fossion : The account of the 6th and 7th C.R. could only be distributed this morning. I note, moreover, that in the draft programme which is submitted for the examination of the Plenary Meeting, it is arranged that the first meeting relative to questions of traffic shall take place this afternoon at 2.00 p.m. I think it would be advisable to give the delegates time to take note of the Report on the work of the 6th and 7th C.R.'s since this document is to serve as a basis of discussion. By arrangement with the Vice-President I suggest that this first meeting should be postponed until to-morrow, Tuesday, at 2.00 p.m. I would also suggest that the meeting of the " Commission des Voies de secours," which has been arranged for Tuesday, the 4th September, from 9.30 a.m. to 12 noon, should be postponed until Wednesday, the 5th September, from 9.30 a.m. to noon.

Baron Szalay : As nobody objects to the proposals made by Messrs. Mahé and Fossion, these are adopted.

I will now call upon Mr. de Hollan, Head of the Reception Bureau, to give you some information.

Mr. de Hollan : For your convenience during your stay with us I think it might be well for you to receive some general explanations, which appear to me as necessary. Each of you will have received an envelope containing some small things. First of all, there is a Delegate's Card, on which you will be good enough to place your signature. This card bears a stamp which entitles you to travel free on tramways or omnibuses. I should perhaps mention that delegates only enjoy this privilege. The delegates may send their ordinary or registered correspondence free, if they will be good enough to deposit them at the Plenary Meeting's special office (Houses of Parliament, 1st Floor). Telegrams may be sent from the same office without fee or through the Central Telegraph Office, as indicated in the information contained in the envelope. The free use of the telephone is granted to you either at the special boxes here or at the Central Telegraph Office, as well as at your Hotel, but please take care to give the word " Conference," followed by the name and number of your Delegate's Card. During the meetings, delegates may be called to telephone boxes in the Parliament Building.

Will you also place the little badge attached to the card in your buttonhole ? I dare to hope that the ladies will not object to wearing this little distinctive badge also.

The little slip that you will find with regard to your hotel should be sent to the Reception Committee as soon as possible, in order that you may receive your correspondence without delay.

Information is given in the programme of amusements for ladies accompanying the Delegates. With regard to the dinner, given by His Excellency the Minister of Commerce, you are asked to inform the Reception Committee of your acceptance as soon as possible, underlining the appropriate word on the slip attached to the invitation. Will you deal with the other invitations in the same manner. I may also inform you that, during the Congress, the Buffet Restaurant of the Parliament will charge you moderate prices.

The Ladies' Committee, which is presided over by Baroness Szalay, will accompany the members of Delegates' families during the proposed excursions and amusements.

I would also ask you, Ladies and Gentlemen, if you wish to take part in the excursions or amusements announced on the blackboard in the corridor, to be good enough to write your names the day before on the list available for this purpose at the Reception Office.

We thank you in advance for your valuable assistance in the accomplishment of our endeavour, which is to make your stay in the capital of Hungary as pleasant as possible. For our part, we place ourselves at your entire disposal with regard to any information which you may require.

Baron Szalay : Has anyone anything else to say ?

Gentlemen, the meeting is closed. (Applause.)

MINUTES OF THE MEETING OF THE CHIEF DELEGATES

(8th September, 1934),

The meeting opened at 9.30 a.m. under the presidency of Baron Szalay, Secretary of State and Chief of the Hungarian Delegation.

(1) The Chief Delegates first of all passed the Management Report, 1934, of the General Secretary, with the exception of Supplement 2.

(2) With regard to Supplement 2 of the Management Report, 1934, Mr. Boulanger outlined the modifications proposed by a small Committee which had already examined the text.

These amendments have been incorporated in the text ; nevertheless, the Chief Delegates take note of the following stipulation :—

" The General Secretary is selected by the Plenary Meeting from amongst the officials of the Administrations that are members," and it is understood that only Government Administrations are involved, and that in consequence the General Secretary cannot be chosen from amongst the officials of Operating Companies.

Further, upon the request of Mr. Chocholin (Czecho-Slovakia), the last line of page 4 of Supplement 2 is amended as follows :—instead of : on the 1st January, read : during the course of the month of January.

Supplement 2, with the above amendments, was then approved.

(3) The Chief Delegates then examined the question of the classification of Albania in the table for the distribution of the expenditure of the C.C.I.F.

In view of the provisions of the ruling laid down in Madrid, there is no objection to granting Albania's request.

(4) The accounts for the fiscal years 1932 and 1933, as also the draft budgets for 1935 and 1936, were approved without amendment. An annual salary increase of 100 Gold Francs is granted to a junior in the General Secretary's Office. It will be entered under the heading of " Unforeseen Expenses."

(5) The Chief Delegates then examined the proposals to be laid before the Plenary Meeting, with regard to the approximate dates and the places for the meetings of the Commissions of the Plenary Meeting, 1935-1936.

The date proposed for the Technical Commissions is the beginning of February, 1936. The selection of the date of the meetings of the Traffic and Exploitation Commissions gave rise to a debate ; several members asking whether it would not be advisable to hasten the work of these Commissions in order that a possible reduction in tariffs might be brought about as soon as possible. Mr. Clara (Spain) stated, for his part, that it was advisable to leave a sufficient lapse of time between the meeting of the Limited Commission and the Meeting of the 6th and 7th C.R.'s, as these questions require fairly extensive preparation. Finally, it was agreed that the 6th and 7th C.R.'s should meet not earlier than three months after the Limited Commission's meeting, and not later than the month of October, 1935.

The date of the meeting of the Limited Commission will be fixed by the General Secretary, by arrangement with the Chief Rapporteur of the 6th and 7th C.R.'s.

Lastly, the next meeting of the Plenary Meeting is fixed for the Spring of 1936.

Mr. Gredsted then informed the meeting that he is authorised to propose that the C.C.I.F. be asked to hold its XIth Plenary Meeting at Copenhagen.

The President thanked Mr. Gredsted for the kind invitation given by the Danish Administration, and assured him that the members of the Plenary Meeting will be very pleased to continue their deliberations in the beautiful city of Copenhagen. (Applause.)

(6) The Chief Delegates decided that, in accordance with Article 2, para. 4, of the Internal Rules of the C.C.I.F., the List of Delegates to the Plenary Meeting at Budapest should only include the names of the Delegates of the Administrations and Operating Companies.

(7) With regard to the way in which the Proceedings of the Plenary Meeting at Budapest should be published, the Chief Delegates approved the proposals received from the Editing Committee which met at Budapest previous to the Plenary Meeting. It was decided that the whole work shall be divided into five volumes, in principle divided as follows :—

Volume 1—Organisation of the C.C.I.F. and Report of the Plenary Meeting at Budapest.

Volume 2—Definitions and methods of testing. Maintenance.

Volume 3—Recommendations of principle.
General Rules relating to the constitution of transmission systems.
Telegraphy and telephony, either co-existent or simultaneous.
Co-ordination of radio telephony and wire telephony.
Specifications.

Volume 4—Protection.

Volume 5—Exploitation.

The Chief Delegates further decided to propose to the Plenary Meeting that an " Editing Committee for the White Book " be established, with powers to proceed (prior to the 1st January, 1935) with the classification of the different opinions and recommendations of the C.C.I.F. in the above-mentioned five volumes.

This Committee will include representatives of the following Administrations: Germany, Belgium, Cuba, Great Britain, France and the United States, as also the General Secretary. It will hold its meetings in Paris at the General Secretariat.

(8) The Chief Delegates agreed to retain the existing C.R.'s and the formation of a new Commission (which will be No. 8) entrusted with the study of international graphical symbols for telephony.

(9) The Chief Delegates will propose to the Plenary Meeting that Mr. Le Corbeiller should be appointed representative of the C.C.I.F. at the forthcoming Plenary Meeting of the C.C.I.R. in Lisbon.

(10) Mr. Valensi had proposed that a new edition of the International Telephone Dictionary in seven languages should be published; this publication should be preceded by a revision and should involve no expense.

Mr. Boulanger stated that the C.C.I.T. had contemplated the issue of an International Telegraph Vocabulary, but had hesitated in view of the expense.

Mr. Muri (Switzerland) thought that it would be of great interest to collect, in a single volume, the terms relative to telephone- and telegraph- and radio-communications, the terms common to these three arts being very numerous.

The Chief Delegates decided to propose to the Plenary Meeting :—

1. to instruct the General Secretary to proceed with the preparation and publication of a second edition of the Telephone Vocabulary ;
2. to express the wish that the C.C.I.T. and C.C.I.R. should be good enough to collaborate with the C.C.I.F. in the publication of a single International Telecommunications Vocabulary.

(11) Mr. Höpfner (Germany) drew the attention of the Chief Delegates to the advisability of conforming to the article in the Statutes of the C.C.I.F. in accordance with which the number of Administrations represented in each C.R. should not, on principle, exceed six. The Chief Delegates approved this point of view.

(12) On the proposal of Mr. Clara the Chief Delegates decided to send Mr. Valensi, General Secretary of the C.C.I.F., the badge of the Xth Plenary Meeting of Budapest, as also his Delegate's Card, with a letter expressing the regret which the Plenary Meeting has felt at his absence ; the letter to bear the signatures of all the Delegates.

The meeting closed at 11.45 a.m.

MINUTES OF THE CLOSING SESSION

(10th September, 1934).

The meeting opened at 2.30 p.m. under the Presidency of Baron Szalay, Secretary of State and Director-General of the Royal Hungarian Posts.

The minutes of the previous sessions of the Plenary Meetings were adopted without amendment.

The minutes of the meeting of the Chief Delegates were read and gave rise to the following remarks :—

Mr. Gredsted (Denmark) : I am greatly touched by the reception which you have given to the proposal that Copenhagen should be the venue of the XIth Plenary Meeting of the C.C.I.F., and I have pleasure in conveying to you the sincere and hearty greetings of the Director-General of Posts, Telegraphs and Telephones of Denmark, who has asked me to assure you that we shall do our best to see that you have a pleasant visit to Denmark.

We cannot offer you a town as picturesque and gay as the Queen of the Danube, nor a beauty-spot like the Lake of Balaton. The temperament of the Danish people, in consequence of the nature of the northern countries, is very different from the animated temperament of the population of the southern countries. But we have, at the beginning of June, when we hope we may be able to fix the meeting, forests of light green beeches, the sea around our Jutland peninsula and the Danish islands. I therefore hope to be able to show you some of the beauties of my beloved country.

Welcome to Copenhagen ! (Loud Applause.)

Baron Szalay : I propose that we unanimously and gratefully accept Mr. Gredsted's invitation to hold the next Plenary Meeting of the C.C.I.F. in Denmark, and I feel sure that we shall have a delightful time there.

I am speaking for the whole meeting in asking Mr. Gredsted to convey to his Government the expression of our gratitude. (Prolonged applause.)

Mr. Le Corbeiller : I thank you, gentlemen, for the honour you have conferred on me by appointing me as Representative of the C.C.I.F. at the IIIrd Plenary Meeting of the C.C.I.R. at Lisbon.

Following the above remarks, the minutes of the meeting of the Chief Delegates were approved without amendment.

Baron Szalay : I have to inform you that we have received a letter from Mr. Valensi and three telegrams in reply to the telegrams which we sent, following the Opening Session of the Plenary Meeting.

Mr. Valensi writes to say how greatly he is touched by the sympathy shown him, and expresses his great regret at not having been able to participate in this Plenary Meeting, which coincides with the tenth anniversary of the founding of the C.C.I.F. He has followed the progress of the work of the Meeting by telephone, and sends you his respectful congratulations on the satisfactory results of your work. As his health is already improving, it will not be long before he will be able to see that the correct procedure is followed with respect to the decisions of the meeting. He has asked me to give his kindest regards to all his colleagues at Budapest and to remember him kindly to them.

We have received the following telegram from Dr. Bleiner, who, as you know, met with a motor accident which fortunately was not serious :—

" Greatly appreciative of the wishes expressed in the name of the meeting. Assure you that state of health very satisfactory. Please accept thanks and kindest regards."

We have also received the following telegram from Mr. de Tersztyansky :—

" Greatly touched. Thank the Plenary Meeting heartily for their good wishes for my recovery."

Finally, Mr. Aigner telegraphed us as follows :—

" Greatly touched by expressions of sympathy. Please convey to the Plenary Meeting my best and most sincere thanks."

I think I am expressing your wishes by wishing Mr. Valensi, Dr. Bleiner and Mr. Tersztyansky speedy recovery.

The new edition of the statutes of organisation of the C.C.I.F., submitted by the meeting of the Chief Delegates, was adopted by the Plenary Meeting without amendment.

Baron Szalay : I think that I am speaking for the meeting in expressing our thanks to the Examiners of the Accounts, Colonel Lee, Mr. Höpfner and Dr. Bleiner, and I propose that their mandates should be renewed. (Applause.)

I would further draw your attention to the following paragraph in the new edition of the Organisation of the C.C.I.F. : " The Plenary Meeting shall appoint three Deputy Examiners, who in an appointed order will replace the regular Examiners when these are prevented from fulfilling their functions."

May I propose that the offices of the Deputy Examiners of Accounts be filled by Mr. Boetje (Holland), Mr. Gredsted (Denmark) and Mr. Heider (Austria). (Applause.)

These proposals were adopted, unanimously.

The meeting then examined the provisional Report of the work of the meeting at Budapest.

Mr. Mahé gave some explanations with regard to that part of the dossier relating to questions of traffic, exploitation and tariffs. He stated that the Secretariat of the C.C.I.F. will send to the Administrations and Operating Companies in Europe a draft of the new list of emergency routes (voies de secours) for purposes of revision before it is definitely printed.

Mr. Gredsted : The question of studying the basis of international telephone tariffs has been placed on the Agenda for the next Plenary Meeting.

Already some years ago, the C.C.I.F. recommended to the Administrations and Operating Companies that the number of terminal zones should be reduced with a view to lowering the total rates of telephone conversations. Such a reduction is naturally very desirable, but in order to obtain a satisfactory result, it is also necessary to reduce the transit rates which constitute the major part of the fee in long-distance communications.

International telephone tariffs are so high that they impede the growth of telephone traffic in long-distance connections, particularly as a result of the devaluation of money in a large number of countries, which nevertheless are obliged to settle their accounts with intermediary countries in gold francs.

It seems to me that it is necessary to find a way of lowering both the rates for terminal traffic and for transit traffic in order that it may be possible to reduce, as soon as possible, the total tariffs for long distances. In my opinion the matter of these reductions should not be postponed until the

next Plenary Meeting of the C.C.I.F., but special arrangements should be made between the Administrations and Operating Companies interested to reduce the tariffs in the near future, so as to obtain the desired increase in international telephone traffic. Under the present conditions the public is most economical and, in fact, inclined to be content with other methods of correspondence, such as air mail, when the telephone rates appear expensive.

After these remarks the meeting adopted that part of the dossier which related to questions of exploitation and tariffs without amendment.

Mr. Le Corbeiller then gave some explanations on that part of the dossier which relates to questions of transmission and maintenance of lines and telephone installations.

He stated that the new programmes of maintenance will shortly be sent to the Administrations and Operating Companies in Europe by the Secretariat of the C.C.I.F. so that they can be revised before being definitely printed.

That part of the dossier was adopted by the Assembly without amendment.

Mr. Le Corbeiller also gave some explanations on the section of the dossier relative to questions of transmission. He indicated the following omission in the wording of the notice entitled : " Tests on Rectifiers " at the top of page 2, line 2. There should be added " . . . and in order to form conclusions in regard to the limits of the normal values of the telephone voltage form-factor."

The meeting adopted the section of the dossier relative to protection with this addition. They also adopted the minutes of the meetings held by the Commission on Symbols under the presidency of Mr. Muri.

Baron Szalay : I would remind you that the notices with regard to questions of exploitation, tariffs and maintenance will be applicable as from the 1st January, 1935.

The General Secretary will, as usual, ascertain from the Administrations and Operating Companies who are members of the C.C.I.F. whether they approve of these new notices and whether they intend to put them into force as from the 1st January, 1935.

The meeting then appointed the Administrations and Operating Companies who wished to be represented on the C.R.'s of the C.C.I.F. in 1935 and 1936. It was decided that the Commissions of Rapporteurs should be constituted as follows :—

1st C.R., entrusted with questions in regard to the protection of telephone lines against interference from electric power installations : Germany, Belgium, France, Great Britain, Italy, Japan, Mexico, Roumania, Sweden and Czecho-Slovakia.

2nd C.R., entrusted with questions covering the protection of cables against corrosion due to electrolysis or to chemical action : Germany, Belgium, France, Great Britain, Italy, Japan.

3rd C.R., entrusted with certain questions of transmission and maintenance : Germany, Belgium, Cuba, Denmark, Spain, United States of America, France, Great Britain, Italy, Mexico, Norway, Holland, Poland, Roumania, Sweden, Switzerland, Czecho-Slovakia, Japan.

4th C.R., entrusted with certain questions of transmission : Germany, Chili, United States of America, France, Great Britain, Mexico, Poland, Japan.

5th C.R., entrusted with certain questions of transmission : Germany, Argentine, Denmark, Spain, United States of America, France, Great Britain, Italy, Holland, Japan.

6th C.R., entrusted with questions of exploitation : Germany, Belgium, Denmark, Spain,

United States of America, France, Great Britain, Italy, Mexico, Norway, Holland, Poland, Roumania, Sweden, Switzerland, Czecho-Slovakia, Japan.

7th C.R., entrusted with questions of tariffs : Germany, Belgium, Denmark, Spain, United States of America, France, Great Britain, Italy, Mexico, Norway, Holland, Poland, Roumania, Sweden, Switzerland, Czecho-Slovakia, Japan.

8th C.R., entrusted with questions in regard to international graphical symbols : Germany, France, Great Britain, Italy, Poland, Switzerland, Japan.

Baron Szalay : Gentlemen, the appointment of the Chief Rapporteurs has up to the present been made at the Plenary Meeting. The Telephone Regulations, which are part of the International Telecommunications Convention of Madrid, 1932, now in force, stipulates that the Chief Rapporteurs shall be elected by the Commissions of Rapporteurs.

I would accordingly propose that after communication to the General Secretary of the names of the different Administrations in the Commissions, the election of the Chief Rapporteurs should be carried out by correspondence within a period of one month.

Mr. Fossion, on the other hand, proposed that for practical reasons the Plenary Meeting should, itself, appoint the Chief Rapporteurs.

An exchange of views took place on this subject in which Messrs. Albanese, Fossion and Van Ubbel mainly took part. As a result of this exchange of views the meeting decided by 16 votes to 3 to appoint the Chief Rapporteurs immediately.

The meeting unanimously renewed the offices of the Chief Rapporteurs, whose names are as follows :

1st C.R. : Dr. Jäger (Germany).
3rd C.R. : Mr. Höpfner (Germany).
4th C.R. : Mr. Cohen (Great Britain).
5th C.R. : Mr. Le Corbeiller (France).
6th and 7th C.R. : Mr. Fossion (Belgium).

On the President's proposal, the Plenary Meeting unanimously appoints as Chief Rapporteur of the 2nd C.R. : Mr. Collet (France), and as Chief Rapporteur of the 8th C.R. : Mr. Muri (Switzerland). (Applause.)

Baron Szalay : Gentlemen, we have now reached the end of our labours. I think I may say that the Xth Plenary Meeting has, like the preceding ones, contributed materially to the progress of telephony, by solving or elucidating the questions which have been put to it. It has further formulated new questions which, after the competent work of the different C.R.'s, will give the next Plenary Assembly material for fruitful work.

I should also like to thank the Vice-Presidents, Colonel Lee, Mr. Albanese and Mr. Muri, who have guided our labours with an authority which has been appreciated by all. I would also thank the Members of the C.R.'s and, in particular, the very excellent Chief Rapporteurs, who by their thorough studies have facilitated the work of the meeting.

Neither would I forget Mr. Le Corbeiller and Mr. Mahé who have so ably replaced Mr. Valensi, nor the Secretaries of the Commissions, nor the Office Staff ; all of them have, in these strenuous days, fully deserved our gratitude.

Before closing, may I repeat that the Hungarian Administration has been particularly appreciative of your having accepted the invitation of its Government, and having given it the honour and pleasure of holding your meeting at Budapest.

We hope that, apart from the results of the discussions, you will take away happy memories of your stay, brief though it has been, in our country.

I wish you a pleasant return journey to your countries, and hope that we shall all meet again in good health at the next Plenary Meeting in Copenhagen. (Loud and prolonged applause.)

Mr. Boetje : Baron Szalay, my colleagues have given me the agreeable task of thanking, in their name, the Hungarian Telephone Administration and its Head for the generous hospitality which it has accorded to the Xth Plenary Meeting of the C.C.I.F.

The Hungarian Administration has thus maintained an old tradition, as we are pleased to remember that the first International Conference of Telephone Engineers was held in this town twenty-six years ago, in 1908. Many of us remember the meetings of this Conference and the influence exercised by that eminent Hungarian Engineer, Mr. Kolossvary, whom we have had the pleasure of greeting in his retirement.

It is therefore the third time that the most advanced problems of modern technique have been discussed in this lovely capital full of historical memories. The present meeting has been directed by you, Baron Szalay, with a competence, tact and impartiality which we shall always remember with admiration.

We shall not be able, either, to forget the sumptuous receptions to which we were invited by the Hungarian Administration, the Group of Hungarian Electrical Companies and Hungarian Broadcasting Company, to whom we tender our warmest thanks.

I am speaking for all in expressing our best thanks to the Reception Office and in particular to its director, Mr. de Hollan. Thanks to him, we shall have very agreeable memories of our stay in Budapest.

We would, in conclusion, ask you, Baron Szalay, to be good enough to convey to His Excellency the Minister of Commerce our respectful greetings, to which we add our best wishes for the prosperity of the Hungarian Administration. (Loud and prolonged applause.)

Baron Szalay : I heartily thank Mr. Boetje for his kind remarks, but I must tell you, gentlemen, that I simply tried to do my best. We are all, the Administration, the Companies and the Reception Committee, pleased to note that we have been able to facilitate your work and to have made your stay in our country agreeable. I shall not fail to transmit your thanks to His Excellency the Minister. (Applause.)

Mr. Le Corbeiller : The Secretariat thanks you very much for the kind words you have been good enough to address to us. It is a real pleasure to work with you, that is to say, with a group of technicians who have a fine knowledge of the questions which are involved, and who study them in an absolutely objective manner. In Mr. Mahé's name and my own, and on behalf of the Secretaries, Messrs. Ollier, Bigorgne, Labrousse, Parmentier and Lavoignat and the Staff of the Secretariat, I again tender you my warmest thanks.

Baron Szalay : I declare the Xth Plenary Meeting of the C.C.I.F. closed.

The meeting closed at 4.00 p.m.

LIST OF QUESTIONS SUBMITTED FOR STUDY BY THE TENTH PLENARY MEETING

(Budapest, 3rd—10th September, 1934).

In each of the following lists, and for each of the questions, the Commission of Rapporteurs has been indicated to whom the study of the question has principally been allotted (and, where necessary, the other Commissions who have been asked to collaborate in this study) ; in addition the category in which the question should be placed has been given, that is to say :—

Category A_1.—Questions to be discussed orally and for which international agreement covering the whole world is necessary.

Category A_2.—Questions to be discussed orally and for which an international agreement covering Europe only is necessary.

Category B.—Questions having only a documentary nature to be treated in writing.

The different lists which follow are called respectively :—

1. Questions of protection against interference of which the study is to be undertaken or continued by the 1st C.R. in 1935 and 1936.

2. Questions of protection against corrosion of which the study is to be undertaken or continued by the 2nd C.R. in 1935 and 1936.

3. Questions of transmission of which the study is to be undertaken or continued by the 3rd, 4th and 5th C.R.'s in 1935 and 1936.

4. Questions of operation and traffic of which the study is to be undertaken or continued by the 6th and 7th C.R.'s in 1935 and 1936.

5. Revision of the international graphical telephone symbols by the 8th C.R. in 1935 and 1936.

1. Questions of protection against interference of which the study is to be undertaken or continued by the 1st C.R. in 1935 and 1936.

Question No. 1.—Category A_1.

(*a*) Study of equivalent interfering voltage and equivalent interfering current of direct current systems.

Note :—This study should be extended to cover traction networks and distribution networks supplied from direct current generators, rotary converters, rectifiers with and without grid control, etc.

(*b*) Limiting values of telephone voltage form factor (for no load and full load) to be met in the construction of different types of machines and apparatus.

Question No. 2.—Category A_1.

What is the value of the noise E.M.F. due to electric transmission lines which can be tolerated in telephone circuits in different cases ?

Note :—For the solution of this question the 1st C.R. will take as a basis the replies which will be given by the other competent C.R.'s to the following questionnaire :—

(1) In the case of open-wire circuits not provided with repeaters, what value can be taken for the noise E.M.F. measured at the end of the open wire interurban line, that is to say, at the point of entry to the exchange, all internal circuits being disconnected at the exchange where the measurements are made, the line being closed at the exchange by its characteristic impedance ? In this connection, the most unfavourable conditions occurring in practice in the telephone service will be taken.

(2) In the case of a cable circuit, what value can be taken under the most unfavourable practical conditions for the noise E.M.F. measured at the end of the interurban cable circuit, all repeaters and other internal parts of the circuit being disconnected at the exchange where the measurement is made, the circuit being closed at the exchange by its characteristic impedance ?

In each case, in view of the problem to be solved by the 1st C.R., it should be understood that the value of noise E.M.F. to be given to the 1st C.R. should refer only to noise due to the electromagnetic action of power lines, all other sources of noise being excluded.

Question No. 3.—Category A_1.

Effect of earthing the neutral of alternating current power systems on the magnitude of noise induced in neighbouring telephone circuits.

Question No. 4.—Category B.

(*a*) Does the new table of protective apparatus used in the different countries represent exactly and completely the existing state of affairs, not only from the diagrammatic point of view, but also from the point of view of the characteristics of the different parts (fuses, arrestors, heat coils) ? (See the White Book, Vol. II, Part 1, No. 17, headed, " Exact determination of the principal characteristics of protective apparatus.")

(*b*) Production of a protective device conforming to the general conditions of the recommendation No. 16, headed, " Ideal protection device " (White Book, 1935, Vol. II, Part 1).

Question No. 5.—Category A_1.

(*a*) Calculation of the noise E.M.F. due to current ripples in the case of direct current traction and distribution systems. Insertion of the corresponding formulæ in the " Directives " of the C.C.I.F.

(*b*) Devices and measures to be applied in the case of parallels between telephone circuits and direct current traction or distribution systems.

Question No. 6.—Category A_1.

Study of the characteristic properties of devices for protection against acoustic shock based on the principle of rectifying elements and an arrestor associated with a potential transformer.

Question No. 7.—Category A_1.

Statistical study of the values of the noise ratio (coefficient de sensibilité) of existing interurban circuits.

Question No. 8.—Category A_1.

In several recent contributions from the electrical industry consideration is given to the future realisation of very long power transmission lines supplied with direct current from rectified alternating current. In particular, consideration is given to the possibility of using an earthed neutral or, sometimes even, of using a single conductor line with earth return. Under these conditions, serious interference is to be feared in neighbouring telephone lines due (*a*) to the use of grid controlled rectifiers, (*b*) the use of an earthed neutral, or the use of the earth as return conductor.

From the point of view of interference with the operation of the telephone circuits, the arrangement of a single conductor, which has been seriously considered, seems to be particularly harmful.

Since it is important that telephone engineers should not let themselves be taken by surprise in this matter, and that they should at once proceed to study the problems involved in the adoption of this new system of power transmission, under what conditions of parallel can the coexistence of these lines and telephone lines be permitted?

Note :—This question concerns, first of all, the 1st C.R. and may subsequently interest the 2nd C.R.

2. Questions of protection against corrosion of which the study is to be undertaken or continued by the 2nd C.R. in 1935 and 1936.

Question No. 1.—Category B.

Can the lead sheath of a cable be replaced by a sheath of benzyl-cellulose or a compound of ethyl and benzyl-cellulose? These two materials are good dielectrics, they withstand the effect of underground water and organic acids and can be bent six times in succession through 90° for a sheath 1.5 mm thick (a cable of this type has a triple layer of paper and over it a layer of metallised paper).

Question No. 2.—Category A_1.

Is there any reason for modifying the conclusions formulated by the C.C.I.F. in connection with the use of electric drainage and insulating joints (White Book, 1935, Vol. II, Part 2) and, if so, what modifications should be made?

Note :—In studying this question, consideration should be given to documents Nos. 34-12, 34-14, 34-15 of the C.M.I. in connection with the results obtained in Italy by the use of electric drainage and insulating joints.

Question No. 3.—Category A_1.

Is there any reason for modifying the proposed Recommendations concerning measures to be taken against electrolytic corrosion (White Book, Vol II, Part 2) in connection with the principles for calculation of the voltage of the rails with respect to earth and of the limits for this voltage?

Note :—In studying this question, consideration should be given to documents Nos. 34-1, 34-2, 34-3 and 34-10 of the C.M.I. reproducing the work of Mr. Gibrat.

Question No. 4.—Category B.

A. What is the best constitution of the lead sheaths of aerial and underground telephone cables :
   (*a*) From the point of view of protection against inter-crystalline corrosion due to mechanical vibration?
   (*b*) From the point of view of protection against corrosion from chemicals in the earth?

B. What are the best coverings (constitution, nature of the products and their methods of application) for protecting the lead sheath and iron armouring of underground cables against chemical and electrolytic corrosion?

Question No. 5.—Category A_1.

Is it desirable to introduce into the specification for the supply of telephone cables :—

(*a*) A clause dealing with the percentage of impurities in the sheath (other than the normal constituents such as lead, tin and antimony)?

(*b*) A clause dealing with the elasticity of the lead sheath for armoured and unarmoured cables?

3. Questions of Transmission to be studied by the 3rd, 4th and 5th C.R.'s.

Question No. 1.—3rd C.R. Category A_2.

(*a*) What are the essential characteristics of an international telephone cable circuit, permitting several simultaneous telephone channels, for which an international agreement should be imposed ?

(*b*) What carrier frequencies are to be used on these circuits ? Should the carrier current be transmitted or not ? Should the lower or upper side band be transmitted ?

(*c*) What are the conditions to be imposed upon multi-channel telephone systems, as well as associated apparatus, such as repeaters, transformers, etc., which transmit voice frequency and carrier currents, from the point of view of non-linearity, particularly with the object of preventing the effects of non-linear crosstalk ?

Note.—In this study distinction shall be made in the case of :—

1. Cable circuits with only one carrier current channel in addition to the ordinary voice frequency channel.
2. Cable circuits with several carrier current channels in addition to the ordinary voice frequency channel.

Parts (*a*) and (*b*) of this question for the first case have already formed the object of a recommendation of the Xth Plenary Meeting (Budapest, September 3–10, 1934).

Question No. 2.—3rd C.R. in collaboration with the 4th C.R. Category A_2.

(Continuation of Question No. 2b of the 1st, 3rd, and 4th C.R.'s, 1931–34.)

(*a*) What is the maximum limit of noise E.M.F. permissible on a continental international telephone communication, and how should this maximum value be divided between the three sections making up the connection : national sending system, international circuit, national receiving system ?

Note.—With regard to the international circuit, distinction should be made between a direct connection and a transit connection ; in the latter case the maximum value allowed for the noise E.M.F. should be divided between the different international circuits.

(*b*) In the case of an open wire line without repeaters, what value should be allowed, under the worst conditions met in practice, for the induced noise E.M.F., measured at the end of the open wire line, with the exchange equipment disconnected and the line itself terminated with its characteristic impedance ?

(*c*) In the case of a cable circuit, what value should be allowed, under the worst conditions met in practice, for the induced noise E.M.F. measured at the end of the cable with the repeaters and exchange equipment disconnected and the line itself terminated with its characteristic impedance ?

Note.—It is understood that, in order to fix limits for the noise E.M.F. (part *a*, Question 2) all the noise on the circuit should be included—induced noise, telegraph noise, clicks, crosstalk, etc. (see Question 2*b* below). Having taken all precautions on the lines and telephone installations to reduce as far as possible all noise other than induced noise, the part attributed to noise induced by neighbouring traction lines and power lines (parts (*b*) and(*c*) of Question 2) can be definitely fixed.

Question No. 2b.—3rd C.R. in collaboration with the 4th C.R. Category A_1.

What is the reduction in the quality of transmission, expressed in nepers or decibels, due to the permissible noise on the international circuits ?

Note.—The noise induced from power lines or neighbouring traction lines is not taken into consideration. The effects to be studied are microphonic noise, crosstalk, telegraph noise, noise from repeater power supply, clicks, etc.

Question No. 3.—3rd C.R. Category A_2.

What are the permissible values for the time of propagation and the difference in the times of

propagation for the filters used with super-audio telegraph installations (or sub-audio telegraph installations) operating on international telephone circuits ?

Question No. 4.—3rd C.R. Category A_2.

(*a*) In order to avoid disturbances on the telephone by super-audio telegraph installations, what should be the maximum and minimum frequency (limited by the filters), effectively transmitted by the monitoring equipment placed in repeater stations and telephone exchanges ?

(*b*) What are the modifications or amendments to be made to the C.C.I.F. Maintenance Instructions for the case where a telephone circuit is used for super-audio telegraphy, particularly with regard to the band of frequencies over which periodic maintenance measurements are made ?

Note.—In order to arrive at a solution for part (*b*) of this Question, systematic tests of super-audio telegraph transmission should be made on a transit circuit through several countries (Paris-Stockholm, for example).

Question No. 5.—3rd C.R. in collaboration with the 4th C.R. Category A_1.

(Continuation of Questions No. 6 of the 3rd C.R., 1931–34.)

(*a*) What is the maximum value of hang-over time (temps de blocage ; Nachwirkzeit) to be recommended for echo suppressors on international telephone circuits ?

Note.—In order completely to suppress the echo produced at the very end of a connection using several switched circuits, it is necessary to provide for a sufficiently long hang-over time and allow a certain tolerance for the weak ending of certain syllables. In the U.S.A. the hang-over time for a transit circuit is made up of the sum of the following three terms :—

1. 2.25 times the time of propagation at 1000 p : s of the cable connection between the echo suppressors, and the most distant end of this connection ; the additional tolerance of 0.25 is provided to take account of the time of propagation of repeaters and associated apparatus and also for the reason that, for certain frequencies of reflection current, the time of propagation may very well be greater than at 1000 p : s.
2. A tolerance of 50 milliseconds for weak endings of syllables.
3. A tolerance of 50 milliseconds for the time of propagation on the extension circuits used on the transit connection. This tolerance is quite satisfactory in the U.S.A. ; it is possible it may not be so in other countries. It is not necessary to provide this tolerance in the case of circuits used only for terminal traffic.

(*b*) Is it necessary to fix maximum limits for the time of propagation on that portion of an international telephone connection between the two echo suppressors furthest apart ?

Note.—In this connection the two following conditions may be distinguished :—
The case where the two halves of each echo suppressor are at the same point of the circuit.
The case where the two halves of each echo suppressor are at different points of the circuit.

It is necessary to study this question, taking into consideration all the possible types of disturbance that can be observed ; these disturbances are analysed in the following Appendix.

(*c*) What are the most favourable arrangements to be made with regard to the location of echo suppressors (in terminal or intermediate stations) particularly from the point of view of automatic toll-switching, super-audio telegraphy and high frequency carrier telephony ?

APPENDIX TO QUESTION NO. 5.

Analysis of disturbances which may be caused by echo suppressors.

In four-wire circuits echo suppressors can produce the following disturbances :—

(1) Two echo suppressors may function simultaneously. This happens when the two subscribers A and B—see Fig. 1—commence to speak at about the same time. There is then a " gap " in the conversation from A to B, because voice currents from B have already passed echo suppressor E_A before voice currents from A have caused the operation of the echo suppressor E_A.

Echo suppressor E_B is then operated for a short interval, and the direction A–B is blocked. Subscriber A is disturbed by hearing just the beginning of the conversation from B. Such a disturbance always occurs when the time τ between the beginning of the conversation from A and from B is equal to or less than the value

$$(t_1+t_2-t_3).$$

This disturbance does not exist when the echo suppressors E_A and E_B are both placed in the middle of the circuit, that is,

$$t_1=t_3 \text{ and } t_2=0.$$

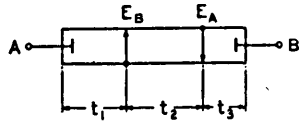


FIG. 1.

(2) The hang-over time, or duration of return to zero of the echo suppressors, prevents one subscriber from breaking in on the conversation from the other subscriber. The hang-over time of suppressor E_A should have a value t_a greater than $2t_3$, and the hang-over time of suppressor E_B should have a value t_b greater than $2t_1$. If these times are too great, the natural intervals between syllables occurring in the course of a conversation are more than covered by voice currents, and breaking in is not possible; finally, a subscriber cannot break in during a pause in the conversation from the other subscriber.

From this point of view it seems desirable to place the echo suppressors at the ends of the circuit so that :—

$$t_1=0 \text{ and } t_3=0.$$

(3) In the case where two or more circuits equipped with echo suppressors are interconnected (see Fig. 2), mutual jamming takes place, the two directions A–B and B–A both being permanently jammed. It may happen, when both subscribers A and B speak, that the suppressors E_C and E_D are operated so that neither subscriber can hear the other. This trouble can be avoided by removing the superfluous echo suppressors E_C and E_D or by reversing their direction.

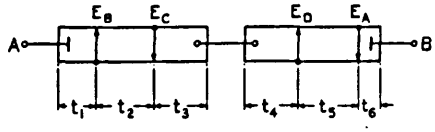


FIG. 2.

Question No. 6.—3rd C.R. Category A_2.

What conditions are to be imposed upon repeaters on very long telephone circuits in order to limit, as far as possible, the variations in gain with time? What is the maximum tolerance for this variation?

Question No. 7.—5th C.R. Category B.

What are the characteristics of automatic volume regulators used by the various Administrations and Operating Companies (at the junction of land lines and radio links) and what are the operating results obtained with this apparatus ?

Question No. 8.—5th C.R. Category A_1.

What are the conditions to be fulfilled by an anti-fading device placed at the receiving end of a radio link in order to ensure that the radio receiver will supply approximately a constant volume to the land lines, in spite of variations in the volume of the radio signal received ?

Question No. 9.—5th C.R. in collaboration with the 3rd C.R. Category A_1.

What means are to be recommended to avoid false operation—due to noise disturbances—of reaction suppressors or echo suppressors on an international telephone connection using radio links and land lines ?

Note.—In the U.S.A. the following arrangements have been employed :—

(*a*) Reaction suppressors with " positive control " of the receiving switching apparatus, so that the receiving path is open only when voice signals are effectively transmitted.

(*b*) Echo suppressors inserted on the land lines, whose sensitivity is automatically regulated in accordance with the intensity of the disturbing noises. (See 5th C.R. C.C.I.F. 1934. Document No. 11—A. T. & T. Co.)

Question No. 10.—3rd C.R. in collaboration with the 6th C.R. of the C.C.I.T. Category A_2.

(Continuation of previous Question No. 20-b of the 3rd C.R., 1931-34.)

(*a*) What values of carrier frequency and power should be recommended for private telegraph transmission between telephone subscribers in the international service ?

Note.—A Commission, including representatives of the Telegraph and Telephone Administration of Germany, France, Great Britain and Holland (under the Presidency of the Delegate of the Dutch Telegraph Administration), will examine the results of the tests, made with values provisionally recommended by the C.C.I.F., and will make a proposition on this question to the C.C.I.F. and C.C.I.T.

(*b*) What measures (both technical and operating) should be taken on a connection between telephone subscribers which is used for a private telegraph transmission, to prevent clicks and other rapid interruptions (produced for example by the false operation of an echo suppressor) which might disturb the telegraph transmission ?

Question No. 10 b.—3rd C.R. in collaboration with the C.C.I.T. Category A_2.

What technical arrangements should be made to avoid disturbances to super-audio telegraph transmission caused by telephone transmission in the case where a circuit is used simultaneously for telephony and super-audio telegraphy ?

Question No. 11.—3rd C.R. in collaboration with the 4th and 5th C.R.'s. Category A_1.

Is it advisable to modify the provisional " weighting " curve for filters in noise measuring apparatus used on international circuits specially set up for music transmission (broadcast transmissions) in order to adapt this curve to the technical conditions of these special circuits ? In the affirmative, what are the modifications to be recommended ?

Question No. 12.—3rd C.R. in collaboration with the 4th C.R. Category A_2.

(Continuation of previous Question No. 5 of the 3rd C.R., 1931-34.)

Is it advisable to recommend a limiting value for crosstalk on a complete international telephone connection and to divide this value between the national sending system, the international circuit

and the national receiving system ? In the affirmative what is this value and how should it be divided ?

Question No. 12 b.—3rd C.R. in collaboration with the 4th C.R. Category A_1.

(*a*) What method is to be recommended for the objective measurement of cross-talk instead of measurement by the voice and ear ?

(*b*) Instead of considering only crosstalk attenuation, is it also advisable to consider crosstalk volume (that is, the volume of noise measured by means of a volume indicator under service conditions), due to crosstalk introduced on a telephone circuit by conversations on one or more neighbouring circuits ?

Note.—The consideration of crosstalk volume would appear to correspond more to actual service conditions than crosstalk attenuation.

(*c*) Is it possible to define the crosstalk between two circuits transmitting the same or part of the same band of frequencies, by a single value, and in the affirmative how should this be defined and measured ?

(*d*) Is it necessary to consider a factor similar to the signal-to-noise ratio when parasitic currents are due to crosstalk ?

Question No. 12 c.—3rd C.R. in collaboration with the 4th C.R. Category A_1.

(*a*) How should one define in calculation, when designing a system for example, the useful signal voltage entering into the definition of signal-to-noise ratio ?

(*b*) How should the useful signal voltage and the parasitic signal voltage entering into the definition of signal-to-noise ratio be measured ?

Question No. 13.—3rd C.R. Category A_2.

(*a*) In order to permit the establishment of automatic international telephone service, between neighbouring countries for example, is it advisable (in the case of voice frequency dialling systems) to fix the frequency or frequencies to be used ?

Note.—For ringing on international circuits the C.C.I.F. has fixed the frequency to be used in consideration of the possibility of transmission through repeaters.

Automatic toll service, which is a future possibility, particularly between neighbouring countries, raises a similar question and it would appear advisable to have an agreement on this subject before such automatic operation is established.

(*b*) Would it be possible to standardise the various voice-frequency signals in automatic exchanges (busy tone, dialling tone, ring-back tone, etc.) ?

Note.—These signals, used in automatic long distance telephone operation, are transmitted over the international circuits and should be adapted to the automatic long distance dialling systems.

Question No. 14.—3rd C.R. in collaboration with the 1st C.R. of the C.C.I.T. Category B.

What conditions should be imposed on sub-audio telegraph installations on a telephone circuit in order to protect the personnel and the equipment ?

Notes :—

1. The conditions should be such as to provide protection for the personnel and equipment as well as to ensure satisfactory quality of telephone and telegraph transmission.
2. The question has been suggested by the German Telephone Administration in Document No. 13 of the C.C.I.T. (Prague) Meeting, 1934, in view of the study of continuous current telegraphy over long distance cables.

Question No. 15.—4th C.R. Category B.

Should the test of dielectric strength be made with continuous current or alternating current or both ? What is the relation between the D.C. voltage and A.C. voltage corresponding to the same dielectric strength ? In the case of A.C. tests is it necessary to prescribe not only the test voltage but also the power of the transformer used ?

Question No. 16.—4th C.R. Category B.

Technical conditions to be fulfilled by message recording systems :—

(*a*) When these systems are used by certain telephone subscribers.

(*b*) When these systems are used on traffic observation desks.

Question No. 17.—3rd C.R. in collaboration with the 4th C.R. Category A_2.

(Continuation of previous Question No. 5 of the 3rd C.R., 1931–34.)

(*a*) Is it advisable to define delay distortion on a complete connection between the talker and the listener on an international connection by several values for the different times of propagation (for example 4 values), that is, the differences of the time of propagation between the highest frequency effectively transmitted and the average voice frequency (on terminal service or on transit service), and the difference of the time of propagation between the lowest frequency effectively transmitted and the mean voice frequency (on terminal or transit service) or merely to specify the limiting value of the index of delay distortion (difference between the maximum and minimum value of the time of propagation for the band of frequencies transmitted by the circuit) ?

(*b*) What is the limiting value in a continental communication :—

(1) for the index of delay distortion for the whole connection between the talker and listener,

(2) for the index of delay distortion on an international circuit,

(3) for the index of delay distortion on the national sending and national receiving system ?

Notes :—

1. The following limits are allowed in the U.S.A.

   The difference between the time of propagation at 1000 p : s. and the time of propagation at the highest frequency effectively transmitted should not exceed 20 milliseconds on circuits used for terminal traffic only, and 10 milliseconds on circuits used for transit traffic.

   The difference between the time of propagation at 1000 p : s. and the time of propagation at the lowest frequency effectively transmitted, should not exceed 40 milliseconds on circuits used for terminal traffic and 20 milliseconds on circuits used for transit traffic.

2. In Document No. 14 of the 3rd C.R., 1934 (pages 23 and 24), the American Telephone and Telegraph Company have suggested that additional studies as indicated below should be made. The recommendations concerning the differences between times of propagation are intended to prevent disturbing effects of phase distortion, but they do not indicate the importance of the reduction in the transmission quality produced by phase distortion on circuits whose length is only slightly less than the limiting length allowed. It seems desirable therefore, to obtain information concerning the influence on the effective transmission equivalent by the reduction of the transmission quality due to phase distortion on circuits of different lengths. The A. T. & T. Co. consider that information should be obtained on this question by making tests of articulation, judgment or repetitions, keeping a constant cut-off frequency, but varying the amount of phase distortion by varying the length of the circuit. While this procedure would also cause some change in the non-linear distortion due to varying length of circuit, this should not be very important at testing volumes of the order involved. In this connection the low frequency phase distortion on four-wire circuits may be materially increased by the use of sub-audio telegraph apparatus, and this should be taken into account in any general tests on phase distortion. However, it seems possible that disturbing effects may be produced which will not be shown up by articulation measurements. It will be possible to get an idea of this effect by means of observations under actual service conditions.

Question No. 18.—4th C.R. Category A_1. (Previous Question No. 10 of the 4th C.R.)

(*a*) What are the essential electrical characteristics for apparatus used to measure room noise ?
What zero reference is it advisable to specify for this measurement ?
How should this apparatus be used to measure room noises of a rapidly varying intensity ?

(*b*) What is the quantitative effect of a certain room noise on telephone transmission ?

Note.—For the study of part (*a*) the C.C.I.F. will collaborate with the International Electrotechnical Commission ; Administrations and Operating Companies are asked to send to the Secretary of the C.C.I.F. detailed specifications of apparatus for measuring room noises (objectively and subjectively), which they are currently using.

Question No. 19.—3rd C.R. in collaboration with the 5th C.R. Category A_2.
(Continuation of previous Question No. 14 of the 3rd C.R., 1931-34.)

(*a*) Is it necessary to modify the recommendation of the Plenary Meetings of Paris, 1931, and Budapest, 1934, concerning the equalisation of broadcast circuits according to the constant voltage method, considering that it has been proposed to equalise these circuits either by the constant electromotive force method or the method known as " constant internal voltage ? " If it is not always possible to apply a single method, in what way should circuits, equalised by different methods, be co-operated ?

(*b*) Is it advisable to fix minimum and maximum limits for the volume applied to the terminals of the first low-frequency broadcast amplifier, on which depend the stations broadcasting the programme relayed over the international circuits, and, in the affirmative, what is this value ?

Note.—It would be possible, for example, to give the maximum and minimum limits for the peak voltage at the input to the first amplifier.

(*c*) Do the maximum impulse indicators, provisionally recommended by the C.C.I.F. for use on circuits relaying broadcast transmissions, provide a convenient indication of the variations in volume and ensure good quality music on these circuits ? Is it advisable to use modulation recorders having a very small time of integration with recording mechanism of weak inertia ?

(*d*) What arrangements should be definitely recommended by the C.C.I.F. for the maintenance of international circuits specially established or arranged for music transmission in order :—

(α) to reduce to a minimum the preliminary tests made by Administrations and Operating Companies before putting these circuits at the disposal of the Broadcasting Company,

(β) to curtail as far as possible, the period from the moment the circuits are taken over by the Broadcasting Company to the commencement of the broadcast transmission ?

(*e*) What arrangements should be made to prevent the transmission of voice and music from disturbing the international service ?

Note.—In order to hasten the solution of this question (in particular sections *b* and *d*), a mixed Commission has been set up consisting of representatives of the International Broadcast Union and the C.C.I.F. This Commission met in Budapest in September, 1934, and made the following propositions which have been unanimously approved by the Plenary Meeting of the C.C.I.F. :—

SYSTEMATIC TESTS OF INTERNATIONAL BROADCAST TRANSMISSIONS.

A. Programme of Tests.

(1) Measurement of levels at 800 p : s with an input voltage of 0.775 volt.

(2) Measurement of levels at 50, 100, 200, 400, 800, 1600, 3200, 5000 and subsequently 6400 and 7000 p : s with an input voltage of 0.775 volt.

The input of the system is taken as the output of the last amplifier under the control of the Broadcast Company originating the programme. If a sinusoidal voltage of 0.775 at 800 p : s is applied at this point the relative level of voltage at the output of each repeater should be equal to 0.7 neper (6.1 decibels) ± 0.2 neper (± 1.7 decibel) except for the repeater nearest the frontier, for which the tolerance is ± 0.1 neper (0.87 decibel).

If instead of being applied at the input, the measuring current is applied at a point of level p, the measuring volts should be $0.775\ e^{p}$.

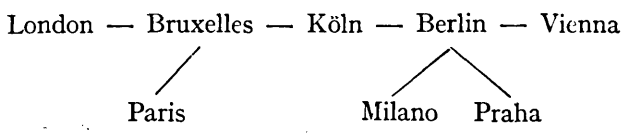
(3) Measurement of non-linear distortion.
   (*a*) Measurement, at the frequencies referred to above, of the output level of the circuit with an input voltage of 1.55 V.
   (*b*) Measurement of the coefficient of harmonic distortion at 50, 100, 200, 400, 800 and 1600 p : s with an input voltage of 1.55 V.

(4) Measurement of circuit noises.
   (*a*) With filter (noise E.M.F.).
   (*b*) Without filter.

(5) Comparison of different types of volume indicators used.
   (*a*) Test over a continuous period at 800 p : s.
   (*b*) Test with impulses of 200 milliseconds every 10 seconds for one minute.
   (*c*) Test with impulses of 20 milliseconds every 10 seconds for one minute.

(6) Exchange of broadcast transmission.

B. Designation of circuits utilised in the tests :



C. Date of the tests.

Up to 1st November, 1934, the Administrations concerned in the tests will send to the Central Administration (Germany) the following information :—

(1) Make-up of the broadcast circuits and level diagrams.

(2) Measuring apparatus.

From 1st November, 1934, to 1st January, 1935, the different countries concerned will line up their portion of the circuits. From 1st January to 1st April, 1935, tests 1 to 4 will be made on each portion of the circuit in one country, and tests 1 to 6 on the whole connection (section B) consisting of the first local circuit and the interurban or international broadcast circuit up to the output of the last repeater, and finally between the installations of the Broadcast Companies (Administrations or Private Companies), operating the stations.

D. Use of Hypsographs (Automatic Level Recorders).

The mixed Commission (U.I.R. and C.C.I.F.) recommend the use of automatic level recorders (hypsographs) for the maintenance of circuits used for broadcast transmissions.

On the circuits concerned, covered by the above tests, hypsographs are already in use at : Paris, Cologne, Frankfort-on-Main, Berlin and Vienna.

E. Study of the distribution of the values of volume during a broadcast transmission.

The mixed Commission (U.I.R. and C.C.I.F.) draws the attention of Administrations and Private Telephone and Broadcast Operating Companies to the advisability of determining for the voice and principal types of music, the fraction of the total emission-time during which the volume reaches or exceeds a certain value.

Such a study may be divided into two parts :—

(1) An analysis of the readings of the volume indicator, preferably by an automatic method.

(2) The determination of the correction factor to be applied to the readings of the volume indicator, taking into account the damping due to the time of integration of the apparatus.

The study thus made should lead to the adoption of a small number of types of curves (i.e. I, Speech ; II, Chamber Music ; III, Symphonic Music ; IV, Dance Music). Each of these curves will then serve to determine in an objective manner and for each type of broadcast, the best regulation to adopt, both from the point of view of modulated power transmitted and the protection of the equipment.

Question No. 20.—3rd C.R. in collaboration with the 6th C.R. Category A_2.

Is it desirable to recommend that, in future, the equipment of toll exchanges (including cord-circuit repeaters) be so arranged that the operator at the terminal exchange on the calling side may also have supervision over the called subscriber ?

In the affirmative what arrangements should be recommended for this purpose ?

Question No. 21.—3rd C.R. in collaboration with the 4th C.R. Category A_2.

(Continuation of previous Question No. 19 of the 3rd C.R., 1931-34.)

What clauses concerning noise should be provided in the specification for the supply of valves for telephone repeaters ?

Note :—

1. With regard to background noise in valves it will be necessary to specify the measuring conditions, and the permissible value of noise voltage produced by this background noise at the terminals of the output of the repeater in which the valve is being used.
2. With regard to microphonic noise in valves due to shock or mechanical vibrations in the valve socket transmitted by the repeater rack, it will be necessary to decide upon the measuring equipment and limiting values of the criterion chosen for the appreciation of this microphonic effect. On this question, distinction may be drawn between valves for high frequency carrier equipments, where oscillographic measurements seem to be used exclusively, and valves for voice-frequency repeaters, for which it is possible to make oscillographic measurements or shock tests (on the bay) associated with chronometric measurement of the duration of the microphonic noise and measurement of the intensity of the microphonic noise.

Question No. 22.—4th C.R. Category A_1.

(Continuation of previous Question No. 4 of the 4th C.R.)

(*a*) What is the best criterion to define the non-linear distortion of subscriber apparatus ?

(*b*) What are the best methods of measuring the non-linear distortion of subscriber apparatus ?

(*c*) What is the reduction in transmission quality due to the non-linear distortion of subscriber microphones ?

Question No. 23.—4th C.R. in collaboration with the 3rd C.R. Category A_1.

(Continuation of previous Question No. 13 of the 3rd C.R., 1931–34.)

(*a*) What is the best criterion to define the non-linear distortion of a long-distance circuit or a part of the circuit (ordinary telephone circuits, telephone circuits providing both voice frequency and carrier channels, and broadcast circuits) ?

(*b*) Is it possible or desirable to define the non-linear distortion of a circuit by means of a criterion other than the attenuation of harmonic distortion, taking account of harmonics and differential sounds due to the non-linearity of the system, when a series of sine waves of different frequencies with equal or different amplitudes is applied at the input to this circuit for a continuous period ?

Note :—

1. For the study of Question 23 (*a*) the C.C.I.F. will collaborate with the International Broadcast Union on the subject of the criterion to be chosen to define the non-linear distortion of a broadcast circuit.
2. In Germany and the U.S.A., two fundamental sine waves of equal amplitudes and different frequencies have been applied at the input to the circuit being studied.

In Germany, consideration has been given to the ratio of the effective value of all the harmonics and differential sounds, produced by the non-linearity on the one hand, and the effective value of both fundamentals on the other, these values being measured at the output of the circuit.

In the U.S.A. consideration has been given to the ratio of the effective value of the harmonic or differential sound which predominates, to the effective value of one of the fundamentals, these values being measured at the output of the circuit.

(*c*) What methods should be used to measure the attenuation of harmonic distortion of a long distance circuit and the variation in attenuation as a function of the amplitude ?

(*d*) What limits should be specified for the attenuation of harmonic distortion of a long-distance circuit and the variation in attenuation as a function of amplitude ?

Note.—To study points (*c*) and (*d*) of this question, Administrations and Operating Companies should carry out tests as follows :—

1. Measurements of attenuation of harmonic distortion and variation of attenuation as a function of amplitude, using values of power corresponding to those used in 1933–34 in the 3rd series of S.F.E.R.T, Laboratory tests, concerning the effect of non-linear distortion on transmission quality.
2. Tests of "judgment" in order to study how the transmission quality varies when the volume, as measured by any one of the volume indicators recommended by the C.C.I.F., varies over a wide range. A sub-commission, consisting of delegates of Germany, U.S.A., Great Britain and France, under the Presidency of the Chief Rapporteur of the 4th C.R., will investigate the results of the new tests made on this question, and compare the results with those obtained in the S.F.E.R.T. Laboratory.

Question No. 24.—4th C.R. Category A_1.

Choice of a "normal room noise" to be regularly used in telephono-metric measurements (reference equivalent, side tone) or articulation measurements, either at the talking or listening operator's position ?

Note.—In order to be able to compare the numerical transmission data, it is advisable, if a room noise is involved in obtaining this information, to use a room noise which is clearly defined in intensity and perhaps even in type.

Question No. 25.—4th C.R. Category A_1.

(Continuation of previous Question No. 7 of the 4th C.R., 1931–34.)

Is it advisable to set up general rules to determine the mean value of the reference equivalent of side tone in telephone sets, under actual service conditions ? In the affirmative, what rules should be adopted ?

Question No. 26.—4th C.R. Category A_1.

(Continuation of previous Question No. 11 of the 4th C.R.)

(*a*) Continuation of studies concerning effective transmission equivalent.

(*b*) Determination of the values to be adopted for the reduction of transmission quality due to the limitation of the band of frequencies effectively transmitted (continuation of Question 2a–3rd and 4th C.R., 1931–34).

(*c*) Specification of a reference system for the direct measurement of effective transmission equivalent of a given telephone system or part thereof.

(*d*) Method of measurement to be adopted to determine effective transmission equivalents.

Question No. 27.—3rd C.R. Category A_2.

(*a*) What is the practical difference between the values of the stability of the whole of a circuit (two-wire, four-wire or combined two and four-wire), measured under normal operating conditions and measured with the ends of the circuit open ?

(*b*) What normal value should be recommended for the stability of an international circuit measured with the two ends open so that the stability of this circuit under normal operating conditions may be at least 0.4 neper (3.5 decibels) as allowed by the C.C.I.F. ?

Question No. 28.—3rd C.R. in collaboration with the 4th C.R. Category A_1.

(Continuation of previous Question No. 21 of the 3rd C.R. 1931–34.)

(*a*) What methods should be specified in order to determine the minimum values of over-all attenuation permissible (for terminal traffic and for transit traffic) on a two-wire or four-wire international circuit from the standpoint of crosstalk, singing and echoes, taking into account the variation of the circuit characteristics with time ?

(*b*) What are the minimum values permissible for terminal and transit traffic on a two-wire or four-wire international circuit ?

Note :—

1. In this connection it will be desirable to specify the general conditions to be fulfilled by the local sending and receiving systems in the case of terminal traffic (that is to say the systems consisting of the subscribers' telephone and the lines and equipment connecting the subscriber to the corresponding distribution centre), particularly when these local systems have low gain amplifiers.
2. A sub-commission consisting of Messrs. Höpfner (Germany), Dr. Osborne (U.S.A.), Belus (France), Timmis (Great Britain), will investigate the results of the tests made by Administrations and Operating Companies to hasten the solution of this question. To carry out the tests the following documents should be taken into consideration : C.C.I.F. 1932–33, 3rd C.R. Document No. 19 & 20 (A. T. & T. Co.), C.C.I.F., 1934, 3rd C.R. Document No. 48 (Germany), and the following Appendix entitled " *Propositions of the American Telephone and Telegraph Co., concerning the determination of the minimum working net losses.* Subsequently this sub-commission will propose values to be adopted.

APPENDIX I (TO QUESTION NO. 28).

PROPOSALS OF THE AMERICAN TELEPHONE AND TELEGRAPH CO. CONCERNING THE DETERMINATION OF THE MINIMUM WORKING NET LOSSES.*

In order to determine the minimum working net loss of a two-wire or four-wire telephone circuit (for terminal or transit traffic), the following four factors should be taken into consideration : echo, singing, crosstalk, and variation in the transmission characteristics of the circuit with time.

* American terminology retained in this Appendix.

A. Echoes. It is proposed :—

(1) that the following definition of the sensitivity of an echo suppressor be adopted.

(*a*) **Zero level sensitivity.**

The zero level sensitivity of an echo suppressor is the amount of loss it is necessary to insert between a single frequency source of one milliwatt having an impedance of 600 ohms/0° and the sending end of a telephone circuit to which an echo suppressor is applied, in order to cause the echo suppressor to be just operated.

(*b*) **Local sensitivity.**

The local sensitivity of an echo suppressor is the amount of loss it is necessary to insert between a single frequency source of one milliwatt having an impedance of 600 ohms/0°, and a 600-ohm resistance across which the echo suppressor is bridged, in order to cause the echo suppressor to be just operated.

For both local and zero level sensitivity measurements, unless otherwise specified, the frequency used should be one at which the echo suppressor is approximately most sensitive.

FIG. 1.—Minimum Working Net Loss of a 4-Wire Circuit. (British Post Office)

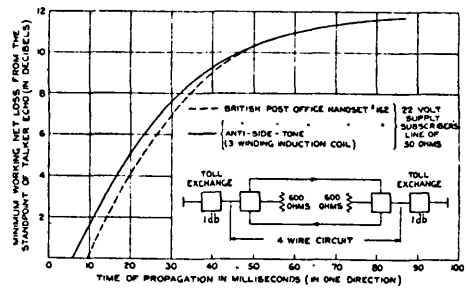
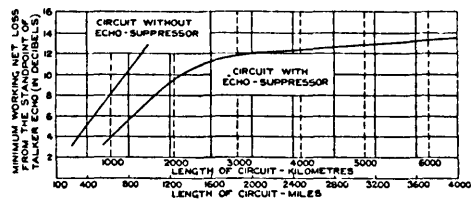


FIG. 2.—Minimum Working Net Loss of a 4-Wire Circuit.—Echo. (A. T. & T. Co.)



NOTE - THIS CONCERNS 0·9 mm 4-WIRE CABLE CIRCUITS LOADED WITH 44 mH ON THE SIDE AND 25 mH ON THE PHANTOM ON 1830 M NORMAL SPACING

(2) that the following definition of hang-over time of an echo suppressor be adopted :

The hang-over time of an echo suppressor is the interval of time during which the echo suppressor remains in the operating condition after the impulse of voice current—or music current—applied at the input to the echo suppressor has reached a value below the operating value.

(3) that Administrations and Operating Companies should obtain talker echo curves on four-wire circuits with or without echo suppressors, following out the instructions, as regards circuits not equipped with echo suppressors, outlined in Appendix 6 of C.C.I.F. Document No. 20 of the 3rd C.R., 1932–33. (The Appendix is entitled *Determination of the talker echo curve. Memorandum of the A. T. & T. Co.*) These curves, in conjunction with the curves in Figs. 1 and 2, will enable an agreement to be obtained as to a common echo curve for design purposes for future international four-wire telephone circuits. (The 3rd C.R. will be responsible for specifying the conditions under which the tests should be carried out on circuits equipped with echo suppressors.)

(4) that a specific method be adopted for determining the minimum echo net losses of two-wire circuits, using as a basis for discussion Appendix 5 of C.C.I.F. Document No. 20, 3rd C.R., 1932–33. (This Appendix is entitled *Determination of minimum echo net losses on two-wire circuits.*)

B. Singing. It is proposed :—

that Administrations and Operating Companies should be asked to obtain information on the distribution of values of passive return loss (or singing point of intermediate repeaters connected to cable pairs and corresponding networks ; also of terminal repeaters connected to different terminations met with on a toll circuit and the network associated with the termination). Curves of the distribution of values of passive return loss would provide more useful information than singing point values, but it may be more practical to measure singing points. It would be useful, besides the curves of values of return loss for the frequency at which singing is likely to occur, to obtain a curve whose abscissa is frequency, and ordinate the passive return loss, below which there are a certain percentage (say 37 per cent.) of measured values. In the case of singing points it seems possible to obtain a practical curve showing the distribution of values of singing points measured. The 3rd C.R. should be asked, in the near future, to specify the method to be followed in obtaining such curves, and also to prepare detailed recommendations for obtaining a curve of the minimum net loss of an international circuit from the point of view of singing.

C. Crosstalk. It is proposed :—

(1) that crosstalk volume be defined in terms of the reading of the crosstalk volume indicator, expressed in decibels above reference noise (that is, the circuit noise which gives the same reading as that obtained from 1 microwatt at a frequency of 1000 p : s, when measured in a circuit of 600 ohms' pure resistance). With this instrument measurements are made of the crosstalk currents on one telephone channel resulting from speech currents in another telephone channel.

(2) that an objective method be adopted for determining the overall service performance of circuits from a crosstalk standpoint, making use of the crosstalk volume indicator.

(3) (*a*) that statistical data be obtained by the several Administrations and Operating Companies regarding the reactions of a large number of observers to various values of crosstalk volume under controlled and varying conditions of room noise and circuit noise, and using specified types of subscribers' instruments at both the sending and receiving ends of toll connections. From such data the percentage of observers who consider crosstalk volume of a particular value intelligible under these specified conditions, may be determined.

(*b*) that this data be supplemented by crosstalk attenuation measurements of the particular toll plant on which the above crosstalk volume data are obtained. This data is considered essential in order that a relation may be determined between various assumed values of crosstalk attenuation and the percentage chance of having intelligible crosstalk under the specified conditions.

(4) that each Administration and Operating Company be invited to obtain statistical data on the crosstalk performance of circuits, of the type of construction recommended by the C.C.I.F. in their respective territories. This data should be obtained during the relatively heavy traffic periods (i.e. during the busy hours), and should include measurements of both crosstalk volume and crosstalk attenuation, the latter measurements to be made on individual repeater sections and, where practicable, on the complete toll circuits. Sufficient crosstalk volume measurements should be made to determine the limiting distribution of crosstalk volume.

(5) that the experimentally determined relationship between crosstalk attenuation and the chance of intelligible crosstalk obtained under (2) be applied to the results of measurements of actual

plant conditions under " 3 " for the purpose of determining acceptable criteria of crosstalk performance, and from these, the limiting crosstalk attenuation values for use as a basis in designing future international projects. Ultimately, the possibility should be foreseen of modifying the actual C.C.I.F. recommendations on the subject of crosstalk in order to specify limits of crosstalk volume instead of limits of crosstalk attenuation.

D. Characteristic Variations as a function of time. It is proposed :—

(1) that the following definition of net loss variation be adopted :—

The net loss variation in either direction of transmission on a telephone circuit is the amount of the deviation of the net loss in decibels in that direction of transmission from the normal value, which will be exceeded 8.5 per cent. of the time. If not otherwise specified, the variation is assumed to be at 1000 p : s.

This variation can be calculated by obtaining the square root of the sum of the squares of the maximum positive or negative deviations from normal to all the independent variables in the net loss of the circuit.

(2) that the net loss variations of toll circuits be calculated as outlined in Appendix 4 to C.C.I.F. Document No. 20, 3rd C.R., 1932–33. (The Appendix entitled *Calculation and measurement of net loss variations of toll circuits. Memorandum of the A. T. & T. Co., 26th July,* 1933.)

APPENDIX II (TO QUESTION NO. 28).

PROPOSAL OF THE 3RD C.R. OF THE C.C.I.F. REGARDING THE DETERMINATION OF THE PERMISSIBLE MINIMUM OVER-ALL ATTENUATION DUE TO SINGING.

In computing the permissible minimum overall attenuation due to singing for each type of circuit there are essentially two methods available : (*a*) the method proposed by the American Telephone and Telegraph Company in documents " C.C.I.F., 1932/33—C.R. 3—Document No. 19 " and " C.C.I.F. 1932/33—C.R. 3—Document No. 20," and (*b*) the method proposed by the German Telephone Administration in " C.C.I.F., 1934—C.R. 3—Document No. 48."

In order to obtain the necessary bases for computing the permissible minimum overall attenuation, due to singing for two-wire circuits, it is proposed that the several Administrations and Operating Companies collect the following data for the types of lines principally encountered :—

(1) Distribution curves of balance attenuation, having as abscissae a number of nepers or decibels, and as ordinates the number of cases where observed values of balance attenuation were equal or less than the number shown as abscissa.

(2) Balance attenuation-frequency curves, having frequencies as abscissae and, as ordinates, the value of balance attenuation for which a given percentage (for example 37 per cent.) of the observed values are equal or less. These curves are not necessary for the calculation of the minimum attenuation according to the method proposed by the German Administration (C.C.I.F., 1934, 3rd C.R. Document No. 48), because this method is based on the most unfavourable value of the balance attenuation within the transmitted frequency band.

In order to compute the permissible minimum attenuation it will be found convenient to plot corresponding curves for the attenuation in the repeater section and the gain of the repeater, in addition to the balance attenuation curves.

In all cases measurements should be made of the balance attenuations which occur each time for a *single* repeater section, and for the corresponding balancing network in use. In these measurements each repeater section should be terminated by an impedance simulating service conditions as closely as possible, that is, in general, using the two-wire repeater normally associated with the repeater section in question, and suppressing in this repeater the direction of transmission towards the measuring equipment. (*See* Fig. 1.)

The same result may be obtained by following the practice of the Bell System, which is to connect two absolutely identical 600-ohm resistances to the two sides of the differential transformer of the 2-wire repeater, associated with the repeater section under test. These resistances replace the line and the balancing networks, as shown in Fig. 2. The value of 600 ohms applies on the assumption that the repeater is designed for 600 ohms.

If a two-wire repeater is not normally connected in at the end of the repeater section under test, this section should, during the balance attenuation measurement, be terminated by a fixed resistance (for example, 800 ohms).

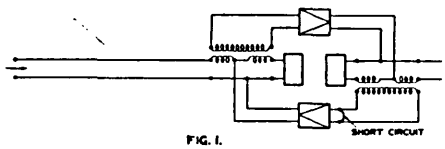


FIG. 1.

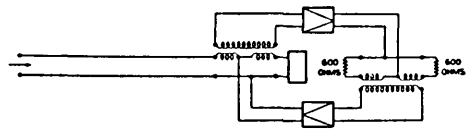


FIG. 2.

In drawing the distribution curves mentioned above under (1), there are shown as ordinates the number of cases where the values of balance attenuation are equal to or less than the number of nepers or decibels shown as abscissae. "Repeater section balance attenuation," is here understood to be the lowest measured value of balance attenuation within the given band of frequencies. In order to determine this value it is recommended that use be made of measuring equipment which permits reading directly the lowest value sought within the band of frequencies in question. Measuring instruments of this kind are described in the White Book, Vol. IV, page 81, under (5*a*), (α) and (β).

On the other hand, for the object indicated above, the use of a two-wire repeater in service is hardly to be recommended, because the value of balance attenuation determined from singing in the repeater might differ considerably from the true minimum value of balance attenuation (within the frequency band in question) because of the fact that in general the repeater gain varies greatly with frequency.

The measurements cited above should be made on the greatest possible number of repeater sections of circuits of the same type. There will thus be obtained for each type of circuit a series of balance attenuation values which permits drawing the desired distribution curves. In doing this in a system of rectangular co-ordinates, there is shown as ordinates the number of cases where the observed value of balance attenuation is equal to or less than, the number of nepers or decibels shown as abscissae. There is thus obtained a family of distribution curves in which each curve is valid for a particular type of circuit.

In order to determine the relation between balance attenuation and frequency as mentioned above under (2), it is first of all necessary to draw distribution curves of the values of balance attenuation corresponding respectively to various frequencies.

Each of the distribution curves to be drawn, and with which we are concerned here, corresponds to values of observed balance attenuation for a given single frequency. In order to be able to draw such curves, variations in balance attenuation with frequency are studied for a series of repeater sections of the same type of circuit under conditions of service termination as described above. In view of the often large and irregular variations of balance attenuation with frequency, balance attenuation measurements made point by point, or a.c. measurements of impedance from which balance attenuation would be derived from computation, require too much time. It is, therefore, recommended that use be made of a measuring method which registers variations of balance attenuation with frequency directly (*see* White Book, Vol. IV, page 83, under (β). Having thus drawn as great a number as possible of such balance attenuation-frequency curves for repeater sections of the same type, there may be read from these curves the various values of balance attenuation corresponding to a given frequency. This procedure is followed for a number of frequencies, for example, 300, 400, 600, 800, 1200, 1600, 2000 and 2400 cycles. Distribution curves may then be drawn of the values of balance attenuations for each of these frequencies respectively as indicated above under (1). This done, there is determined for each frequency, f, the value of balance attenuation, A, to which a given percentage (for example 37 per cent.) of the observed values (at this frequency) are equal or less. Finally, in a system of rectangular co-ordinates there is drawn the curve of variations of A as a function of f, as mentioned above under (2).

In addition to the measurements described above, involving various repeater sections, it would be desirable to make tests to obtain approximate data on *terminal* balance attenuations at the extremities of a long distance telephone circuit. For these tests it would be suitable to select as large a number as possible of typical connections between a subscriber and the toll office ; for each of these connections there is determined the balance attenuation obtained between the compromise network used in service, and the impedance of the subscriber's connection as seen from the toll office. The " compromise network " is the fixed impedance network provided on the toll office side of the terminal installation of the long distance circuit in question (terminal repeater, terminating set, balancing network). The results of these measurements made at the ends of long distance circuits, should be used for drawing curves similar to those described above for repeater section balance attenuation values.

There is thus need for drawing two types of distribution curves having for their abscissae a number of nepers or decibels, and as ordinates the number of cases where the observed balance attenuations are equal to or less than the number of nepers or decibels shown as abscissae. In the first case there is only *one* distribution curve to be drawn (for a given type of circuit). This curve represents the minimum value of balance attenuation within the frequency band considered. In the second case there should be drawn a series of distribution curves, each curve corresponding to a particular frequency.

Question No. 29.—3rd C.R. Category A_2.

(Continuation of previous Question No. 16 of the 3rd C.R., 1931–34.)

Is the frequency at present used on international service for signalling (500/20 p : s) the most suitable one, having regard to recent developments on telegraph systems and long distance automatic

selection ? If not, what is the most suitable frequency to be adopted for future international circuits ?

Note.—On this question the Dutch Administration has sent the following information concerning a system, using a frequency of 2500 p : s which has been employed in their internal service :—

An uninterrupted sinusoidal current of + 1.0 neper (+ 8.7 db) at 2500 p : s is applied to the circuit at a point of zero level. In the voice frequency range, such a level is never attained for a frequency of 2500 p : s, so that the voice currents do not cause false operation of the signalling apparatus.

The signalling apparatus consists of copper-oxide rectifiers, ordinary relays and a circuit tuned to 2500 p : s. The attenuation of the line being 0.35 neper (3.04 db), the absolute receiving level of the signalling current of 2500 p : s is + 0.65 neper (5.65 db), and the receiving apparatus will not function at a level less than, or equal to, zero, so that the voice currents never attain the level required to operate the receiving apparatus.

For the application of this system it is necessary for the circuit to transmit effectively a frequency of 2500 p : s. One year's experience using this system has shown favourable results, and no crosstalk disturbances has been noticed on cables operated with this signalling system.

Question No. 30.—4th C.R. Category B.

(Continuation of previous Question No. 1a of the 4th C.R.)

(*a*) What is the mean value of acoustic pressure produced by the voice on the diaphragm of the microphone of the sending system of the S.F.E.R.T., when the operator speaks with " normal volume for telephonometric tests " ?

(*b*) What value should be adopted as the reference volume for the calibration of volume indicators ?

Note.—Technical reports No. 99 and No. 100 of the S.F.E.R.T. Laboratory give details of numerous tests on this question.

From the results of these tests it is possible to determine the corresponding values of acoustic pressure on the diaphragm of the S.F.E.R.T. microphone without distortion, and compare these values with :—

1. those already published in scientific and technical works on speech power ;
2. the results obtained in the laboratories of different Administrations and operating companies who have made, or will shortly make, simliar tests to those outlined above for the S.F.E.R.T. Laboratory.

Question No. 31.—4th C.R. Category A_2.

(Continuation of previous Question No. 3 of the 4th C.R., 1931-34.)

In order to obtain a comparison of the various types of volume indicators, it is advisable to adopt as a standard for telephonometric tests a definite sequence of logatoms instead of different phrases actually used in the various countries ?

Question No. 32.—4th C.R. Category A_1.

(Continuation of previous Question No. 5 of the 4th C.R., 1931-34.)

Specification for the apparatus intended to replace the human voice in tests of microphone efficiency.

Question No. 33.—4th C.R. Category A_1.

(See previous Question No. 8 of the 4th C.R.)

What is the best system to be utilised to standardise the articulation testing crews of different countries ?

Note.—Two methods have been provisionally indicated by the C.C.I.F. :—

One, known as *Method I*, is described in Appendices B1 and B2, and the other *Method II* is described in Appendix C (White Book, 1935, Vol. IV, p. 228). It is desired that Administrations and operating companies should apply, as a test, these two methods for the correction of the results of articulation tests, and should send to the Secretary of the C.C.I.F. their comments so that they may ultimately be taken into consideration by the 4th C.R.

The following appendices—No. 1 (sent by Dr. Collard) and No. 2 (sent by Siemens & Halske), contain useful information on this subject. In particular it is desirable that Administrations and operating companies who make articulation tests, should determine for their testing crews, the two characteristic curves mentioned in Appendix I, and send them to the Secretary of the C.C.I.F. for examination by the 4th C.R.

APPENDIX I (TO QUESTION NO. 33).

SPECIFICATION OF CHARACTERISTIC CURVES FOR THE COMPARISON OF RESULTS GIVEN BY DIFFERENT ARTICULATION CREWS.

(Note contributed by Dr. Collard.)

A method for the calibration of articulation crews has been given by the C.C.I.F. in Appendices B1 and B2 (White Book, 1935, Vol. IV, pp. 219, 225). The object of this method is to eliminate the degree of training of the crew and thus make the results obtained by one crew comparable to those obtained by another crew. In order that this comparison may be made correctly, it is necessary, however, that the two crews should have sufficiently similar characteristics; for example, one cannot expect that articulation results obtained by a crew of men would agree with those obtained by a crew of women, because the frequency components of a woman's voice are in general higher than those of a man.

It is suggested that the two types of curves indicated below should be used to characterise an articulation crew.

(1) Articulation tests are made on the S.F.E.R.T. without distortion with different values of attenuation; the results are converted into corresponding values of band articulation and are plotted as a function of sensation level (Fig. 1).

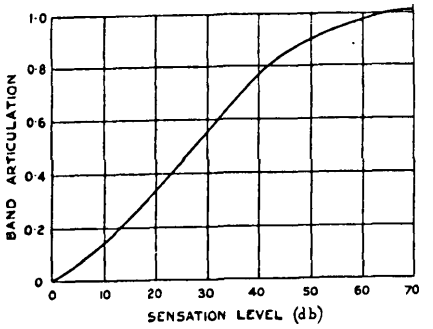


FIG. 1.

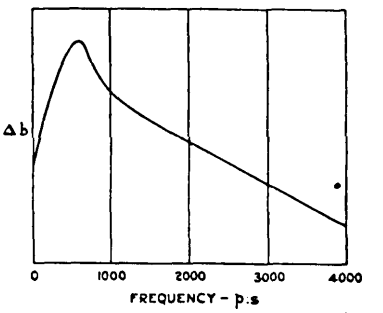


FIG. 2.

(2) Articulation tests are carried out on the S.F.E.R.T. without distortion with different low pass and high pass filters, and with a sensation level of about 70 db (8 nepers). The corresponding values of band articulation are plotted against values of cut-off frequency and two curves are thus obtained, A for low pass filters, and B for high pass filters.

From curve A is deduced a curve A_1 giving, for a cut-off frequency f, the increase of band articulation ab when the cut-off frequency changes from (f—50) p : s to (f+50) p : s. In the same way a curve B_1 is obtained from curve B.

In general, curves A_1 and B_1 coincide. If they do not the mean of curves A_1 and B_1 is drawn (Fig. 2).

These characteristic curves will be obtained in the S.F.E.R.T. Laboratory with the S.F.E.R.T. articulation crew.

In addition Administrations and Private Companies who possess results similar to those above or who can undertake such tests, will communicate to the C.C.I.F. the characteristic curves thus

obtained for their respective crews. The 4th C.R. will examine the results of these different tests to see whether the characteristic curves obtained in the different countries are in agreement, and whether " normal characteristic curves " can be specified.

Eventually, in order that articulation results obtained in different countries may be properly comparable, it will be specified that crews for articulation testing shall be so constituted that their characteristic curves do not deviate from the " normal characteristic curves " by more than a specified amount.

APPENDIX II (TO QUESTION NO. 33).

OBSERVATIONS FROM MESSRS. SIEMENS & HALSKE, WITH REGARD TO THE INTERNATIONAL ARTICULATION METHOD.

A study, of which the results have been communicated in 1934 in reply by the German Administration to Question No. 8 of the 4th C.R. (see pp. 18 to 26 of document No. 29, 4th C.R., C.C.I.F., 1934), has been made ; it is proposed to use a calibration circuit more nearly comparable to the circuit to be tested than is the circuit used hitherto.

The differences between the measured results, expressed as a function of time, have been considerably reduced by the correction methods given by the C.C.I.F. Furthermore, in this connection very similar results have been obtained by the two methods, I* (described in Appendices B_1 and B_2) and II (described in Appendix C, White Book, 1935, Vol. IV, Part 2). At the same time it has been possible to obtain agreement within a few per cent. between results obtained by two crews with very different degrees of training. The accuracy of the international articulation technique which for the moment is, perhaps, not satisfactory in all cases, can probably be improved by modifications in the method of operation.

With the German provisional working standard for effecting transmission (see Document No. 29. 4th C.R., C.C.I.F., 1934, page 10), articulation tests were made in which the room noise had a value between 20 and 50 " phons," the normal value being 40 " phons." In each case the attenuation was 3.5 nepers. The measurements were made with two crews of five operators each, an old crew which was very well trained and a newly found crew with little training. For each measured point five tests were transmitted, which corresponds to 1000 logatoms. For correcting the results a calibration circuit was used consisting of the working calibration system for effective transmission with a mean value of room noise of 40 " phons." For each of the previous measurements a calibration was made on the calibration circuit a little while after or before the measurement. The value of ideal band articulation necessary for the correction in accordance with Method I, was deduced from the highest calibration value 62.2 per cent. and was found to be 0.28. This value was also taken in the case of Method II, as the representative value for a well-trained crew. In order to apply Method II it was necessary to complete the curves of Appendix C (see vol. IV, part 2, section I) as far as a value $x = 0.2$, Table 1 gives the following values for the two crews taking part in the tests :—

(*a*) In column 2, the calibration values obtained on the standard circuit described above.

(*b*) In column 3 to 5, values of articulation obtained for different values of room noise, i.e. in

* The ideal band articulation was not calculated in these tests, but was deduced from the measurements.

column 3 value of room noise, in column 4 values of articulation corrected by the first method, and in column 5 values corrected by the second method.

In order to appreciate more easily the effect of the corrections on the distortion of the individual test results the deviations (percentage differences with respect to the smallest value) have been collected in Table 2.

The deviations have been reduced to a half or even more, both in the case of Methods I and II.

The two methods lead to results which agree within a few per cent. As the second method has a more rapid application Messrs. Siemens & Halske think that it might be preferred.

TABLE 1.

Room Noise (" Phons.")	Values obtained on the calibration circuit, L_1=62.2 per cent.	Logatom Articulation.		
		Measured.	Corrected.	
			By Method I.	By Method II.
20	50.6 per cent.	64.0 per cent.	75.0 per cent.	76.0 per cent.
30	46.8 ,, 56.8 ,,	60.8 ,, 61.3 ,,	75.5 ,, 66.0 ,,	76.0 ,, 66.5 ,,
40	62.2 ,,	62.2 ,,	62.2 ,,	62.2 ,,
50	54.6 ,,	48.3 ,,	54.5 ,,	55.5 ,,
60	62.2 ,, 58.8 ,,	34.7 ,, 40.6 ,,	34.7 ,, 43.0 ,,	34.7 ,, 43.5 ,,
CREW II				
20	23.1 per cent. 28.1 ,, 36.2 ,,	30.1 per cent. 39.0 ,, 40.1 ,,	75.0 per cent. 77.0 ,, 69.0 ,,	73.0 per cent. 76.0 ,, 67.0 ,,
30	39.5 ,, 38.0 ,,	43.1 ,, 40.2 ,,	66.0 ,, 66.0 ,,	66.5 ,, 64.5 ,,
40	62.2 ,,	62.2 ,,	62.2 ,,	62.2 ,,
50	24.7 ,, 33.5 35.9 ,, 44.2 ,,	22.7 ,, 28.8 ,, 30.3 ,, 32.4 ,,	60.0 ,, 54.0 ,, 56.0 ,, 47.0 ,,	58.0 ,, 56.0 ,, 54.5 ,, 47.5 ,,
60	22.5 ,, 31.2 ,, 38.7 ,,	12.8 ,, 15.0 ,, 20.1 ,,	38.0 ,, 31.0 ,, 33.0 ,,	41.0 ,, 34.5 ,, 36.0 ,,

TABLE 2

Room Noise (" Phons ")	20	30	40	50	60
CREW I	75.5 per cent.	71.0 per cent.	62.2 per cent.	55.0 per cent.	39.0 per cent.
CREW II	73.0 ,,	66.0 ,,	62.2 ,,	54.0 ,,	35.5 ,,
DEVIATION (i.e. percentage difference with respect to the smallest value	3.4 ,,	7.6 ,,	0 ,,	1.9 ,,	9.9 ,,

There still remains the question as to how far it is possible to obtain agreement by correcting the results obtained by different crews. In this connection Table 2 gives the mean of the corrected values obtained by the two crews for different values of room noise. Although the measured values differ considerably, the differences between the corrected values are not more than a few per cent.

There is reason to believe, however, that the agreement can be improved. The measured values follow the same general trend, but the individual values are often very different in the two cases. One is led to think that this is due to the different times at which the measurements and the calibration have been made. In future it is intended to transmit the necessary lists of logatoms alternately (for example, a list on the calibration circuit, then a list on the circuit under test, then a list on the calibration circuit, etc.), until five lists have been transmitted over the calibration circuit and five over the circuit to be tested.

Question No. 34.—4th C.R. Category A_2.

(See previous Question No. 9 of the 4th C.R.)

Conditions to be imposed on subscribers' sets which may be used on international connections and including either loudspeaking receivers or radio-diffusion microphones associated with amplifiers.

Question No. 35.—4th C.R. Category A_1.

(Previous Question No. 6 of the 4th C.R., 1931-34.)

What are the most appropriate methods of determining the transmission characteristics of microphones and receivers ?

Note.—It is desirable to carry out tests to determine the actual distance between the microphone and the mouth of the telephone user (in the case of hand microtelephones), under the worst transmission conditions, where the user, in order to make himself better heard, slightly tilts his handset so that his mouth may be nearer the microphone.

Question No. 36 (New).—3rd C.R. Category A_2.

Are the values for capacity unbalance in cable circuits, as laid down by the C.C.I.F. satisfactory for carrier current telephony ? If not, what new values should be imposed ?

Question No. 37 (New).—3rd C.R. Category A_2.

Does the recommendation under " Effective Resistance " in Specification A.II of the C.C.I.F. entitled " Essential Clauses for a Typical Specification of General Application to Loading Coils for International Telephone Cables " apply also to coils used on circuits for carrier telephony and on broadcast circuits ?

Question No. 38 (New).—3rd C.R. Category A_2.

What specification should be fulfilled by repeater station cabling, particularly with regard to insulation, dielectric strength and crosstalk ? From the standpoint of crosstalk is it not necessary to draw a distinction between the case where the circuits are or are not equipped with repeaters in the stations considered ?

RECAPITULATION.

3rd C.R.

Numbers of the new questions of transmission to be studied principally by the 3rd C.R. :

1, 2, 2b, 3, 4, 5, 6, 10, 10b, 11, 12, 12b, 12c, 13, 14, 17, 19, 20, 21, 27, 28, 29, 36, 37 and 38.

Numbers of the new questions of transmission in the study of which the 3rd C.R. will merely collaborate :

9 and 23.

4th C.R.

Numbers of the new questions of transmission to be studied principally by the 4th C.R.:

15, 16, 18, 22, 23, 24, 25, 26, 30, 31, 32, 33, 34 and 35.

Numbers of the new questions of transmission in the study of which the 4th C.R. will merely collaborate :

2, 2b, 5, 11, 12, 12b, 12c, 17, 21 and 28.

5th C.R.

Numbers of the new questions of transmission to be studied principally by the 5th C.R. :

7, 8 and 9.

Numbers of the new questions of transmission in the study of which the 5th C.R. will merely collaborate: 11 and 19.

4. Questions of Operation and Tariffs, which are to be studied by the 6th and 7th C.R. in 1935 and 1936.

Question No. 1.—7th C.R. Category A_2.

Should the basis of the international telephone tariffs, as laid down in Recommendation No. 43, entitled " International Telephone Rates " be revised ?

Note.—The basis referred to above was established in 1926, following a study of the costs of international telephone services. Since then the costs have probably changed, and it seems desirable to study the question again. Detailed questionnaires relating to costs have been prepared and sent out to all Administrations and Operating Companies of the C.C.I.F.

Question No. 2.—7th C.R. Category A_2.

In Recommendation No. 43, entitled, " International Telephone Rates," it is recommended that 0.80 gold franc should be apportioned to a terminal exchange and 1 gold franc to a transit exchange.

Thus, whilst the 0.80 gold franc rate apportioned to the terminal exchange represents : (1) the expense of staffing and equipment of the exchanges and (2) the expense of the circuit for connection to the terminal exchange, the 1 gold franc apportioned to each transit exchange represents only the expense of the exchange (staffing and equipment).

Should not opportunity be taken so to modify the apportionment of the various components as to make them correspond more closely to the relative costs ?

Question No. 3.—6th and 7th C.R. Category A_1.

Are there grounds for :—

(*a*) maintaining 3 minutes as an indivisible unit or reducing for example to 2 minutes the minimum duration of the rate unit applicable to international telephone conversations ?

(*b*) Charging by $\frac{1}{2}$ minute, rather than one minute, after the expiration of the initial unit for conversations, exceeding the minimum duration ?

Question No. 4.—7th C.R. Category. A_1.

Can a more favourable scale of rates be considered than is now in force for subscription calls:

(*a*) during the period of light traffic ?

(*b*) during the period of heavy traffic ?

Question No. 5.—7th C.R. Category A_2.

The extra charge for " Préavis " and " avis d'appel " calls, appears to be unduly high, especially for very long connections. Should not the present scale for these charges be revised ?

Question No. 6.—6th and 7th C.R. Category A_1.

Should a revision be made of the conditions governing the admission of and the rates contemplated for radio-broadcast telephone subscription calls, referred to in Recommendation No. 50, entitled " Radio-broadcast Telephone Transmission " ?

Question No. 7.—7th C.R. Category A_2.

By the terms of Art. 30. §14 of the Telephone Regulations which form part of the International Telecommunication Convention of Madrid 1932, the charge for a Bourse call is equal to that appropriate to a call in the same category and of the same duration, plus an extra charge of one-third of the basic unit charge subject to agreement between the Administrations and/or Operating Companies concerned.

Several important Administrations do not levy this extra charge. Is it not desirable to recommend a general acceptance of this procedure; in effect to revise the method of charging for Bourse calls ?

Question No. 8.—7th C.R. Category A_2.

In order to simplify the fixing of an assumed transit rate and to facilitate the accounting in connection with telephone calls passed over emergency routes, would it not be desirable to fix the assumed rate in the following manner :—

(*a*) for Administrations who co-operate in the setting up of the connection (through a transit exchange) : the assumed part of the transit charge should be equal to the sum obtained by adding the two terminal rates, which are normally due to them for the circuits used between the two terminal exchanges.

(*b*) for Administrations who do not take part in the setting up of the connection, but on whose territory the direct circuit employed happens to be located (no transit exchange being involved) : the assumed part of the transit charge should be the normal transit charge for a direct circuit ?

Note.—If this proposal is accepted a " List of normal charges for direct circuit " should be compiled by the C.C.I.F. to replace the present " List of Emergency Circuits." By consulting the former list, it will be possible to render accounts, without delay, for the telephone calls over the emergency routes, and thus render superfluous the fixing of assumed rates by correspondence.

Question No. 9.—6th and 7th C.R. Category A_1.

(*a*) Certain users of the telephone demand increased facilities in connection with international calls with " préavis " or " avis d'appel," or rather, that the system of personal calls, now used in extra-European services, should be introduced in the European service. What should be done in that respect ?

Note.—The resolution of the International Chamber of Commerce of 19th October, 1934, should be referred to in this connection.

(*b*) Is it desirable to specify the conditions, under which the valid duration of a "préavis" may be prolonged (see paragraph 85, Art. 17. §3 of the Telephone Regulations, which form part of the International Telecommunication Convention of Madrid, 1932 ; see also the last paragraph of Art. 39 in the Instructions for operators of the European international telephone service, 1934) ?

Note.—At present it is laid down that " the valid duration of a ' préavis ' *may* be prolonged twenty-four hours at the calling subscriber's request, *when he has been informed* that the call can be put through the following day at an approximately specified time." Would it not be better to make this regulation more specific by adopting one of the following alternative texts :—

1. " The valid duration of a ' préavis ' is twenty-four hours if the calling subscriber so desires."
2. " The valid duration of a ' préavis ' will only be prolonged twenty-four hours at the request of the subscriber, if the latter has been informed that the call can be put through the following day at an approximately specified time ? "

Question No. 10.—6th C.R. Category A_2.

Should the practice of assigning a serial number to each demand for a call in the international service be discontinued (Avis No. 29, entitled " Assigning a serial number to each demand for a call ") ?

Question No. 11.—6th and 7th C.R.'s. Category A_2.

Should not the daily call-over in the international telephone services be abandoned, the international terminal exchanges forwarding one to another by post at periods fixed by mutual agreement, a statement showing the number of chargeable minutes originated at each end, divided as to chargeable zones, class of conversation, and indicating any emergency routes utilised, on the understanding that the right shall be reserved to request the resumption of the daily call-over, should that course be deemed necessary ?

If so, what form of statement is most suitable from the point of view of the international accounts ?

Question No. 12.—6th C.R. Category A_1.

In order to facilitate the work of the operating services, would it not be desirable to prepare a map of the international circuits, incorporating in schematic form the details shown in the nomenclature, published by the International Telecommunication Bureau at Berne ?

Question No. 13.—7th C.R. Category A_2.

(*a*) What should be the rental charge for a telegraph circuit, superimposed on an international telephone circuit, when such a circuit is placed at the disposal of State Administrations or private organisations, respectively ?

(*b*) Should Recommendation No. 22, " Renting to private services of international channels of communication, not involving submarine cable," be revised ?

Question No. 14.—6th and 7th C.R. Category A_1.

Should not a concession be made to international travellers in the form of reduction of the normal rates on a certain number of calls (for example, 12) on the same principle followed by the Railway Companies, who allow reductions in fares for certain journeys of fixed distance or duration ?

5. Revision of International Graphical Symbols for Telephony by the 8th C.R. during 1935 and 1936.

The Xth Plenary Meeting of the C.C.I.F., which was held at Budapest, September 3–10, 1934, found it impossible to present complete and final proposals regarding telephony, telegraphy and

radio communication to the International Electro-technical Commission (I.E.C.), which was meeting at Prague in October, 1934. The Plenary Meeting felt that the most convenient procedure would be to appoint a Mixed Commission of representatives from the C.C.I.F., the C.C.I.R. and the C.C.I.T., who, before the beginning of 1935, should formulate the proposals to be presented to the I.E.C. During its meeting at Prague, in October, 1934, the I.E.C. approved this procedure and the Mixed Commission, I.E.C.—C.C.I.F.—C.C.I.R.—C.C.I.T. was formed and will meet at Berne in May, 1935.

In order to expedite the work of the Mixed Commission, the Plenary Meeting examined the symbols, contained in the I.E.C. publication No. 42, entitled " International Symbols. Part 3. Graphical Symbols for Weak-Current Systems." It also appointed a Commission of Rapporteurs (8th C.R.), which will meet at Berne in May, 1935, immediately before the aforementioned Mixed Commission in order to prepare the final revision of the international graphical symbols. The Chairmen of the 1st, 2nd, 3rd, 4th and 5th C.R.'s of the C.C.I.F. are invited to this meeting of the 8th C.R. to represent their respective Commissions during the discussions of telephonic symbols of particular interest to them. Pending the results of the work of this Commission, the Plenary Meeting at Budapest suggested that the final document should comprise one section containing the material common to the three branches of the technique, and another section containing the terms peculiar to telephony, telegraphy and radio communication.

It also proposed that the following modifications should be incorporated in the I.E.C. publication No. 42, the numbers below corresponding to the reference numbers in this publication :—

No. 2, read : alternating current, general symbol ; and alternating current of commercial frequency.

Add, after No. 2 : alternating current of audio-frequency 

alternating current of super-audio frequency 

alternating current of high frequency 

No. 11, replace the word *circuit* by *conductor.*

No. 35, instead of *moving,* read *removable.*

No. 42, the plates of the condensers should be drawn in heavy lines.

No. 44, read : Resistor, reactive or non-reactive, general symbol.

No. 45, read : Resistor, non-reactive.

Add, after No. 45 : Resistor, non-metallic.

No. 47, add : general symbol.

Add, after No. 49 : Resistor, variable by any means. 

No. 50, read : Resistor, variable, by a cursor or sliding contact.

Add after No. 53 : Current rectifier, general symbol 

Add after No. 71 : Loud speaker

Delete explanatory note after No. 72.

Delete : Nos. 73, 85, 86, 87, 88, 97, 98 and 99.

No. 121, read : Primary Cell or Accumulator.

Add after No. 121 : Voltmeter Ⓥ

Ammeter Ⓐ

Frequency meter Ⓕ

Ohm-meter Ⓡ

No. 131, the symbol should be shown thus : 

To No. 141 and 146 add the note : all diagrams should indicate the contacts in the un-operated position.

No. 161, read : *Contact* instead of *Contact, make.*

Delete No. 162.

Nos. 163 to 171. The symbols, shown in the third column, should be deleted.

No. 193. The 3rd variant should be deleted.

No. 194, read : signal lamp.

Add after No. 194 : Lamp, Resistor 

Delete No. 195.

No. 202, the symbol is replaced by 

No. 215. The 3rd variant should be deleted.

No. 221. Add the following note : The nominal operating current, expressed in amperes, should be indicated alongside the cut-out (fuse).

Delete Nos. 223 and 244.

No. 231. The symbol is replaced by 

No. 232. The symbol is replaced by 

No. 233. The symbol is replaced by 

No. 241. Add after " detailed form " : (example)

No. 261, read : Telecommunication line, general symbol

No. 262, 263 and 264 to be replaced by :

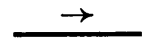
Telephone line F

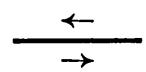
Telegraph line T

Add the note : The thickness of the line drawn should vary according to the importance of the circuits.

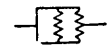
No. 265. The note should read : " The line shall be broken only to indicate the number of the circuit, which indicates the cable pair."

The Commission considers that after No. 268 the following symbols with optional titles should appear :—

Circuit transmitting in one direction : 

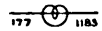
Circuit transmitting in both directions : 

Circuit, telephone, phantom : 

Circuit, telephone, double-phantom : 

Nos. 271 to 285 prefaced by the general symbol 

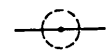
Add the note : The values of the inductance of loading coils and the spacing may be shown.

Example : 

Before No. 291 add a symbol for an amplifier.

Delete the numbers on Nos. 291, 292 and 293.

No. 297, read : Distant selective calling at low frequency. 

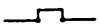
Add, after No. 297 : Distant selective calling at voice frequency. 

No. 314. The symbol is replaced by 

No. 325, read : Repeater with echo suppressor 

Add after No. 325 : Distortion correcting network 

The Xth Plenary Meeting of the C.C.I.F. made the following suggestions regarding the list of graphical symbols, established by the C.C.I.T. at its Plenary Meeting in Prague (May–June, 1934) :—

No. 11. The symbol  should be a common general symbol for telephony and telegraphy.

Nos. 22 to 25, and 29 to 32 should be made to agree with the new symbols, proposed above, for the various frequency bands.

No. 28. A square should be used instead of a rectangle.

Nos. 39, 40 and 41, should be improved.

No. 42. The symbol should be replaced by 

No. 44. The symbol should be modified.

Nos. 64 to 73. The  and the  should be deleted as general symbols.

Supplementary symbols should be enclosed in 

Delete No. 75 as a symbol.

Nos. 76 to 79 should be made to agree with the symbols definitely adopted for lines and equipments.

COMMISSIONS OF RAPPORTEURS IN THE C.C.I.F., 1935 AND 1936.

1st C.R., dealing with questions concerning protection of telephone lines against the disturbing influence from power installations :—

GERMANY : Dr. Jäger (*Chief Rapporteur*) and Dr. Klewe.
BELGIUM : Mr. Parfondry.
FRANCE : Messrs. Drouët and Collet.
GREAT BRITAIN : Mr. P. B. Frost.
ITALY : Mr. C. Albanese.
JAPAN : .....
MEXICO : Dr. Mauritz Vos.
RUMANIA : Mr. B. H. McCurdy.
SWEDEN : Mr. Swedenborg.
CZECHOSLOVAKIA : Mr. J. Michalek.

2nd C.R., dealing with questions concerning protection of telephone cables against corrosion due to electrolysis or chemical action :—

FRANCE : Mr. Collet (*Chief Rapporteur*).
GERMANY : Dr. Klewe.
BELGIUM : Mr. Parfondry.
GREAT BRITAIN : Mr. P. B. Frost.
ITALY : Mr. A. Baldini.
JAPAN : .....

3rd C.R., dealing with certain questions of transmission :—

GERMANY : Mr. K. Höpfner (*Chief Rapporteur*) and Messrs. Gladenbeck, Düll and Glitsch.
BELGIUM : Mr. Haemers.
CUBA : Mr. P. E. Erikson.
DENMARK : Mr. N. E. Holmblad.
SPAIN : Mr. J. M. Clara Corellano.
UNITED STATES OF AMERICA : Mr. H. E. Shreeve.
FRANCE : Messrs. Aguillon and Bélus.
GREAT BRITAIN : Messrs. J. G. Hines, R. M. Chamney and F. E. A. Manning.
ITALY : Mr. C. Albanese.
JAPAN : .....
MEXICO : Dr. Mauritz Vos.
NORWAY : Mr. S. Rynning-Tönnessen.
HOLLAND : Messrs. H. J. Boetje, J. Winkel and J. Tj. Visser.
POLAND : Mr. Henryk Pomirski.
RUMANIA : Mr. B. H. McCurdy.
SWEDEN : Mr. A. V. A. Holmgren.
SWITZERLAND : Dr. H. Keller.
CZECHOSLOVAKIA : Mr. J. Michalek.

4th C.R., dealing with certain questions of transmission :—

GREAT BRITAIN : Mr. B. S. Cohen (*Chief Rapporteur*) and Messrs. A. C. Timmis and A. J. Aldridge.
GERMANY : Mr. Braun.
CHILI : Mr. R. A. Mack.

UNITED STATES OF AMERICA : Mr. W. H. Martin.
FRANCE : Mr. Chavasse.
JAPAN : .....
MEXICO : Mr. F. Markman.
POLAND : Mr. Czeslaw Rajski.

5th C.R., dealing with certain questions of transmission :—

FRANCE : Mr. Ph. Le Corbeiller (*Chief Rapporteur*).
GERMANY : Mr. Glitsch.
ARGENTINE : Mr. E. M. Deloraine.
DENMARK : Mr. N. E. Holmblad.
SPAIN : Mr. J. M. Clara Corellano.
UNITED STATES OF AMERICA : Mr. H. E. Shreeve.
GREAT BRITAIN : Mr. A. J. Gill.
ITALY : Mr. G. Bleiner.
HOLLAND : Mr. J. Tj. Visser.
JAPAN : .....

6th C.R., dealing with operating questions :—

BELGIUM : Mr. Fossion (*Chief Rapporteur*).
GERMANY : Mr. Ehlers.
DENMARK : Mr. M. Gredsted.
SPAIN : Mr. J. M. Clara Corellano.
UNITED STATES OF AMERICA : Mr. H. E. Shreeve.
FRANCE : Mr. Debry.
GREAT BRITAIN : Messrs. W. H. Weightman and G. W. Gomm.
ITALY : Mr. M. Regnoni.
JAPAN : .....
MEXICO : Mr. B. Wahlquist.
NORWAY : Mr. M. Wahl.
HOLLAND : Mr. Th. W. L. M. de Winter.
POLAND : Mr. Stanislaw Debicki.
RUMANIA : Mr. J. J. Parsons.
SWEDEN : Mr. Halling.
SWITZERLAND : Mr. A. Möckli.
CZECHOSLOVAKIA : Mr. F. Matous.

7th C.R., dealing with rate questions :—

BELGIUM : Mr. Fossion (*Chief Rapporteur*).
GERMANY : Mr. Ehlers.
DENMARK : Mr. M. Gredsted.
SPAIN : Mr. J. M. Clara Corellano.
UNITED STATES OF AMERICA : Mr. H. E. Shreeve.
FRANCE : Mr. Debry.
GREAT BRITAIN : Messrs. W. H. Weightman and S. T. Keyte.
ITALY : Mr. M. Regnoni.
JAPAN : .....
MEXICO : Mr. B. Walquist.

NORWAY : Mr. M. Wahl.
HOLLAND : Mr. Th. W. L. M. de Winter.
POLAND : Mr. Stanislaw Debicki.
RUMANIA : Mr. J. J. Parsons.
SWEDEN : Mr. Halling.
SWITZERLAND : Mr. A. Möckli.
CZECHOSLOVAKIA : Mr. F. Matous.

8th C.R., dealing with the revision of international graphical symbols for telephony :—
SWITZERLAND : Mr. A. Muri (*Chief Rapporteur*).
GERMANY : Mr. Rättig.
FRANCE : Mr. Drouët.
GREAT BRITAIN : Messrs. P. J. Ridd and J. Reading.
ITALY : Mr. Bottani.
JAPAN : .....
POLAND : Mr. K. Dobrski.

VARIOUS QUESTIONS OF A DOCUMENTARY NATURE.

The Xth Plenary Meeting of the C.C.I.F. at Budapest (September 3rd—10th, 1934) examined, amongst others, certain questions for which no recommendation has been issued. It was, nevertheless, decided that the record established in regard to them, although not to be incorporated in the recommendations of the C.C.I.F., should form part of the minutes of the Plenary Meeting.

This record is reproduced below in the following three sections :—

1. **Acoustic Vocabulary :** This section groups the provisional definitions relating to acoustics, which are of particular interest to telephone engineers.
2. **Precautions to be taken during work carried out in manholes for underground cables.** This section contains a summary of information, collected by the C.C.I.F. from Administrations and Operating Companies with regard to the following points :—
   (a) Tests to ascertain the presence of dangerous or injurious gas. (b) Ventilation and lighting of manholes. (c) Methods to be adopted for the splicing, soldering and drying of cables in manholes, where dangerous or injurious gas may be present.
3. **Table, correlating the graduation of the psophometer called for in the C.C.I.F. specification with that of the psophometer, used by the American Telephone & Telegraph Company.**

1. ACOUSTIC VOCABULARY.*

Period (période ; Period). The shortest duration, after which the periodic phenomenon is identically repeated.

Cycle (cycle ; Schwingung). A complete series of values that is followed, in the course of a period, by a physical magnitude characterizing a periodic phenomenon.

Frequency (fréquence ; Frequenz). The frequency of a periodic phenomenon is the number of periods occurring per unit of time (or occurring per unit of time if the phenomenon is sufficiently prolonged), or the number of cycles which recur (or would recur) per unit of time.

The unit of frequency is : unity per unit of time. If a second is taken as the unit of time, the unit of frequency is unity per second (s^{-1}). In certain countries this unit is called the Hertz (Hz).

The following expressions are strictly correct : " A sound of 1000 cycles per second "—" A sound of 1000 periods per second "—" A frequency of 1000 per second "—" A frequency of 1000 Hertz."

Bel, decibel (bel ; décibel, Bel, Dezibel). The bel is the term which follows the number N, defined by the formula :—

$$N = \log_{10} J^1/J_0$$

where J_0 and J_1 signify the values of two powers.

The decibel is the term, which follows the number N, defined by the formula :—

$$N = 10 \log_{10} J/_1 J_0$$

where J_0 and J_1 signify the values of two powers.

By extension, a ratio of the two pressures P_0 and P_1 (or of two velocities V_0 and V_1) may be expressed in decibels by means of the following formulae :—

$$20 \log_{10} P_1/P_0 \text{ or } 20 \log_{10} V_1/V_0$$

these different expressions being equivalent when the ratios of pressure or velocities are equal to the square root of the ratio of the corresponding powers.

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* **Translator's Note.**—In the original French text the terms are given in the following order : French, German and English. Where the American expression differs from the English, it is given immediately after the English term. In this translation the sequence is : English, French, German, American.

Neper—decineper (néper, décinéper. Neper Dezineper).—The neper is the term which follows the numbers N and N^1 defined by the formulae :—

$$N = \log_e P_1/P_0 \qquad N^1 = \log_e V_1/V_0$$

when P_0 and P_1 represent the values of two pressures, V_0 and V_1 the values of two velocities.

The decineper is the term which follows the numbers N and N^1 defined by the formulae :—

$$N = 10 \log_e P_1/P_0 \qquad N^1 = 10 \log_e V_1/V_0$$

where P_0 and P_1 represent the values of two pressures ; V_0 and V_1 the values of two velocities.

By extension, a ratio of two powers J_0 and J_1 may be expressed in nepers or decinepers by means of the following formulae :—

$$\tfrac{1}{2} \log_e J_1/J_0 \text{ or } 5 \log_e J_1/J_0$$

these different expressions being equivalent when the ratio of the powers is equal to the square of the ratio of the corresponding pressure or corresponding velocities.

Bar (bar, Bar). Unit of pressure equal to 10^6 dynes per square centimetre (adopted in meteorology by international agreement).

Microbar (barye, Mikrobar). C.G.S. unit of pressure equal to 1 dyne per square centimetre.

Static pressure (Pression statique—Gleichdruck) is the pressure which exists in the medium when no sound wave is present. The C.G.S. unit is the microbar.

Instantaneous Sound Pressure (Pression acoustique instantanée—Augenblickswert des Schalldruckes, Excess pressure) at a point in an acoustic field, is the difference between the pressure existing at this point at the instant considered and the static pressure. The C.G.S. unit is the microbar.

Effective Sound Pressure (Pression acoustique efficace—Effektivwert des Schalldruckes) is the root mean square value, during a period, of the instantaneous sound pressure. The C.G.S. unit is the microbar.

Maximum Sound Pressure (Pression acoustique maximum, Scheitelwert des Schalldruckes) during one cycle is the maximum absolute value of the instantaneous sound pressure during that cycle. The C.G.S. unit is the microbar.

Note.—In the case of a sinusoidal wave this maximum sound pressure is also called : the sound pressure amplitude.

Peak Sound Pressure (Pointe de pression acoustique—Spitzenwert des Schalldruckes) is the maximum value of the instantaneous sound pressure within a specified time interval. The C.G.S. unit is the microbar.

Average acoustic power (Puissance acoustique moyenne—Schalleistung). In the case of a free progressive plane sinusoidal wave, the average acoustic power transmitted through a given surface is the average instantaneous value during a period of the product $a \times \rho \times v$, when a represents the area of projection of the surface on the wave-plane, ρ the instantaneous sound pressure and v the instantaneous velocity of the particles.

This average value is equal to :—

$$J = aP^2/c\rho \text{ ergs per second,}$$

where P represents the effective sound pressure, c the speed of progression of the plane-wave and ρ the density of the medium at rest.

In the case of a divergent spherical free progressive wave, where a is a small element of the surface of the wave, the denominator $c\rho$ of the above expression should be replaced by $c\rho \cos^2\alpha$, where α is the phase displacement between the instantaneous sound-pressure and the instantaneous

velocity of the particles given by $\tan \alpha = c/\omega r$, ω being the pulsation of the sinusoidal wave considered, and r the distance of the small element of the surface from the centre of the wave.

Sound energy density (Densité d'énergie acoustique—Schalldichte). From the average acoustic power defined above for a free progressive plane sinusoidal wave :—

$$J = aP^2/c\rho = aPV.$$

when P is the effective sound pressure and V the effective value of the velocity of the particles. It can be shown that the energy, contained in a straight cylinder with a base a and height $\lambda = cT$ (T being the period), is equal to :—

$$a\lambda P^2/C\rho^2$$

Conventionally, the term $P^2/C\rho^2$ is called " Sound energy density " at a point in the field. The C.G.S. unit is erg per cm^3.

Sound intensity (Intensité acoustique or intensité sonore, Schallstärke or Schallintensität). In the case of a plane or spherical free progressive wave, the sound intensity is the average acoustic power transmitted per unit of surface normal to the direction of propagation. The C.G.S. unit is erg per cm^2 or 10^{-7} watts per cm^2.

Note.—In practice the sound intensity at any given point may approximately be computed from a measurement of the pressure, assuming that a plane sinusoidal wave is involved. For more complex acoustic fields the sound intensity, so computed, may differ considerably from the true value.

Intensity level (relative to an intensity to be specified)* (Niveau absolu d'intensité acoustique, Schallstärkepegel). Assuming that, by international agreement, a sound of a definite sinusoidal frequency were chosen as a " reference of sound " and an intensity I_0 of this sound taken as a " reference of sound intensity," then the intensity level of any sound with an intensity I has the magnitude :—

$$10 \log_{10} I/I_0 \text{ decibel}$$

In Germany and the United States of America it has been suggested that the reference of sound should be a sound with a sinusoidal frequency of 1000 p : s.

The following values have been suggested for the reference of sound intensity :—

1. **In Germany :** the sound intensity of a sinusoidal sound of 1000 p : s, which in a free wave produces a sound pressure of $10^{-4}\sqrt{10} = 3.16 \times 10^{-4}$ dynes/cm^2 (corresponding approximately to the threshold of audibility). The latter value is 2.4×10^{-10} microwatt/cm^2.

2. **In the United States of America :** 10^{-16} watts/cm^2. In the case of plane or spherical waves moving freely in air (20° C and 760 mm barometric pressure) this reference of sound intensity corresponds to an effective sound pressure of 2.04×10^{-4} microbar (dynes/cm^2), which is below the normal threshold of audibility at 1000 p : s.

Threshold of audibility (Seuil d'audibilité, Hörschwelle) at any specified frequency is the minimum value of the effective sound pressure of a sinusoidal wave of that frequency which, following a period of silence, gives to the observer a pitch sensation. The measuring conditions should be carefully specified in each case.

Normal threshold of audibility (Seuil normal d'audibilité ; normale Hörschwelle) is the modal value of thresholds of audibility for a large number of normal observers.

Threshold of feeling (Seuil de sensation douloureuse ; Schmerzgrenze des Hörers) at any

* **Translator's Note.**—The English term includes the part in brackets ; this does not, however, conform to the definition, which has been phrased on the assumption that a reference level is specified.

specified frequency is the minimum value of the effective sound pressure of a sinusoidal wave of that frequency, which produces an unbearable sensation on the observer. The measuring conditions should be carefully specified in each case.

Normal threshold of feeling (Seuil normal de sensation douloureuse ; normale Schmerzgrenze) is the modal value of thresholds of feeling for a large number of normal observers.

Sensation level (Niveau d'intensité acoustique par rapport au seuil ; Schallstärkepegel der Hörschwelle). For a sinusoidal sound of a sound intensity I and a given frequency the sensation level is :—

$$10 \log_{10} I/I_s \text{ decibel}$$

where I_s is the sound intensity corresponding to the threshold of audibility at that frequency.

Loudness (Force du son ; Lautstärkeeindruck) is that subjective quality of a sound which determines the magnitude of auditory sensation, produced by that sound on a given observer.

Equivalent loudness (Intensité acoustique subjective ; Lautstärke) of a sound is measured by the intensity level of the sound of reference frequency (sinusoidal at 1000 p : s), which on the average produces the same sensation of loudness of a number of normal observers as the sound being measured. It is sometimes expressed in " Phons."

Masking effect of a sound (Effet de masque d'un son ; Verdeckung). The masking effect on a sound (masked sound) of another sound (masking sound) is the shift of the threshold of audibility (expressed in decibels) of the masked sound, due to the presence of the masking sound.

Auditory sensation area (Zone d'audibilité ; Hörfläche) is the area enclosed by the curve of the threshold of audibility for the various frequencies and the curve of the threshold of feeling for the various frequencies.

Audiogram (Audiogramme ; Audiogramm) is a graphic representation of the variation of the threshold of hearing with frequency.

Noise audiogram (Audiogramme en cas de bruit ; Lärmaudiogramm) is a graphic representation of the masking effect, due to a given noise as a function of the frequency of a masked pure sound.

Equivalent loudness contours (Lignes d'égale intensité acoustique subjective ; Linien gleicher Lautstärke). In a plane co-ordinate system with frequency as abscissae and intensity levels (relative to an intensity to be specified) as ordinates, equivalent loudness contours are the lines joining points representing pure sound of equivalent loudness for various frequencies.

Instantaneous speech power (Puissance vocale instantanée ; Augenblichswert der Sprechleistung) is the differential with regard to time of the sound energy, emitted by a speaker at any given instant.

Average speech power (Puissance vocale moyenne ; mittlere Sprechleistung), for a given time interval, is the average instantaneous speech power over that interval.

Phonetic speech power (Puissance vocale phonétique ; no corresponding German term, as this conception is not utilized) is the maximum value of the average speech power, for 0.01 second intervals, of a vowel or consonant sound.

Peak speech power (Pointe de puissance vocale ; Spitzenwert der Sprechleistung) is the maximum value of the instantaneous speech power over the time interval considered.

Intelligibility of phrases (La netteté pour les phrases ; Satzverständlichkeit) is the percentage of phrases of any text correctly received with reference to the total number of phrases transmitted.

Intelligibility of words (La netteté pour les mots ; Wortverständlichkeit)—is the percentage of words from typical lists correctly understood with reference to the total number of words transmitted.

Logatom articulation (La netteté pour les logatomes ; Silbenverständlichkeit or Logatomverständlichkeit) is the percentage of logatoms from typical lists correctly understood with reference to the total number of logatoms transmitted.

Sound articulation (La netteté pour les sons ; Lautverständlichkeit) is deduced by a measurement of the logatom articulation, observing the percentage of vowels and consonances correctly understood with reference to the total number of vowels and consonances contained in the logatoms transmitted.

Acoustic impedance (Impédance acoustique offerte par une surface ; akustischer Scheinwiderstand). In the case of a sinusoidal acoustic wave, the propagation of which may be designated by a single parameter l, of the nature of a length (for example a co-ordinate along the axis of the propagation of the acoustic wave under consideration), there is for each portion of the medium an alternating sinusoidal variation, ρ, of the pressure and an alternating sinusoidal variation x of the abscissa l.

The velocity of the particles in the portion of the medium is :

$$v = \frac{dx}{dt}$$

By definition, the quotient of the effect values of the the pressure ρ and the flux v on a surface s around the point considered (flux velocity $\varphi = vS$) is the modulus of the acoustic impedance at that point. The phase shift of φ (or of v) with respect to ρ is, by definition, the argument of the acoustic impedance at that point.

The complex number thus defined by its modulus and its argument is a measure of the acoustic impedance, which is thus defined per unit of area or for a small area s around the point considered. The C.G.S. unit is $g.s^{-1}.cm^{-4}$ and is sometimes called " acoustic abohm."

Unit area impedance (Impédance acoustique ; akustischer Scheinwiderstand für die Flächeneinheit, Schallwiderstand.) Under the above specified conditions the unit area impedance is the quotient of the effective values of the sound pressure ρ and the velocity v.

Mechanical impedance (Impédance méchanique ; mechanischer Scheinwiderstand) is the quotient of the effective values of a sinusoidal periodic force F and the velocity v at the point of application.

Note.—The British Standards Institution has suggested that the C.G.S. unit of acoustic impedance should be called the " webster," and the C.G.S. unit of mechanical impedance should be called " kennelly " ; also, that the word " briggs " should follow the logarithmic expressions of certain quotients of acoustic magnitudes. These suggestions should be examined by an international body, comprising all organisations interested.

Acoustic resistance (Résistance acoustique ; akustischer Wirkwiderstand)—is the real component of the acoustic impedance.

Note.—The C.G.S. unit is the $g.s^{-1}.cm^{-4}$ and is sometimes called " acoustic abohm."

Acoustic reactance (Réactance acoustique ; akustischer Blindwiderstand) is the imaginary component of the acoustic impedance.

Note.—The C.G.S. unit is the $g.s^{-1}.cm^{-4}$ and is sometimes called " acoustic abohm."

Acoustic inertance (Inertance acoustique ; Träge or akustische Masse) of a medium is that coefficient which, when multiplied by $2\pi f$, gives the component of acoustic reactance due to the inertia of the medium.

Acoustic stiffness (Raideur acoustique ; Steife) of a medium is that coefficient which when divided by $2\pi f$, gives the component of acoustic reactance due to the elasticity of the medium.

Acoustic compliance (Elasticité acoustique ; Nachgiebigkeit) of a medium is the inverse of the acoustic stiffness of the medium.

Velocity resonance (Résonance de vitesse ; Geschwindigkeitsresonanz)—in the case of a mechanical system, whose vibratory state can be designated by a single parameter x of the nature of a length, and to which is applied a sinusoidal force F, a velocity resonance is created in that mechanical system at a given frequency f_0 if the derivate v of the parameter x with reference to time ($v = \frac{dx}{dt}$) has a greater value at the frequency f_0 than at all neighbouring frequencies, the force F retaining a constant effective value.

Note.—In the case of a singly resonant system consisting of a mass, a resistance and a stiffness, in series, the resonance frequency as defined above is also the frequency at which the mass and the stiffness reactances are numerically equal, and hence the frequency at which the applied sinusoidal force and the resulting sinusoidal velocity are in phase.

Amplitude resonance (Résonance d'amplitude de vibration ; Amplituden-resonanz.) In the case of a mechanical system, whose vibratory state can be designated by a single parameter X in the sense of a length, and to which is applied a sinusoidal force F, an amplitude resonance is created in that mechanical system at a given frequency f_0 if the amplitude vibration of that system has a greater value at the frequency f_0 than at all neighbouring frequencies, the force F retaining a constant effective value.

Resonant frequency (Fréquence de resonance ; Resonanzfrequenz)—is a frequency f_0 at which resonance exists. The unit is the unit of frequency.

Note.—Where there is a possibility of confusion, it is necessary to specify whether amplitude resonance or velocity resonance is considered.

Anti-resonance (Antirésonance ; Antiresonanz) is defined in a manner analogous to resonance, but considering a minimum (of either the ratio F/v or the amplitude resonance at a constant value of F) instead of a maximum, as in the case of resonance.

Anti-resonant frequency (Fréquence d'antirésonance ; Antiresonanzfrequenz) is a frequency f_0, at which there is anti-resonance.

Free vibration (Vibration libre ; freie Schwingung). A system is said to be in free vibration, when it oscillates without any external force acting.

Forced vibration (Vibration forcée ; Erzwungene Schwingung). A system is said to be in forced vibration when it oscillates under the influence of an externally applied sinusoidal force.

Natural frequency (Fréquence propre or naturelle ; Eigenfrequenz). A system is said to have a natural frequency when having been displaced from its normal position by an external force, it vibrates at a well-defined frequency (natural frequency) after the external force has ceased to act.

Natural period (Période propre ; Eigenperiode) of a system is the period of its movement when that system is in a state of natural resonance. The C.G.S. unit is the second.

Note on Different Forms of Resonance.

In the case of a system whose motion can be described by the equation :

$$M\frac{d^2x}{dt^2} + R\frac{dx}{dt} + Sx = A\cos\omega t$$

the characteristics of the different kinds of resonance in terms of the constants of the above equation are given in the table below :

	Velocity Resonance.	Amplitude Resonance.	Natural Resonance.
Frequency	$\frac{1}{2\pi}\sqrt{\frac{S}{M}}$	$\frac{1}{2\pi}\sqrt{\frac{S}{M}-\frac{R^2}{2M^2}}$	$\frac{1}{2\pi}\sqrt{\frac{S}{M}-\frac{R^2}{4M^2}}$
Amplitude of Vibration	$\frac{A}{R\sqrt{\frac{S}{M}}}$	$\frac{A}{R\sqrt{\frac{S}{M}-\frac{R^2}{4M^2}}}$	$\frac{A}{R\sqrt{\frac{S}{M}-\frac{3}{16}\frac{R^2}{M^2}}}$
Maximum Velocity ..	$\frac{A}{R}$	$R\sqrt{1+\frac{R^2}{4MS-2R}}$	$R\sqrt{1+\frac{R^2}{16MS-4R^2}}$
Phase Shift between Amplitude of Vibration and the applied force	$-\frac{}{2}$	$tan^{-1}\sqrt{\frac{4MS}{R^2}-2}$	$tan^{-1}\sqrt{\frac{16MS}{R^2}-4}$

When R is small compared with $2\sqrt{MS}$ there is little difference between the three forms of resonance given above.

Conjugate impedances (Impédances conjuguées ; konjugiertkomplexe Scheinwiderstände)—Two impedances are said to be conjugate to each other when their effective resistances are equal and their reactances are equal in magnitude, but opposite in sign.

Transfer impedance (Impédance de transfert ; no equivalent term exists in Germany, where this conception is not in use) between two points is the complex ratio of an applied sinusoidal force (or pressure) at one point and the resultant velocity (or volume velocity) at the second point.

Insertion loss (Affaiblissement d'insertion ; Einfügungsverlust) is the loss of apparent power caused by the insertion of a system S between two portions S^1_E and S^1_R (of a system S^1) with impedances Z_E and Z_{R1}, respectively. Expressed in nepers, it is equivalent to one-half the Napierian logarithm of the ratio of the apparent powers delivered to the portion S^1_R before and after the insertion of the system S. Expressed in decibels it is ten times Briggs' logarithm of the same ratio.

Transducer loss (Affaiblissement transductique; Wirkdämpfung) is the loss of real power, caused by a system being inserted between two impedances Z_E (transmitter) and Z_R (receiver). Expressed in nepers, it is equivalent to one-half the Napierian logarithm of the ratio of the maximum real power, which Z_E can deliver direct to the receiver Z_R and the real power, which it delivers to Z_R through the medium of the inserted system. Expressed in decibels, it is ten times Briggs' logarithm for the same ratio.

(1) **Propagation constant per unit length** (Constante linéique de propagation ; Fortpflanzungskonstante)—of a uniform transmission system of infinite length is the natural logarithm of the ratio of the complex numbers representing, in a mechanical or acoustic system, the steady state velocities v (or the volume velocity $\varphi = vS$) at two points (or over two surfaces) in the system, separated by a distance of unit length.

(2) **Propagation constant per member** (Constante élémentaire de propagation ; Fortpflanzungsmass) of a system consisting of a periodic structure of infinite length is the natural logarithm of the ratio of the complex numbers representing, in a mechanical or acoustical system, the steady state velocities v (or the volume velocity $\varphi = vS$) at two points (or over two surfaces in the system), separated by a distance equal to the length of an element or a cell.

Attenuation constant (Constante d'affaiblissement itérative ; Dämpfungskonstante or Dämpfungsmass je Abschnitt) is the real part of the propagation constant of a uniform system of infinite length or of a system consisting of an (infinite) periodic structure. The unit is the neper, or the decibel, per unit length or per element.

Iterative phase constant (Constante de déphasage ; Phasenkonstante or Winkelkonstante)—is the imaginary part of the propagation constant of a uniform system of infinite length or of a system consisting of an (infinite) periodic structure. The unit is the radian per unit length or per element.

Iterative impedances (Impédances itératives ; Kettenwiderstände) are those by which a passive transmission system is terminated, when the input impedances of the system from either end is equal, in modulus and argument, to the terminating impedance at the other end of the system.

Image impedances (Impédances images ; Kennwiderstände) are those by which a passive transmission system is terminated, when at each end of the system, the impedances in both directions are identical in modulus and argument.

Note.—This is equivalent to stating that the image impedance at either end is the geometric mean of the open and short circuit impedances of the system, seen from that end. The image impedance of a symmetrical system is the same as its iterative impedance.

Transfer exponent (Exposant de transfert ; Vierpolübertragungsmass) of a passive transmission system is one-half the natural logarithm of the complex ratio of the steady state product of the effective values of the force and the velocity (or the pressure and the volume velocity) respectively at the input and the output of the system, when the latter is terminated in its image impedances.

Transfer constant (Constante de transfert ; Vierpolübertragungskonstante or Vierpolübertragungsmass) of a uniform system or a periodic structure is the transfer constant of the system per unit length or per element.

Image attenuation exponent or constant (Exposant et constante d'affaiblissement sur images ; Vierpoldämpfungskonstante or Vierpoldämpfungsmass) of a system is the real part of the transfer exponent or constant of that system.

Image phase exponent or constant (Exposant et constante de déphasage sur images ; Vierpolphasenkonstante or Vierpolphasenmass)—is the imaginary part of the transfer and exponent or constant of that system.

Cut-off frequency (Fréquence de coupure ; Grenzfrequenz) of a non-dissipative system is the divisional frequency immediately on one side of which the attenuation constant is zero and immediately on the other side of which the attenuation constant is not zero.

The cut-off frequency of a dissipative system is the frequency which would be the cut-off frequency in a non-dissipative system having the same constants for the reactive elements.

Force factor (Impédance électro-mécanique ; elektromechanischer Kopplungsfaktor). Let there be an electro-mechanical system, separately excited and satisfying the two equations :

$$f = zv + Ai$$
$$e = -Av + Zi$$

where f is the force applied to the oscillating mechanical element, e the electro-motive force applied to the electric circuit, v the velocity of the mechanical element, i the current in the electric circuit and z, Z and A co-efficients defining the system at a given frequency. The coefficient A represents the electro-mechanical impedance of the system and is the complex quotient of the force f and the current i, when the mechanical element is blocked ($v = o$) or, disregarding the sign, the complex quotient of the electro-motive force e and the velocity v, when the electric circuit is open ($i = o$). The electro-mechanical impedance is proportional to the magneto-motive force of the permanent magnet or to the density of the magnetizing current.

In an electro-acoustic system, the electro-acoustic impedance is defined, in the same manner, by considering a pressure p and a flux velocity φ, instead of a force f and a velocity v.

Blocked impedance (Impédance bloquée ; Leerlaufwiderstand) of a transmission system is the impedance measured at the input when the impedance of the output system is made infinite.

Note.—For instance, in the case of an electro-mechanical system, the blocked electrical impedance is the electrical impedance measured when the mechanical system is prevented from responding.

Normal impedance (Impédance normale ; Normalwiderstand) of a system is the impedance measured at the input of the systems when the output is connected to its normal load.

Motional impedance (Impédance cinétique ; Bewegungswiderstand) of a system is the vector difference between its normal and its blocked impedance.

Microphone (Microphone ; Mikrophon) is a passive instrument, which transforms acoustic vibrations into electric oscillations.

Microphone transmitter (Emetteur microphonique ; Mikrophonsender) is an electro-acoustic system, comprising a microphone and a source of energy. It generally functions as a relay in that the energy of the electric output is greater than the acoustic energy, delivered to the input.

Telephone receiver (Récepteur or récepteur téléphonique ; Fernhörer) is an electro-acoustic system, which transforms electric oscillations into mechanical vibrations. In practice a telephone receiver most frequently comprises a synchronous electro-mechanical transformer with a permanent magnet or an electro-magnet, and does not function as a relay.

Loudspeaker (Haut-parleur ; Lautsprecher) is a telephone receiver designed to radiate considerable acoustic power in a room or open air.

Acoustic system (Système acoustique ; Akustisches System) is a system designed to transmit sound.

Transducer (Système de transmission ; Übertragungssystem) is a structure receiving power from one system S_1 and delivering it, in the same or in different form, to a second system S_2. These systems may be electrical, mechanical or acoustic.

Passive transducer (Système de transmission passif ; passives Übertragungssystem). A transducer is said to be passive when the power delivered to the second system S_2 is obtained solely from the power furnished by the first system, S_1.

Symmetrical transducer (Système symétrique ; symmetrisches System) is a structure, whose output and input impedances have equal magnitude and phase.

Dissymetrical transducer (Système dyssymétrique ; unsymmetrisches System) is a structure, whose input and output impedances have different magnitude and phase.

Equivalent network (Réseau équivalent ; gleichwertiges Netzwerk) is one which, at a given

frequency or over a band of frequencies, may be substituted for another without changing the characteristics of the network, to which it is attached.

Selective transducer (Système de transmission sélectif ; selektives Übertragungssystem) is a structure designed to give some predetermined insertion loss-frequency or phase-frequency characteristic.

All-pass transducer (Système de transmission passe-tout ; dämpfungsfreies Übertragungssystem) is a structure whose attenuation constant is zero at all frequencies.

Filter (Filtre, Filter). A mechanical or acoustic filter is a passive transducer, which transmits fairly well the power within a certain band of frequencies (bands passed) and prevents, more or less effectively, the transfer of power from all other frequencies. (Bands suppressed.)

Low pass filter (Filtre passe-bas ; Tiefpassfilter) is one which passes a band of frequencies from zero to fc (cut-off frequency) and bars all frequencies from fc to infinity.

High pass filter (Filtre passe-haut ; Hochpassfilter) is one which passes a band of frequencies from fc (cut-off frequency) to infinity and bars all frequencies from zero to fc.

Band pass filter (Filtre passe-bande ; Bandpassfilter) is one which passes a band of frequencies from fc_1 to fc_2 (cut-off frequencies) and bars all frequencies from zero to fc_1 and from fc_2 to infinity.

Band elimination filter (Filtre à élimination de bande ; Bandsperre) is one which passes bands of frequencies from zero to fc_1 and from fc_2 to infinity (fc_1 and fc_2 are cut-off frequencies) and bars the frequency band from fc_1 to fc_2.

Composite wave filter (Filtre composite ; zusammengesetztes Filter mit Anpassung) is a network of serially connected filter sections, some or all of which are different in their transfer constants, but adjacent sections of which are equal in their image impedances at their junctions.

Constant resistance structure (Filtre à résistance constante ; Filter mit konstantem Widerstand) is one whose iterative impedance in at least one direction is a pure resistance and is independent of the frequency.

II. PRECAUTIONS TO BE TAKEN WHEN WORKING IN MANHOLES ON UNDERGROUND CABLES.

1. Tests for explosive or asphyxiating gases in manholes.

The gases most frequently met with in manholes are of two kinds, both explosive :

(*a*) Fire-damp (natural gas) containing a relatively large percentage of methane or ethane, or both together, usually with small percentages of nitrogen and carbonic acid. Fire-damp is not a noxious gas, but if it exists in sufficiently large quantities in a manhole it may produce asphyxia, by reason of lessening the oxygen content of the air.

(*b*) Lighting gas (artificial gas) produced from coal or heavy petroleum oils. It contains a large proportion of carbon monoxide which is very harmful, usually with large percentages of hydrogen and methane. Carbonic acid, nitrogen and also oxygen are present in relatively feeble proportions.

Considering the age of many gas pipes, the difficulty of discovering the existence (and of actually locating the exact position) of an escape, the use of impermeable material on the surface of roads and streets which hinders the escape of the gas into the atmosphere, and also the vibration produced by the

traffic which leads to displacement of the earth under the roadway and the formation of pockets where gas may accumulate—it is extremely important to possess a method of indicating, in underground chambers of telephone cable routes, the presence of gas capable of producing explosions.

From the preceding it will be seen that the apparatus to be used for tracing the presence of gas in manholes must satisfy the following conditions :—

(*a*) It must show the presence of carbon monoxide (CO) or carbon dioxide (CO^2).

(*b*) It must be of solid construction.

(*c*) It must be inexpensive.

(*d*) Its operation must be simple in order that it may be used by all classes of workmen who in underground telephone cable chambers are called upon to carry out splicing, plumbing, desiccating, etc.

As an example of an apparatus satisfying these conditions, the palladium chloride indicator for carbon monoxide which is described in Appendix I, may be mentioned.*

Before commencing any work in a manhole or jointing box, it is absolutely necessary carefully to inspect it to be sure that it does not contain gas.

The manholes are provided with covers. On taking off the cover the greatest care should be taken in order that no sparks are produced by the use of a hammer, bar, etc. If, during the cold weather, it is necessary to thaw the ground around the manhole, a salt solution should be used or, in difficult cases, lime. Before lifting off the cover, of course, care must be taken that there is no fire close by. Smoking is forbidden in the manholes or in the neighbourhood of pulling-in boxes or open jointing boxes.

If the presence of gas is shown during such inspection, no work should be carried out in the manhole before the gas escape is repaired by the gas authorities, and the manhole or box has been freed from gas.

It is also desirable that an official superintendence of underground works should be organised in large towns in order that each underground chamber may be inspected periodically (for example every three months), even if no work is being carried out there at the time. As a record of these inspections, the report form shown in Appendix III could be used.

In addition to these 3-monthly visits, additional visits must, of course, be paid by the same inspecting forces when the presence of lighting gas is reported by workers. Reports drawn up by these inspectors and sent to the local safety authorities, should form the subject of a very careful " order " by the Highway Commissioners and the various gas authorities concerned. As soon as the presence of lighting gas is observed, work must be stopped and not recommenced until after a full investigation by the representatives of the telephone service and the gas authorities. The stoppage of work and permission to recommence should be officially advised to all the services interested as soon as the report has been completed.

Finally, it is desirable that instructions to all workers in underground manholes include the cessation of all work as soon as the presence of gas has been recognised, either by smell or by the use of some kind of detector, and that work must not be recommenced until after the competent service has taken action and the official ban has been removed.

*Various other arrangements may be mentioned, especially those used in Sweden. The gasoscope of Strache, the gas detector of Nellissen, and the carbon monoxide detector of Degea.

2. Precautions to be taken when working in pulling-in manholes. Lighting of manholes during work.

When the pulling-in manhole is not ventilated by permanent ventilators properly installed and well maintained (see Appendix IV), it is a good thing to ventilate the chamber by means of a portable ventilating machine (motor or hand driven) before commencing work, and also from time to time during the course of the work.

Before entering the manhole it should be left open for ten minutes at least, even after having established that there is no harmful or explosive gas present. At the same time the neighbouring manholes and boxes on both sides of the one where the work is being carried out should be open so that a current of air may clear any gas from the duct line. The manhole covers of the nearby boxes should be left off as long as work is being carried out in the intermediate manhole.

Before commencing work in manholes which will be of long duration, or which will necessitate the use of an open flame (plumber's torch, etc.), all the entrances should be blocked, so that no harmful gas can enter the manhole. Empty ducts can be conveniently sealed by means of tight-fitting stoppers (in concrete for example). In the case of ducts occupied by cables it will be necessary to stop them, in the case of a small cable with stoppers made in two parts shaped to the holes to be stopped, or in the case of large diameter cables with a stuffing of hemp. This stopping should be finally completed by the use of some plastic substance. If such stoppers were not fitted previously and are fitted specially for the work in the manhole, it will naturally be necessary to remove them at the end of the work.

In the course of the work it will be necessary to take precautions against the risk of a new accumulation of gas between two tests. To this end use should be made of an apparatus giving a visual or audible alarm, when gas has accumulated to such a degree that it is dangerous for the workmen to continue.

Various forms of safety lamps, as used in the mining industry, have been tried ; all suffer from the defect that the rising of the flame which occurs when conditions become dangerous cannot be quickly seen in a manhole where another more powerful source of light exists for illuminating the manhole during the work.

It is preferable to use a type of lamp similar to miners' safety lamps, but having some alarm arrangement. In Great Britain a lamp is used which includes an arrangement formed by a spiral bi-metallic ribbon suspended above the flame. The presence of inflammable gas causes the flame to rise. This results in the temperature of the bi-metallic ribbon being increased and an electrical contact is closed which lights a red lamp (alarm lamp). In this way the presence of 1 per cent. of lighting gas is indicated after about 40 seconds. If there is a shortage of oxygen, the lamps go out and an indication is given to the workers that it is dangerous for them to continue. This alarm safety lamp used in Great Britain is known as the " Naylor " lamp.

In Germany, a safety lamp (known as the " Fleissner " lamp) is used which contains a prismatic mirror. The presence of explosive gas mixtures is indicated by the aureole form taken by the flame and also by a characteristic noise which constitutes an audible alarm signal. Also, if it is noticed, upon looking into the prismatic mirror, that the flame lowers or goes out, this is an indication of insufficient oxygen in the manhole, and of a risk of asphyxiation. Variations in the flame are clearly seen, thanks to the prismatic mirror, and the noise that is given out when explosive gas is present is easily perceptible.

With regard to the lighting of manholes, there is no doubt that the best method of avoiding explosions is lighting by low tension electric lamps, so arranged that no switch or other piece of apparatus

in the manhole is capable of causing sparks or arcs. Portable lamps having reflectors and metallic screens should be used, connected by a cable (india-rubber for instance) to an accumulator kept outside the manhole. It is desirable that the plug for the lamp should be in the battery box in order that it should be impossible, without unscrewing the lamp holder, to cut off the current inside the manhole.

This method of lighting obviously requires a means of charging accumulators (generally, alkaline accumulators which are light and easily maintained are used, although they are more expensive than lead accumulators), but this method of lighting is the only one which gives real security, especially if one is not absolutely certain that no harmful or explosive gas can accumulate even after having made a test which has proved negative.

Jointing, Plumbing and Drying Cables in Manholes where Gas may be Present.

If it cannot be certain that no harmful or explosive gas can accumulate at any moment during the course of work in a manhole, the introduction of any flame must be forbidden with the exception of alarm safety lamps, as quoted above.

In this case to joint and plumb a cable, the following methods only can be used :—

(*a*) Electric soldering of the jointed conductors* (if soldered joints are necessary) and electric plumbing of the lead sleeve. In this process the plumber's metal is melted in an electrically-heated pot and run into a collar (heated in the same way), which gives the desired form to the wipe. The electric generator and the transformer are, of course, kept outside the manhole. Only the cables connecting the collar to the secondary winding of the transformer enter the manhole. The transformer has a few tens of volts on the primary, so that the secondary has a pressure of only a few volts.

(*b*) Jointing and soldering without the use of open flame lamps. In this method the metal for the plumbing, and the soldering irons must be heated above ground and sent down into the manhole when required. For example, the following method can be adopted :—

The jointing of the conductors of the cable is effected by twisting together their ends. If it is necessary to solder the joints, as in the case of long-distance cables, a copper soldering iron is used with resin-cored solder (the soldering iron being heated outside the manhole and only being sent down at the moment its use is required).

The wipes between the lead sleeve and the cable sheath are made by pouring the plumber's metal over the sleeve and the cable sheath until the temperature of these has been sufficiently raised, after which a cloth is placed under and around the wipe in order to retain the liquid metal and to mould it around the cable sheath and the lead sleeve, and to completely surround it when it solidifies on cooling. When the wipe has been sufficiently heated in this manner, a large portion of the metal is removed and a fresh quantity is poured on the work around the joint in a paste to which is finally given the form of a smooth surfaced wipe. In this way there is no necessity to use a blow-lamp, the necessary heat being obtained from the metal which has been poured over the wipe, but it is necessary to take care that the right proportion of tin exists in the plumber's metal. If the proportion of tin is above 40 per cent., it is difficult to make the wipe, for there is not sufficient time between the moment when the metal commences to solidify and forms a pasty mass which can be satisfactorily handled, and the moment when it solidifies. On the other hand, if the proportion of tin is less than 38 per cent., the wipe will probably be leaky.

Drying out the ends of the cables in the manholes where there is a risk of explosive gas, presents

* This method has been patented by the " Electrische Löt-Schweissgesellchaft."

some difficulty. Some countries use for this purpose hot liquid paraffin, which is heated (outside the manhole) to approximately 190° C. before being used.

The use of paraffin, however, has certain drawbacks, the paper tending to crack during subsequent handling; the use of paraffin also renders it more difficult to see the identification marking on the insulating papers. The use of very highly-coloured paper in order to resist the discolouring effect of the paraffin has been shown to be undesirable from the point of view of the electrical qualities of the cable. Another method of drying on site has recently been tried in Great Britain. This method uses silica-gel, a very hard vitreous substance which is like fine gravel. Its chemical composition is 100 per cent. pure silica (SiO^2). It is prepared in such a way that it has a very distinct physical structure; it is chemically inert. It absorbs moisture from the air to 40 per cent. of its own weight without increasing its volume and without ceasing to have a dry appearance. It may subsequently be heated to evaporate the moisture and be used again. This cycle of operations can be indefinitely repeated without affecting its efficiency. This substance is used in the form of a bandage with which the joint is covered underneath the lead sleeve. This method has given very promising results.

APPENDIX I.

Description of the palladium chloride indicator for carbon monoxide and its method of use.

Description. The palladium chloride indicator for detecting carbon monoxide which is shown in Fig. 1, with the component parts in Fig. 2, has been constructed to trace very small quantities of lighting gas or of any other gas containing carbon monoxide. The indicator consists of the following parts (see Fig. 2) :—

1. A base.
2. A rubber disc.
3. A plate which rests on the rubber disc.
4. A cover with coloured buttons.
5. A threaded fixing ring which assembles the whole apparatus together.
6. Test papers used during the test.

The active substance is a solution of palladium chloride in acetone and water. It is supplied in small glass phials and must not be used for any other purpose than that for which it is supplied. This solution does not change by being kept in the ordinary manner, but if its efficiency is doubted, it should be thrown away and a new phial used.

In assembling the constituent parts of the apparatus, the reserve test papers are placed on the base and under the plate (3) a single sheet of test paper is placed between this plate (3) and the cover (4) the fixing ring (5) assembles the whole in a semi-rigid manner so that it is possible to turn the cover (4) without displacing the test paper which is underneath it. A small circle of white paper will now be seen between the two coloured buttons on the cover, and this is exposed to the air for examination.

The presence of lighting gas or of any other gas containing carbon monoxide is revealed by the darkening of the exposed portion of the test paper. If the proportion of carbon monoxide in the atmosphere examined reaches 0.05 per cent., the test paper will become the colour of the lighter button. If the proportion reaches 0.1 per cent., the test paper will be as dark as the darker button.

By turning the cover, ten successive tests can be made with the same sheet of test paper, a new and clean disc of the test paper being exposed to the atmosphere examined, for each test.

Method of Use. The palladium chloride indicator should always be used before entering a manhole and before any type of flame (even that of a safety lamp) is taken into an underground manhole or jointing box.

In making a test to see whether or no there is gas in the manhole, the manhole cover should be raised sufficiently for the indicator to be introduced into the manhole at a point mid-way between the roof and the floor, the indicator being held by a thread or a wire fixed to the wrist.

When the test is being made in a jointing box placed under the roadway, the indicator should be placed at the entrance of the conduit connecting the jointing box to the main conduit run.

To carry out this test there is no need to stop any work which does not require the use of a flame. Buried jointing and junction boxes should be treated in the same manner.

The test should be carried out in the following way: A small quantity of palladium chloride solution is placed on the test paper by lightly placing the mouth of the phial containing the solution on the centre of the uncovered portion of the test paper which appears in the hole in the cover between the coloured buttons. Just a sufficient quantity should be used to completely saturate all the visible portion of the test paper, but no more. The apparatus is then ready for use and should be exposed

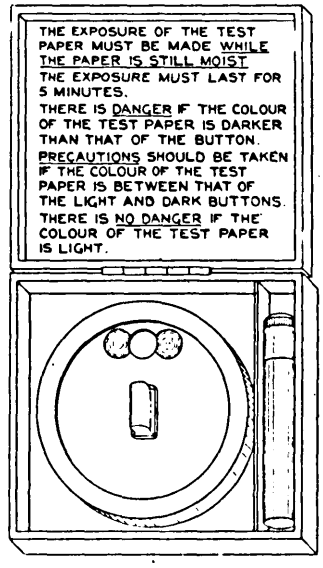


FIG. 1.

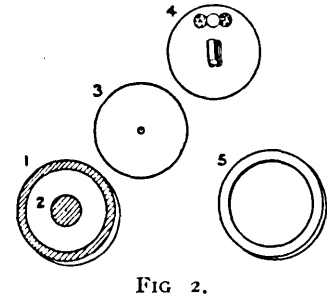


FIG 2.

in the suspected atmosphere for five minutes. The test must be made immediately after the test paper has been saturated with the palladium chloride solution. If the paper is allowed to become dry before exposure, it will not indicate the presence of gas.

After five minutes' exposure, the indicator should be withdrawn and the tint of the test paper compared with that of the coloured buttons placed each side of it.

The cover itself is the colour which the test paper should keep, if there is no gas present containing carbon monoxide. If the test paper does not become darker than the lighter of the two buttons on the indicator cover, there is no danger in working in the manhole. If the paper becomes a colour intermediate between the light and dark buttons, work may be carried on without danger during consecutive periods of two hours, but only on condition that the test is renewed from time to time, for example, every half hour. If the test paper becomes darker than the darker button, the atmosphere is dangerous and there is a risk of explosion. In such a case the supervising engineer and also the police should be advised. Under such conditions no work must be undertaken, and if a pulling-in manhole is

concerned, no one should be allowed to enter it until it has been well ventilated, as well as the adjacent manholes and boxes, and until new tests have proved that these manholes and boxes no longer contain gas.

When work is recommenced, tests with the palladium chloride indicator should be made every half hour, until six consecutive tests have shown that there is no danger.

APPENDIX II.

Description of the " Osmomètre " apparatus used by the Telephone Service of Paris, and its method of use.

1. Description and Operation. The leak indicator known as the " Osmomètre " (see illustration) consists of an apparatus having a scale upon which moves a needle controlled by a diaphragm, working in a similar manner to the actuating box of an aneroid barometer. This diaphragm closes a cylinder of which the other end is closed by a special porous composition which gas can cross by endosmosis. By slightly unscrewing the lower part of the apparatus the interior is exposed to the atmosphere and the apparatus is ready for use.

Let us suppose that the needle is at zero point on the scale and that the tap is open, the apparatus being in pure air. If having closed the tap the apparatus is transferred into an atmosphere filled with lighting gas, the needle is seen immediately to deviate to the left and take up a fixed position at the end of a few seconds. The point on the scale at which the needle comes to rest indicates the percentage of the mixture of air and gas; for example, if the needle points to division 5, this indicates that the atmosphere in which the apparatus is situated consists of 5 per cent. lighting gas to 95 per cent. air.

The following gives details of the operation :—

The cylinder closed by the porous substance at first contains pure air; then the apparatus being transferred into the suspected atmosphere, the gas penetrates by endosmosis into the cylinder through the porous substance quicker than the air can escape. A pressure is accordingly established in the cylinder which acts upon the diaphragm which is slightly distorted; this diaphragm being connected, as stated above, to the needle, causes the latter to take up a position varying according to the amount of the distortion.

2. Method of Use. The illustration shows the end and side views of the apparatus.

The " Osmomètre " has an advantage over chemical detectors such as palladium chloride indicator, of giving instantaneous indications and recording the content of the gas in the mixture of gas and air.

It is a means of measuring the presence of lighting gas which has been indicated by its smell, especially in jointing and pulling-in manholes built on multiple conduit routes.

It is employed in three ways :—

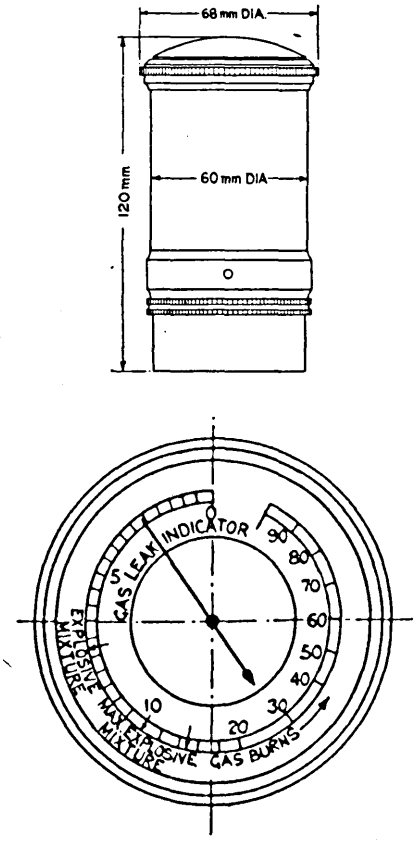
(*a*) Before opening the cover of the manhole, the " Osmomètre " apparatus is placed on the keyhole of the cover and surrounded by a cloth.

(*b*) By lowering the apparatus into the manhole, after opening the cover.

(*c*) By placing the apparatus in the mouth of the multiple conduit.

The method given in (*b*) is the most general, while method (*c*) permits of tracing the conduit which is leading the lighting gas into the manhole.

The apparatus is particularly useful in proving the absence of lighting gas in manholes after gas escapes have been repaired. In practice very often the smell of gas persists even after the leak has



OSMOMETRE

been repaired. In these cases indication by smell only would not allow work to be continued in a manhole which had been condemned owing to the presence of gas.

The " Osmomètres " as used by the Telephone Service of Paris, are reasonably cheap and very robust. One apparatus has been in use for more than 4½ years without repair or replacement and is still in perfect condition.

APPENDIX III.

Form used for the quarterly inspections of manholes or subways by the Paris Telephone Service.

Superintendent of Telephone Service of . . .

REPORT OF VISIT No. . . .
to the telephone duct route and subway.

Construction Department.

Duct route.*
Subway.*
Manhole No.†
Kilometric Point No. . . .Kilometric Point No. . . .‡

REMARKS :

Smell at the opening of the cover :
Smell in the manhole or in the subway :
Results of the test with the " Osmomètre " or the palladium chloride indicator or any equivalent testing apparatus :
Height of water :
State of the duct stoppers :
State of the floor, sump, etc. :
State of the ceiling :
State of the entrance :
State of the ventilating pipes :
State of the ventilating grilles :
State of the cover :
State of the cables :
State of the walls :

Date.....
Foreman :

Date.....
Superintendent of Works :
.....
Date.....
Sectional Engineer :
.....

* Cross out the indication not needed.
† Indicate the number of the manhole and its exact position.
‡ For use in the case of subways only.
† and ‡ Cross out the indication not needed.

APPENDIX IV.

Permanent ventilation of underground telephone cable manholes.

The first permanent ventilating devices used in distribution boxes or manholes of the telephone cables of Paris, were constructed in 1928 on manholes on a multiple way duct route.

These devices were similar to those which had previously been used by the Gas Company of Paris to ventilate its underground expansion chambers. They consisted of two openings at the ground level

covered by grilles connected by pipes, one to the upper portion of the manhole, and the other to the lower portion. The mouth of the ventilating pipes in the manhole was at each end of the longest diagonal of the parallelopiped formed by the internal walls of the manhole, from which is derived the name " diagonal ventilation " which is sometimes used in describing this system.

Originally the following theory, which it is said appears satisfactory, was applied to the working of this device. In case of a gas leak the gaseous mixture in the manhole which was lighter than air (density effect) flowed out by the higher opening, whilst the fresh air which was heavier, entered by the lower opening. The atmosphere of the manhole became more healthy by reason of a current of air circulating on its greatest diagonal. Ventilation resulting from the density effect when the external temperature was lower than the temperature of the manhole would be increased by the " temperature effect." In reasoning thus there is evidence of a belief in the existence of " no wind " condition at ground level or an equal effect of the external wind on each grille.

Although the arrangement mentioned above had not been the subject of a systematic study until 1930, experience had shown that underground manholes supplied with this arrangement were drier and less subject to condensation than ordinary manholes.

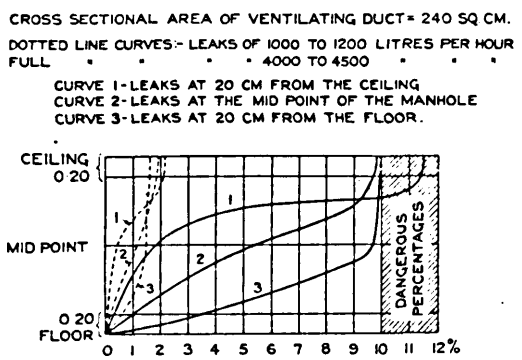


FIG. 1.

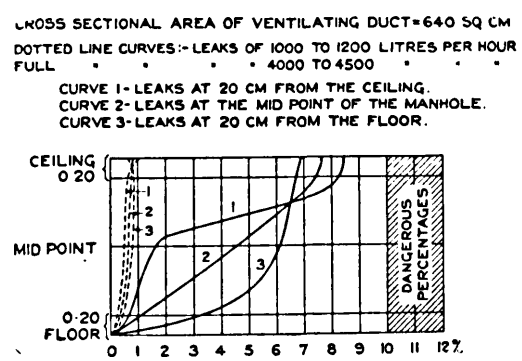


FIG. 2.

In 1930, the French Administration of the P.T.T. made a systematic study of the ventilation of underground subways, and these studies also included underground cable manholes by placing them in experimental conditions resembling as closely as possible conditions met with in practice (an underground manhole of the normal dimensions was specially built for these studies and experiments were made in it with real gas escapes).

When at the end of the experiment the statistics were studied, they showed that :—

1. There was a continuous ventilation during 123 days of the year, when the external temperature was below 12° C., which is the normal temperature in underground manholes.

2. There was no ventilation during 110 days when the temperature did not fall below 12° C.

3. A slight ventilation took place during the remaining 132 days, but only during the few hours when the surrounding air temperature fell below 12° C.

However, ventilation due to this temperature effect is usually very slight and only becomes appreciable with large differences of temperature ; thus in very frosty weather with no wind, in the

case of a manhole fitted with this diagonal ventilating arrangement, it can clearly be seen that the ventilating outlet from the manhole appears wet, while the inlet and the paving are covered with ice or rime.

Calculations have been carried out which show how low are the pressures due to " density effect " and which tend to cause ventilation when the average amounts of gas are equal to, or less than, the lower limit of inflammability. Ventilation in calm weather resulting from the density effect in manholes provided with diagonal ventilation is, however, of very appreciable efficiency, as will be seen from the curves shown by Figs. 1 and 2, since this device in a manhole arranged with a ventilating opening of 240 cm^2 permanently removes escapes of from 4000–4500 litres per hour, without the atmosphere in any part of the manhole reaching the lower limit of inflammability.

Ventilation due to density effect is very much modified by the effect of wind on the grilles. Experience has drawn particular attention to this point. The pressure effect due to the wind appears to be, generally speaking, much more important than the density effect. Theoretically, this effect would be nil, if the grilles were systematically placed in the direction of the wind. This is never the case in practice ; dissimilarities always exist (different positions of the grilles, buildings, trees, different lengths of pipes, etc.). The pressure due to the wind may increase or decrease the density effect according to the direction of the wind. In the latter case, in manholes fitted with diagonal ventilation devices, fresh air enters by the upper orifice and the light gas leaves by the lower. This circulation of the gas is less satisfactory than the normal one, since it is preferable to empty first the more concentrated mixture found under the ceiling rather than to dilute the whole of the atmosphere in the manhole before clearing it, and this may present some danger.

Experience with a closed manhole shows in practice that in the case of a gas leak in the manhole the richer and consequently more dangerous mixture is formed first at the upper part of the manhole under the ceiling. Everything else being equal, the mixture under the ceiling will be the richer the nearer the escape is to the ceiling. The mixture throughout the manhole will not become uniform until after several hours, in accordance with the law on the mixture of gases. From these observations it is obvious that from the point of view of safety it is especially important to clear the gas from the upper portion of the manhole.

These considerations have shown the desirability of making use of the wind effect to specially ventilate the upper portions of the manholes.

In place of endeavouring to obtain a symmetry of the grilles in the direction of the wind, endeavours have been made to create dissymmetry of the grilles with regard to the wind. Instead of bringing out the pipes at different heights, recommendations have been made to bring them both out at the upper portion of the manhole so as to be certain of emptying the more dangerous gas which is concentrated under the ceiling.

Dissymmetry of the grilles may be obtained, for instance, in the case of square manholes by placing the grilles along the two walls forming an angle, but this is evidently an exceptional use. It has been suggested that the grilles should be inclined slightly towards or away from another ; this procedure apparently is not possible on level footways. Mr. Chappuis has brought forward the use of grilles with inclined bars which he has called " wind traps." The principle of these grilles, which are fixed two by two in such a way as to present their bars to the wind in the opposite direction, permits of making use of a considerable part of the wind force in the ventilating pipes, reaching as much as 30 per cent. of the value of the wind at ground level.

Two models of grilles with inclined bars have been used by the Telephone Service of Paris. One

is similar to that shown in Fig. 3. This model, of which 500 have been used, has shown certain faults due to the poor adhesion of the cement to the carborundum in the bars which form a truncated V.

Another model of grille with inclined bars is shown in Fig. 4, and a smaller number of these have been used in order to examine the deterioration in service and the non-skid qualities. These have shown better results: there is no risk of slipping nor of deterioration. In addition, this model affords a larger passage for the gases than the grille with carborundum bars. This has permitted the use of ventilating pipes of 30 cm interior diameter and 10 mm thick in the same frames.

The most recently constructed underground manholes of Paris have been fitted with these devices to provide ventilation.

Conclusions. Ventilating equipments with two orifices* fitted with grilles with inclined bars and ventilating pipes terminating directly under the ceiling of the manholes, and with a sufficiently large diameter (20–30 cm) appear to be really efficient in evacuating dangerous gas mixtures†. In addition they help to keep the manhole dry when it is of watertight construction and when water does not reach it by the conduits or the cover, but simply percolates through the concrete. They are not, however, in general use.

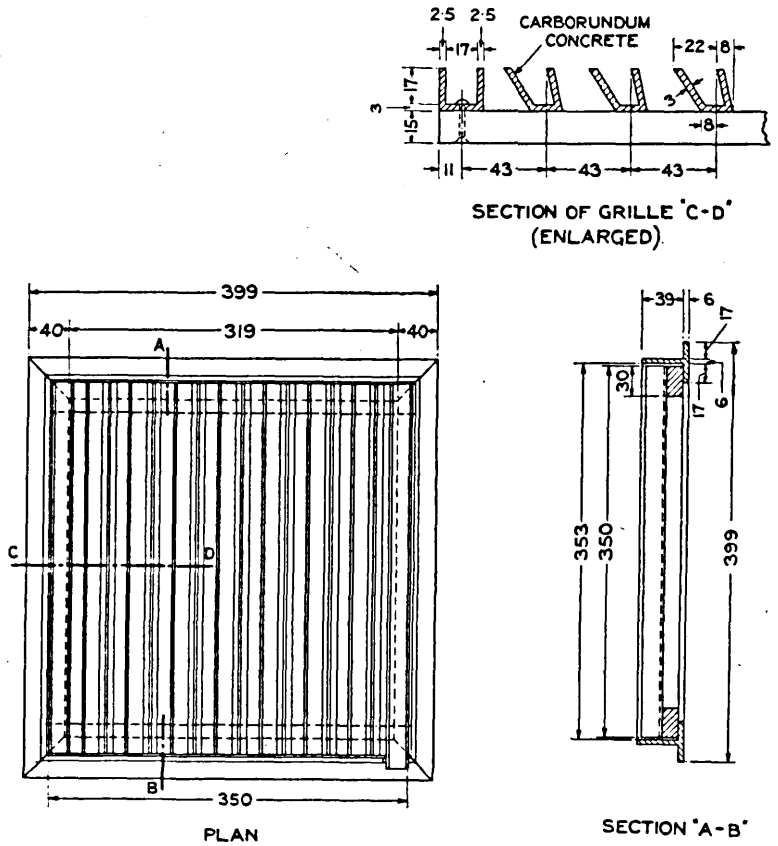


FIG. 3.

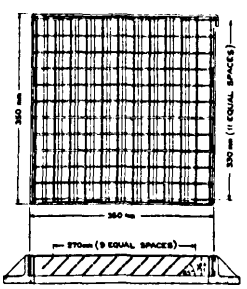


FIG. 4.

Under the roadway the weakness and deterioration of the grilles and sumps render their use very difficult. It is the same under the gravel footway, where due to the deterioration of the grilles and sumps it is difficult to maintain them. On the other hand, they are perfectly suitable for paved footways, such as are met with on cable routes in towns.

* Devices with a single orifice are absolutely inefficient, and their use, therefore, should be condemned.

† For 230 days of the year, when one can reckon on a wind of 2.5 m. per second, the device is capable of clearing the products of an escape reaching 11 cubic metres per hour without the atmosphere of the manhole reaching the lower limit of inflammability. For the other days of the year, it is still possible to reckon on satisfactory efficiency due to density and temperature effects.

The use of static ventilating devices, although assisting greatly towards security, must not be allowed to dispense in any way for the manholes to which they are fitted with the application of the standard security measures laid down for the carrying out of underground work, nor the supervision and periodic inspection.

III. Table, correlating the graduation of the psophometer, called for in the C.C.I.F. specification, with that of the psophometer used by the American Telephone & Telegraph Company.

The C.C.I.F. considers that the psophometer should be so graduated that, when an 800 p : s voltage is applied to its input terminals, the reading on the instrument should be the effective value of the applied voltage. On the other hand, the psophometer used by the American Telephone & Telegraph Company, is graduated in decibels. Its zero point represents a condition, where a 1000 p : s voltage is applied to the input terminals across a pure resistance of 600 ohms, which dissipates 1 $\mu\mu W$, or $10^{-12} W$. A reading of zero decibel on the American instrument therefore corresponds to 0.0245 mV at 1000 p : s.

The voltage at 800 p : s, which would correspond to a reading of zero decibel is :

$$0.0245 \times 1840/1000 = 0.0452 \text{ mV},$$

the reason being that the " weighted " values, due to the filter network, are 1000 at 800 p : s and 1840 at 1000 p : s (See page 116, Vol. II).

Thus, the correlation between a reading of N decibels on the American instrument and a reading of U mV on the C.C.I.F. psophometer is in accordance with the equation :

$$N = 20 \log_{10} U/0.0452$$

The table below gives the relation between the graduations (N) of the American instrument and the noise E.M.F.

N Decibels with reference to 10^{-12} W at 1000 p : s	U Milli-Volts at 800 p : s	N Decibels with reference to 10^{-12} W at 1000 p : s	U Milli-Volts at 800 p : s	N Decibels with reference to 10^{-12} W at 1000 p : s	U Milli-Volts at 800 p : s
10	0.14	30	1.43	50	14.3
11	0.16	31	1.60	51	16.0
12	0.18	32	1.80	52	18.0
13	0.20	33	2.02	53	20.2
14	0.23	34	2.27	54	22.7
15	0.25	35	2.54	55	25.4
16	0.28	36	2.85	56	28.5
17	0.32	37	3.20	57	32.0
18	0.36	38	3.60	58	36.0
19	0.40	39	4.03	59	40.3
20	0.45	40	4.52	60	45.2
21	0.50	41	5.05	61	50.5
22	0.57	42	5.70	62	57.0
23	0.64	43	6.40	63	64.0
24	0.72	44	7.15	64	71.5
25	0.80	45	8.05	65	80.5
26	0.90	46	9.05	66	90.5
27	1.0	47	10.0	67	100
28	1.13	48	11.3	68	113
29	1.27	49	12.7	69	127

BIBLIOGRAPHY ON TELEPHONE TRANSMISSION

ABBREVIATIONS

(a) German Publications

A. f. E.	Archiv für Elektrotechnik.
E. F. D.	Europäischer Fernsprechdienst.
E. N. T.	Elektrische Nachrichtentechnik.
E. T. Z.	Elektrotechnische Zeitschrift.
F. i. W.	Das Fernsprechen im Weitverkehr.
Fk.	Das Fernkabel.
M. TRA.	Mitteilungen aus dem Telegraphentechnischen Reichsamt.
Ph. Z.	Physikalische Zeitschrift.
S. Z.	Siemens-Zeitschrift.
T. u. F. T.	Telegraphen- und Fernsprechtechnik.
V. G. N.	Veröffentlichungen aus dem Gebiete der Nachrichtentechnik.
W. V. S. K.	Wissenschaftliche Veröffentlichungen aus dem Siemenskonzern.
Z. f. t. P.	Zeitschrift für technische Physik.

(b) English Publications

B. Repr.	Bell Reprint.
B. S. T. J.	Bell System Technical Journal.
B. T. Q.	Bell Telephone Quarterly.
Elec.	The Electrician.
Electrochem. Soc.	Electrochemical Society.
El. Com.	Electrical Communication.
El. Eng.	Electrical Engineering.
El. Rev.	Electrical Review.
El. W.	Electrical World.
Eng.	Engineering.
G. E. R.	General Electric Review.
I. P. O. E. E.	Institution of Post Office Electrical Engineers.
J. A. I. E. E.	Journal of the American Institute of Electrical Engineers.
J. A. S. A.	Journal of the Acoustical Society of America.
J. Fr. I.	Journal of the Franklin Institute.
J. I. E. E.	Journal of the Institution of Electrical Engineers.
J. S. M. P. E.	Journal of the Society of Motion Picture Engineers.
Mech. Eng.	Mechanical Engineering.
P. O. E. E. J.	Post Office Electrical Engineers' Journal.
Phys. Rev.	Physical Review.
Pr. I. R. E.	Proceedings of the Institute of Radio Engineers.
Pr. Ph. S.	Proceedings of the Physical Society of London.
T. A. I. E. E.	Transactions of the American Institute of Electrical Engineers.
W. P.	World Power.
W. W. & R. R.	Wireless World and Radio Review.

(c) French Publications

A. P. T. T.	Annales des Postes, Télégraphes et Téléphones.
B. P. T. T.	Bulletin de l'Administration française des P.T.T.
B. S. F. E.	Bulletin de la Société française des Electriciens.
B. S. I. E.	Bulletin de la Société des Ingénieurs Electriciens.
B. Techn. T. T. suisses	Bulletin technique de l'Administration des Télégraphes et Téléphones suisses.

Ecl. Elec.	Eclairage Electrique.
Gén. Civ.	Génie Civil.
Ind. Elec.	Industrie Electrique.
Ind. V. F. et T. A.	Industrie des Voies ferrées et des Transports automobiles.
Journ. Phys. et Rad.	Journal de Physique et le Radium.
Journ. Télégr.	Journal Télégraphique (publié par le Bureau International de l'Union Télégraphique).
Lum. Elec.	Lumière électrique.
Onde Elec.	Onde électrique.
Rad. Elec.	Radioélectricité.
R. G. E.	Revue Générale de l'Electricité.
R. T. T. et TSF.	Revue des Téléphones, Télégraphes et T. S. F.
Tech. Mod.	Technique moderne.
T. S. F. Mod.	T. S. F. moderne.

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