THE

Telegraph and Telephone Journal.

VOL. XII. FEBRUARY, 1926. No. 131.

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Subscription: To the public, 5s. 0d. per annum, including postage. To the Staff, 3s., including free delivery to any Post, Telegraph, or Telephone Office. Single Copies: To the public, 4d. each, or post free 5d. To the Staff, 3d. each. Orders should be sent to the Managing Editor, TELEGRAPH AND TELEPHONE JOURNAL, *G.P.O. North, London, E.C.*1.

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TELEGRAPH AND TELEPHONE MEN AND WOMEN.

XXV.—
MR. W. J. MEDLYN.

MR. W. J. MEDLYN, the superintending engineer for the South Lancashire Engineering District, is a Cornishman by birth. He entered the Post Office service as a learner at Falmouth in 1884, and, in the following year, received his appointment as telegraphist at Cardiff. Then came a brief interlude of service with the Direct Spanish Telegraph Company at Falmouth, a return to Cardiff Post Office, and, in 1891, appointment as clerk in the engineering department at Cardiff. From 1892 to 1896 he was employed at various coast repeater stations, followed by five years' service as sectional engineer at Leeds.

In 1901, when the Post Office was establishing a telephone system in London in competition with that of the National Telephone Company, Mr. Medlyn was transferred to the engineer-in-chief's office, where his chief work consisted of the redesign of the Post Office trunk switchboards and signalling system. The London Trunk Exchange, which was opened in 1904, and other trunk exchanges of the same type, are standing memorials of Mr. Medlyn's labours. One of Mr. Medlyn's achievements was the invention of the three-minute time check which bears his name.

Since 1908 Mr. Medlyn has been stationed at Manchester, at first as assistant superintending engineer of the old north-western district, and, since 1913, as superintending engineer of the present district.

Mr. Medlyn takes an active interest in the proceedings of the Institute of Electrical Engineers, and is at present vice-chairman of the north-western centre of the Institute.

Mr. Medlyn has an apparently unlimited capacity for work, and if he has a favourite motto at all, it must surely be the Biblical injunction that whatsoever the hand finds to do should be done with all might.

THE WORK OF THE PARIS TELEGRAPH CONFERENCE, 1925.*

BY F. STRONG, *Accountant-General's Dept.*

PRIOR to 1865 the international telegraph services in Europe were, broadly speaking, regulated by two separate conventions concluded between two different groups of countries. The Congress of Paris, in 1865, was convoked in order to negotiate a Convention which would be susceptible of general application, and the result of this Congress, which was attended by representatives of some 20 States, was the birth of the International Telegraph Union. A Convention or Treaty was drawn up, and this was completed by two annexes, one showing the tariffs agreed upon, and the other detailing the Regulations to be observed in the conduct of the international telegraphic services.

Congresses followed at Vienna 1868, Rome 1872, and lastly at St. Petersburg 1875, where there was manifested a general desire to make the Convention an act "stable, simple, practical, general, and of a character to facilitate adhesions," by recasting it so that the Convention proper should include only those provisions which were fundamental and invariable, those dispositions, including tariffs, which might be subject to modification from time to time being transferred to the Règlement or Service Regulations. This was done, and as a result the Convention of St. Petersburg has remained unchanged from 1875 down to the present time, subsequent re-unions having had the character of Administrative Conferences convoked to consider modifications of the Tariffs and the Règlement.

The Convention lays down among other things the right of all persons to correspond by means of the international telegraph system; the right of an Administration to stop any telegram dangerous to the State; the bases of tariffs; and the right of Administrations to conclude between themselves special arrangements not affecting the interests of other States.

The Service Regulations annexed to the Convention cover the general organisation; the procedure to be followed in transmitting telegrams; the special services admitted; and the rules for accounting for the charges.

The Conference of this year, which was the first to be held since 1908 and the eleventh since the foundation of the Union, was attended by representatives of 78 Telegraph Administrations and of 44 Cable and Wireless Companies.

The rule is one Administration one vote, and Companies can make propositions but cannot vote. The provision for a single vote for each Administration is, however, subject to the qualification that in the case of there being different Administrations of one Government, the intention to exercise additional votes in respect of each Administration should be notified in advance of the Conference, and each Administration should have a special and distinct representation. The Conference witnessed the introduction of three additional votes in this way, as the Portuguese Colonial Administration, which had hitherto attended as one Administration only, divided itself into four, viz., firstly Angola, secondly Portuguese Guinea and adjacent islands, thirdly Portuguese possessions in India, China, and East Indies, fourthly Mozambique. It would be interesting to speculate on what would be the number of the representatives of the British Empire if a search were made among our political institutions for separate Administrative units ranging from the Friendly Islands to the Isle of Man.

With 17 years' arrears to overtake, with the political changes produced by the War, and with the developments due to wireless telegraphy and the expansion of telegraphic communications generally, a keen and expectant gathering assembled.

The first business of the Conference after the opening formalities had been observed was the reading and adoption of the standing orders to govern its deliberations. By these orders, which were passed without any remark, the French language is used for the discussions and the acts of the Conference. At a later stage of the Conference, a resolution was proposed by the representatives of Japan for the admission of English as a second language, to be used for all purposes of the international telegraph services. The delicate task of the mover of the resolution in proposing in the very temple of the cult itself the introduction of a rival deity was performed with tact, but the hard fact was brought out that English is supreme in the commercial relations of the world. That being so, what more natural than to utilise it as a vehicle of expression by a service so intimately associated with commerce as the international telegraph system. The resolution received only two votes (Japan and China), not because the claims of German, Italian, and Spanish were also urged, and not perhaps out of courtesy to the country entertaining the Conference. The resolutions did not in terms propose to admit English into the deliberations of future Conferences themselves, but the inference, if the resolution had been carried, would have been obvious; and there was probably a vague consciousness among the delegates that a certain simplicity and distinction would be lost if the Conference became bilingual. The proximity of the Radiotelegraph Conference to be held at Washington was also very present in the minds of the delegates, and it may have been felt that the real decision could be conveniently deferred, to be taken later under the auspices of the New World.

The agenda consisted of 1,200 propositions which had been formulated by the different Administrations, and others had been brought along by various Delegations, apparently to make sure that our stay in the "Gay City" might not be unduly brief; and the consideration of these occupied the delegates for a more or less strenuous eight weeks. In accordance with precedent five Committees were appointed under the head of Convention, Tariffs, Regulations (or Traffic procedure), Telephones, and Drafting, to examine the various proposals and to make recommendations to the full Conference. The presidency of the Conference is ascribed to the representative of the country which has issued the invitations, but the chairmanship of the Committees is not governed by the standing orders. On former occasions the appointments have been regarded as being within the gift of the country acting as host. A democratic innovation was made at Paris in leaving the choice of chairman to election by the members of each Committee respectively, it being claimed that this was the procedure which had been followed by the Postal Congress. It may, however, be explained that under either system the choice of chairman is arranged between the representatives of the dominant countries, the principal difference being that under the system of election by the individual Committees it is necessary for "spontaneous" nomination of the chairman designate to be arranged beforehand. If one is allowed to add that the adoption of the system of election enabled an unwritten rule that the entertaining Administration should not enjoy chairmanship of a Committee as well as presidency of the full Conference to be set aside, it will be understood that the compliment to the example of the Postal Congress was more apparent than real.

The Committees were in the main rather unwieldy; indeed, at many of their sittings there were as many delegates present as at the sittings of the full Conference, and the suite of Committee rooms provided by the French Government was neglected in favour of the main Conference hall. In these conditions it became necessary to refer the more intricate or contentious questions to sub-Committees of small, that is to say, relatively small, numbers.

I propose to deal briefly with only one or two aspects of the work of each Committee.

It is scarcely to be wondered at that a Convention drafted some 60 years ago, when international electrical communication was in its infancy, could not be regarded as wholly covering the ground at the present day. Rather is it matter for marvel that it should have been so well drafted as to have been susceptible—with possibly some straining of terms here and there—of general application under modern conditions; and while several Administrations had formulated proposals for amendment of the Convention, none of these proposals was of a fundamental character. The Committee charged with their examination soon came to what was the only possible decision, namely, that an *Administrative* Conference had no power to modify the Convention. There was, however, some tendency to press for the calling of a special Conference at an early date for the sole purpose of revising the Convention of 1875; but it was ultimately agreed that the real desideratum was to endeavour to secure the amalgamation of the Telegraph Convention with the Radiotelegraph Convention, which has so far led an independent existence with separate Conferences. The Telegraph Convention and Regulations apply to all forms of wire telegraphy; the existing Radiotelegraph Convention and Regulations were the result of a Conference held in London in 1912, and were intended primarily to deal with the wireless telegraph services between ships at sea and stations on land. Certainly, a general provision was included to meet a particular point regarding wireless telegraphic communication between two countries, but such services were then undeveloped, and no detailed regulations were considered. In the general conduct of a wireless telegraphic service between two countries, the procedure for the exchange of telegrams, the bases of tariffs, and so forth, follow in general the lines of the Regulations applicable to the ordinary telegraph services; but technical matters, such as the allocation of particular wavelengths, would appropriately fall to be considered in relation to the Wireless Regulations.

It was resolved, therefore, that the Telegraph Conference of Paris should give formal expression to its opinion that, after the next Radiotelegraph Conference, the Contracting Governments should consider the best way of modifying in Congress the Telegraph Convention of 1875, and of introducing into it the provisions of the Radiotelegraph Convention.

There the matter rests for the moment. The next Radio Conference will be held at Washington probably in the Spring of 1927, when it is hoped that that Conference will pass a resolution in similar terms. The way will then be clear for the desired fusion of the two Conventions into one general Electrical Communications Convention. One wonders if that will exist another 50 years before the developments of science and invention break it down. Probably not, though the necessary disruptive element does not seem to have yet risen above the horizon unless it is radiotelevision.

The next question to which I propose to refer is one which came within the purview of the Tariffs Committee, and is that of the conditions governing the use of secret or code language in commercial telegraphic correspondence. Those present who have had occasion to occupy themselves with this subject will, no doubt, excuse some preliminary explanation for the benefit of others who, not having had to trouble about this particular problem, have much reason to "Thank the goodness and the grace That on their birth have smiled."

* Paper read to a meeting of members of the Accountant-General's staff, Dec. 15, 1925.

Commercial codes are not of the romantic kind familiarised in the "Gold Bug" and other stories, in which the letters of a message are substituted by signs or figures in accordance with a key. No novelist could decipher a commercial code word without the code book. "Abafeseidl," for example, is a code word taken from a code book in which the meaning is given as "Make offer for inferior quality wheat payment by three months' cheques on first-class banker, or cash less discount at the official bank rate, at choice of buyer."

The interest of the telegraph service is two-fold: first, to have rules of construction which will keep within measure the difficulties of the counter clerk and the telegraphist; second, to fix an equitable charge.

It will be readily appreciated that any group of letters or syllables which is meaningless to the telegraphist will be more liable to error in transmission than a word of equal length which is recognisable. Further, unless the group can be memorised at a glance, the speed of transmission is reduced, and in addition a greater strain is imposed on the operator.

In these circumstances, then, it has been the object of Telegraph Administrations in the past to impose such conditions as would give to the public a reasonable facility, while at the same time securing that code language should not be of such a character as would result in inaccurate transmission or in a general slowing-down of the service.

The question has, however, been one of which a satisfactory solution has been singularly difficult to find. At the London Conference of 1903, a daring step was taken by admitting in addition to any dictionary word, however recondite, the use of code language composed of artificial words; but it was a condition that such synthetic words should be pronounceable according to the usage of certain specified languages, viz., English, French, German, Italian, Spanish, Portuguese, Dutch, or Latin. This opened the flood-gates for dubious combinations, and the next Conference, that of Lisbon of 1908, found it necessary to dam the torrent by establishing an expert Committee to which code-makers could submit their codes for certification.

The War interrupted the work of this Committee, and free play was again given to new codes containing many harassing combinations not even remotely fulfilling the condition as to pronounceability. The keen competition between the various private telegraph enterprises (and between private enterprises and those which are State-controlled) resulted in the acceptance of combinations of letters which certainly could not be considered as fulfilling the rules. The result has been a progressive tendency to employ code words which are more and more difficult to transmit, and give rise to an increasingly large number of errors and repetitions.

With the view of remedying the unsatisfactory state of things, a number of proposals were submitted by various Administrations. Some advocated the resumption of the examination and certification of codes; others included the abolition of all restrictions as to the construction of code words coupled with a heavy surcharge; others again leaned to a policy of imposing some arbitrary order of vowels and consonants with the view of reducing the practical difficulties in handling; while others proposed that the limitation of length should be 5 letters instead of 10.

In the discussions which ensued it was ultimately agreed that the resumption of the certification of code books was undesirable. Their examination was extremely onerous and costly; agreement on a clearly-defined standard of pronounceability was hardly practicable; and even though certificates may have been issued, it was in practice virtually impossible to impose any check on individual code words.

The proposal which secured most support was to shorten the length to 5 letters but to permit any 5 letters to be used without regard to pronounceability. The existing 10-letter code words could be cut in half by the users and sent as two consecutive words, so that the adoption of the proposal would not invalidate any large proportion of present-day code books. Furthermore, it was thought that two groups of 5 letters could be transmitted with less difficulty, and therefore a lower average of error, than one group of 10 letters. Clearly, however, the rates would have to be revised to avoid an increase in charge of 100%, and the proposal was, no doubt, the more attractive as the re-modelling of the tariff schedules might give scope for increasing indirectly the revenues of the Administrations.

No real evidence was available as to the probable saving, if any, to the telegraph service in the transmission of two 5-letter groups instead of one 10-letter group; nor were there any data as to the economy which the public might be able to effect from the larger supply of code words made available by the abandonment of the condition as to pronounceability. The revision of the tariffs, if the proposal were adopted, would therefore have been guesswork, and it became obvious that a decision ought not to be taken without a fuller investigation into the matter than could be given at the Conference. It was perforce relegated to a special inter-Conference Committee to explore exhaustively.

This Committee of Study, which consists of representatives of 15 Telegraph Administrations, held its first meeting at the close of the Conference and settled its programme of work. A questionnaire and form of statistics were prepared for circulation to all Telegraph Administrations and Companies, and communications to code-makers and to the Press were drafted. The Committee will meet to consider the answers and statistics when these are ready, and it is hoped that the study of this problem may be completed by the end of next year. The final report of the Committee is to be considered at the first Conference which meets after presentation.

(*To be continued.*)

THE TELEPHONE DEVELOPMENT OF THE WORLD AT THE END OF 1924.

By W. H. GUNSTON.

(*Continued from page 78.*)

Erratum.—In the first paragraph of the first half of this article (p. 77) the increase of telephones in France was given as 521,559 instead of 54,559. This figure was, however, correctly given under the heading "*France*" at the top of page 78.

TABLE D.—NORTH AMERICA.

	Telephones.	Population thousands.	Population per telephone.
United States (15,369,101)...	16,159,550	108,000	6.6
Canada (1,009,203)... ...	1,083,964	8,800	8.1
Mexico (50,360)	53,000	16,000	302.
Cuba (47,786)	52,000	3,000	60.
Other West Indies, est. ...	3,000	—	—
Central America (18,018) ...	18,500	—	—
	17,370,000	146,000	8.

United States.—The telephone systems of the States are in the hands of numerous companies of which the principal are those known as the "Bell" corporations associated with the American Telephone & Telegraph Company of New York—as will be seen from the following statement:—

	Telephones.
"Bell" system	11,242,318
System in connexion with the "Bell" ...	4,664,232
Independent systems...	253,000
	16,159,550

The total has increased by upwards of 790,000 since 1923, an increase of nearly 5%. It will be seen from Tables F and H that there were 139 cities in the United States with upwards of 10,000 telephones, and 16 with upwards of 100,000.

Canada.—While the telephone system here is administered by upwards of 2,000 companies, by far the most important administrations are the "Bell" companies, operating in Quebec, Ontario, British Columbia, and Nova Scotia, and the Governments of Manitoba, Saskatchewan and Alberta. The following is the development of Canada by provinces:—

	Telephones.
Ontario	476,054
Quebec	208,269
Saskatchewan	98,056
British Columbia	89,310
Alberta	67,657
Manitoba	66,965
Nova Scotia	39,265
New Brunswick	28,307

The total increase in Canada is 34,761 or 5.6%.

Mexico, West Indies, Central America.

The figures are obtained from a very reliable American source. Various companies operate in Mexico and the West Indies.

TABLE E.—SOUTH AMERICA.

	Telephones.	Population 1,000's.	Population per telephone.
Argentine (157,041) ...	170,000	8,700	51
Bolivia (2,706) ...	2,700	—	—
Brazil (93,846)	96,000	30,650	319
Chile (30,272)	30,000	3,800	127
Colombia (11,463) ...	12,000	—	—
Ecuador (4,712) ...	5,000	—	—
Guiana (2,300)	2,300	—	—
Paraguay (392)... ...	400	—	—
Peru (9,140)	9,200	—	—
Uruguay (24,184) ...	24,000	1,400	58
Venezuela (10,550) ...	10,500	—	—
	362,000	64,000	177

The figures in brackets show the total number of telephones in existence in 1923.

The South American telephone systems are chiefly operated by private companies, except in British, French, and Dutch Guiana. There are also about 2,000 State telephones in Ecuador. The figures for 1924 in the foregoing statement (E) are estimated on those for 1923.

AUSTRALASIA.

	Telephones.	Population (thousands).	Population per Telephone.
Australia (300,192) ...	343,151	5,633	16
New Zealand (106,764)...	115,549	1,320	11
Hawaii (16,816) ...	17,300	256	15
Other places	2,000	—	—
	478,000		

Australia (*State System*).—Nearly 43,000 telephones were added in 1924, an increase of 14%. The following is the development of the various Colonies :—

	Telephones.
New South Wales	133,568
Victoria	106,553
Queensland	40,878
South Australia	34,372
Western Australia	17,390
Tasmania	10,390

Sydney and suburbs had 80,900 telephones; Melbourne, 67,734; Adelaide, 22,778; and Brisbane, 16,945.

New Zealand (*State System*).—The Dominion is, telephonically speaking, the fourth best developed country in the world. 8,785 stations were added during 1924, an increase of nearly 8%. Wellington had 13,801 telephones, Auckland 12,781, and Christchurch 9,632.

Appended are statements showing the development of the chief cities of the world.

TABLE F.—CITIES WITH 75,000 TELEPHONES AND UPWARDS.

	Telephones.
New York	1,315,368
Chicago	741,883
*London Telephone Area	439,223
Boston and suburbs	393,161
*Berlin (Greater)	392,172
*London (Administrative County Area) ...	353,865
Philadelphia	332,025
Los Angeles	260,567
*Paris	227,968
Detroit and suburbs	210,429
San Francisco	201,515
Cleveland and suburbs	171,666
Pittsburg „ „	170,119
St. Louis „ „	163,530
Toronto	142,292
Cincinnati and suburbs	131,541
*Hamburg-Altona	127,783
*Copenhagen	125,307
Montreal and suburbs...	123,994
*Tokio	119,885
Washington	118,278
Kansas City and suburbs	117,057
Milwaukee „ „	112,254
Baltimore	110,783
Minneapolis	110,420
*Stockholm	102,829
Buffalo and suburbs	95,783
*Vienna	94,318
Oakland and suburbs	90,474
Seattle	90,939
*Buenos Aires (1923)	87,213
*Sydney and suburbs	80,900

Portland (Oregon) 79,221 and Newark (N.J.) and suburbs 77,040, *Osaka 76,426 and Indianapolis 75,523.

All the cities except those marked with an asterisk are in North America.

TABLE G.—LIST OF CITIES (OR TELEPHONE AREAS) WITH UPWARDS OF 500,000 INHABITANTS AND A RATIO OF NOT MORE THAN 25 INHABITANTS PER TELEPHONE.

San Francisco	3.3
Washington	3.9
Chicago	4.0
Los Angeles	4.2
Boston and suburbs	4.3
Toronto	4.3
Kansas City and suburbs	4.6
New York	4.6
†*Stockholm and suburbs*	4.7
Cincinnati and suburbs	5.0
Milwaukee and suburbs	5.2
Pittsburg and suburbs	5.4
Philadelphia	5.9
Buffalo	6.1
Copenhagen and suburbs	6.2
St. Louis and suburbs	6.3
Cleveland and suburbs	6.3
Montreal and suburbs	6.4
Detroit and suburbs	6.5
Newark (New Jersey) and suburbs	7.0
Baltimore	7.2
Berlin (Greater)	10.2
Jersey City and suburbs	10.6
Hamburg-Altona, &c.	10.8
**Munich*	11.0
**Leipzig*	11.5
**Cologne*	12.0
Sydney and suburbs	12.1
Melbourne and suburbs	12.3
London (Adm. County)	12.7
**Dresden*	13.0
**Breslau*	13.0
Paris	13.3
**Brussels*	14.6
**Rotterdam*	16.0
Tokyo	19.0
Vienna	19.0
Buenos Aires	19.0
**Amsterdam*	19.6
Osaka	21.5
Manchester and Salford	22.1
Glasgow	23.4
Liverpool	23.5

* The telephone statistics for these cities probably include those for the suburbs, for which it is difficult to get close estimate of the population.

† The ratio for the City of Stockholm proper (380,503 inhabitants) is 3.7.

The cities whose names are *not* in italics are all in North America.

TABLE H.—CITIES WITH UPWARDS OF 10,000 TELEPHONES. (THE FIGURES IN BRACKETS REPRESENT THOUSANDS.)

U.S.A. :—(The principal cities are mentioned in table F)	139
Germany :—Berlin (392), Hamburg (127), Munich (57), Leipzig (53), Cologne (52), Frankfurt (48), Dresden (46), Breslau (39), Düsseldorf (32), Stuttgart (30), Nuremberg (28), Bremen (25), Hanover (28), Chemnitz (19), Essen (18), Magdeburg (18), Mannhein (20), Königsberg (17), Duisburg (17), Stettin (15), Dortmund (15), Elberfeld (13), Barmen (12), Halle (12) ...	24
Great Britain :—London (439), Manchester (58), Glasgow (47), Liverpool (45), Birmingham (36), Edinburgh (19), Leeds (16), Newcastle (16), Bradford (15), Hull 14), Sheffield 14), Cardiff (12), Bristol (12), Nottingham (11), Belfast (11)...	15
Canada :—Toronto (142), Montreal (123), Vancouver, Winnipeg, Ottawa, Hamilton, Quebec, London, Edmonton, Halifax (N.S.) Victoria (B.C.)	11
Japan :—Tokyo (119), Osaka (76), Kobe (22), Kyoto (20), Nagoya (18), Yokohama (13)	6
Australia :—Sydney (80), Melbourne (67), Adelaide (22), Brisbane (16), Perth (10)	5
France :—Paris (227), Marseilles (17), Lyons (15), Bordeaux (10) ...	4
Switzerland :—Zurich (24), Basle (14), Geneva (14), Berne (12) ...	4
Sweden :—Stockholm (102), Göteborg (27), Malmö (14)	3
Netherlands :—Amsterdam (39), Rotterdam (30), The Hague (27) ...	3
Belgium :—Brussels (47), Antwerp (19)	2
Italy :—Milan (17), Rome (14)	2
Russia :—Moscow (29), Leningrad (21)	2
Spain :—Madrid, Barcelona	2
New Zealand :—Wellington (13), Auckland 12)	2
South Africa :—Johannesburg (16), Cape Town (12)	2
China :—Peking (34), Shanghai (21)	2
Argentine :—Buenos Aires (87)	1
Austria :—Vienna (94)	1
Brazil :—Rio de Janeiro (32)	1

Chile :—Santiago (10)	1
Cuba :—Havana (34)	1
Czecho-Slovakia :—Prague (25)	1
Danzig :—Free City of (13)	1
Denmark :—Copenhagen (125)	1
Egypt :— Cairo (13)	1
Hungary :— Buda Pest (32)	1
India :—Calcutta (10)	1
Ireland :—Dublin (13)	1
Mexico :— Mexico (27)	1
Norway :— Oslo (37)	1
Poland :—Warsaw (32)	1
Portugal :—Lisbon (13)	1
Rumania :— Bucarest (10)	1
Uruguay :—Monte Video (14)	1
	246

Liege, Constantinople, Alexandria, Bombay, and Riga are all approaching a total of 10,000 telephones.

Of these 246 cities, 152 are in North America, 71 in Europe, 9 in Asia, 7 in Australasia, 4 in South America and 3 in Africa.

ELECTRICAL INTERFERENCE WITH RADIO RECEPTION.

WE print below an extract from an interesting circular which has been issued recently by the Bureau of Standards in Washington. Although it does not throw any additional light on the subject, it shews in a collected form the general position at present, and especially the difficulties of preventing any interference with broadcast reception.

"Radio reception is, in some localities, seriously disturbed by interference arising from electrical apparatus in the vicinity. A brief outline of the sources of such interference and the methods usually in mitigation is given herein. The only general remedy for electrical interference is co-operative effort on the part of users of radio and users or owners of the electrical sources of disturbance to reduce or eliminate the causes of the trouble.

Much of the work in mitigation of electrical interference results in an improvement in the operation of the electrical devices or supply lines, and is thus a double gain. There are, however, some electrical devices which, even when in perfect working order, cause disturbances which result in interference with radio reception. *In many cases it is possible to provide filters, shields,* chokes, etc., either at the source of disturbance or at the receiving set, which do much to relieve the difficulties.

Part of the disturbance from electrical devices is practically inevitable, and must be regarded, like atmospheric disturbances, as part of the inherent *limitation of radio reception. In other words, the limitation upon radio* reception is not only the distance and the power of the transmitting stations and the sensitiveness of the receiving set, but also the omnipresent background of slight electrical disturbances which drown out signals below a certain intensity. This background of electrical disturbances is the underlying reason why reception from local stations is inherently superior to reception from distant stations.

Power-Line Induction.—A frequent cause of interference is the presence of alternating-current power wires near the antenna or receiving set. Low-frequency voltages (usually 60 cycles) are induced, and the resultant current flowing in the receiving circuit causes a "humming" sound in the telephone receivers. The low pitch of the hum will usually identify this source of interference. A method of eliminating or at least reducing the magnitude of this interference is to place the antenna as far as possible from the wire lines and at right angles to them. When the interference cannot be eliminated by such means, the proper choice of a receiving set may help. An inductively-coupled (two-circuit) receiving set is less susceptible to such interference than a single-circuit set. The use of one or more stages of radio-frequency amplification should also help to filter out the audio-frequency interference. It has been suggested that audio-frequency interference might be shunted around a receiving set having a series antenna condenser by connecting between the antenna and ground terminals of the set a high resistance, which will offer lower impedance to the audio frequency than will the receiving set itself.

Sparking Apparatus.—Sparks are produced in the normal operation of many types of electrical apparatus (such as motors, doorbells, buzzers, gasoline engines, x-ray apparatus, violet-ray machines, some forms of battery chargers, rural telephone ringers, heating pad thermostats). Sparks are also sometimes produced at defective insulators, transformers, etc., of electric wire lines. *Sparks usually give rise to electric waves which travel along the* electric power wires, and by them are radiated out and are then picked up by radio receiving sets. The noise thus produced in a radio set may come from a disturbance which has travelled several miles along the electric power wires.

One remedy for such types of interference is to eliminate the spark. This is possible if the spark is an electrical leak and not necessary to the operation of the machine in which it occurs. Many very useful electrical machines, however, require for their operation the making and breaking of electrical circuits while they are carrying current, and whenever this happens a spark is produced. It is impossible to eliminate these machines, so that it is necessary to make the spark of such nature or so arrange the circuits that the radio-frequency current is reduced or prevented from radiating.

To prevent the radio-frequency current produced by a spark from getting on to the lines connecting the sparking apparatus some form of filter circuit is necessary. A condenser (1 microfarad, more or less) connected across the sparking points will short circuit a considerable amount of the radio-frequency current, or a condenser connected from each side of the line to ground.* will serve the same purpose. A choke coil in each side of the line in addition to the condensers connected to ground forms a simple filter circuit which should prevent frequencies in the broadcast range from getting on the line. A *high inductance (choke coil) or high resistance connected in each side of* th line changes the characteristics of the circuit so as to reduce the amount of power radiated. If such filter circuit is not effective or is impractical, the apparatus may in some cases be surrounded by solid metal sheet or wire screen which is thoroughly grounded. The screen should completely surround the apparatus. This may be difficult. For example, in shielding the ignition system of a gasoline engine the spark coils and all wires and other parts of the system must be enclosed in metal shields and these must be very well grounded.

Location of Source of Interference.—The first thing to do in tracing the source of trouble is to make sure that it is not in the receiving set itself. The next thing is to open the electric switch at the house meter; if the interfering noise is still heard in the radio set, the source is then known to be outside the house. It is then desirable to report the situation to the electric power company. Many of the companies have apparatus for the purpose of following up complaints of this kind. Usually a sensitive receiving set with a coil antenna is used to determine the direction from which the interfering noise comes, and this outfit is taken from place to place until the source is found. The location of such sources is often a very difficult and baffling undertaking. The trouble sometimes comes from a spark discharge over an insulator to ground, or between a pair of wires, or it may be that the wire is touching some object such as a tree, pole, guy wire, etc. Such a spark discharge is a loss of power to the operating company and a potential source of serious trouble, and for these reasons the company is probably more interested in finding and eliminating this type of trouble than the radio listener. Large leaks and sparks may often be observed at night, especially in wet weather. However, sparks which are too small to be readily noticed may cause serious interference to radio reception.

Commutators.—Where d.c. motors are in operation near a radio receiving set interference is sometimes caused, especially when the brushes on the motor are sparking badly. The sparking should be reduced as much as possible by cleaning the commutator and proper setting of the brushes. The remaining interference is sometimes overcome by placing two condensers (about 2 microfarads each) in series across the power supply line and connecting their midpoint to a good ground system. This is substantially as outlined above under "Sparking Apparatus."

Bell Ringers.—Another source of interference is the ringing machine used in rural telephone exchanges. Telephone engineers can reduce or eliminate interference by connecting a filter between the machine and the ringing keys; constants of a suitable filter are given on page 44 of *Radio Broadcast*, May, 1924.

Precipitators.—Many cases of radio interference have been caused by electrical precipitators which are used to prevent smoke and noxious fumes or material from leaving the chimney. The precipitator operates by establishing a highly-charged electric field inside the chimney of such a nature and direction that particles going up the chimney are charged and driven against the walls where they stick. Precipitators cause interference for the reason that the high voltage used in their operation is obtained from a rectifier which produces sparks and generates radio-frequency alternating currents as well as the direct current which the precipitators need. If the precipitator is so designed and arranged that the distance between the rectifier and the chimney is only a few feet or if the entire apparatus including all leads is housed in a metal building there is usually no trouble. But if the rectifier is separated from the chimney the wire which joins them forms a good antenna which will radiate and cause interference for 20 miles or more. Interference from these precipitators can be eliminated by placing a grounded wire screen entirely around these wires and thoroughly grounding the wire screen and the rectifier. If screening of the various parts is impracticable, damping resistances can be inserted at various points in the wire line which will reduce the amount of power radiated. Tuned circuits connected across the spark gap of the rectifier will assist by absorbing the radio-frequency power."

* When any connections are made to the power line, in order to avoid fire and personal injury, only apparatus that is carefully tested as to voltage and current-carrying capacity should be used, and the power company should be consulted before making the installation. Additions to the power lines should be made only by qualified persons.

NOTES ON TELEGRAPH PRACTICE.

BY G. T. ARCHIBALD.

XIII.—Concerning Telegraph apparatus used by the Post Office—Past and Present—Multiplex and Start-stop Printing Systems.

INTERESTING as is the record of manual Morse and Automatic telegraphic apparatus the story of multiplex printing systems is perhaps the most entrancing of all, and notwithstanding the remarkable progress made in this direction during the past twenty years it may safely be said that multiplex printing telegraphy is still in its infancy.

It was generally supposed until quite recently that the first multiplex system was that invented in 1852 by Mr. M. G. Farmer, of Boston, U.S.A. It is clear, however, from an article in "The Romance and History of the Electric Telegraph" by Mr. A. H. Roberts, published in Volume 17, Part 1, of the *Post Office Electrical Engineers' Journal*, that the honour belongs to Mr. A. V. Newton whose specification was registered in 1851. There is no evidence that Newton's multiplex ever received a practical trial, but his system provided for direct communication between more than two offices on the lines of the divided multiplex system now in use, and, for that reason alone, it is deserving of mention.

The Hughes system, the first printing telegraph system to be used commercially in this country, seems to have been neglected by the Post Office from 1870 until 1889 largely on account of the cost of the apparatus and the need for specially trained operators. In the latter year, however, the Post Office acquired the business of the Submarine Telegraph Company, and was brought into contact with Continental administrations which were already using the Hughes system and in course of time it was installed on all important Anglo-Continental routes. The Hughes was duplexed in 1893, the London—Paris circuits being the first to be so equipped. This development might have been expected to open up a new field for the system in the absence of any other efficient duplex printing apparatus, but it was not until 1908 that duplex Hughes was established on inland routes. Very satisfactory results were obtained between London and Glasgow, London and Liverpool, London and Manchester and Glasgow and Manchester, the output generally averaging about fifty telegrams per operator per hour, but individual hourly outputs of from seventy to ninety were not uncommon. Other systems capable of dealing with more traffic on a single line were then coming into prominence, and to the regret of many telegraphists all Hughes apparatus had been withdrawn from inland circuits by 1916. It is, however, interesting to note that most of the Hughes apparatus recovered at that time was used in France during the remainder of the war period.

It is to the Baudot multiplex system that we must look for the greatest development during recent years. This system in its simplex form was invented by Monsieur Baudot, a French engineer; it is founded on the Hughes printing and Meyer multiplex systems, and employs a five-unit code for the transmission of signals. The signals are transmitted to line by means of five keys, and an audible signal called the "Cadence" is used to indicate to the signalling operator the exact moment at which his signals may be transmitted. Each operator has the use of the line for a fraction of a second during each revolution of the brushes which travel synchronously over the distributor plates at the sending and receiving stations and which allot the line to the sending and receiving points. At the receiving end the incoming signals are distributed to the relative printing instruments, and a paper tape is pressed against the revolving type wheel when the received impulses have selected the appropriate combination, and the printing train is brought into operation.

The following description of the passage of the signals over the line of a multiplex circuit may be interesting to those who are not familiar with this form of working.

Assuming that the following messages are being signalled simultaneously on the four sending channels:—

(1) Come to-day if possible.
(2) Staying to-night.
(3) Shall arrive at noon.
(4) Congratulations and best wishes.

the letters and spaces are signalled over the line in the following order — CSSCOTHOMAANEYLG — ILRTN — AOGATDRU. etc. The letters, etc., are sorted out to the relative receivers at the distant office.

It is interesting to note that the development of the five unit code did not follow the same lines in all the countries which adopted it. In Germany it was used on a high speed automatic system just as Mr. Murray had utilised it, whereas America and, latterly, this country, applied it to multiplex following the French precedent. America adopted the free keyboard and transmitter method of signalling in preference to the French five-key direct signalling system. Both systems have been tested in this country, and it is becoming increasingly evident that type-keyboard signalling, which has now been adopted by France and Germany, is superior in many respects to the older French method of direct signalling.

Mr. Stubbs tells us in the paper already mentioned that although the British patent is dated 1882 the Baudot system was not brought to the notice of the Post Office until 1897. Mr. Stubbs thinks, and rightly we may hope, that the system must have been considered, but that certain inherent weaknesses in the early types led to its being ignored. In the latter year, after a successful trial on the Paris route of a Simplex quadruple installation in competition with the Hughes, it still had no attraction for the inland service, largely, it may be assumed, because it was a simplex system.

In 1905 Mr. A. C. Booth, of the Post Office Engineering Department, succeeded in duplexing the Baudot, and all modern duplex multiplex systems are based upon Booth's arrangement. The London—Berlin route was the first to be equipped with Booth-Baudot multiplex, a double duplex installation being fitted up in 1910. This was followed in the same year by a quadruple installation—subsequently converted to sextuple—between London and Birmingham on an underground loop with a channel speed of 30 words a minute. The circuit was a pronounced success. It gave a uniform daily output of about 3,600 telegrams in twelve hours, but this figure was exceeded on occasions, and as many as 827 telegrams have been disposed of in one hour Equally good results were obtained on the quadruplex installations working between London and Liverpool and Glasgow, individual hourly operator outputs of seventy and sixty telegrams respectively being not infrequent.

That these results were regarded as satisfactory is evidenced by the fact that whereas only six inland routes were equipped with multiplex apparatus in December, 1915, the number had risen to 143 in September, 1925.

This rapid development was accelerated by the introduction of "divided" or "split" circuits whereby three stations are served on one installation. Thus A works to B, and to C, and B works to A and to C. In the early stages of divided working the installations were subject to many stoppages. Latterly, however, by the introduction of mechanical regenerative re-transmitters at the intermediate offices, more stable conditions have been obtained, and most of these installations are now working well. Re-transmitters are equivalent to Baudot keyboards and are electrically operated by the received signals at the intermediate office, the effect being to re-form and re-energise the signals of the terminal offices.

The divided type of multiplex circuit is usually employed to serve routes which, although justifying printing telegraph apparatus, do not warrant the provision of a full quadruple installation. This arrangement has the exceedingly important advantage that lines are saved between A and B and B and C.

Upwards of one hundred of the routes served by multiplex systems are accommodated on divided Baudot installations.

Another advantage obtained through three station working and one which well illustrates the elasticity of the system is that the apparatus can be so arranged that one, two or three of the available arms may be alloted to any two of the three offices included in the circuit, and further, by means of a simple switching operation at the intermediate office an additional arm may be placed at the service of two of the stations if and when the traffic between them demands additional facilities. This latter facility is extremely valuable on such circuits as Grimsby—Birmingham—Bristol where one of the Grimsby—Bristol arms may be used either between Birmingham and Grimsby or Grimsby and Bristol as required by the incidence of traffic.

Four or even five station multiplex circuits may ultimately find their way into the British system, but at the moment development along these lines seems improbable.

It may not be out of place to point out that practically all the Baudot apparatus in use in this country has been made either in the Post Office Factory or by British manufacturers.

When it became clear that high speed duplex automatic working was not entirely suitable for the British telegraph service, Mr. Donald Murray proceeded to the task of inventing a multiplex system which incorporated the advantages of automatic working, and, in 1911, a double duplex installation was brought into operation between London and Manchester.

The principle features of this installation were :—

(i) the distributors were driven by phonic wheel motors and vibrators.

(ii) the sending operators perforated the tape on "free" typewriter keyboards.

(iii) the transmitters started and stopped automatically according as the tape was slack or tight.

(iv) the received telegrams were printed direct on to telegram forms.

The results were promising but the retention of lengthways perforation of the sending tape which had been employed in the Murray automatic was a disadvantage remedied by Mr. Murray in his later apparatus. The form feed, too, was not entirely satisfactory, and was likewise abandoned in later installations.

Probably the weakest point was the typewriter fitted to the first receivers, these were of the type wheel variety and proved to be a constant source of trouble. In this case Mr. Murray effected considerable improvement by the introduction of type bar printers.

The European war interfered with the manufacture of Mr. Murray's multiplex apparatus in this country, but the Western Electric Company of Chicago in association with the Western Union Telegraph Company, which had purchased Mr. Murray's American rights were able to supply this type of apparatus. In 1915 the Post Office purchased a complete Western Electric installation with a channel speed of 40 words per minute. This installation included cross perforated tape, provision for the invisible correction of slip perforating errors and automatic start-stop facilities : correction was obtained from the signals. Placed on the London—Manchester route the apparatus at once gave excellent results, as many as 6,000 telegrams being disposed of in a single day. Another set was purchased in 1919 and installed on the same route.

In the meantime experience with the Baudot system had shewn that it was possible to obtain good and reliable apparatus of British manufacture, and no further American multiplex apparatus has been purchased. For some time multiplex development proceeded along the lines of the French administration. Experience with the Murray and the Western Electric systems encouraged the British administration to turn seriously to the development of the "free" keyboard and transmitter method of working on such circuits, and the present policy is to convert five-key Baudot multiplex installations to this form of working at speeds of from 35 to 40 words per minute. It is estimated that even at 30 words per minute the output is increased by approximately 15%.

(*To be continued.*)

FIFTY YEARS' TELEPHONE PROGRESS.*

BY W. DAY, M.I.E.E.

(*Continued from page* 86.)

The principles of machine switching have found expression in the evolution of two distinct systems—one known as the "stored impulse" system and the other as the "step-by-step" or Strowger system. In the "stored impulse" system the impulses resulting from dialling are held in suitable apparatus at the Exchange until outlets to the selective agents are available.

In the step-by-step system the switches respond directly and successively to the dialled impulses. Both systems require such conscious effort on the part of the subscriber as is necessary to dial correctly. That surely is not asking a great deal. Yet the placing of the responsibility for obtaining the required number upon the subscriber instead of an operator, marked a distinct departure from the ideal of those who developed the modern C.B. switchboards, an ideal which aimed at relieving the subscriber as far as possible of all conscious effort. And it is not surprising that for a time there were many advocates of a compromise, of a system in which the subscriber merely lifted his receiver and asked for a number in the usual C.B. manner ; the call being afterwards completed by machine switching set in motion by an operator.

However, this semi-automatic system has not been favourably considered even for the more dense and complicated of areas. The requirements of such districts will be met by the adoption of one of the most notable of recent telephone developments, the invention of the Director and its application to the Step-by-Step system.

The Director— a very ingenious switching mechanism—renders unnecessary the predetermination and even the ultimate adoption of a rigid numbering scheme, since in Director-served areas, that is areas in which the digits exceed 5, the subscriber retains his existing number unless the subscriber is served by a P.B.X. subject to the following qualifications :—

(1) If the number does not already consist of 4 digits, then 1 or 2 cyphers, as may be necessary, are prefixed to give this condition.

(2) The three-code or call letters of his exchange must be dialled in addition to those numericals constituting his number.

(3) It may be necessary to alter the name of the exchange to prevent clashing of the code letters and their numerical equivalents.

On the other hand, in non-director multi-office areas, i.e. those serving theoretically not more than 100,000 lines, the trunking scheme—that is the allocation of levels at the outgoing exchange is definitely associated with the subscribers' numbers. Further, the Director makes possible uniformity of calling methods in the same area for both manual and automatic exchanges during the transition period, and it also enables economical use to be made of existing cables. There is no need here to attempt an outline of the means whereby the Director in its capacity as a mechanical operator first receives notification of and then obtains the required exchange and subscriber. The Director, regarded as a unit, is marked by great compactness, by comparative simplicity of design, and it bestows upon the step-by-step system a flexibility which will greatly facilitate the still difficult work of re-telephoning our greatest cities.

Concurrently with the foregoing developments, the attention of Telephone Authorities has been continuously directed to the vitally important and very difficult problems associated with the provision of external plant.

These problems arose out of the increase, at an even more rapid rate, in the number of lines, together with a constant and insistent demand for an extension of communication range. Remarkable, indeed, is the record of success attending their efforts, extending as they do from Bell's early conversations to trans-Continental and trans-Oceanic speech—from the transmission of a few words over a few feet to the broadcasting of orchestral concerts. Fortunately the fundamental achievements which have made possible such phenomenal progress stand out clearly from a mass of minor, although by no means insignificant efforts. The earliest telephone circuits were of single iron wire. This was very unsatisfactory, owing to the leakage of current from parallel circuits frequently making speech impossible. The difficulty was overcome by providing metallic or two-wire circuits. This may be regarded as the first preliminary step towards annihilation of distance so far as telephone transmission is concerned. Even then the circuits were liable to inductive disturbances from adjacent pairs, and a system of twisting or crossing the wires was adopted—a practice to be afterwards applied much more scientifically to paper cables.

The limiting distance for speech transmission over iron wire was soon reached, and of the two alternatives silver was too costly and copper as then manufactured did not possess sufficient strength. But it was known that from the purely electrical standpoint copper was far superior to iron, and efforts were directed towards producing copper wire suitable for suspension. Success was ultimately accomplished through the efforts of Mr. Doolittle, who, in conjunction with various manufacturers, succeeded in producing hard-drawn copper wire : an achievement which greatly advanced Telephony by enormously increasing the possible range of speech. This range was again extended by increasing the size of wire until the conductors, weighing

* Paper read before the London Telephone and Telegraph Society.

600 lbs. and 800 lbs. to the mile—the heaviest wires practicable—were erected for long-distance circuits. It then appeared impossible to further increase the limit of commercial speech. Meanwhile efforts to obtain improvement in telephone cables resulted in the production of the air space paper-core type.

Its evolution may be summarised as follows:—

At a very early stage in telephone growth the great difficulty in leading congested open routes into big towns and cities necessitated consideration as to the possibility of cables affording the required relief. This problem became more urgent as the difficulty of providing accommodation for the increasing number of lines and routes became greater. The first telephone cables were made of copper wires covered with gutta percha laid up in groups of four, suitably intertwined around a jute core with an outer layer of tarred tape. These groups of wires were then drawn into iron pipes. Persistent attempts were also being made to obtain suitable multi-conductor cables. The earliest types of such cables included cotton covering to separate the conductors, whilst the insulation was of paraffin wax or resin oil. The latter was used to fill the space between the conductors and also between the cable core and the lead pipe or tube. Later notable advances were the replacement of the cotton covering by paper and the use of dry air instead of the paraffin wax as the insulating material. This successful transition was dependent on the fact, and took place as soon as it was demonstrated, that lead sheathing could be so applied to the cable core as to prevent the ingress of water. The advantages of the air space paper-core cable made possible the effective relief of congested open routes and also a greater range of communication. But this improved transmission was accompanied by the drawback of increased overhearing due to the closer packing of the conductors. For a while this disability threatened serious limitation to the use of air-space cables for long-distance telephone circuits. The problem was solved to a certain degree by systematically crossing the conductors of one quad with those of another, thereby neutralising the inductive disturbance and thus preventing the overhearing. Subsequently, and owing to the introduction of loading coils to be referred to a few sentences later, it became necessary to balance electrically the cable wires to a much greater degree of refinement and accuracy. Up to the present time, precision testing, which determines the crossing of the wires so as to obtain an electrically balanced cable, has to be made whilst laying the cable, since the required symmetry cannot be obtained during manufacture. The use of finely balanced cables and the invention of loading coils were matters of the greatest technical importance.

Very early in telephone history—1877—a great mathematician, Oliver Heaviside, stated in the form of what is now regarded by competent authorities as a masterly effort of mathematical analysis, the fundamental laws concerning telephone transmission, or, in other words, the relationship which exists between these electrical characteristics known as Resistance, Inductance, Capacity, and Leakance. In presenting the essence of the theory of telephone transmission he stressed greatly the importance and beneficial effect of self induction, which had hitherto been regarded as an evil. Heaviside, like many of the telephone pioneers, was a self-made man in the sense that he did not receive what is frequently referred to as "academic" training. His writings are characterised by a virility—a picturesqueness of phraseology and a lack of unnecessary respect for those who could not appreciate the truth of his teaching.

Yet there are diversities of gifts even amongst the masters. Heaviside laboured in the realm of the abstract. He enunciated the principle that by adding inductance to a cable its transmission of speech qualities could, in theory, be rendered perfect. But it remained for one, Dr. Michael Pupin, to convert Heaviside's theory into a commercial instrument by evolving a practical rule for enabling loading coils to be inserted in telephone cables. Dr. Pupin has had a remarkable career. His autobiography is the story of a lad who landed in America alone and destitute. That struggle which is the portion of genius when associated with the driving forces of poverty and determination has been his. In spite of his extraordinary vicissitudes Dr. Pupin has won through to a foremost position amongst modern practical scientists and has greatly advanced the telephone art by his contributions. The use of loading coils, which enabled much smaller wires to be used to obtain a required transmission efficiency, resulted in great economies during the subsequent extension of the telephone system. The commercial and engineering success of balanced and loaded main cables reacted upon service demands which greatly increased. Yet even with loading it was necessary in comparatively long-distance cables to provide conductors of a size which gravely limited the number it was possible to provide in a single cable. Thus there loomed ahead the difficult problem of obtaining adequate duct space for large groups of cables. But, very timely, the last of the great fundamental contributions to the development of the main underground system as we know it to-day, viz., the thermionic valve, became available. Before its adoption the conductors in the longest of these cables were of the order of 300 lbs. per mile, but the valve made possible the use of 20-lb. conductors, thus paving the way for further enormous economies in copper and also in duct space. The valve, with its associated input and output transformers, has certainly revolutionised main-cable practice.

Let us now glance at submarine cable progress; a matter of cardinal importance, owing to the expansion of international telephony. The earliest of these cables were of the four-wire gutta-percha type. Later came an improved form of G.P. together with loading—the inductance being added either by coils suitably spaced or by continuous iron wire or wires wound round each conductor. But the electrical and mechanical properties of gutta-percha are such that the conductors are of necessity comparatively large. As a result, the number of wires in comparatively long-distance cables of this type is limited to four, otherwise the weight of the cable militates against expeditious handling. This limitation has been overcome by the design of air-space paper-core cables enclosed in double lead sheaths protected by steel wire armouring, and containing 16 continuously loaded conductors of comparatively small diameter. Moreover, it has been possible to manufacture such a cable in lengths of 10 nautical miles, thus very greatly reducing the number of joints, each of which is always a possible source of trouble, particularly in a submarine cable. This type of cable will greatly facilitate international telephony, and its production is of far-reaching significance, particularly for this country.

Here it is convenient to refer to a development known as carrier multiplex telephony or wired wireless. The object of this system is to increase the revenue-earning capacity of a metallic circuit by enabling several communication channels to be provided thereon. The respective channels are provided by means of high frequency currents generated continuously by thermionic valves. The carrier frequencies, as they are termed, range from the highest note audible to the human ear to the frequency used for wireless telephony. Each channel has a different frequency band or range separated by a margin sufficient to avoid overlapping.

At the transmitting end the high-frequency waves are modulated or changed in shape by another valve so as to follow the variations of the sound waves impinging upon its associated transmitter. At the receiving end these modulated waves are rectified again by a valve and pass through the necessary amplification and receiving apparatus which reproduces the originating speech. It is also necessary to use an arrangement of inductances and capacities known as electrical filters, to avoid the frequencies proper to one channel trespassing into any of the others. Carrier telephony is said to be in considerable use in America. But in this country its scope is limited by two main factors, firstly, that our main routes are loaded underground cables; secondly, that climatic and physical conditions are unfavourable. So far as the cables are concerned the present type of loading coils in use make carrier telephony impracticable, owing to their reactive effects. As regards the open lines it is difficult to maintain the necessary degree of balance between the circuits. This drawback makes it undesirable to repeat the same frequency on the same route, owing to the possibility of inductive disturbance, and reduces the number of carrier channels which can be provided over a single route, or, indeed, closely parallel routes to the number that can be provided along a single metallic circuit. This number depends upon the physical condition of the line and the possibility of maintaining continuously the standard necessary for high-frequency working, a standard which is of greater importance for carrier than for voice frequencies.

And now we pass to the crowning achievements in the realm of Radio Telephony. It is difficult to compress into a few sentences an adequate and worthy reference to these great triumphs, yet to complete this review it is necessary to make the attempt. Here, for the first time, the marvellous responsiveness of the electron is harnessed for the transmission of speech. This has been made possible through the instrumentality of the thermionic valve in its fourfold capacity as rectifier, amplifier, generator, and modulator of high-frequency oscillations. Before the coming of the valve, which has been described as the greatest invention since the steam engine, and, indeed, until it had been developed as a generator and modulator, radio communication had been confined practically to wireless telegraphy. In pre-valve days the electric waves were generated chiefly by the spark gap method and received by the magnetic detector, although some of the more important stations utilised continuous waves as generated by the Poulsen method or by powerful high-frequency generators.

In 1883 Edison observed that if an insulated electrode is inserted into an ordinary glow lamp, there is a current of negative electricity from the filament to the electrode. This phenomenon was investigated by Professor Fleming, who, as a result, invented the valve, which is a detector of far greater sensitivity and reliability than any previously in use. A further improvement was effected by De Forrest, who suggested the surrounding of the filament by a metallic grid. This enabled the valve not only to detect but also to amplify the received oscillations, and, as is well known, made possible an enormously sensitive detector consisting of a series of amplifying valves. But, as already indicated, it was not until the valve had been further developed, both as a generator and modulator of high-frequency currents that radio telephony on a commercial basis became practicable. This was due to the fact that the valve, when used as a generator, produces a pure wave very sensitive to control by a modulating valve, which in its turn can be made infinitely responsive to sound-wave fluctuations. But no matter how responsive the transmitting, and how delicate the receiving instruments, long-distance radio communication would be impossible were it not for the effect of the atmosphere upon electrical waves, which are thereby reflected round the earth's surface instead of travelling through space and passing far above receiving stations.

Prior to 1901 physicists and scientists doubted the possibility of signalling round the earth. In that year, however, Senatore Marconi demonstrated experimentally by passing wireless signals between Ireland and America, that electric waves could be made to follow the earth's surface—an epoch commencing discovery from which dates all long-distance radio.

It is now stated to be certain that this results from the ionised condition of the upper layers of the atmosphere. The theory advanced is that the sun splits up the atmosphere—and to a much greater extent in its upper than in its lower layers—into positive and negative particles, which in varying degree, according to the state of the atmosphere, both reflect and absorb the radio waves. The reflective power confines the waves to the atmospheric

layer or shell surrounding the earth and they are thereby prevented from moving into space; whilst the power of absorption—which is greater by day than by night—results in weaker signals during daylight. Over long distances the waves that actually travel along the ground are supposed to be so greatly weakened that they do not reach the distant station.

Until 1924, practical achievements, including Trans-Atlantic Telephony, were based on the assumption that very long waves were essential. These necessitated large and powerful apparatus. During 1924, Senatore Marconi, using low power and wavelengths of under 100 meters, proved that, contrary to all previous knowledge, the *daylight* range of wireless communication over wide spaces increases very rapidly as the wave length is reduced.

By this means audible speech was found to be experimentally possible between England and Australia, thus indicating the early possibility of another truly remarkable extension of the range of speech.

At present, great distance long-wave telephony is accompanied by the difficulty of maintaining a fixed level of reception, owing ro the rapid variability of the ionized layers over a wide range. But it is claimed that the development of very short waves, i.e. those under 100 meters, may result in direct and certain communication being obtained with the most distant places during the whole or at least the greater part of the 24 hours. These very short waves have a greater penetrative power, a greater selectivity, a greater responsiveness—which enables them to be more readily focussed into a beam, and are more economical to generate than waves of the lengths hitherto used. Whether any or all of these statements are subsequently found to be completely justified or not, it is certain that the work done on short waves will greatly modify wireless practice, and it takes its place in the great succession of splendid achievements which mark the first fifty years of telephone progress. Such progress in the application of increasing physical knowledge constitutes an exceedingly fruitful contribution to the construction, maintenance, and improvement of the fabric under which men dwell, so that they may live in greater security and happiness. The effort of the scientist and the extension of those pursuits which scientific invention has made possible has renovated the whole field of human activity. Fugitive, indeed, are the filaments of thought. Yet in an unseen and subtle way they link the various interests of man. And the respect for scientific methods and inventive genius extends far beyond the atmosphere of science and invention. This respect permeates the whole circle of mans' opinion, destroys in silence erroneous sentiments, diffuses a new intellectual force, and nourishes a more tolerant spirit.

PROGRESS OF THE TELEPHONE SYSTEM.

THE number of telephone stations working at the end of November, 1925, was 1,347,227, a net increase of 11,778 over the October total. The continuance of the general improvement in new business, as anticipated in last month's issue, is well borne out in the November figures. The number of new stations 20,530 and the net increase both constitute records.

The monthly analysis of Telephone statistics is as follows :—

	London.	Provinces.
Telephone Stations—		
Total at Nov. 30	472,668	874,559
Net increase	4,794	6,984
Residence Rate Installations—		
Total	91,835	154,568
Net increase	1,848	2,205
Exchanges—		
Total	107	3,845
Net increase	—	22
Call Office Stations—		
Total	4,397	15,492
Net increase	23	101
Kiosks—		
Total	176	1,467
Net increase	9	67
New Exchanges opened under Rural Development Scheme of 1922—		
Total	—	818
Net increase	—	18
Rural Party Line Stations—		
Total	—	9,761
Net increase	—	36
Rural Railway Stations connected with Exchange System—		
Total	—	668
Net increase	—	10

The number of inland trunk calls made during September—the latest statistics available—was 7,202,606, an average of 277,023 calls per day. During the six months ended September 30, the number of calls dealt with was 42,813,074.

The growth in the trunk traffic is illustrated in the following table :—

Six months ended.	Total No. of Calls.	Increase over previous half-year. Calls.	% increase.
March 1923	30,009,407	—	—
September 1923 ...	33,763,673	3,754,266	12.5%
March 1924	35,844,207	2,080,534	6.2%
September 1924 ...	38,426,978	2,582,771	7.2%
March 1925	38,861,461	434,483	1.1%
September 1925 ...	42,813,074	3,951,613	10.2%

The number of outgoing Anglo-Continental calls for the month of September was 18,244 or 1,725 more than in August, whilst the incoming calls numbered 22,462 or 1,902 more than in August. Compared with September, 1924, there was an increase of 2,061 outgoing calls, and 4,794 incoming calls.

Further progress was made during the month of December, 1925, with the development of the local exchange system. New exchanges opened included the following :—

LONDON—Grangewood, Pinner.

and among the more important exchanges extended were :—

LONDON—Burgh Heath, Chingford, Chislehurst, Ilford, Ravensbourne, Speedwell, Sutton, Wallington.

PROVINCES—Altrincham, Batley, Birmingham (Central), Eccles, Erdington, Godalming, Grimsby, Llanelly, Loughborough, Parkstone, Rusholme, South Shields, Stroud, Tonbridge, Walsall, Weybridge, Woking.

During the month the following additions to the main underground system were completed and brought into use :—

Newcastle-on-Tyne—Hexham.
London—Sevenoaks—Tunbridge Wells.
Derby—Belper.
Leeds—Hull.
Liverpool—Ormskirk.
Uxbridge—High Wycombe (portion of the London—High Wycombe—Oxford)

while 115 new overhead trunk circuits were completed, and 107 additional circuits were provided by means of spare wires in underground cables.

RETIREMENT OF MR. RANSLEY.

ON Dec. 18 the members of the Staff met in the District Office to make a presentation to Mr. C. G. Ransley, who is retiring from the post of District Manager at Guildford.

The company met under the chairmanship of Mr. J. Hood, Chief Clerk, and included Mr. Moorhouse, District Manager at Reading, Mr. J. H. E. Wakefield, Sectional Engineer, and Mr. G. Pepperdine, Postmaster of Guildford, together with heads and staffs of various departments in the Guildford Telephone District.

The presentation of a four valve wireless set was made by Mr. T. J. Hickmore, Contract Manager, who spoke of the happy relations which had existed between Mr. Ransley and staff, and offered best wishes of the company for many happy years in which to enjoy his leisure. Similar expressions were voiced by Mr. Moorhouse, Mr. Wakefield, Mr. Pepperdine, and Mr. B. H. Bayley who spoke on behalf of the District Office Staff. The good wishes of the staff were conveyed to Mrs. Ransley, who has always taken an interest in the staff social events from time to time.

Mr. Ransley, in reply, spoke of his early days in the Telephone Service, and of his experience in different parts of the country. Mr. Ransley, who is still very energetic, despite the fact that he is retiring under the age limit, said it was his intention to find some profitable occupation as an outlet for his energies. He thanked all those who had so kindly subscribed to the present.

It should be mentioned that the District Managers and old friends of Mr. Ransley at Headquarters helped greatly to provide the equipment for the wireless set instead of making a present of their own as is usually the case.

Mr. and Mrs. Ransley were the guests of the staff at a dance held the same evening.

The
Telegraph and Telephone Journal.

PUBLISHED MONTHLY IN THE INTERESTS OF THE TELEGRAPH AND TELEPHONE SERVICE, UNDER THE PATRONAGE OF THE POSTMASTER-GENERAL.

Editing and Organising Committee - - - J. STUART JONES. JOHN LEE. J. J. TYRRELL. W. A. VALENTINE. J. W. WISSENDEN.

Managing Editor - - - W. H. GUNSTON.

NOTICES.

As the object of the JOURNAL *is the interchange of information on all subjects affecting the Telegraph and Telephone Service, the Managing Editor will be glad to consider contributions, and all communications together with photographs, diagrams, or other illustrations, should be addressed to him at the G.P.O. North, London, E.C.1. The Managing Editor will not be responsible for any manuscripts which he finds himself unable to use, but he will take the utmost care to return such manuscripts as promptly as possible. Photographs illustrating accepted articles will be returned if desired.*

VOL. XII. FEBRUARY, 1926. No. 131.

TELEGRAPH STATISTICS.

THE telegraph statistics of the International Telegraph Union for 1923 which have just been published provide some interesting reading. Apologists may extenuate and economists deplore a diminishing traffic, yet these returns shew Great Britain as easily first in the number of internal and international telegrams exchanged during the year by any country belonging to the International Union. The largest users of the telegraph were :—

	Telegrams.
Great Britain	78,427,153
Japan...	69,676,208
Germany	59,335,700
France	59,060,760
Belgium	20,314,707

Then follow India with 19 millions, Australia 17.7 millions, Russia 17 millions, New Zealand 14.7 millions and Spain 14 millions. We have remarked before on the fact that those countries with a highly developed telephone system do not as a rule take a high place in these returns. One looks in vain for heavy traffic and extensive mileages in Scandinavia or Switzerland, as the returns of length of telegraph wire in kilometres will confirm. Germany appears first in this list with upwards of 2,700,000 km. but as this figure includes telephone trunk mileage it is of little use for purposes of comparison. The other countries with the most extensive systems are :—

	Kilometres.
France	791,894
Russia	628,606
India	555,912
Great Britain	427,061
Japan...	261,685
Spain	133,127
Mexico	128,269
Ireland	117,636
Poland	112,190

Telephone and telegraph systems are to a great extent complementary one to another, and to get an adequate idea of the development of a country in one service it is necessary to correlate it with the development of the other. But to add telephone calls to telegrams and expect to get an intelligible total is something like trying to add x to y.

ANGLO-CONTINENTAL TELEPHONE SERVICES.

"THERE is still room for improvement in Continental telephoning from London," says a leading daily paper; and we who are not puffed up, even by the knowledge that the Continental services are rapidly improving, shall not venture to deny the contention. But we must also add that there is still room for improvement in public understanding of telephone matters, for the paragraphist goes on to relate how his friend in Brussels, after registering a call for London at about 6 o'clock in the evening, expected at least an hour's delay, and was put through in a few minutes. And this, at what the writer would imagine was the busiest hour of the day in Brussels. Whether 6 o'clock is the busiest hour of the day in Brussels, we know not; we do know that it is one of the slack hours on the Anglo-Continental circuits. Most English offices are closed by this time, and Continental friends, however busy they may be at 6 o'clock, cannot ring up their London correspondents while these are on their way home.

On returning to London, the speaker rang up the trunk exchange "just out of curiosity," and learned that there was an hour's delay to Brussels. This is extremely probable if it occurred at the busy hour of the Continental traffic, especially on a day after one of the recent storms, when many circuits were temporarily out of action.

The comfort and clearness with which a Rotterdam friend spoke to London is next enlarged upon, the inference apparently being that, whilst there is a poor service between London and the Continent, there is a good one between the Continent and London. It might almost be inferred that the writer imagines that the outward service is conducted over bad English lines, while the inward service is conducted over separate lines of good Dutch or Belgian provenance. From how many London hotels can one talk to the Continent from one's bedroom, we are asked. The answer is: from all such as have telephones fitted in the bedrooms and have made the necessary arrangements for the exchange of trunk calls.

This, of course, is a question for the hotel management rather than for the Telephone Administration.

Telephone men are not eager to revel in the sentimental luxury of being misunderstood though virtuous, but they must sometimes wish that critics in their eagerness to score a point against a Post Office service would show more understanding. It is for this reason that we have laboured the point that, when the service between the Continent and England is good, clear, and rapid, the service between England and the Continent will be good, clear, and rapid likewise. The year 1926 promises to be a notable one in Anglo-Continental telephony, for it is hoped by means of the new Aldeburgh-Domburg cable to provide direct underground circuits between London and the principal German towns before the summer is over, and by the end of the year it is probable that the direct underground lines and submarine cables which are designed to afford much increased telephonic facilities between this country and France and Belgium, will also be working. When these are completed the services will be less liable to fortuitous interruptions, and communication should be as rapid as that obtainable on any known long-distance service.

HIC ET UBIQUE.

The works of the telephone service are sometimes condemned in advance.

"A few days ago one of my correspondents," says "ONLOOKER," in the *Leeds Mercury*, "referring to the extension of the automatic telephone system, said that the only exception to its welcome was at Shrewsbury, where after a trial of the new system, there had been a reversion to the old one. I am informed that the new system is not yet in operation at Shrewsbury, although the lines have been laid and the instruments installed for some months. Therefore it could not have proved unsatisfactory."

This correspondent evidently wishes to reverse the process of those described by Shakespeare:

"That give accosting welcome ere it comes."

We have every sympathy with the British Broadcasting Company in respect of the unlooked-for storm brought upon their heads by the broadcasting of Father Ronald Knox's burlesque news bulletin. It is always easy to be wise after the event. It seemed safe enough to provide clients with a characteristic effort by a well-known humorist like Father Knox, but perhaps it should have been remembered what a large number of old ladies of both sexes are susceptible to Bolshevik scares and believe Communist intriguers to be as omnipresent as the Hidden Hand of blessed memory. The *Daily News* suggests (with due warning to those who may be disposed to take the recommendation too seriously) that the Royal Commission on Broadcasting shall consider the prohibition of all jokes, jests and japes of a later date than 1884, and the broadcasting of burlesques on a special wave-length. Certainly, as the *New Statesman* points out, we seem in danger of making too heavy a concession to the humourless minority.

The *Evening News* publishes a Berlin report of an experiment in insect psychology by Dr. Wolfgang Kohler. Selecting a particularly affectionate pair of ants, he took the female to a house five miles from his laboratory, and connected her with the male ant by means of very sensitive telephones. When an assistant placed the male ant near the mouthpiece at the other end, the female immediately crawled towards the telephone, attracted by the noise made by the male ant five miles away.

How curious must be
A conversation by telephony
'Twixt male and female ant!
Those who, like Doctor Kohler, want
To study insects' strange psychology
May learn from this instructive tale,
Wonders for which words fail.
"Go to the ant, thou sluggard," said
The wise, much-married, proverb-writing king.
Accordingly our doctor, led
Thereto by overmuch imagining,
Selects a pair of ants,
Especially affectionate,
(Entomological romance
How art thou now become articulate!)
And bears the female some five miles away
Leaving her mourning mate at home to stay,
And then connects the pair by telephones
So sensitive
As sure results to give.
Then lo! in the receiver's mouth faint tones
Were heard, whenas the male participant
Made a noise like an ant,
Which hearing, in a twitter,
His mate began to crawl to the transmitter.
Ein Hauch der liebe tilget Raum und Zeiten.
That is to say: Love's breath,
Stronger than death,
Annihilates the space between, say, Brighton,
And anywhere you will.
This female insect was so human,
That, like a woman,
Hearing a male five miles away
Calling her, though with signals soft and still,
She hastened to respond without delay.
—*Don't you believe it?* As for that,
Some folk there be with souls released from trammels
Who, straining at a pentateuchal gnat,
Gulp, notwithstanding, scientific camels.

W. H. G.

CORRESPONDENCE.

FIFTY YEARS TELEPHONE PROGRESS.

TO THE EDITOR OF "THE TELEGRAPH AND TELEPHONE JOURNAL."

I notice from the report in your January issue that Mr W. Day, in his interesting paper on the above subject, when speaking of calling appliances, says: "*The earliest attempt to solve this problem consisted of devices by* which the telephone itself could be used."

It would be interesting to know from what source he derived information as to this.

So far back as 1860 or 1861 Philipp Reis, who so nearly achieved a successful telephone, equipped his apparatus with a signalling key and simple form of sounder, and it certainly seems strange if Bell did not adopt at the outset so obvious an arrangement as the electric bell.

To the best of my knowledge and belief the earliest instruments used in this country were so provided. In support of this I may mention that in an article which appeared in *Engineering* on Nov. 16, 1877, it is mentioned that *the call of a bell secured the attendance of the person at the distant end*; and in *The Field* for January 19, 1878, there was an account of a demonstration at the offices of The Electric Telephone Company, 115, Cannon Street, London, E.C., which describes the apparatus as being equipped with an electric bell.

Mr Day further states in regard to the devices which he mentioned "These were soon superseded by an invention of Watson's—Bell's co-worker—in which use was made of a machine capable of sending alternating currents and actuating a magnetic bell at the distant end. The introduction of magneto ringing as an accessory to the telephone led amongst other things to the provision of a switch with numerous contacts by which the circuit was automatically changed from the ringing to the speaking condition."

As to this I can positively testify from personal knowledge and sketches in my possession that the electric call bells which formed part of the telephone sets in use in 1879, when I joined the service, were provided with switchhooks which performed the functions which he mentions, viz: the diversion of the line from the ringing to the speaking condition and vice versa.

I do not know precisely when the magneto calling system was invented by Watson, but I do remember definitely that it was not adopted by The National Telephone Company until the middle of 1881, after which the electric call system was gradually withdrawn.

ARTHUR E. COTTERELL.

Beckenham, Kent. Jan. 13, 1926.

RECENT DEVELOPMENTS IN THE INLAND TELEGRAPH SERVICE.*

BY L. SIMON.

THERE may be many among my hearers to whom the title of this paper will sound like a paradox. How is it possible, they may ask, to speak of development in connexion with the Inland Telegraph service, which has been going downhill for some years, and shows no sign yet of recovering from the fratricidal blows inflicted on it by its younger brother, the Telephone service? They may gently remind me of that large deficit which Sir Henry Bunbury and Mr. Waldegrave analysed for us not so long ago. They may tell me that there is nothing for the Inland Telegraph service to do except to adjust itself as painlessly as may be to the conditions of advancing age and decrepitude; and they may suggest that if the word "development" can properly be used at all in this connexion, it is only in the sense in which we might say of a retired Civil servant that he had "developed" arterio-sclerosis, or more rigid habits of economy.

It would, of course, be idle to attempt to blind oneself to certain painful facts about the Inland Telegraph service. The excess of expenditure over revenue is a very solemn fact, and one that, as the poet says, "winna ding"—whatever that may mean. The British public appears to be obsessed by the idea that telegraphing is a thing to be done only in case of need, and to be quite unaware of the spiritual uplift that it might achieve by sending shoals of telegrams for the pure joy of the thing. Hence, in a time of trade depression and rapid telephone development, the number of telegrams sent goes down from year to year; and nobody can say when the bottom will be reached. Nor is there any sufficient reason, so far as I can see, for feeling confident that there will one day be a rebound. Hope is easy, and I am prepared to hope with the most sanguine: but reasoned confidence is another matter. It is, indeed, suggested sometimes that we could induce the public to send more telegrams by means of a vigorous advertising campaign. But it seems to me that the only kind of advertisement which could hope to be really effective would be directed definitely against the telephone service; and from advertisement of that kind we are obviously debarred. "When you get tired of wrong numbers, go back to the good old telegraph service"—advertisement of that type might be effective, but it is not practical politics. Of course, enlightening the public about the less well-known facilities which the telegraph service offers is perfectly legitimate; but it cannot be expected to produce very much extra traffic. Nor, so far as I am able to judge, is there much hope of stimulating traffic by introducing a lower rate for telegrams to be transmitted and delivered only during the less busy hours, or by adopting a system of ready-made congratulatory telegrams, or by any other means of which I have heard. These are, of course, personal opinions, and I am far from wishing to dogmatise about them: but, so far as I am concerned, I am no believer in the possibility of artificially stimulating the inland telegraph traffic. And if anybody chooses to maintain that it will never revive without some form of oxygen, but will continue to decline, I can go no further than to say that in the nature of the case he cannot prove his assertion, any more than I can prove the opposite.

I am prepared, then, to admit that the Inland Telegraph service has fallen on evil days so far as the amount of traffic is concerned, and that the evil days may continue indefinitely. For all that, however, there is nothing paradoxical about the title of my paper. It is the simple fact that these recent years of declining traffic have seen quite extraordinary developments in the methods of handling such traffic as there is—and, incidentally, it is not even now quite negligible, as it still amounts to something approaching a million telegrams a week. I propose to review these developments briefly under two main heads: first, improvements in the actual apparatus by means of which telegrams are transmitted and received, and secondly, improvements in the arrangements for their acceptance, circulation and delivery. I will add nothing further by way of preface except to say that for our present purpose the elastic term "recent" may be taken as meaning roughly "post-war," though I may sometimes have to go back to pre-war history to find the beginning of a development which has got into its stride only during the last six or seven years.

On the side of apparatus, the first development that calls for mention is the conversion of the main telegraph routes from Morse, Wheatstone, or Wheatstone-Creed to Multiplex working. The Baudot, which is the common form of Multiplex working, was used before the War only in connexion with lines to the Continent, with the exception of an installation between the Central Telegraph Office and Birmingham, which was opened in 1910, and of installations between the Central Telegraph Office and Liverpool and Glasgow, which were opened in 1914. In those days opinions still differed in regard to the comparative merits of Multiplex and Wheatstone working, and the question was referred in 1915 to a Committee under the chairmanship of Captain Norton, then Assistant Postmaster-General. This Committee pronounced unhesitatingly in favour of Multiplex, and urged its extension in the British Telegraph Service.

So long as the War lasted it was not possible to extend Baudot working very quickly, but by 1918 there were 20 installations, all between the Central Telegraph Office and the larger Provincial towns, with the exception of an installation between Manchester and Liverpool. In addition, a Multiplex installation of the Western Electric type was introduced between the Central Telegraph Office and Manchester in 1915.

The installation between the Central Telegraph Office and Birmingham, opened as I have already said in 1910, had at first four duplex arms, but the number of arms was increased later to six, affording 12 traffic channels working at 30 words per minute, with successful results. Subsequently, however, installations were restricted to four-arm or quadruple duplex sets, and that type of multiplex equipment is now recognised as standard. In a few cases, where electrical conditions are favourable and heavy traffic loads warrant it, a fifth arm has been added; but these instances are to be regarded as exceptional, and may disappear in the near future.

When the equipping of the heavier traffic routes, mainly between London and the principal business centres, had been completed, there still remained a number of routes between provincial centres which carried appreciable loads of traffic, though in no case was the traffic between any two points sufficient to exhaust the full capacity of a Baudot installation. Attention was therefore directed to the production of a split or divided form of multiplex working, whereby three stations could be served by one installation, with appreciable savings in line costs. A circuit between A and C is split at B. By the use of suitable multiplex repeating arrangements at the intermediate office B, two direct duplex channels can be provided between the terminal offices A and C, two duplex channels between A and B, and two duplex channels between B and C. The number of channels working between any two of the three offices can, of course, be varied within the limits of the system, and by means of switches at the intermediate office such variations can be made without delay to meet sudden fluctuations in traffic.

Divided multiplex working was successfully established between Manchester, Leeds, and Newcastle-on-Tyne in 1921, and the system was gradually extended until 40 installations had been completed. Results on the whole have been good, but some difficulty has been experienced in maintaining a standard of stability comparable with that of direct or two-station multiplex circuits. Of course a higher standard of adjustment and balance is demanded by the more complicated divided circuit, and on long lines the working margin for varying conditions is small. In order to ascertain and remove, if possible, any weaknesses in apparatus or organisation, an enquiry was made during last winter into the working of the circuits at the principal centres. As a result of that enquiry, in the course of which representative supervising and dirigeur officers were consulted, certain changes have been authorised. These include the provision of mechanical retransmitters at intermediate offices; the adoption of a new type of "brush," consisting of a strip of silver solder alloy backed by a strip of watch-spring, in place of the earlier copper-wire "brush"; the standardisation of the mechanical as against the electrical form of correction; and the introduction at "corrected" stations of a type of vibrator with an adjustable weight on the reed, which makes it possible to adjust the speed of the phonic wheel-drive without stopping the circuit.

These changes have not yet been completely carried out, but there is already evidence that they tend to produce greater stability and efficiency. At the beginning of 1924 the estimated total number of hours lost weekly through apparatus stoppages on multiplex circuits averaged 2 hours 8 minutes per circuit in the case of direct circuits, and approximately 15 hours per circuit in the case of divided or three-station circuits. A recent return showed the comparative figures as 1 hour 15 minutes and approximately 7 hours—a weekly saving of 53 minutes per circuit for direct working and of 8 hours per circuit for divided working. It is not, however, suggested that the improvements just mentioned are necessarily final. The silver solder "brush," for instance, is found, in some cases, to wear down the distributor plate more rapidly than a copper "brush," and experiment is still going on with a view to finding a completely satisfactory type of "brush." Again, it may be found desirable in some cases, where a steady and reliable supply of power is not available, to replace the standard vibrator and phonic wheel-drive of the distributor by a short belt-drive from a small motor, with a Baudot spring governor to steady the speed. Obviously there is no finality in these matters until something like perfect working can be attained under all varieties of conditions. We have not reached that stage yet, but we have made considerable progress towards it in the last few years.

Side by side with these improvements in multiplex working from the point of view of circuit stability, an important development is taking place in regard to the method of operating. Slowly but surely the miniature five-keyed piano (as a layman may be forgiven for calling it) of the original Baudot system is being replaced by the type-keyboard perforator. This change—the change, in technical language, from manual to automatic Baudot working—involves the interposition of punched slip between the sending instrument and the line: that is to say, the operator, instead of sending signals direct to line, as he does in the original Baudot system, punches holes in a slip, which is then passed automatically through a transmitter at the side of the type-keyboard. The operator is thus relieved of the necessity of working in cadence, and can type just as quickly as he likes; while the speed of the transmitter is not limited by the capacity of human fingers. In practice, however, the speed both of operating and of transmission has to be kept to something not very much higher than the 30 words a minute of the normal Baudot. The useful speed of transmission is limited not only by the capacity of the circuit, but also by the speed at which the tape can be gummed up at the receiving end; and the useful speed of the manual operator, again, is limited by the consideration that it is undesirable, especially in view of possible requests for repetition, for the operator to be punching very much in advance

* Paper read before the Post Office Telephone & Telegraph Society of London.

of the transmitting apparatus. Hence it follows that the effective speed-limit for an automatic Baudot installation is not likely to be more than 35 or at most 40 words a minute, and that such an installation offers no scope for really rapid typing. None the less, the automatic possesses very tangible advantages over the manual. Even if the speed of the transmitter be limited to the old standard of 30 words a minute, as for the most part it still is, there is an average increase in operator output of no less than 15%, due to the fact that there is little, if any, loss through missed cadences. And the task of the operator is greatly simplified, because for each letter or figure he presses a single key instead of a combination of keys, and he is free to vary his speed within certain limits, provided that he keeps the transmitter fed and does not get too much ahead of it. To this latter aspect of the matter—the significance from the operator's point of view of the increasing use of the typewriter-keyboard—I shall have to revert later on.

The type-keyboard which is principally in use on Baudot circuits is one invented by two officers of the Post Office, and named after them the Booth-Willmot machine. An ingenious feature of this machine is the arrangement by which it is adapted to the Baudot code. With the Baudot keyboard one combination of keys may produce either a letter or a figure, according as the letter or figure inversion is brought into use. In a keyboard one key may similarly represent either a letter or a figure; but the best lay-out is not necessarily one in which letters and figures will be associated in precisely the same way as in the Baudot scheme. The Booth-Willmot machine is so designed that the associations of letters and figures on the keys can be governed purely by considerations of convenience for typing, and yet the appropriate signal for each letter or figure according to the Baudot code will be produced by the depression of the corresponding key. It is thus possible to retain the Baudot type-wheel at the receiving end while substituting the Booth-Willmot for the Baudot keyboard at the sending end.

In addition to the Baudot system, which is only now beginning to be modified by the introduction of the type-keyboard in place of the five keys, there are two other systems of multiplex telegraphy in use in our inland service, each of which was based from the outset on the use of the type-keyboard to punch slip for automatic transmission. Since 1915 the London-Manchester route has been worked by the Western Electric Multiplex system; and more recently the Murray Multiplex has been installed on the London-Sheffield route. Both these systems employ Mr. Donald Murray's code instead of the Baudot code. Another feature which distinguishes them from the Baudot system is that the signals are printed at the receiving end not on a running tape, which has afterwards to be gummed on a telegram form, but on a continuous roll of paper, so that, as each message is completed, the portion of the roll on which it appears can be cut off for subsequent delivery to the addressee. This method of column-printing, as it is called, has the obvious advantage over tape-printing, that it saves all the work of gumming. It has also one or two disadvantages. If the receiving telegraphist has to correct an error in a telegram, he must either make the correction on the actual form which is to be delivered, thus possibly rendering it unsightly, or demand the repetition of the whole message, with consequent waste of time. From this point of view nothing can rival the beautiful elasticity of the tape-printing method, which allows any bit of tape containing a discovered error to be either torn off and thrown away, or covered over by the portion of tape bearing the correct version. Another disadvantage of column printing lies in the difficulty of producing a delivery form of suitable appearance. It is clearly no easy matter to use a form like the ordinary "C" form, with print at the top, because that would interfere with the vertical continuity of the telegraph printing, and would demand complicated arrangements to ensure that it fell always into the vacant space. A solution of this kind, which would give us page printing instead of merely column printing, has been attempted, and he would be a bold man who should say that it will not ultimately be achieved. But so far no practicable page-printing device has been evolved, and we have to make the best that we can of column printing.

In any case, however, it is not likely that there will be any considerable extension of column printing on multiplex circuits in the near future. It is in another field that the real battle between column printing and tape printing is likely to be fought—the field of what is called start-stop apparatus. This type of apparatus, which consists of a type-keyboard and printer at either end of a circuit, derives its picturesque if not very illuminating designation from the fact that the mechanism, except for the motor, is normally at rest, until a key is depressed at the sending end, and stops moving as soon as the corresponding letter or other symbol has been printed at the receiving end. The start-stop principle is at present represented in practice only by two American machines called the Teletype and Kleinschmidt respectively; but at least one British firm of telegraph manufacturers is at work on the production of a start-stop machine. We have already 62 start-stop machines in use, and there is a wide field for their further employment. They are not adapted—at any rate at present—for multiplex working, but they work duplex, and their capacity for "eating up" the traffic is remarkable. The instruments at present in use work at a speed of forty words a minute, but we hope before long to have British machines which will be capable of a higher speed. As a speed of thirty words a minute would be considered very good for Morse working, it is obvious that start-stop apparatus can be advantageously substituted for Morse where there is a fairly heavy load.

But it is not only the sphere of Morse that is being and will continue to be invaded by the start-stop machine. A few months ago Baudot working between Manchester and Blackpool was abandoned in favour of the Teletype, and the heavy season traffic of last summer was successfully handled by three pairs of Teletype machines with duplex working. It is true that three circuits have to be used instead of one; but, on the other hand, the maintenance of the expensive and complicated Baudot apparatus is saved, and three operators at either end do the work for which formerly four operators and a dirigeur at either end had to be provided. There will undoubtedly be other cases of the same kind—cases, that is, in which Baudot working was justified so long as the only alternative was Morse, but has ceased to be justified with the emergence of start-stop apparatus. If in any such case there is not a sufficiency of wires to make the reversion to simple duplex working possible, that difficulty may be overcome by the use of the "voice-frequency" system, which promises to produce at least six channels of communication out of one physical loop. Thus start-stop apparatus and the voice-frequency system between them seem likely to effect something like a revolution in the Inland Telegraph service; and if my concern were with the future and not with the recent past, I might foreshadow the complete disappearance of both Morse and multiplex working, at any rate on all but the very busiest and the very lightest routes, as a possible development—bearing in mind that the Morse system, while perhaps it has no need to fear the competition of start-stop apparatus on very lightly-loaded routes, is being driven off those routes to a large extent by the use of the telephone for the transmission and reception of telegrams, and that the voice-frequency system may one day render multiplex working almost, if not entirely, superfluous.

All the Teletypes at present in use on public circuits in this country are equipped for tape printing. The Kleinschmidt is a column-printing machine, and we employ it between the Central Telegraph Office and the Savings Bank for official purposes. It is, however, generally agreed that we must aim at getting rid of the extra work involved in gumming tape so far as possible, and the standard form of start-stop apparatus for some time to come will probably be one which can be used either for column or for tape printing. So long as the sending operator's load is light enough to leave him time to look after the incoming messages, his task will be appreciably simplified by the adoption of column printing. But where the conditions are such that during the busy period of the day one operator at either end of the circuit can be fully occupied in sending, so that there must necessarily be a second operator at either end for reception, the case for column as against tape printing is less clear. We must, therefore, go through a period of experiment before committing ourselves to either method; and it may well be that neither can ultimately be excluded.

I referred above, in passing, to the use of the telephone for the transmission and reception of telegrams. This is a particular instance of the general growth of the telephone habit, and it shows, I hope, that the telegraph service bears its younger rival no grudge. Nor is this the only indication of a neighbourly feeling. There is a sort of bridge between the telegraph and telephone systems in the phonogram service, which belongs to telephones from the point of view of technique, and to telegraphs in respect of the nature of its traffic. Over this bridge there has passed from the telephone to the telegraph side an idea which should prove very fruitful. I refer to what is known as the ancillary system of working. The distribution of phonogram calls among a group of operators may be effected in one of two ways. You may have all the calls received at a concentrator switchboard, and distributed thence to the operators who will actually take down the telegrams: or you may dispense with the concentrator by arranging that each call shall light simultaneously a lamp on each one of a series of panels, so that any operator who happens to be disengaged can "plug in" and take the call. This latter method is that known as ancillary, and is being widely introduced in phonogram rooms. It is also now finding its way into telegraph instrument rooms, where hitherto the concentrator switch has been the only means of grouping incoming telegrams. The system is in operation at Newport, Mon., and is about to be introduced at some other offices. It is obviously much more elastic than the ordinary system, under which (except when a concentrator is in use) each telegraphist has access only to one circuit at any given time; and as compared with the concentration method it has the advantage of saving the telegraphist at the concentrator switch.

We have even gone further in the direction of taking leaves out of the telephone book, and have tried at Leicester a system of automatic distribution from a concentrator switch. This system works well enough; but in practice, so far, it does not enable the concentrator switch to be left unattended, and until that can be done, there is little inducement to adopt it more widely. Nor, so far as can be seen at present, is there any other way in which the wonderful developments of automatic working in the telephone field can be turned to account for the benefit of the telegraphs.

Just as we are not above using the telephone for the transmission and reception of our telegrams, so we are willing to press wireless telegraphy into service whenever the conditions are favourable. That, in the present stage of wireless development, does not happen very often. But we have wireless communication always available as a standby, in case of wire interruptions, between London and Aberdeen; and we are in a position to maintain communication with outlying islands by means of temporary wireless installations when they are cut off by the breakage of a cable which cannot be speedily repaired.

Before leaving this part of my subject I wish to say a word or two on a question to which I referred briefly above—the question of the significance, from the telegraphist's point of view, of the developments as a result of which the type-keyboard and the telephone tend more and more to displace types of apparatus designed specifically for the transmission of telegraphic signals. It is often suggested that these developments are to be deplored in so far as they threaten to make the telegraphist's craft, which is his special pride, a thing of the past. But before shedding any tears, we ought, I think, to make sure that we are not allowing ourselves to be misled by an incomplete

analogy. The substitution of machine-made for hand-made objects may involve a definite aesthetic loss to humanity, because the machine-made object lacks that touch of personality which the good craftsman can impart to the work of his hands. But the telegraphist, however skilful at his craft, does not make anything in which his own individuality can be permanently enshrined. In any case he but operates a machine to produce a certain transient effect; and the effect produced is of the same kind, whether the operation of the machine requires a greater or a less degree of specialised skill. Nor is it the case that, if Morse and Baudot manual keyboard operating were to be replaced entirely by type-keyboard operating and telephoning, the degree and amount of skill required by the art of telegraphy as a whole would be lessened. The opposite is more likely to be true, because the newer method of operating is rendered possible by the use of more intricate and delicate mechanical and electrical devices, and these cannot be produced and maintained without a higher level of technical proficiency than is demanded by more elementary forms of apparatus. The actual work of signalling may be done by operators with a less specialised kind of skill than that required for keying Morse or Baudot signals, but on the other side there will be ever-growing scope for technical skill in the maintenance and perfection of the new machines. Hence it does not appear to me that this is one of the cases in which the elimination of a particular type of craft involves, on balance, a loss from the point of view of the community.

There is also, of course, the point of view of those telegraphists who, having by long practice acquired expertness in signalling telegrams by the older methods, lack either the capacity or the opportunity to cultivate the different kind of skill which the more recently developed systems demand. For them as individuals the change-over, no doubt, has its melancholy side, and their position deserves sympathetic consideration; but regard for the interests of individuals cannot be allowed indefinitely to bar progress.

I pass now to the second part of my subject—namely, recent developments in the arrangements for the acceptance, circulation, and delivery of telegrams.

As regards acceptance there is little to be said. The time-honoured method of handing in telegrams over Post Office counters is not likely to be superseded. But the practice of dictating telegrams by telephone has grown considerably of late, and will no doubt continue to grow. It is naturally confined for the most part to those who have telephones in their houses or offices; but a non-subscriber may find it useful on occasion to dictate a telegram from a call office to some more or less distant telegraph centre when the local Post Office is closed, and we have begun to meet that need more fully by arranging, in some cases, for the acceptance of telegrams from unattended call offices. This facility is to be widely extended, and we hope soon to have in general use a type of coin-box which will respond to sixpenny pieces and shillings, so that the would-be patron of the service will no longer have to make a small "corner" in pennies.

In the field of circulation much greater changes have taken place: in fact, it is only within recent years that the application of definite principles to the circulation of telegrams has been attempted. The history of telegraph routing has been outlined in Mr. G. T. Archibald's valuable "Notes on Telegraph Practice," which are appearing in the *Telegraph & Telephone Journal*, and his account indicates a painfully slow evolution from neglect of the problems of circulation, through a haphazard empiricism, up to the scientific system which is now in operation. The condition of things in what may be called ancient times may be gauged from the fact that telegrams from Bolton in Lancashire for Scarborough in Yorkshire circulated via London. Towards the end of last century steps were taken to divert traffic from the Central Telegraph Office; but the alternative routings were not definitely laid down, and one result was that there was competition between the larger Provincial centres for the privilege of transmitting traffic from the smaller offices. A better era dawned with the appointment of Traffic Managers in 1900; and by 1906 many additional inter-provincial long-distance circuits had been provided, and each office with two or more outlets had an authorised circulation list. In 1913 the system of individual circulation lists was abandoned in favour of a scheme which laid down certain general principles for cross-country circulation; but this scheme broke down, largely through the change of conditions brought about by the increasing use of machine telegraph apparatus, and in 1919 we were back again at the system of a complete circulation list for each office. But with 15,000 or more telegraph offices that system involved an excessive amount of labour and complication, and the need for a simpler scheme became insistent.

This need was met in 1922 by the introduction of what is known as the Zone System of routing telegrams. The country is divided into eleven zones, each with a Zone Centre. Each zone is again subdivided into areas, each with its Area Centre; and in an area there may be several groups of minor offices, each with its Group Centre. Every Zone Centre has one or more direct circuits to every other Zone Centre; and within the zone each Area Centre has direct communication with the Zone Centre, and each Group Centre with its own Area Centre. All these are "basic" circuits—that is, they are provided as a matter of course, even though in a particular case the amount of traffic between, e.g., a Group Centre and its Area Centre is not sufficient to warrant the maintenance of a direct circuit. But provision has also to be made for the type of case in which, e.g., an Area Centre in one zone has a great deal of traffic for an Area Centre in another zone. In such a case it would be indefensible to insist on routing all the traffic through the two Zone Centres. Such cases—which are, of course, fairly numerous—are met by the provision of "non-basic" circuits subject to defined conditions, the principal of which is that there should be a certain ratio between the amoun of traffic and the length of the circuit. The ratio originally laid down, and still in force, is that of 1.2 telegrams daily for each mile of radial distance. The non-basic circuits necessarily complicate the circulation, which would be delightfully simple if we could tolerate a state of things in which a Group Centre worked only to its Area Centre, an Area Centre only to its Zone Centre, and a Zone Centre only to the other Zone Centres; but precise rules have been worked out to govern the routing over non-basic circuits, and as between basic and non-basic circuits, and in the result we have arrived at a position in which retransmission is kept within reasonable limits, and in which the proper circulation of telegrams from any office to any other is ascertainable by reference to definite principles, and no room is left for competition or mutual recriminations.

There cannot, I think, be any question that the Zone System, in its broad features, has come to stay; but it is obviously capable of adaptation in detail to changing circumstances. The decline in traffic which has taken place since the system was adopted, together with the growing use of machine telegraphs on the more heavily loaded routes, raises the question whether the number of Zone Centres cannot be reduced, with the consequent saving of some inter-zone circuits which are justified not by the amount of traffic carried by them, but only because they are "basic." It is also a question whether the ratio of traffic to mileage which is held to warrant a "non-basic" circuit could not with advantage be made somewhat higher. Changes in these directions would tend towards a greater degree of concentration of traffic on the biggest offices. That may appear at first sight to be a retrograde step; and admittedly it involves disadvantages. Other things being equal, an increase in the number of transmissions which a telegram has to undergo between two given points is not desirable. Again, the larger the office, the greater is likely to be the "office drag"—that is, the time required for the internal circulation of a "through" telegram from the circuit over which it is received to the one over which it is to be sent on. But as we cannot abolish the big offices, it seems common sense to make as much use of them as we can; and we are scarcely doing that if, at the very time when we are equipping these offices with relatively high-speed apparatus, we allow them to share in the general decline of traffic. We must, therefore, it seems to me, pursue a policy of concentration of traffic on the big offices, though we must equally beware of pushing it so far as to reduce the efficiency and rapidity of the service below a reasonable standard.

As regards the night and Sunday traffic, a policy of concentration seems to be even more clearly indicated. At times when only a few offices are open, and telegrams are infrequent, circuitous routing can be tolerated to an extent which would be excessive in the busy hours. There is nothing absurd in circulating (for instance) night telegrams from Lancashire to Yorkshire via London, provided that by so doing we are enabled to close down a line between two provincial offices without having to increase the night staff at the Central Telegraph Office. We are at present moving along these lines, and, while the scope for saving is obviously small, we should be able here and there to reduce the number of night duties. The same end has been achieved at one or two all-night offices by the transference of telegraph working during the late night and early morning hours from the Instrument Room to the Counter. We may be able to carry the process still further by using trunk telephone wires for telegrams during the night. On the face of it, there seems to be a certain waste in keeping two systems of communication open at times when there is not enough traffic to tax more than a small part of the capacity of one; and one might jump to the conclusion that all night telegraph work ought to be done by telephone. The problem is not, however, so simple as it might appear to be at first sight. Telephonic transmission is not suitable for press work, nor for a large batch of telegrams handed in more or less at the same time, as for instance on the arrival of a steamer at a port. But we have already found two cases in which it is possible to transmit such night telegraph traffic as there is over the trunks; and there may well be others.

A very recent extension of the use of pneumatic tubes for the circulation of telegrams in London deserves mention in passing. There is now a sort of tube exchange in the War Office, connected on the one hand with the Central Telegraph Office, and on the other hand with about fifteen Post Offices in the Western and South-Western Districts, many of which formerly exchanged traffic with the Central Telegraph Office by wire.

In the matter of delivery of telegrams, finally, a very important change was carried out some five years ago. Before that time the accepted theory had been that each telegram delivered by hand must be sent out with the least possible delay after its arrival in the delivery room; and the messenger staff at each office had to be maintained at such a strength as would enable this requirement to be met, subject only to the possibility of giving to one messenger two or more telegrams for neighbouring addresses which happened to come to hand at the same time. The demand for economy led to a search for a more rational and less wasteful practice; and what is known as the "walk delivery" system was the result. Under this system, which is in force at practically all except the smaller offices, the delivery area of an office is divided into a number of "walks," and as telegrams arrive in the delivery room they are sorted according to "walks." At regular intervals—normally of 5 and 10 minutes for the more and the less important "walks" respectively—the telegrams on hand are sent out for delivery, those for one "walk" being, of course, entrusted to one messenger or group of messengers. The system has been found to work very well, and its adoption has improved the delivery service as a whole, though naturally not every telegram is sent out as soon as it would have been under the old arrangement. Incidentally, the "walk delivery" system saves the Post Office a very substantial sum every year.

Then there have been improvements in the methods of carrying out the operations which are ancillary to delivery. Among these I will mention

only the substitution of stencilling for printing where a large number of envelopes has to be prepared for telegrams to one address—a change which has saved us over £10,000 a year.

In the delivery of telegrams, too, as in their acceptance and circulation, the telephone is playing an increasing part. Delivery by telephone is not necessarily economical from our point of view where the premises concerned are near the delivering Post Office; but it makes for expedition and reduces the need for boy messengers. A confirmatory copy of every telegram delivered by telephone is sent out by post. Quite recently we have made arrangements by which any telegram found to be intended for a telephone subscriber, if too late to be received at and delivered from the normal delivery office, is offered to the addressee by telephone from a more distant office up to 11 p.m. Thus, so far as telephone subscribers are concerned, the hours of telegraph delivery have been materially extended in most parts of the country.

This concludes my review of recent developments in the Inland Telegraph service. While I have left many minor improvements of organisation unmentioned, I have, I hope, said enough to show that the service is very far from standing still. However unkindly the traffic curve may behave, and however great may be the encroachments of the telephone, telegraph men and women realise that their service has still an important and necessary function to fulfil in the life of the community. There is no spirit of weariness or defeatism in their ranks. On the contrary, there is everywhere a keen desire to progress, a readiness to devise and experiment with new methods, so as to maintain the efficiency of the service at the high level to which it has been brought by the ability and the progressive spirit displayed in the past. If, with that improvement of general conditions for which we are all hoping, the telegraph traffic recovers, I feel confident that the developments of the last few years will be found to have placed the service in a position to cope efficiently with the heavier demands which will be made on its capacity.

TELEGRAPHIC MEMORABILIA.

As most of us have noted during these last twelve or eighteen months, as may also have been gathered from items published in these columns radio questions and radio ethics have not been able to keep themselves out of the Law Courts! This applies to all five continents. The U.S.A. with her huge Sixty Million Dollar Radio Suit is the most prominent at the moment. This suit, according to the *Electrical World*, was filed on Dec. 3 last in the U.S.A. District Court at Boston on behalf of Professor R. A. Fessenden, of Chestnut Hill, Mass., against the General Electric Co., Radio Corporation of America, Westinghouse Electric & Manufacturing Co., Western Electric Co., Inc., United Fruit Co., Wireless Speciality Apparatus Co., and International Radio Telegraph Co., under the Sherman Act and Clayton anti-trust law. One cannot at the moment quite see the connexion between radio matters and a fruit company, by the way! The defendants are charged with lessening and finally destroying competition, restraining commerce and injuring the plaintiff through combination and control of radio apparatus manufacture and use. A list of between two hundred and three hundred inventions, title to which, it is contended, resides in the plaintiff, is appended to the bill. Then last, but not least, the London *Daily Express* recently informed us that no less than 600 summonses were issued against residents in Aberdeen for possessing unlicensed wireless receiving sets! Who wad 'a thocht it?

From an American source we learn that an instrument which measures altitude electrically, and about eight times as accurately as the ordinary barometer, to a height of at least one mile, has been constructed by the French physicists, Drs. Huguenard, Magnan and Planiol. The apparatus, says the *Electrical Review*, is based on the fact that a heated object cools off much more quickly in dense air than in very thin air or "near-vacuum," because in a near-vacuum there is very little matter to conduct or convey the heat away. The density of air depends on the altitude, so that an instrument that will measure air density will also give a measure of the altitude.

The device consists of a wire of great resistance, so that when an electric current is passed through it, a high temperature can be attained. Heat is immediately lost by radiation, convection currents in the air, and to a certain extent by conduction. After each of these leaks has done what it can, the temperature of the wire has reached equilibrium; and when once this balance is attained, changes in the temperature of the wire will be due to changes in the density of the surrounding air.

The electrical resistance of the wire changes with the temperature; a variation in the density of the air will therefore cause a variation in the intensity of the electric current, and this fluctuation can be used to measure the altitude, since the density varies according to the distance above sea level.

Dr. W. H. Eccles, vice-chairman of the Wireless Telegraphy Commission, recently stated in *The Times* that the hub of the Imperial radio communication scheme is the station at Rugby, which was designed by the Commission and the Wireless Section of the Engineering Department of the Post Office. Succinctly the novel features may be catalogued as follows: The masts, power plant, auxiliary machinery, and thermionic valves have all been supplied by British contractors; the buildings have been erected by the Office of Works; the high-frequency circuits have been made and installed by the Engineering Department of the Post Office. The Commission, being unfettered in its choice of methods and apparatus, has been able to break away from standard practice. Thermionic valves solely are used for generating the electrical waves, the sum total of the valve power amounting to about 1,000 kilowatts or three times as great as that of any other valve station. Of this equipment two-thirds will be used for Morse telegraphy and one-third will be reserved during the coming year for experiments in long-range telephony. Telegraphy will be conducted on both long and short waves, so that several messages may be sent simultaneously to various parts of the globe. The telephony plant has a range of more than 5,000 miles.

Another and unique feature is the fact that the waves radiated from the aerial have their origin in the vibrations of a tuning fork, which are magnified by stages, by banks of thermionic valves, till they reach the total of over 700 h.p. and pass to the aerial circuits. The fork thus governs the wavelength and keeps it rigorously constant. "Rugby is the first great station absolutely free from involuntary variations of wavelength and will revolutionise the methods of preventing interference between wireless services" says the professor. This new method has been developed within the Wireless Section of the British Post Office by its efficient Research Staff. During the preliminary trials quarter power reached Java and Hong-Kong; half-power was heard well in Australia and very strongly in America; still higher power gave good signals in New Zealand and was reported "stronger than any other station" by South Africa, and was stated to give signals of "amazing clarity" in Sydney. The tests made in Rugby town, two miles from the station, to ascertain how far the concerts from the B.B.C. station at Daventry, 12 miles away, are interfered with by the Morse transmission at Rugby, proved that although Rugby was, at the time, using in its aerial about 25 times the power used in the Daventry aerial, there was no interference whatever in the latter station.

The Rugby station will start upon its Imperial mission as soon as range tests are completed, within two or three months. This all-round service will be supplemented by a "beam" service to each of the four largest Dominions as soon as the "beam" stations have passed similar tests. In the meantime the long and short-wave equipment at Rugby will ensure satisfactory transmission to every part of the Empire throughout the 24 hours, concludes Professor Eccles.

The annual report of the Post Office Relief Fund for the year ended August 31, 1925, is an appealing document. During the last five years over £175,000 have been disbursed in allowances to widows and dependants of Post Office employees who lost their lives during the war.

New cases are still coming in. There were 31 of these last year, and were due to the death of men disabled during the war. If any poor words of mine should be the means of inducing if only a *few* more of my colleagues to come forward with the promise of but a few pence per week subscription for a period of not less than twelve months it would help to relieve the anxiety of the Committee who fear that a contingency may otherwise arise which would compel them to reduce the amount of the allowances to these widows and orphans.

Since the inception of the Fund benefits have been given to 3,141 widows and 6,122 dependants, of which latter no less than 5,601 are orphans.

It is not only that money is paid out to help these worthy folk, but a personal interest is taken in every case by members of the local committees and each case is unobtrusively watched. Where the education of boys and girls is concerned and where the State has evidently a legal obligation the willing co-operation of the Ministry of Pensions is obtained in a way which no individual could possibly obtain.

About 1,290 of the children are at present time receiving either Secondary Education or other training. The Ministry of Pensions pays fees and part of the expenses for 232 of these children, while in 46 other cases, scholarships covering part of the cost, have been gained; and in these 278 cases a small supplementary grant is given by the Fund to meet certain incidental expenses travelling expenses to and from school, for example, not covered by thes Ministry's grants or by the scholarships. In the remainder of the cases, numbering 1,012, the whole cost of the education or training is borne by the Fund. The expenditure under this head, which at the present time is at the rate of about £20,000 a year, is expected to increase still further during the next two or three years.

AUSTRALIA.—The new Commonwealth Government wireless telegraph station at Camooweal, Queensland, which was opened in November last, completes the chain of stations across Northern Australia—Wyndham (W.A.) to Wave Hill (Northern Territory) thence to Camooweal, and then on to Brisbane. As there is no telegraph office at Camooweal, the station will bring a large area into closer touch with civilisation, and if squatters and private persons desire to link up with any of these stations by either ordinary or wireless telephony, the telegraph department will be prepared to handle their traffic for them.

BELGIUM.—The Belgian Government some time ago decided to install an underground cable between La Panne and Herbesthal, and another between Lille and Rosendael, with the object of opening up direct communication between Germany and England, on the one hand, and France and Holland, on the other. *The Times* now reports that the Minister of Railways, Posts and Telegraphs has received tenders for the laying of these long-distance cables from various firms, and has decided to give three-quarters of the work to certain Charleroi concerns, the remaining quarter being assigned to a German firm. It is anticipated that the work, which will cost the State about 70,000,000 fr. (approximately £660,000), will be completed within two years. It is expected that an increased revenue of 10,000,000 fr. a year will accrue

to the Belgium telephone and telegraph administration from the new cables, this sum representing the approximate value of the communications which the Belgian administration is at present compelled to refuse owing to the absence of direct cables.

CANADA.—Reuter's Ottawa agency reports that the Department of Marine has authorised a wave-length of 52.51 metres as the "Trans-Canada" wave-length exclusively for long-distance relay work. This is also the authorised wave-length for communication with other parts of the Empire, while another and American correspondent affirms that an American company has "stolen" this same wave-length!

CHINA.—Reuter's Trade Service, Shanghai, speaking of the telephone systems of China, says that the Ministry of Communications is taking steps to install a wireless telephone service between Tientsin and Shanghai.

Our special correspondent reports that according to the *Peking Leader* at the special conference held recently between Mr. Yeh Kung-Cho, the Minister of Communications, and the telegraph operators' representatives in Peking, the question of increased salaries for telegraphists was discussed without any definite result being arrived at. It is estimated that £240,000 (English) would be required annually if the men's application was agreed to. The Minister of Communications declared that there was no way by which this sum would be available unless the Chinese militarists paid for their telegrams at half rates, but up to the present none of the provincial Governors will pay up!

COMO.—An international electro-technical congress, which will be attended by electrical engineers from all countries, will be held at Como in 1927 to commemorate the first centenary of the death of Alessandro Volta, the physicist, who died at Como on March 5, 1827. Count Alessandro Volta (1745-1827), the Italian physicist, was born at Como, and afterwards became Professor of Physics there. He made many important discoveries in electricity. He produced the first voltaic battery, and his name is commemorated in this invention, and in the unit of electrical pressure—*the Volt*.

FINLAND.—The Helsingfors correspondent of Reuter's Agency informs us that at a meeting held on Dec. 12 a number of companies and private persons interested in broadcasting in Finland decided to form a joint stock company to make arrangements for broadcasting in Finland. The company will probably begin its activity on Jan. 1.

FRANCE.—The further fall of the franc has been followed by a fresh increase in foreign telegraph and telephone rates says Reuter's Paris agency. The basic rate now has to be multiplied by 5.3 for international messages, as compared with a multiplication by 4 at the beginning of August, 1925, and by 5 on Dec. 10, 1925. Contrary to the practice obtaining hitherto, substantial increases have also been made in French colonial rates, the same multiplier index being applied as for international telegrams except in the case of messages sent to French colonies by wireless, or via Dakar, in which case the basic rate will be multiplied by 3.5 only.

Following the resolutions that were adopted at the International Time Commission at Cambridge in July, 1925, says the *Electrical Review*, certain changes were made in the transmission of time signals from radio stations in France on January 1. In May next another change will take place it is understood.

GERMANY.—As previously stated in the *Telegraph and Telephone Journal*, the German Government have been experimenting with telephoning to and from moving trains. As a result of these trials travellers on express trains running between Hamburg and Berlin are now able to telephone by wireless from the railway trains, and the service will be extended to other services as soon as possible.

HOLLAND.—The London *Daily Mail* states that a Commission representative of the police force and radio authorities has reported that wireless is useful to the police as an efficient and speedy means of communication, and that its cost, in comparison with the service it could render, is very small.

INDIA.—In March, 1925, the Indian Radio Telegraph Co., Ltd., was registered, with an authorised capital of 3 crores of rupees, about three million rupees. The company was formed to erect radio-telegraph and telephone stations under Government concessions. It is intended, in the first instance, to erect a station at Kirkee, near Poona, for the purpose of transmitting and receiving messages to and from Great Britain. It will be of the "beam" type, and the British Government has agreed to erect a similar station in England. The station was expected to be ready for service nine months from the date of the final approval of the plans by the Government and the acquisition of the site.

Broadcasting in India is still in its infancy and has not yet been carried out on a commercial scale. Radio clubs have been formed in some of the principal cities and experimental programmes are transmitted. Certain definite recommendations have been made by interested parties, to the Government, and as a result of these the Government has stated its willingness to grant a licence to a broadcasting company, subject to certain conditions.

So far the bulk of imports of radio apparatus has been of British origin; at present no apparatus is made locally, but possibly sets may be assembled locally from imported component parts. The foreign competition so far encountered is mainly from the United States, France, and Germany.

This company, according to the *Daily Telegraph*, has also been granted a licence by the Government of India to form a separate broadcasting company for India, with stations in Calcutta and Bombay. The capital of Rs. 15,000,000 is all underwritten, it being an entirely Indian company with Indian capital. Both stations are expected to be working in 1927. The company is to take 80% of the licence fees and the Government the remainder.

As distinct from the Indian Radio Telegraph Company, there is also every prospect of a company being registered early in this year under the Indian Companies Act, for the establishment of a broadcasting service in India, says the *Morning Post*. It was in March last that the Government of India announced its willingness to issue a licence to such a company for a period of ten years, and for the first five years of its licence the company was to have a monopoly of broadcasting. So far as can be ascertained, only one application was received for the broadcasting licence, and the Government has recently modified its conditions.

IRISH FREE STATE.—The first broadcasting station in the Free State at Dublin commenced operations on Jan. 1. It is owned by the Government and works on a 390-metre wave-length; its call sign is 2RN and its plant was supplied by the Marconi Co.

It is also proposed to form, at an early date, an Irish Centre of the Institute of Wireless Technology, with the objects of promoting the general advancement of radio technology, and procuring the recognition of the status of the Institute by the Government, by public and local authorities, and other bodies in the country.

ITALY. The Italian Government has recently granted a concession to the Società Italiana Ernesto De Angeli, of Milan, to establish six wireless transmitting and receiving stations in connexion with the electric power station at Ardesio (Bergamo) and at the transformer and distribution-sectionising stations at Ponte Nossa (Bergamo), Casellazzo (Milan), Legnano, and Milan. The purpose of the stations is to transmit by radio operating instructions to the engineers in charge at the different stations. The concession, which is run for a period of ten years, authorises a wave-length of 1,000 metres for the Bonate Supra and Castellazzo installations and 1,750 metres for the others. Messages are only to be transmitted between the hours of 7.30 and 9.30 a.m. and between 4 to 6 p.m., although in cases of emergency messages may be transmitted at any other time. The installations are stated to be the first of their kind in Italy.

JUGO-SLAVIA.—Reuter's Belgrade correspondent declares that the Ministry of Posts and Telegraphs has authorised the erection of a wireless transmitting station at Agram (Zagreb), which will probably be opened by the first of March.

LATVIA.—H.M. Consul at Riga (Mr. G. Shepherd) has forwarded to the Department of Overseas Trade extracts of the regulations governing the use of broadcast radio receivers. Permits are issued for the installation and use of sets on payment of the subscription for one quarter, the holder being entitled to acquire sets and parts thereof either from the Post and Telegraph Main Administration or from private firms possessing the requisite manufacturing or trading permit of the Administration. Quarterly subscriptions range from three lats, a *lat* is about equal to 9½*d*. English on a gold basis, in the case of State and municipal institutions, hospitals, &c., and six lats in the case of the ordinary subscriber, up to 90 lats in the case of kinemas, hotels, &c. All articles must be stamped according to the regulations which came into force in November, 1925, the sealing charges being as follows: Receivers and amplifiers, 10 lats per valve (max. 40 lats for one apparatus); separate tuning apparatus, 10 lats; crystal receiving sets, 2 lats; valves 2 lats each; ear-phones 1 lat (double 2 lats); and loud-speakers from 5 to 20 lats, according to size (price). The total sealing dues, charged yearly for small appurtenances sold by commercial undertakings, vary from 100 to 500 lats, according to the town or district in which the sale takes place. Wireless apparatus is not specifically mentioned in the Latvian customs tariff, but is probably included in telegraph and telephone apparatus, the rate for which is 0.50 gold franc per kilogm.

MADEIRA.—Marconi's Wireless Telegraph Co., Ltd., has recently commenced work upon the erection of a wireless station under its Portuguese concession near Canical, Madeira, on a small table-land about 800 ft. above sea level. The building is to be constructed of ferro-concrete and cement blocks, all of which, together with the water, has to be transported up the mountain side, a new road having been made for this purpose. The work is being done by a British firm, the Madeira Supply Co., Ltd., engineers, of Funchal, of which Mr. J. H. Quicke is the chief engineer.

MANCHESTER.—It was recently announced, by a Manchester engineer, that the apparatus at the head Post Office for handling telegrams by telephone is being replaced by equipment of the latest type, and auto-Baudot apparatus has recently been installed to provide eight channels between Manchester and London. The volume of traffic makes the London-Manchester group the heaviest telegraph channel between any two offices in the world. This is a challenge!

PERU.—One of the most bitterly contested concessions in the recent legislative history of Peru terminated with the Senate's ratification of the Marconi contract for twenty-five years for the administration of the Peruvian post, telegraph and wireless services. The concession has been in effect under a referendum clause since 1921, though the opposition of politicians and private interests threatened its annulment, says the *Financial Times*. It is understood that its ratification coincides with the initiation of an energetic construction programme, including the erection of a "beam" station for communicating with the United States, Buenos Aires, Rio de Janeiro, and Bogota. The programme provides for expenditure exceeding £500,000.

SALVADOR.—The 500-watt broadcasting station which has been built by the Government Telegraph and Telephone Division was expected to

commence operations at the end of 1925, says *Commerce Reports*. Its wave-length will be between 400 and 500 metres.

SIBERIA.—The Westinghouse Electric & Manufacturing Co., of East Pittsburgh, Pa., U.S.A., has recently secured an order for a 20-kw. broadcasting station for Vladivostock, Siberia.

SPAIN.—Reuter's Trade Service, Madrid, is responsible for the two following items:—A contract has been entered into between the Government and the *Compañia Ibérica de Telecommunicacion, of Madrid, for the erection of a* broadcasting station at Málaga, the cost of which is estimated at between 50,000 and 70,000 pesetas. Although Málaga will not become a general distributing centre, the new station is expected to create a demand for radio equipment, both in the adjoining provinces and in Spanish Morocco.

The Radio Barcelona Co. proposes to establish a luminous time service by means of an electric lantern on one of the pylons which it has erected at Tibidabo, near Barcelona, to support the aerial recently installed for the new large station. In this way nearly all the province of Barcelona will be able to regulate its watches and clocks. The company is studying means of retransmitting the Eiffel Tower time.

SWEDEN.—During the past year over 100,000 receivers' licences have been issued, says *Commerce Reports*, and it was expected that the figure would reach 120,000 before the close of 1925. The Royal Swedish Telegraph Administration has prepared a report on the radio situation, and has requested *an appropriation of 1,050,000 crowns for the erection of a large broadcasting* station to be located in the central part of Sweden. It is said that this station will broadcast on a 1,350-metre wave-length. Calculations show that approximately 2,000,000 persons live within a radius of 200 kilometres of the proposed site, and it is expected that the station will increase the number of receivers' licences issued by about 70,000.

UNITED STATES.—Mr. David Sarnoff, general manager of the Radio Corporation of America, in an address to the Boston Chamber of Commerce, said that statistics prepared by the Radio Corporation indicated that the business done by the radio industry in 1925 would aggregate approximately $350,000,000.

The Bound Brook station, the transmitting station of the Radio Corporation of America, was opened officially on Jan. 1, and, in connexion therewith Daventry broadcast special greetings to America, which were picked up at Belfast (Maine) and relayed from there to all the associated American stations.

Reuter's Trade Service from Bismark (N.D.), is responsible for the following regarding broadcasting and its assistance to farmers. The State Railroad Board received a complaint that the installation of wireless receivesr by farmers enables the latter to listen to the market and receive earlier returns, so that if the market falls they can sell their stored grain before the elevator operator learns of the change in price. The Board admits that the situation may be a difficulty for the elevator man, but says that the Board can do nothing in the matter.

The Electrical and Wireless School near Winchester, at Flower Down, has now sent three entries of apprentices to the Central Trade Testing Board, and in no case has a lad failed. This is a "record" held by no other R.A.F. training centre. Sir Philip Sassoon, Under-Secretary of State for Air, recently inspected the school, some 1,100 strong, and the workshops, where 290 lads, 556 men, enlisted by direct entry, and 14 officers on a signals course, *are being trained in the theory and practice of wireless. The Times* explains that a wireless operator-mechanic of the highest grade must be a fitter, have a thorough knowledge of all electrical plant used by the R.A.F. and of the generators used in aircraft, be able to wire aircraft for wireless, operate and repair the instruments, and, in addition, be able to send and receive Morse clear or in code. The minimum standard required is reception for five minutes at 20 words a minute with not more than three errors, and to simulate actual working conditions in the air all practice is carried out with a definite amount of interference cutting the received signals. Actually 60% of the lads fulfilled the conditions, receiving at 25 words per minute. No other trade in the ranks has so many opportunities, and there are always at each entry examination more applications than the establishment at the moment calls for. Each lad receives three years' training.

The British Radio Research Board (Department of Scientific and Industrial Research) has recently published Part II of its investigation into the variation of the apparent bearings of radio transmitting stations at present being carried out under the leadership of Mr. R. L. Smith-Rose of the National Physical Laboratory. Those interested in direction-finding and some of its problems will discover a wealth of information in this "Special Report No. 3." (H.M. Stationery Office, 4*s*. 6*d*.)

It should again be emphasised that there are marked differences in the effects which are observed in working overland oversea. Thus, on the longer waves the situation of the transmitting and observing stations was such that all the paths of transmission less than 200 miles in length were entirely overland, which fact accounts for the abnormally large variations recorded at night for ranges of from 100 to 30 miles. For distances of less than 30 miles, the majority of the direction-finding readings are found to be accurate to within 2 deg. When the path between the transmitting and observing stations is entirely oversea, and free from any land or coastline effects, the errors in observed bearings lie within the above 2 deg. limits for all ranges up to nearly 100 miles. This accuracy is generally sufficient for most navigational purposes; also, for oversea working a 100-miles range is adequate for the ordinary application of radio direction-finding to marine navigation.

I have been rather unfortunate! In our last issue under "Paris" carefully revised information was given regarding the vexed question of rates, and at the termination of the explanatory paragraph the following statement was made:—"As regards extra-European traffic, an increase in the maximum terminal charges at the European end is authorised, but the rates payable by the public will not be increased, the increases, if imposed by the Governments, being absorbed by the cable companies." The accuracy of this information has, however, been challenged as regards the cable companies, but all that the writer is prepared to say in reply is that the information was received from the very highest source and the proofs referred to another of equal reliability, but it is probable that there is a misunderstanding. The rates laid down are maxima, and, of course, rates lower than maxima may be imposed, and my later information is that not all the cable companies are prepared to absorb the maxima.

A very pleasant evening was spent on the 18th ult. at the I.E.E. when Mr. Simon (Secretary's Office) gave a very lucid paper on "Developments in the Inland Telegraphs" of this country. Mr. Simon administered something in the shape of a cold douche to the Inland Telegraphs, just touched with a measure of moderately warmed optimism regarding the future. The discussion which followed was of excellent quality, and the replies of Mr. Simon to his questioners were clear-cut, dignified, and incisive. We were warned, however, that the Telephone was the coming King, and that the Inland Telegraphs, at any rate, were likely to bear a similar relationship as regards progress as that between the Parcels Post and Letter Post. Yet we did not seem to come away from the gathering with any degree of dispiritedness, but when the compositor sent me my proof of this particular column with the "galley" headed TELEPHONE MEMORABILIA, thus, in leaded type,—well, I just sat down to him and told him—that,—he was incorrectly informed!

The Electrical Review of Jan. 15 gave a most interesting account of the progress of the Canadian and South African Service Stations in connexion with the Imperial Wireless "Beam" communication scheme, with six beautifully reproduced photos of the Bodmin Transmitting Station (Rectifying Panels), the Bridgwater Receiving Station, the Bodmin Power Generating Plant, &c., and the "Canadian" and "South African" masts.

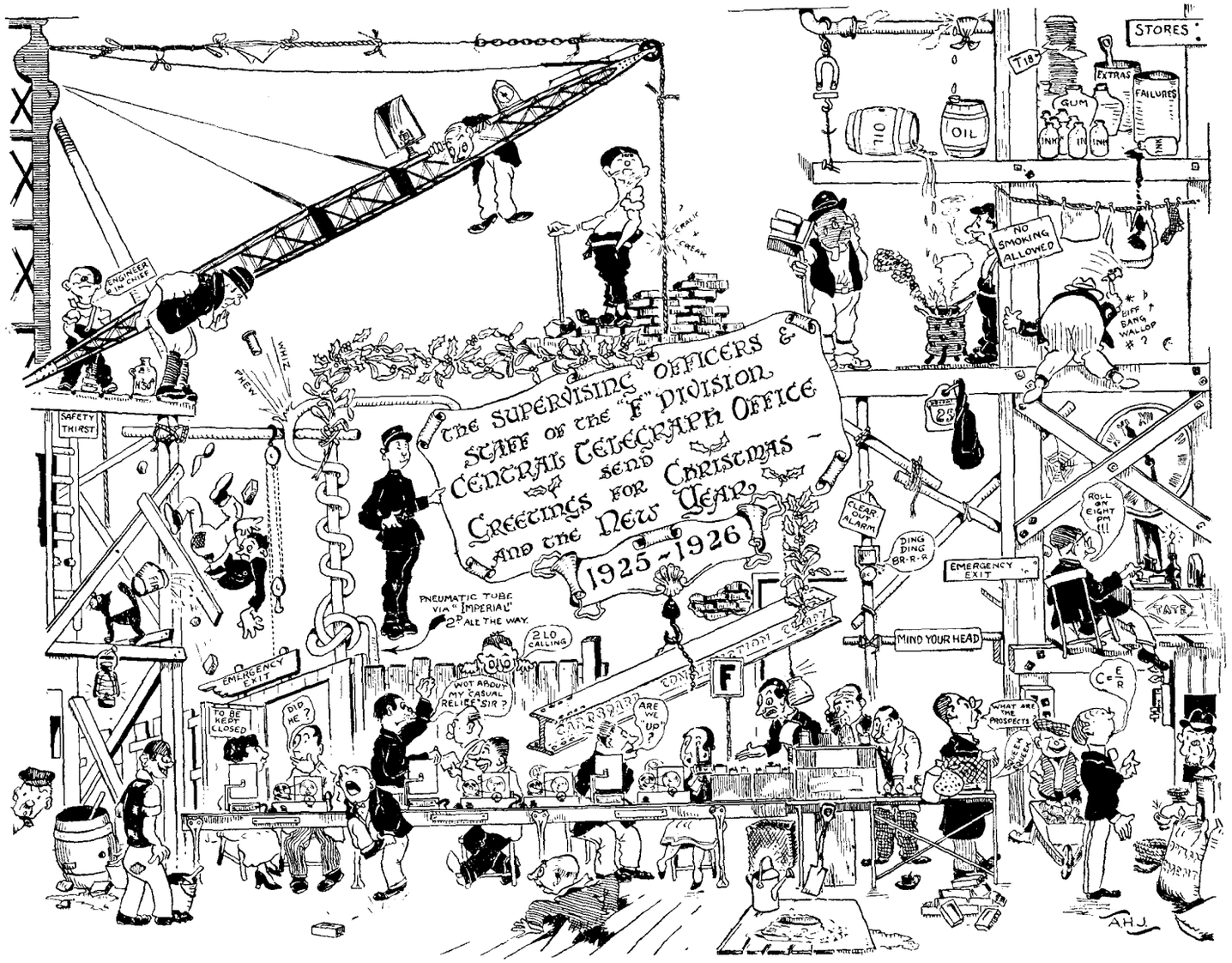
At the Bodmin transmitting station the generating plant is mounted on a concrete raft, *supported on cork to prevent vibration reaching the transmitting set*, while the valve oscillators themselves are mounted on a similar raft.

Experience.—Those who gain no experience are those who shirk the King's highway for fear of encountering the Duty seated by the roadside."—*George Macdonald.* J. J. T.

CODOC.

IT is a cryptic-seeming word, and when it is interpreted it means "Centels Operatic Dramatic and Orchestral Club," and when, in turn, "Centels" is interpreted it means Central Telegraph Office. This is our latest venture and it is not lacking in ambition. It produced "The Charm School" in the autumn, and on the 11th and 12th January it gave us an admirable performance of "The Gondoliers." Certainly it was an admirable performance. The chorus was beyond praise; the principals were thorough and accomplished in their art; the whole rendering was on a very high level indicating a devotion to careful rehearsal and a sense of team-work which was notable. All the accessories were worthy of the occasion, and all that one could find for regret was that the gathering of our young men and maidens had not more space for its display. The Committee has fully justified its ambition and it has revealed, by a manifestly careful choice, more evidence, even than most of us expected, of the existence of talent in the men and women of this great staff. The manifestation of delight and of appreciation when the curtain came down (and went up again) at the close of the second performance was a demonstration of goodwill and gratitude which was unusual even at family gatherings of this type where audience and players are members of one body.

"J. J. T." wished to write about it. He would have been able to excel even himself with such an opportunity. But it may be that there is something to be said which lies outside even his sphere. For it is the generosity of art which matters. These young men and maidens must have given time and leisure richly and without stint to have offered us such a tribute to the corporate life of the office. When the curtain went up on the scene even those of us whose minds are pinned to the official side of our relationship must have felt the glow of a pride which went beyond official pride. Art is long and life—even official life—is short, and our knowledge of each other can bear a deepening which will suggest inspirations of which we can only have the vaguest conjectures. J. L.



THE Christmas Card of the "F" Division of the C.T.O. is here reproduced for the benefit of the readers of the *Telegraph and Telephone Journal* by the courtesy of the artist, Mr. A. H. Johnson, and the organiser of the idea, Mr. C. Young, who by their united efforts have not only amused, but have faithfully depicted the spirit of good-humour which has prevailed through the many trying months of the reconstruction of the larger portion of the C.T.O. London, and in addition have been able by the sale of the cards, 12 ins. by 10 ins., to hand over the sum of £1 18*s.* 6*d.* to the Benenden Sanatorium Games Fund.

The genius of Mr. Johnson has, by the skilful artistry of exaggeration, reproduced certain incidents which will be easily recognised by those who witnessed them, and will at the same time the better enable some of our provincial brethren to understand the situation "at the other end of the wire" during rebuilding! [The block and printing of the cards was beautifully reproduced by Messrs. Baines & Scarsbrook Ltd., Swiss Cottage, N.W.]

SHEFFIELD TELEPHONE DISTRICT.

Mr. W. Thyne, Chief Clerk, has been transferred to a similar position in the Glasgow Telephone District after 27 years' service in Sheffield. On Nov. 27 he was presented by the District Manager (Mr. S. C. Smith) on behalf of the staff, with a handsome mahogany music cabinet, before a large and fully representative gathering of the staff.

The Postmaster-Surveyor (Lt.-Col. F. N. Westbury) and the Assistant Postmaster (Mr. L. Ettling) fully supported the remarks of the District Manager regarding the esteem in which Mr. Thyne is held. The chief officers of the sections in the District Manager's Office also spoke, and wished their colleague every success. Mr. Thyne, in well-chosen words, suitably responded.

TELEPHONE NOTES.

The Spirit of Service.

Dr. John E. Mackenty, of New York, a leading surgeon in cases of carcinoma of the throat, desirous of helping his patients to recover their speech after operation on the larynx, approached the Bell Laboratories, who kindly released two of their most valuable scientists for research work on the problem. These two, Clarence E. Lane and Dr. Harvey Fletcher, developed an artificial larynx which is said to be very successful. To-day, for instance, there is a Justice of Peace in the Supreme Court in Cuba who, once having had his voice destroyed by surgical operation, now presides with all judicial dignity, and handles his cases easily with the aid of the "larynx." The resulting speech is described as being a monotone which gives one the impression *that the user is merely somewhat hoarse. Only some 600 persons are said* ever to have survived carcinoma (cancer) of the throat, but for the sake of these few the artificial larynx has been developed, and is being made with little or no return for the labour involved. "Even if all the instruments were paid for, which they cannot be" says *Telephone Review*, the sum realised "would not come within seeing distance of the cost in time, labour and materials to the Company. Yet no one, reading the letters which come in to bear witness to what these instruments have done, could count it anything but profitable." The Bell Laboratories are justifiably proud of this achievement in itself and the benefits which this use of their power has bestowed on a very unfortunate section of humanity. More than this, they have thus *irresistibly if indirectly appealed to the good will of an immeasurably wider* public.

The Fessenden Wireless System.

"Professor Reginald A. Fessenden, scientist and inventor, who is best known as the one who has done the most to perfect the submarine signal," says *Telephony*, has named eight of the largest manufacturers of radio apparatus and supplies in the United States as defendants in a suit for $60,000,000. His contention is that the concerns he designates have combined illegally to destroy the value of many of his radio devices. Asserting that he

has been damaged to the extent of $20,000,000, he declares that under the law he is entitled to three-fold damages as well as the cost of the suit. The case is interesting from many points of view, and in part answers the question which has often passed through the writer's mind as to what had become of the Fessenden system of wireless, of which much was heard some 10 or 12 years ago. Perhaps its greatest interest lies, however, in the light it throws on the interpretations which may be put on American anti-trust laws, which, of course, are the statutes invoked. For instance, the appellant states that "the defendants, in violation of the Sherman and Clayton anti-trust laws, have lessened the value of his inventions to such an extent that he seeks redress through the courts." And finally, he declares, apparently as an argument in favour of his case, and therefore, one which is good at law, that the defendants "have at times refused to negotiate for the purchase of patents and devices, and at other times have offered, and are now offering for them much less than their fair value."

Two Interesting Automatic Developments.

Automatic Telephone gives details of two interesting pieces of new automatic apparatus—a telephone with a transmitter and receiver combined, which is said to work satisfactorily on automatic systems, and an automatic switching unit for use in very small rural areas. As regards the former it says: "Presented for the first time at the recent convention at Chicago . . . the great interest with which the apparatus has been received, has proved the existence of a definite need for an instrument of this type." The demand is undoubtedly there, and if, as is claimed, the "monophone" has overcome the difficulty of the "delicate and wobbly type of cradle mechanism associated with so called 'microphones,'" its future should be assured. There are two features in the "Type 15, Strowger Automatic Exchange" which strike one as much by their practicability as their novelty. First, magneto telephones are used, and secondly, code ringing on party lines is controlled by the subscriber himself by means of the dial. "To call any particular telephone line, the subscriber dials a two-figure number. To ring the bells on that line he then dials a combination of '2's and 8's' . . . for short and long rings respectively." Thus, if a party on 24 line had a calling code of say two long and one short rings, the calling subscriber would dial 2—4—8—8—2 and this, of course, could be his directory number. On the other hand, there is a "snag"—there always is! In this rural automatic system "there is installed one connector switch for each subscriber's line or trunk in service," which, in American parlance is, as it appears to the writer, "going some"; especially as the "switch itself is exactly the same as has been used for many years" in public automatic exchanges. Says the article "One of the objections sometimes raised to small automatic exchanges . . . is the relatively high first cost of the central office equipment." That objection apparently still stands.

Motorists! spare that Pole.

Somewhere in the fairway of motor traffic in a town in South Dakota there stands a telephone pole. Recently a motor, approaching the pole, skidded and the driver, rather than charge the formidable obstacle, ran on to the side walk and hit a woman. Followed the usual legal tussle, which boiled down eventually to the question of whether the pole or driver was at fault. "But for the pole, the driver would have continued his course over the place occupied by the pole," it was argued. However, the Supreme Court decided that the woman "was not thrown against the pole, the car did not strike the pole, the pole did not deflect the car. . . It caused no injury by physical contact with anyone." Of course not. In fact it was precisely through avoiding these things that the pother arose. But perhaps a more chivalrous motorist will one day come along, "dare defiance fling" and—fell that pole.

Training the Telephone Engineer.

"With the opening of the fall term, the Massachussetts Institute of Technology takes another important step in carrying out its policy of maintaining the closest possible contact with the industries of the country," says *Telephone Engineer*. Arrangements have been made with the Bell telephone system, it appears, by means of which a carefully selected group of students of the Institute, who have successfully completed the first two years of the regular course in electrical engineering at the Institute, will be sent to New York. The group will be divided into two sections, which will work in "opposite numbers," one section doing its four months on practical telephone engineering work as Bell workmen, while the other is doing its four months at the Institute in theoretical study, and vice versa. Another feature is that the course requires the students to attend regular Institute classes while they are doing their practical training in New York. These classes will be held during the evenings by instructional staff specially maintained in New York for the purpose by the Institute. During the period of practical training, the students will be on the pay roll of the Bell system, and must turn out their day's work like other workmen; but as fast as they master one job they will be transferred to another. They will complete their practical training by doing actual telephone operating, and spending a final period in the Bell telephone laboratories, carrying out research work and studying the design and development of engineering apparatus for both wire and radio systems. After three years, the higher degree of Master of Science in electrical engineering, as well as that of Bachelor of Science, is to be conferred upon those who successfully complete the course.

Integrity and Thrift Increase Ability.

The United Telephone Co. of Kansas claims that it is the company's policy "to surround itself with a class of employees that are above the average in integrity, in their thrift, habits, and in ability." A laudable object enough, but the means by which their thriftiness is achieved—if it is—are, to say the least of it, distinctly novel. To all prospective employees, a booklet is presented "with a request that you read it thoroughly before deciding finally that you would like to be one of the United organisation." Again, "we want you to understand that you are being held accountable only for one-tenth of your salary," but "should an employee fail to comply with this savings plan, the company reserve the right to ask for his resignation." Every month you will receive a savings report card similar to the one shown, continues the booklet. "These should be filled in promptly and returned to the general office through your manager or foreman." Item 1 on the card reads "This is to certify that I have this month saved and invested the sum of $———" and item (2) "The total amount I have saved since July 1, 1922 amounts to $———" Another item shows "Payment on debts made prior to your employment by us." In view of the 10% enforced savings, the cost of running a motor car, renting a telephone and buying "an umpteen valve set," to say nothing of incidentals such as "all electric" houses, one wonders what sort of salary is paid.

Automatic Telephones in the Far East.

"Automatic telephones, a portion of which are of British manufacture, are finding favour in the Far East. They appear to be the only satisfactory method of dealing with the large number of different languages (some 26) commonly spoken in the large towns," says *Electrical Review*. The Darien system, in China, equipped for 4,800 lines, is the largest, and was opened in 1922. Harbin is equipped for 3,000 lines and was opened a year earlier. The four municipal exchanges in Shanghai were recently completed. Work has begun on an installation to serve the Tientsin district, and of course, as previously stated in this column, Japan is replacing a substantial part of her destroyed system by automatic exchanges.

Direction Finding at Sea.

The second part of the report of the Radio Research Board, upon an investigation into the variation in the apparent bearing of radio transmitting stations, throws into relief the difficulties attending as well as the value of wireless direction-finding operations. "When the path between the transmitting and observing stations is entirely oversea, and free from any land or coastline effects, errors in observed bearings lie within 2 degrees," it says, and "this accuracy is generally sufficient for most navigational purposes." It was the remarkable sufficiency of wireless bearings in the open sea, coupled with their apparently fantastic inconstancy near land, which led us in the early days of direction-finding into such tantalising situations. One day a ship would be picked up by this means with the greatest ease and accuracy under the worst conditions, while the next, "sparks" would be the butt of endless "leg pulling" over some grotesquely inaccurate bearing of a particular land station. Nevertheless, the navigator is so used to working to charts and allowing for this error or that, that he never totally rejects even the most approximate of approximations. Frequently he is reduced to mere guesswork. The work of charting the errors to be expected in the wireless bearings of all stations in various areas likely to be passed through by ships approaching land, is research of a very high practical order, since the perfecting of any system which will give true bearings over moderate distances does not appear to be in sight.

E. S.

THE INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS: BOOTH-BAUDOT AWARD.

The Council wishes to call attention to the "Booth-Baudot Award" of £5 which is now offered annually for the best improvement in telegraph, telephone or wireless apparatus or systems. The award for the year 1925 is governed by the following conditions:—

1. The Award will be restricted to employees of the British Post Office.
2. Applications for the Award should be made between Jan. 1 and March 31, 1926, and such applications should refer to improvements made, or suggested, during the twelve months ended Dec. 31, 1925.

   Attention is drawn to the fact that recipients of Awards *via* the Post Office Awards Scheme in respect to any improvement in telegraph, telephone or wireless apparatus or systems are eligible to apply for the Booth-Baudot Award in respect thereto.
3. At the discretion of the Council of the Institution of Post Office Electrical Engineers the Award may be withheld if, in the opinion of the adjudicators appointed by the Council, after full consideration of the applications received, no award is warranted.
4. Applications for the Award, accompanied by full details of the improvement, should be addressed to the Secretary, The Institution of Post Office Electrical Engineers, G.P.O. (Alder House), London, E.C.1.

R. V. HANSFORD,
Secretary.

LONDON TELEPHONE SERVICE NOTES.

10,000,000.

The ten million mark for one week's calls originated at Exchanges in the London area was passed in two successive weeks during the peak week just before Christmas. For the last four years there has been an average increase of 1,000,000 calls per week for this period, which is by far the busiest of the year. It would seem that this increase can only be arrested, at any rate for some time to come, by some unforseen shortage of plant.

The record figure is due to the very considerable increase in the number of telephones installed compared with a year ago. The average number of calls originated per exchange line has receded slightly, but this has been the natural result of strenuous efforts to reduce the number of overloaded circuits.

Telephonists' Society.

The annual New Year's Dance of the London Telephonists' Society was held as usual on the first Saturday in the New Year—Jan. 2—when about 220 members and friends assembled for a very enjoyable evening at Bishopsgate Institute. Those of us who have taken part in the events of the Society since its first days, umpteen years ago, know that one of the indispensable ingredients of this regular function is Mr. Skinner and his orchestra, who play many old familiar airs as well as the latest dance tunes, but render the latter far more musical than does the usual jazz band of monotony and noise. And those who, knowing Mr. Skinner, know what to expect in the way of music, were not disappointed.

Mr. Buckeridge, also an indispensable ingredient, was once again M.C., and Mr. Thirkell, our Secretary, was as indefatigable as ever in seeing that everything went on wheels.

It was generally regretted that our President for this season, Mr. W. J. White, who had hoped to be present with Mrs. White, was kept away at the last minute by family bereavement, and several other regular attendants, past presidents, and vice-presidents were unavoidably absent, so that the veterans of the Society were a very small muster this year.

When the orchestra terminated the interval valse with the Army bugle call, "Come to the cookhouse door, boys!" the company trooped to the supper room without the least reluctance, and the carnival caps found on the tables soon resulted in a very gay scene. Some of the headdresses were very striking and unusual, and of course some of the gentlemen found themselves with hats intended for ladies and vice versa, with startling results, and the orchestra's musical inquiry "Where did you get that hat?" that greeted the return to the ballroom was distinctly apt. The M.C. and Secretary, disguised as Egyptians in scarlet fezes, were quite new personalities. Mr. Skinner might have been gentle Smee, escaped from Peter Pan's pirates and various other folk usually associated with dignity assumed an appearance of unexpected frivolity.

The evening came to an end all too soon, when at 11.15 the last dance was followed by the National Anthem and Auld Lang Syne. Those who could not come, and those who want to come again, should keep a note of Jan. 1, 1927, when the hall and Mr. Skinner are booked for a repeat performance.

Culled from the Exchanges.

Avenue Swimming Club.—Our second annual social was held on Jan. 8, and we haven't had a merrier time since this New Year began!

There were songs and recitations by our talented girls and boys—and games for those who didn't dance, to add to the evening's joys.

Mr. Collins sang with fervour two lyrics that haunt us yet, and Miss Williams warbled charmingly "The Second Minuet." To Miss Smith's elocution we listened with delight, and enjoyed Miss Ella's dancing—she was such a dainty mite!

Our Chief presented the prizes for competition and games—the winners blushed with pride and joy as they answered to their names.

Our orchestra excelled themselves in their efforts to make things go, and we sang as we tripped it joyously on the light fantastic toe.

If all our friends enjoyed the night they were caught in our social web, they will come to our dance at Australia House, to be held on 11 Feb.

C. A. S.

London Wall Exchange Social.—The Nautilus Swimming Club, attached to London Wall Exchange, held a social and dance at the Food Reform Restaurant, Holborn, on Tuesday, Jan. 5, at which the prizes for last session were presented by Miss Johnstone. The awards were: Miss Sharplin for progress, Miss Chambers for diving, Miss Rowe for fast swimming, Miss Cummings for best attendance.

The evening passed away pleasantly, the following members of the staff and friends kindly giving their services and ably entertaining a very appreciative audience:—Misses Rose, Pope, Danger and Bunting, vocal solos; Misses Lowther and Sharplin, pianoforte solos; Miss Francis, elocutionary recitals; Misses Longman, Garnham and Chester, humorous song.

The time was filled up with dancing and games. The M.C.'s of the evening were Misses Rose and Fitch.

Putney.—On Saturday, Jan. 2, the staff of the Putney Exchange gave a tea to children attached to the Tooting centre of the Shaftesbury Society and Ragged School Union. The children, gaily decked with the contents of their crackers, made a festive picture, and did ample justice to the plentiful fare provided.

A humorous operetta presented by members of the staff was much enjoyed, and uproarous laughter attended the performance of the "wearer of the motley." Lights were lowered, and a real Christmassy story was told, and as a fitting climax, the gaily lit Christmas tree was unladen.

Dolls, motor cars, pistols, balls, as well as sweets, oranges and apples, were distributed, and so ended an evening enjoyed by children and workers alike.

Avenue Poor Children's Tea, Jan. 9.

It was the Staff of Avenue
Who gave the Children's Tea,
And full three hundred little guests
Comprised the company.

To Grace's Alley Mission Hall
They came from near and far,
And naught cared they that it used to be
The 'Old Mahogany Bar'!

Round were their eyes as they all filed in,
At sight of the tables spread—
And they scarcely waited for Grace to be sung,
So eager were they to be fed!

How swiftly the piled-up plates of cheer
Disappeared from the festive board,
As pastries, sausage rolls and tarts
Were clamorously encored!

When the very last piece of cake was gone,
And the tables were cleared away,
Mr. Seymour Salmon entranced us all
With his conjuring display.

We watched the nimble thimbles hop—
Saw handkerchiefs tied in knots,
And wonderful magic flowers appear,
That never were grown in pots!

Then later, came the Christmas tree,
With its burden of dolls and toys,
Which Father Christmas handed sown
To jubilant girls and boys.

Each child received a gay handkerchief,
And a penny—brand new from the Mint,
And each little face wore a glow of pride
At sight of its golden glint.

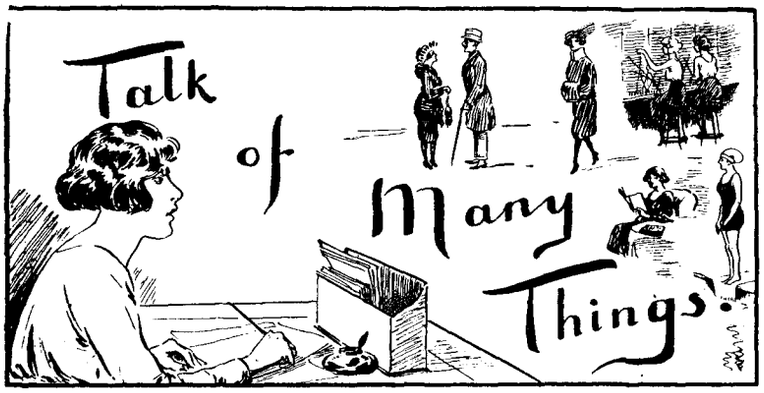
At last, when all the fun was o'er,
Our juvenile guests were sped
With bulging bags of fruit and sweets,
Before they went home to bed.

We thank the Staff (both Day and Night)
For their generous help that day—
We appreciate their self sacrifice
Far more than we can say.

Since virtue is its own reward,
We're strongly inclined to believe
They have proved that it is—beyond all doubt—
More blessed to give than receive.

C. A. S.

WE TELEPHONISTS



"And whether Pigs have Wings."

RECENTLY I revisited the scene of some of my youthful dissipations—I went to the Zoological Gardens in Regents Park. You can tell how long ago I made my former visits and how grown-up and superior I have since become. If I had been youthful recently and did not now wear spats I should have called it "The Zoo," and I should not have added "Regents Park," because, of course, "The Zoo" is an adequate address to anyone but an old, joyless, toothless, senseless relic. But because I had not yet quite arrived at the seventh age of man, or perhaps because I feared I might be tending in that direction, I went.

Outside the entrance I had been a vastly superior fellow of importance, with social and official dignity, and I had declined to purchase a pennyworth of nuts for twopence. In consequence I was unable to meet the touching and confident request of a trustful squirrel. Then my conscience smote me, and my soul rattled like the parched pea it was. I blushed for my hard heart, and I bought penitently.

Once past the barrier I smelt again the smells of memory, and I fed my nuts to all the animals who appeared to honour me with their notice. Probably most of them loathed nuts, and not a few must have wished rather for my pemmican flesh and under-proof blood. I gazed with no small degree of astonishment at all the wonderful, beautiful, fearsome, pathetic, and fascinating creatures round me—and I wondered what *they* thought of the people they have shown to them from day to day. The answer is to be found I think in the expressions of boredom and indifference which most of the animals exhibit. We should probably be the same if we were stared at continually. Personally I should grow insufferably tired if a lion came running round every time I took a meal, and even if I only fed on Fridays, like the snakes, I should prefer to do it in privacy.

Not being young enough to muse upon these thoughts with the fresh imagination of a child, I broke off to watch the sea-lions feed. I laughed loudly at their barking, and applauded their brilliant fielding as they caught the fish thrown to them. After that—alas, the elephants had gone to bed or I might—but at any rate I saw the office where the elephant-ride tickets are sold. It is an ordinary office, but a wonderful one, for it is the gateway of the road which leads back through time to fairy tales and marvellous jungle adventures. Then I went to the Aquarium, and here one "finds such stuff as dreams are made on!" I felt "all goosey" at the sight of the octopuses. I saw sea-horses, but I did not believe them at first. I took exception to the grin of the skate, for he was the only creature who appeared to be amused at the sight of my face. I must confess to a gasp of surprise when I discovered that fish move their eyes—which is suspiciously like the commencement of a poem, and that would inevitably bring an expression of boredom and indifference to those outside the cage of

PERCY FLAGE.

P.S.—As regards pigs, the answer is in the negative—particularly the human variety!

Sydenham Exchange.

The combined Committees of the Tennis and Swimming Clubs are organising another dance, to be held at the Dartmouth Hall, Forest Hill, on Tuesday, Feb. 23.

It is the general wish that the same hall should be engaged, but the Committee have decided that, to ensure greater comfort to the dancers, the tickets sold must be *strictly limited to one hundred.*

Will our friends at other Exchanges who intend again to favour us with their support kindly let us know early. There is likely to be a big rush for tickets, and the Committee would not like to disappoint anyone who helped us to make the last dance such a success. The members of the Committee are :—

President, Miss Bowley.

Miss Arnott, Tennis Club.	Miss Marsh, Swimming Club.
Miss Verbrugge, ,,	Miss Matthews ,,
Miss Piccard, ,,	Miss Elliott, ,,
Miss G. M. Turner ,,	Miss Bennett, ,,
	Miss Whorwell, ,,

Please order your tickets from any of the above in good time.

G. M. T.

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By the courtesy of the *Daily News*, we reproduce a photograph of a pleasant little ceremony which took place at the South London Hospital for Women on the last day of 1925. Miss Cox, the Superintendent of the Female Exchange Staff of the London Telephone Service, is seen in the picture with Lady Cowdray, Chairman of the Hospital, at the bedside of one of the small patients. Miss Cox, who was accompanied by representatives of the staff from various districts, had just presented to the Chairman the wireless installation provided under the *Daily News* scheme, and paid for from funds raised by the women of the London Exchanges. In all a total of over £313 was raised, and sets are being provided for the Elizabeth Garrett Anderson Hospital as well as the South London Hospital. It was appropriate that the presentation should have been made by Miss Cox, since the initiation of the fund in the L.T.S. was due to her personal interest. That her suggestion was readily and generously responded to is evidenced by the sum subscribed. Miss Cox, in making the presentation, said: "We hope that the wireless will be not only a luxury but a very real factor in hospital treatment. It is not only a companion who will be talkative or silent at will" (we have known sets that didn't quite conform to this description) "but who will provide material for discussions with the fellow sufferer in the next bed, with whom, without its aid, it is sometimes difficult to find a subject of mutual interest, except the discussion of one's case—a subject better forgotten."

Lady Cowdray, in responding, also emphasised the advantages of wireless entertainments as compared with friends "because you can close it down when you can't bear it any longer." Such sentiments coming from those belonging to what is not generally known as the silent sex are perhaps a little startling, but albeit fully justified when one remembers that such entertainments include burlesque news bulletins from over the border.

H. D.

The Telephone Play.

As these notes will be in print before the second performance of the play, it will be necessary to reserve any comments or criticisms that may be received until the March issue.

Contributions to this column should be addressed: THE EDITRESS, "Talk of Many Things," Telegraph and Telephone Journal, Secretary's Office, G.P.O. (North), London, E.C.