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FIFTY YEARS OF STATE TELEGRAPHS.

(Continued from page 44.)

The Telephone.—(1) (a) Now we turn to the Telephone—perhaps the pioneer amongst the miracles of modern science.

(b) It was twenty years and more from the time that Ronalds wished to submit his scientific toy to the Admiralty before Cooke and Wheatstone produced a practical electric telegraph. Compare with this the facts that Bell's invention of the Telephone was produced in 1876, exhibited as a scientific toy in England the next year, and Telephone Exchanges were in full working order in 1879.

(c) I have intentionally referred to the Telephone of 1876 as a "toy", because it was the term said to have been used by a great predecessor at the time; and I can understand Preece's amusement at the unobservant observers who repeatedly quoted it as indicating his attitude towards a great invention! Quite recently *The Times* Commissioner quoted this old charge.

He said:—

"The Post Office authorities, when the telephone was first brought to England, pronounced it a scientific toy, of no commercial value, and they refused to take it up."

(d) This is what Preece actually said when, with pride and delight, he introduced Bell's Telephone to the British Association in 1877:—

"It is evident that in Reis' telephone everything at the receiving end remained the same excepting the number of vibrations, and therefore the sounds emitted by it varied only in tone, and were therefore notes and nothing more. The instrument remained a pretty philosophical toy and was of no practical value."

You will see that the offending word was not applied to Bell's telephone at all, but to a device that not only was then, but still is, "of no practical value."

Preece proceeds "... it remained for Professor Graham Bell ... to make the discovery by which tone, intensity and quality of sounds can all be sent. He has rendered it possible to reproduce the human voice with all its modulations at distant points." And Preece ends his communication:—

"... there is no doubt that scientific enquiry and patient skill will rapidly eliminate all practical defects."

What could be more scientifically sympathetic, especially in view of the fact that at the very same meeting the inventor himself said: "I do not bring this before you as a perfected invention, as it is only in an embryo state"

(e) Personally I suspect that Preece *did* actually use the term of Bell's telephone, although not publicly. He was by no means averse from "ragging" some of his relations; but *The Times* correspondent should know Preece's record better than to think of him as apt to stifle invention.

(2) In 1880, as the Postmaster-General said in his Report, the telephone was brought prominently under public notice by two companies whose object was "to establish what are called Telephone Exchanges The Department is advised that the system of these companies constitute an infringement of the monopoly . . . and steps have been taken to protect the rights of the public."

On Dec. 20, 1880, the High Court of Justice decided in the action of the *The Attorney-General v the Edison Telephone Company* :—

That a telephone is a telegraph within the meaning of the Telegraph Act.

That a telephone message is a telegram.

That the operations of defendants infringe the Postmaster-General's monopoly.

How correct this judgment was is amply demonstrated by the well-known facts of the present day that a great volume of telegram traffic is handled by telephone and that the expansion of the telephone system automatically restricts the growth of telegraph business. Although this statement is open to an obvious retort, I leave it as being substantially and essentially correct.

(3) One of the lines of argument suggested by Preece was that it could be "shown experimentally how gradual and imperceptible the transition is from a telegraphic apparatus pure and simple (like a sounder) to the telephone as at present used."

He must have been very disappointed that the case was fought on affidavits. It would have been such a joy to him to exhibit in court the working models that were to prove his case. They are only Museum exhibits now!

(4) *Telephone Policy.*—The telephone having been declared to be a telegraph within the meaning of the Act, and, therefore, within the monopoly of the Postmaster-General, it became necessary for the Post Office to decide upon its policy in the matter. This was formally announced by the Right Hon. Henry Fawcett (Postmaster-General, May 14, 1880 to Nov. 7, 1881) in 1881. He explained that the Post Office would not work the Government monopoly exclusively, but would grant licenses to approved companies in such manner as would serve best to prevent a monopolistic condition from arising. There may have been good reasons for its adoption, but an oil and water policy like that was bound to fail. The licence granted in 1881 to the United Telephone Company even authorised competition with the Exchanges of the Postmaster General himself.

(5) With such open competition, in self-defence and indeed in the interests of the new art, the stronger had to absorb the weaker. It even appeared that companies were started in order that they might be bought up. How else can one account for the launching of a "New Telephone Co.," in competition with the N. T. Co.? So in 1892 the position was reviewed, and it was admitted that the results had not worked according to plan.

I must confess that I am of the sceptics who wonder at but fail to believe in or admire the 11,000 telephone companies of the United States. What chaos there would have been but for the paramount influence of the "Bell" Company!

Trunks.—(1) As the local telephone service expanded the need for inter-communication between distant towns became more clamant. The National Telephone Company, having exchanges in many towns, naturally felt the necessity earliest, and was forced to provide such facilities to its subscribers. After a time it became evident that a licence to a local company was almost valueless while its rival could virtually claim a monopoly of speech communication with areas outside its own boundaries.

(2) Whether or not the Post Office realised that the trunk system was really a serious burden to the enterprising company that had developed it, I do not know. As early as 1879, Preece had urged that restriction of all licensees to operate only within the licensed area (which in those days was limited to a radius of half a mile from the exchange), and control of all trunks by the Post Office, would provide a very tight coupling with the various companies and give the Department full control of the telephone business. It was not until 1892 that the Treasury decided upon adoption of this course and that a Bill to give effect to that decision was submitted to Parliament. The Telegraph Act, 1892, was passed on June 28. At the same time the radial limit was relaxed.

(3) Authority to proceed being thus secured, the business of surveying the existing plant belonging to the National Telephone Company and assessing its value had to be taken in hand. Many an officer now holding a good position may date his success from opportunity presented and good work done at that time. In the result on April 4, 1896, the Accountant-General handed the representative of the National Telephone Company a warrant for £459,114 3s. 7d.—probably a bigger cheque than any reader has paid into his banking account for a long time! For that sum we acquired 29,000 miles of wire on 2,651 miles of route.

(4) The transfer itself was an exceedingly difficult technical matter. Every small company had employed its own chief engineer, who had made a point of introducing special features into his system. Even when the National Telephone Company had absorbed the small company they had not troubled to modify the working; so that our internal plant survey officers were constantly coming across fresh "gadgets" as we might say now, but that the technical people at Headquarters then might have called "snags." Naturally these variations all had to be provided for in order that they might work in with the trunk communication system that we had determined upon; that is an automatic calling and clearing system. All the time we were working at heavy pressure, and I acquired a horror of dates being fixed for the transfer. At last Cooper came one day (I think it must have been about March 1895) to tell me that it had been "finally decided" that the transfer should take place on May 1. I took immediate opportunity to tell Preece that it couldn't be done. He said it must—the Secretary insisted. I explained that unless we entirely abandoned our agreed scheme the supply of so many pounds of a very fine silk-covered wire was essential, that only one firm could produce this and that at the rate of a few ounces a week—I ventured to suggest that the game of fixing dates should be held in abeyance, and that it would probably be better to effect the transfer by stages.

(5) Ultimately, the first stage of the actual transfer was reached by transfer of the South of England circuits on April 4, 1896, and the final section was taken over on Feb. 6, 1897.

(6) Of course it was not really only a matter of "transfer." Supplementary circuits were provided on an extensive scale, so as to provide a coherent scheme of trunk communication for the whole country. By the end of 1896-97 the 29,000 miles of wire, of the company's system had been supplemented by nearly 20,000 miles making, with circuits in course of construction, a total mileage of 52,800 miles; which gave over 880 separate trunk circuits. The total cost to March 31, 1898, was under £1,200,000, including the payment to the National Telephone Company.

(7) **Double Time at Single Rate.**—In 1903 it was arranged that for communication upon Trunks at night (between 8 p.m. and 6 a.m.), the ordinary rate should cover a 6-minute call instead of the normal 3-minute period.

Telephone Exchanges.—"Active Competition."

1. The licensees got very little competition from the Post Office until the Telegraph Act of 1899 authorised an expenditure of £2,000,000 for the provision of telephone exchange facilities in London and other places.

This decision was arrived at to meet the ever-growing complaints of the public that the Telephone Companies had utterly failed to meet the telephonic requirements. In fact we have already tried the non-national system and it failed!

2. The same Act empowered authorities of boroughs and urban districts to work telephone areas outside the limits of their ordinary jurisdiction; subject of course to the license of the Postmaster-General.

3. **Telephoning London.**—(a) Again the engineers were confronted with a big work—the telephoning of London. In anticipation, Mr. (now Sir John) Gavey (Engineer-in-Chief, 1902-1907) and the late Mr. Matthew Cooper (whose sudden death in 1900 was a very serious loss to the department), visited the U.S.A. in 1898. One result of that visit was the decision to adopt the Common Battery System for the principal London exchanges. It was then being called the Central Battery System, but I pointed out the inconvenience of using that word, already extensively appropriated to designate the principal exchange of a city.

(b) The telephone experts of America admitted that the telephoning of London was the biggest proposition that telephone engineers had ever had to tackle, and freely said they would follow the operations with the keenest and closest interest.

(c) We commenced by the design of a duct system that, although too expensive for present-day general practice, has been very widely adopted by other authorities.

(d) Then we devised and designed manholes for footway and roadway as a more convenient and far cheaper method of handling cables than that previous adopted of leading-in to an adjoining building for distribution of cable circuits.

(e) The provision of a great underground system of cables all over London to meet not only our own needs but to hand over to the National Telephone Company on rental terms to enable them to carry on was a task of no insignificant magnitude. Incidentally, it involved systematic recovery of all the G.P. cable previous installed, which represented greatly increased efficiency at greatly reduced cost (1902-3).

(f) **The Central Exchange.**—The Central Exchange, laid out for 14,040 subscribers and opened in 1902, had only 5,847 subscribers connected, when a second exchange of capacity for 16,200 subscribers was being laid down.

(g) We find Central, Western, Victoria, and four Thames Valley Exchanges opened in one year, with Mayfair, Hampstead, Croydon, Epsom, Sutton, Ealing and Crouch End well in hand.

(h) I have an idea that people with whom the Post Office does business do not find the incompetence that is so easily discovered by *The Times* Commissioner. For instance, I wonder if the National Telephone Company, when they agreed that they would share the costs of inter-communication between the two systems when P.O. subscribers in London reached 10,000 expected that this qualification would be attained as early as 1903—the year after we started?

(i) **Wayleaves.**—Volumes have been or could be written about wayleaves; pounds have been spent to save payment of shillings, but until Parliament ignores private and municipal rights in property, the Post Office will continue to struggle against more impossible conditions than any other administration has ever had the need or needed the courage to face. When we came to telephoning we realised how thoroughly the National Telephone Company, with absolutely no statutory rights or powers, had "queered our pitch." Where we had grudgingly submitted to be "fleeced" for 1s. they had flung largesse to the receptive property owner. The effect was to take us into the Law Courts, or alternatively to thrust us underground.

We found in fact that this general stir led local authorities and private owners alike to become very jealous of their rights in regard to wayleaves and local control. One Corporation Surveyor, for instance, having agreed the "depth, course and position" of the Department's pipes in the terms of the Act, refused to allow a variation of as much as one inch from that so "agreed."

4. **Principles of Telephone Extension.**—In 1905 in giving a list of 76 places where telephone exchanges had been opened, giving also trunk communication, the Postmaster-General mentioned that at nearly all there was previously no telephone service. That represents the general sound principle upon which Post Office service of the public has been based.

5. **Telephone Transfer.**—(a) In 1905 an Agreement was made with the National Telephone Company which provided that the Post Office would take over by purchase the company's telephone system at the end of 1911 on the termination of the licence. Provision was made to ensure the proper maintenance and development of the system meantime.

Here again I may not wander into the fields of surveying, of accounting, of collating, of conferring or (more attractive still) of anecdoting upon which a whole campaign was fought out. It has matter for a volume by itself.

(b) It must suffice to note that at midnight on Dec. 31, 1911, the addition of the National Telephone Company's great system to the not inconsiderable existing system of the Post Office became an accomplished fact. So far as I can make out deterioration of the Service commenced one minute later and has progressed ever since!

(c) The figures for the plant transferred compared with the then existing Post Office plant give some indication of the problem that the amalgamation must necessarily have presented:—

	N.T.Co.	Post Office.
		Mar. 31, 1912.
Underground.		
Miles of conduit	3,435	5,728
Miles of wires	827,400	705,650
Overhead.		
Poles and standards	No. 423,300	miles 53,105
Bare wires—miles of wire	258,500	298,401
Aerial cable	110,000	—
Submarine:		
Miles of wire	—	2,249

(d) The Company transferred 1,565 exchanges, having about 562,000 subscribers' telephones. This brought our total of exchange subscribers' telephones to 704,000.

(e) The price finally paid to the company was £12,470,264. The company's original claim was £21,046,7000 and the Post Office estimate £9,381,048.

Growth of Plant and Traffic.—It will be of some interest to compare figures for the year after transfer and corresponding figures for last year for both trunk and local services:—

	1897.	1920.
Trunks.		
Miles of wire	52,800	441,092
Trunk calls	5,898,247	54,049,389
Average cost	5.45d.	8.4d.
Local exchanges.		
Miles of wire	1913.	1920.
No. of subscribers	2,199,951	2,806,971
Calls	704,000	—
	797,000,000	848,500,000

Automatic Working.—1. *Automatic Signalling.*—Under Preece's guidance the British Post Office was far in front of all telephone administration in its recognition of the value of automatic working, and even as late as 1897 we could record that experts constantly expressed surprise and admiration at the extent to which we had perfected automatic signalling.

2. *Automatic Switching.*—(a) The first automatic switch was brought to this country in 1899. I did my best to induce the Department to install one as an official switch so that we might be in touch with its development. Scribner, the inventor, said that if we had one we must take over one of their trained mechanics to maintain it, and it was decided that we had better hold our hand.

(b) At the present time, however, it is a fact that we have in actual use not only samples of all promising types of automatic switchboards, but also that our percentage of automatically-operated subscribers 'sets to the total number is higher than that of any other telephone administration in the world.

Minor Developments.—(1) *Continuous Day and Night Telephone Service.*—The Post Office at a very early date aimed at an "open always" telephone service, and by 1914-15 of 3,052 exchanges, only 357 had any restriction in regard to the period of service.

(2) *Trunk Service.*—It was an obvious inconvenience that trunk communication should have to be originated in a building quite distinct from the local exchange. In 1912, at the time of the telephone transfer, there were 293 such cases; by 1915 this number had been reduced to 83.

(3) *Reply-paid Vouchers.*—Telephone subscribers who usually dictate their telegrams by telephone may use reply-paid vouchers in payment of accounts for telephone fees, &c. (1912).

(4) *Spelling Code.*—There is, I fancy, one little detail of instruction of the operators who transmit telegraph messages by telephone that might be improved upon. I refer to the method of using the code, which is meant to help operators to get difficult words through. This is how it works. I had a service call the other night. The operator said: "Here's a long message in French, will you take it?" "Go ahead!" and he did, something like this:—

T for Thomas; E for Edward; L for Louisa; L for Louisa; M for Mary; E for Edward; W for William; H for Harry; A for Alfred; T for Thomas; I for Isaac; T for Thomas; W for William; A for Alfred; S for Sarah.

That was not the message. Probably most of you can TELL ME WHAT IT WAS, but my French was not equal to it!

Technical Developments.—It may have occurred to some of you that I have rather avoided technical matters. So I have—a fifty years' history of technical details would be somewhat indigestible. But I had better speak of a word or two.

(1) *Superposing.*—It is only a word, but what a vast work it represents to us now. How strange to us now looks the day of small things. In regard to this as in so much else our visitors are apt to say, "you have nothing much to learn from us."

These circuits, that we call "phantom" circuits—surely less prosaic folk would call them "fairy" circuits! I cannot tell you all we do with them. How we get a phantom circuit additional from two physical circuits, and it is a better circuit than either; how we bluff a telephone circuit into taking a telegraph circuit into itself although putting that same circuit beside it might cause it serious interruption; or how we combine a bit of a telegraph line with a bit of a single wire telephone circuit to improve the efficiency of the telephone circuit.

(2) *Loading.*—Is only another word, but it carries one into the fairy land of science where miracles are worked. The researches of Oliver Heaviside led the way. I remember his articles in the *Electrician* when the editor remarked that he was proud to have the articles in his columns because such work should be published, but probably few readers could follow its meaning! Then Pupin put Heaviside's mathematics into the form of coils with iron core, and we had "coil-loading"; and someone else, later on, stretched out the iron core and wound it round a copper conductor, and we had "continuous loading"; and now we know that we had to wait for many years for this because we had not the knowledge to read aright the mathematics of that long ago.

(3) *Balancing.*—This is another word of great import too. One that we are specially interested in because our own engineers have probably done as much as any to give it practical application.

It means that we so sort out and connect sections of the various pairs of wires in a cable, that we secure accurately balanced pairs over long distances, whereby loading and superposing can be made supremely beneficial.

(4) *Telephone Repeaters.*—When in 1893 I wrote in the *Manual of Telephony* that a fortune awaited the inventor of an efficient telephone repeater, I neither thought we were within sight of a solution nor did I realise that the "fortune" would be so divided between a multitude of workers that it would only accrue to the art and not to the individual. Yet so it is. The so-called Thermionic Valve first used for Radiographic work has now been

developed to meet the far more exacting requirements of the duties of a telephone repeater. This is a true repeater; that is to say, its introduction does increase the efficiency of speech to the limit of the worst sections of the line, so that the shorter the section the better the speech. In fact the "valve" is also an "amplifier"—it is capable of magnifying the incoming energy as much as 1,000 times. It has been stated that the Admiralty, in order to pick up certain buzzer signals between German ships, employed as many as 19 thermionic amplifiers in cascade—a magnification of about a million times.

For ourselves we were among the first to hail its advent and to take advantage of it.

We have applied it to telegraph circuits. For example, the speed of our £250,000 war cable to Russia was increased by 60 per cent. by the application of valves. Our new underground cables to the north of Britain (although meant for far greater distances) will consist of conductors only one-fifth the weight of those laid in 1913; and only one-tenth the weight of the aerial wires erected for the same purpose twenty years ago, when, with the completion of a most carefully-planned cable on the best known lines, we had just proved it impossible to telephone underground to Birmingham. All by means of what looks like a rather curious incandescent lamp.

We have nine Telephone Repeater Stations already working and others "under weigh," several of which will be specially built on selected sites.

Miscellaneous.—*Storms and Lightning.*—The periodical occurrence of severe storms has blazed the course of the history of open telegraph wires with disaster. Hitherto, not only has regard for economy prevented the obvious adoption to an all-underground system, but the efficiency of the service was dead against it. Now that loading and balancing and thermionic valves are with us, and there is a progressive reduction in the cost of underground work, no doubt in due course—and building of hundreds of miles of cable route takes a considerable amount of time—we shall be less dependent upon absence of storms for continuity of our communications.

(2) A great storm which swept the country in 1876 definitely shaped the policy towards construction of underground circuits. At that time we had over 8,000 miles of wire underground as compared with 1,928 miles in 1870.

(3) Old telegraphers remember still the snowstorm of Dec. 26, 1886. It bore the "record" of its time. It swept the whole countryside and left London with only 7 circuits to the provinces.

No doubt this storm greatly accelerated the policy of extending the underground system, and the next year shows that of the 1,745 circuits to the C.T.O., not one passed over London—every one came in underground.

(4) Snow storms and gales in Feb., 1900, cost £13,000 to repair. It is remarkable that the Postmaster-General awarded a gratuity of one day's pay to all workmen of the Engineering Department who were employed in restoring communications.

(5) At the end of March, 1916, a most severe gale, accompanied by snow and freezing rain swept across the whole country from the north-east. It left a belt of devastation. Over 41,500 poles had to be re-erected, more than 17,000 miles of copper wire had to be issued to replace that thrown down. The cost of repair was at least £350,000.

(6) *Lightning.*—Little more than 20 years ago the occurrence of a storm accompanied by lightning was virtually a signal for the practical cessation of all operating of a telephone exchange, owing to the nervousness of the operators. We realised that with our wide-flung Trunk system that would be insupportable, and we set ourselves systematically to inspire the confidence of the staff by adoption of every possible precaution. And we succeeded.

Personal tribute.—Amongst the figures which outstand in the memories of the older engineers is Harry R. Kempe. Everyone knew his technical ability; many recognised his great mechanical ingenuity; and I fancy that an unusually large circle delighted in his genial personality. I wish that I could have given more than a paragraph to some of his contrivances. I have already referred to the Sounder Silencer. The Water level Apparatus was also his, and one of the prettiest of mechanical contrivances—the electrically-driven quarter-minute clock—was also due to him (1898).

Staff.—At the transfer the Government determined to continue the practice of the companies and to work the telegraphs by women as well as by men. In these days we are used to the idea, but it was a distinct experiment in 1870. In 1871 and in 1914, the number employed were:—

		1871	1914-15
Men	...	2,035	191,032
Women	...	479	62,718
		<u>2,514</u>	<u>253,750</u>

The earlier figures, of course, represent telegraph operators almost entirely, but the figures for the year before the War relate to all classes in Post Office service.

Technical Education and Instructions.—It has not been possible to refer to the encouragement of technical efficiency that has been systematically extended to the staff, and as systematically responded to. Nor can anything more than reference be made to the printed technical literature that has been issued; from the first modest paper of June, 1870, on "Technical Terms,"

to the pamphlet issued this month with the same title as one of a series of "Technical Pamphlets for Workmen," the production of which series was initiated by the present Engineer-in-Chief last year, and of which nearly sixty of the series have already been issued.

It must suffice, too, only to mention the foundation by the Department of the Institution of Post Office Electrical Engineers (whose publications have a world-wide circulation) and of our own Telegraph and Telephone Society, continued from the corresponding organisation of the late N.T. Co.

Suggestion.—I wonder whether a mere engineer may venture on a constructive administrative suggestion.

When Parliament decreed the birth of Postal Telegraphs, the total number of employees of the Post Office was 28,429, and the Telegraph employees to be added numbered 2,514, making a total of 30,943. To-day the Postmaster-General, through the Secretary, rules an army of about a quarter of a million men and women.

His business includes:—

i. Collection and delivery of:—

Letters, &c.	5,800 millions
Parcels	132 "

ii. Savings Bank with—

Depositors over	9 "
Deposits "	23 "
Amounting to "	£51 "
Withdrawals "	11 "
Amounting to "	£50 "
Annual Interest payable "	£4½ "
Total Deposits "	£187 "

iii. Money Orders and Postal Orders, about 175 million transactions of value £120 "

iv. Telegraphs with receipts over £3 "

v. Telephones with receipts over £6½ "

(1914 figures are used).

It seems to me questionable whether Parliament can reasonably pretend to hold a single Minister responsible for this vast concern; and that there would probably be a clear advantage in having one Minister of Posts and another of Telegraphs. It is scarcely to be expected that the head of the present department can obtain such a grip upon the enormously technical system of telegraphs and telephones as to be in a position of effectual control.

Of course, there would be no need to separate public telegraph from postal business, but the respective charges could be settled, as presumably such charges are settled, in respect of the enormous work now done by the Post Office in payment of old age pensions and other matters which I have not included above.

War.—(1) *South Africa.*—In many ways, the War in South Africa (1900-01) was a blessing in disguise—it helped us to understand some of the difficulties of real war. How ludicrous it seems now to read that 210 men of the Engineering Department served in South Africa, and that important works suffered in consequence. All but 13 (including 7 R.E.'s) who died in South Africa, were back in 1902.

(2) *The War.*—(a) The Post Office Telegraphs were in the War from the first moment—the five German cables from Borkum to Brest, Vigo, Tenerife and Fayal being cut by our cable ship in the early morning of Aug. 5, 1914.

(b) Throughout the War the cable repairs required of the Post Office Submarine Department numbered no less than 285.

(c) In September, 1915, the *Monarch* struck a mine off Folkestone and sank with the loss of three lives. She was replaced a year later by the new *Monarch* at a cost of £65,000.

(d) A total of over 114,000 emergency works were carried out for the Naval, Military and Civil authorities during the War. Some were of very great magnitude, such, for instance, as the Telephone Exchange at the Hotel Cecil, with 41 Operators' positions and 2,000 lines, plus 300 junctions. It was ready for service in eight weeks from the time of receipt of the order.

(e) Major Purves' work in charge of designs, to meet the needs of the armies, is fairly well known. Under his direction, about 200 items of special apparatus were designed; contracts exceeding a million pounds in value were placed for such items; and the designs produced are now the accepted standards.

(f) To Mr. Sinnott was due the design of some of the military cables, including the novel device of enamelled copper wire, gutta-percha covered. This, at a later date, but during the War, was patented in the British Patent Office, by a citizen of Berlin!

We supplied, of various types of trench and field cable, nearly 45,000 miles, with a wire mileage of about 200,000 miles.

(g) The Post Office purchased, examined, tested and supplied to the Military Authorities, stores to the total value of nearly 9½ million pounds.

(h) When War was declared, the Post Office became responsible for withdrawal of all wireless apparatus—there were 2,916 licenced stations, and 800 unlicenced. We erected 22 detecting stations for the tracing of illicit signalling, and in other ways the services of our skilled Radio Engineers were utilized by the Forces of the Crown.

(j) The help rendered by our very restricted Research Section was quite considerable. Mr. Pollock's assistants produced about 23,000 sound-ranging microphones, which G.H.Q. officially reported had located over 80 per cent of all the enemy gun positions at the front.

(k) These are only a few of the ways in which the Engineers of the Post Office helped War work. Other departments did their share also, and the War work of the British Post Office would form a really entrancing story for some Post Office man to take in hand.

(l) The effect of the War upon development of our ordinary system may be illustrated by the following figures of overhead trunk circuits during the last six years.

	Miles of Wire.	Number of Poles.
1914-15 ...	22,040	17,200
1915-16 ...	12,000	7,100
1916-17 ...	844	353
1917-18 ...	783	543
1918-19 ...	215	218
1919-20 ...	6,400	4,300

(m) Damage to telegraphs by air raids and bombardment from the sea cost the department about £11,000.

(n) Our contribution of men was of a much more serious character.

Staff of all grades released from the Engineering Department (excluding 106 members of K Telegraph Co. of R.E.) numbered 12,877—about 51 per cent. of the total employed immediately prior to the outbreak of War. Of these, 942 lost their lives while on active service. The Post Office as a whole, sent about 85,000, including 700 or 800 women; and a total of 8,870 lost their lives.

(o) The War found the telephone system under Government control, and the fact was of inestimable value to the Nation. The United States Government had to take charge of the telephone service there during the two years of its participation in the War. Our five years of war did not disorganise our service more seriously than the U.S.A.'s two years did their numerous organisations.

Insurrection in Ireland, 1916.—Insurrection seems a condition so foreign to our experience that one must just refer to the Sinn Fein Insurrection in Dublin at Easter, 1916. The resource and initiative of the Post Office Engineers went a long way towards saving the situation, as they secured communications with London and obtained military protection for the vital telephone communications.

Conclusion.—In making a review of the work, one is constantly impressed with the feeling that never a chance is missed by the Post Office busy bees to improve the shining hour. At one time you will find them designing a new submarine cable, with a view to better communication with the Continent. Then, when there is no new cable to be laid, they must needs carry on an exhaustive series of experiments to ascertain what distant provincial town can get through by telephone to Belgium or what distant places in France can speak efficiently to London.

In presenting this address, Ladies and Gentlemen, I have sought to deal with the subject with a due regard for historic proportion; I have prepared an "Apology for State Telegraphs" in the old ecclesiastical schoolman's sense—a statement of the considered facts of the case *for*. When I commenced my work I had a feeling that at some stages it might be reasonable to be apologetic; to admit that at this stage or at that, private ownership of the system might have given better results; but I submit, that with such a record of consistent and substantial progress, there is no reason to be apologetic; that with such a record, it may justly be held that the wisdom of the decision arrived at 50 years ago has been amply justified by the results.

I would also venture to suggest that, altogether apart from such justification, present-day criticism of a Government Telegraph and Telephone System as such, borders on the ridiculous; that if the Government announced an intention to transfer its telephone business to a private syndicate, there would be a howl of protest, even from the critics themselves.

The system is not perfect. It has grave defects, as well as minor blemishes. Like many another, I have spent a lifetime in developing small improvements and removing blemishes. More able men have dealt similarly with bigger matters, and are still concentrating skill and experience of inestimable value to the perfecting of a great ideal. Such work is work to rejoice over and be proud of, but criticism, the only logical outcome of success in which would be denationalisation, can only be thought of as folly.

I must apologise for the inordinate length of this communication, which, even so, has quite woefully failed to give an adequate account of the subject.

THE BAUDOT.—XVI.

By J. J. T.

FIG. XLV gives two sketches of selector levers showing their curious shape, the washered axles *a* also the feet *f* which trail into the slots of either *T* or *T*¹. Each selector lever has its own particular position in relation to the combiner wheel. They are not interchangeable, being carefully ground down to fit with special exactitude.

Fig. XLVI gives another photographic view of the combiner wheel with its gearing *R*, selecting disc *V* and cams *K* and *K*¹, the rest and working tracks *T* and *T*¹, printing wheel *V*¹ and type-wheel *W*. The two latter, as already mentioned, are fitted to the

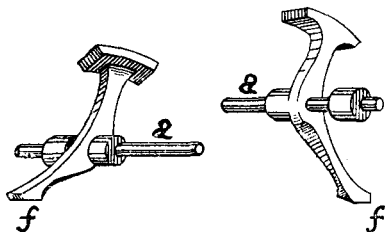


FIG. XLV.

axle *X* by an extension *X*¹ which extends beyond the receiver casing. *X* carries a cam, *K*¹, the cam itself being adjustable on *X* by means of a fixing screw *L* shown in the photo on the under side of the axle.

Bearing in mind the position of *V*¹ and *W* outside the receiver casing, we continue our study of the sequence of levers, &c., and their movements consequent upon the jerking upward of the sixth lever *C*⁶, Figs. XLII, XLVI and XLVIII. Owing to a failure of the type in some of the impressions of the last issue of the T. & T. JOURNAL, this lever was incorrectly described as *C* instead of *C*⁶ in the text, p. 29, par. 2.

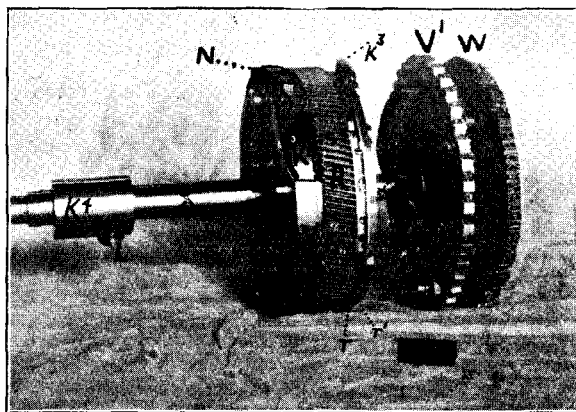


FIG. XLVI.

Upon an extended axle of *C*⁶ is rigidly fixed the "propulsion" lever *OO*¹ (Figs. XLVII and XLVIII) and into this lever is embedded one end of the "finely tempered steel spring" already mentioned. The free end of this spring passes underneath the end of an adjustable tension screw *B* (Fig. XLVIII). To the free end of *OO*¹ is fitted a crank *K*, which carries the propelling rod *R*, the lower end of which is screwed into a second crank *K*¹. The length of *R* may be slightly modified by means of its screw-ends which fit into *KK*¹. *K*¹ carries a short arm *f* which bears *P* known as the pedal. This

pedal fits on to the front of the receiver casing and its free end terminates in a hammer-head *H*. A click *C* pivoted at *e* presents its lower end *d* to the under surface of the hammer-head *H*, support being given to *d* by the flat spring *F*. The retaining end of *C* holds *Ca*, the printing cam, in position when no printing is taking

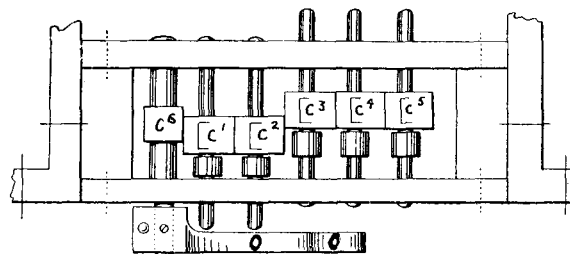


FIG. XLVII.

place. The sequence of movement is therefore as follows:—When *C*⁶ is thrown slightly backwards by the rejection of the selector levers the motion is imparted to *OO*¹ which draws the rod *R* up with it; the arm *f* carried in the same direction, throws the hammer-head *H* of the pedal *P* on to *d* which being pressed down-

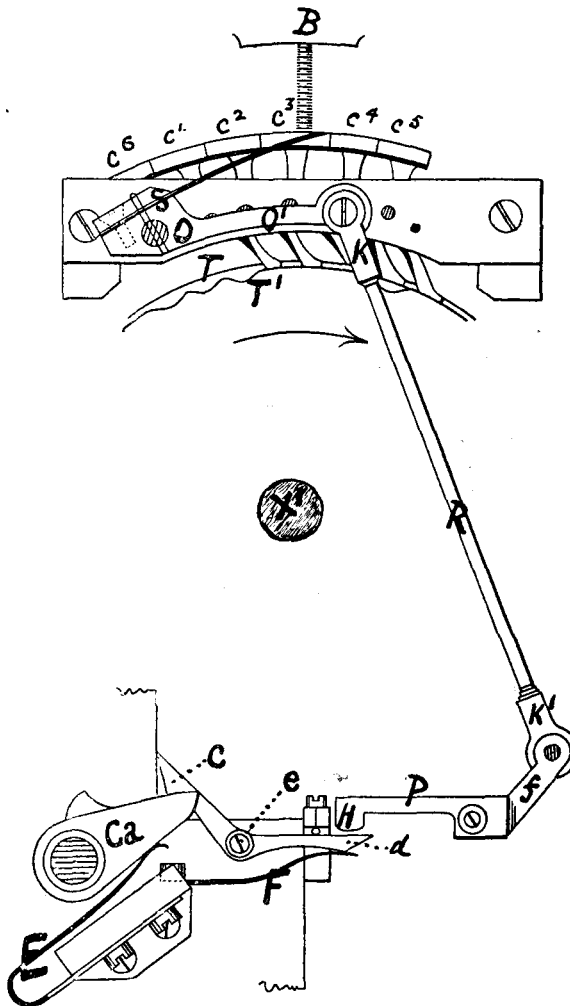


FIG. XLVIII.

wards draws back the retaining end of the click *C* which thus releases the printing cam *Ca*. This latter, impelled by a strong steel spring *E*, flies upward, its nose engaging with the teeth of the printing wheel *V*¹ (Fig. XLVI) which rotates just above it upon the axle *X*¹ (Fig. XLVIII).

(To be continued.)

THE TELEPHONIC DEVELOPMENT OF THE WORLD AT DEC. 31, 1919.

BY W. H. GUNSTON.

DESPITE four years of War in which all the larger telephone-owning countries (except Sweden) were engaged, the total number of telephones in the world has increased from about 14,500,000 in 1913 to 19,370,000 in 1919. In Europe the increase is from 3,950,000 to 4,880,000.

These figures are based on recent official information except in the case of a few countries which are not in a position to supply data. In these cases, as explained in the following notes, recourse has been had to estimates computed from the latest obtainable figure. Information respecting some of the extra-European States, whose telephonic development is in the hands of several telephone companies, is difficult to obtain, and estimates have been resorted to in these cases also.

EUROPE.

The total number of telephones in Europe is approximately 4,880,000, giving a ratio 1 telephone to 82 inhabitants. This proportion would be much better if Russia, Spain and the Balkans were excluded. It is a remarkable fact that within a boundary embracing Sweden, Norway, Denmark, Germany, Austria, Switzerland, Holland, Belgium and Great Britain, are included 3,870,000 of the 4,880,000 telephones in Europe, giving a ratio of 1 telephone to every 35 inhabitants. The Latin countries account for only about 610,000 of the total number of telephones, and other States for about 400,000. Whether the striking difference in the development of the Latin States and those which are mainly Teutonic either by race or speech is due to language, temperament or latitude is a problem of which there is no obvious solution.

Austria, which had 160,000 telephones in 1913 has now, after the loss of Bohemia, Carniola and the Coast Provinces, 114,075. Vienna has 79,858 telephones, and Graz 4,257.

Belgium had 54,691 lines in 1914, but most of these were dismantled during the German occupation. The system is so far re-established that there are now 30,383 lines, which converted to stations should represent about 38,000. There are 10,813 lines in Brussels and 5,348 in Antwerp.

Bulgaria.—No recent information is obtainable. This country had 4,378 telephones in 1915.

Czecho-Slovakia.—No information obtainable. On the basis of the development of Bohemia, Moravia, &c., before the War, it is estimated that there are 54,000 telephones in this country. Prague had well over 10,000 stations before the War.

Denmark.—The number of stations is given as 207,130, but this is probably the number of lines, as there were 219,460 stations in 1918 and the progress in Denmark is steady. The number of stations should be about 238,000, of which 85,363 are in Copenhagen.

Estonia has 1,896 stations, of which 863 are in Tallinn (Reval).

Finland.—No information has been received since 1911, when there were 35,000 stations in this country. As there is no clue to the rate of development no further estimate has been attempted.

France, which had 328,000 telephones in 1913, has now 399,519, inclusive of those in Alsace-Lorraine. Paris has 149,050 stations; Marseilles 10,891, and Lyons 9,780.

Germany, despite the loss of its Polish provinces, Alsace-Lorraine and other territory, has increased since 1913 from 1,302,607 to 1,767,156 stations. Berlin has 187,982; Hamburg 80,697; Munich 41,504; Leipzig 37,732; Frankfurt 35,003; Cologne

33,764; and Dresden 32,006; while altogether 21 cities have over 10,000 stations.

Great Britain has increased from 774,300 in 1913 to 911,937. London has 311,350 stations; Glasgow 40,936; Liverpool 38,493; Manchester 37,748; Birmingham 24,528; and Edinburgh 17,224. Twelve cities in all have over 10,000 telephones each.

Greece.—No information has been received respecting this country, which had 1,967 telephones in 1912.

Hungary.—It is difficult to estimate the number of telephones in this country, which is not yet in a position to furnish statistics. Allowing for loss of territory, there should be about 60,000 telephones within the present limits of the Republic. Budapest had over 20,000 stations before the War.

Iceland had in 1919 2,033 stations, of which 998 were in Reykjavik.

Italy.—The number of telephones in 1919 (99,637) shows an actual decrease compared with 1918 (115,668). This is attributed "to the invasion of Venezia and the necessities of War." Milan has 15,331 stations, and Rome 13,425.

Jugo-Slavia.—No recent information is obtainable, nor has any estimate been attempted. The few thousand telephones in this State would make little difference to the total for Europe.

Luxemburg has 5,190 telephones, of which 2,236 are in the town of Luxemburg.

Netherlands.—Information for 1919 is not yet available. There were, however, 134,507 telephones in this country in 1918, and at the usual rate of development there should be about 142,000 now. Amsterdam has 20,211 telephones, and the Hague and Rotterdam each over 10,000.

Norway also has not furnished figures for 1919. It had 122,699 in 1918, and should have about 133,000 now.

Poland.—The total number of telephones is 36,169, of which 22,400 are in Warsaw. This points to an extraordinary destruction of the system during the last few years. In 1915 there were 37,000 telephones in Warsaw and Lodz alone, to say nothing of the rest of Poland, Posen, Galicia, &c.

Portugal.—The Anglo-Portuguese Telephone Company has 12,836 stations, and there are probably about 2,000 on the State system. Lisbon and district has 9,413 telephones.

Rumania.—No recent information available. Rumania had 20,000 stations in 1914 and has since had a large accession of territory. On the other hand, it must have suffered considerably from the War.

Russia.—No information is procurable from Russia, and any estimate of its total number of telephones must necessarily be uncertain. There were 324,500 telephones in the Empire in 1915, but after deducting those in Poland and the Baltic States, about 250,000 would remain. Allowing for a decrease of 50,000 owing to unsettled conditions, 200,000 might approximate the present total in Russia, Lithuania and the Ukraine.

Spain.—Information for 1919 is not yet available. There were 57,391 telephones in 1917, and at the usual rate of increase the present total might be 75,000.

Sweden.—The number of telephones has increased from 234,089 in 1913 to 388,794 in 1919. Stockholm has 126,961, Gothenburg 21,850, and Malmö 11,227.

Switzerland.—There were 96,624 stations in 1913 and there are 138,843 now. Zurich has nearly 20,000 stations, and Geneva and Basle over 10,000.

Turkey.—The Constantinople Telephone Company had 5,820 stations in April, 1919, and 6,078 in April, 1920.

EUROPE.

	Telephones 1918	Telephones 1919	Population† Millions	Ratio of inhabitants to telephones
Austria	—	114,075	9.5	83
Belgium	—	38,000	7.5	198
Bulgaria	—	4,378	5.5	1,256
Czecho-Slovakia	—	54,000*	13.	240
Denmark	219,460	238,000*	2.9	12
Estonia	—	1,896	0.48	253
Finland	—	35,000*	3.	86
France... ..	367,898	399,519	41.5	104
Germany	—	1,767,156	57.	32
Great Britain	854,043	911,909	45.5	49
Greece	—	2,000*	6.	3,000
Hungary	—	60,000*	12.	200
Iceland	—	2,033	(86,500)	43
Italy	—	99,637	37.5	375
Jugo-Slavia	—	—	11.6	—
Luxemburg	4,627	5,190	(259,800)	50
Netherlands	134,507	142,000*	6.8	47
Norway	122,699	133,000	2.6	20
Poland	—	36,169	13.	361
Portugal	10,935	14,000	9.6	700
Rumania	—	20,000*	17.	850
Russia	—	200,000*	?	—
Spain	—	75,000*	20.	266
Sweden	373,993	388,794	5.5	14
Switzerland	124,192	138,843	3.8	27
Turkey	5,820	6,078	?	—
		4,886,000	400.	82

† The population figures are based on the latest Censuses, the dates of which vary between 1910 and 1916. Those for France and the other States with altered boundaries are estimates for the years 1918 and 1919.

* Estimated. See foregoing notes.

ASIA.

The feature of the telephonic development of Asia is that the further East one goes the more telephones one finds. Japan has over 309,000; China and Hong Kong about 33,000; Dutch Indies, 32,000 and India, 30,000; whilst in Persia, Arabia and Turkey in Asia the telephone is practically non-existent.

The figures for Japan are official, whilst those for China are based on an American estimate of 27,000 for 1914. This has not been increased, as it appears to be already sufficiently liberal. An official statement shows that there were 14,112 telephones in China in 1912.

India has 10,797 stations on the Government system and 19,225 on the systems of various companies. There are 7,429 telephones in Calcutta and 7,153 in Bombay.

In the Dutch East Indies there are 28,984 State telephones, and about 3,000 more on companies' systems; 7,060 of these are in Batavia, and 4,850 in Soerabaja.

The ratio of inhabitants to telephones has not been worked out in the case of Asia and Africa, where the proportion of telephones to vast millions would be of little significance.

ASIA.

	1918 (Telephones)	1919 (Telephones)
Japan	290,724	309,385
Chosen (Corea)	11,763	12,300*
Manchuria	6,558	7,000*
Formosa	6,757	7,300*
Sakhalin	819	900*
China (American est. for 1914)	—	27,000
Hong Kong	4,771	5,575
Phillipine Islands (based on American figures)	—	7,000
Dutch East Indies	29,348	32,000
Singapore	2,801	2,916
Malacca and Penang	—	1,339
French Indo-China	1,191	2,000*
India	26,492	30,022
Ceylon	3,011	3,100
Russia in Asia (1915)	—	18,600
		466,000

(Population 910 millions.)

* Estimated.

AFRICA.

Telephones in Africa are almost entirely confined to Egypt, South Africa and the French and other British Colonies. There are 20,827 stations in Egypt, of which 8,033 are in the Cairo district. South Africa has 42,419, of which 15,657 are in the Johannesburg area and 7,736 in the Cape Town area.

AFRICA.

	1918	1919
Egypt	20,689	20,827
Tunis	3,675	4,000
Abyssinia	—	105
Gold Coast (1917)	—	224
Senegal, Dahomey, French Guinea	—	about 500
Madagascar	—	about 500
Belgian Congo	—	about 200
British East Africa and Uganda	—	about 600
South Rhodesia	—	about 900
Union of South Africa	38,396	42,419
		70,300

(Population 180 millions.)

(To be continued.)

REVIEWS.

"Telegraphy." By T. E. Herbert, A.M.I.E.C. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, W.C.2. 18s. nett.—This is the fourth edition of a book first published in 1906, which has been brought up-to-date by the author, a Post Office Engineer, with the aid of his colleagues who are specialists in their particular branches of the art. The treatise, which rightly professes to be a detailed exposition of the Telegraph system of the British Post Office, is recommended by the examiners of the City and Guilds of London Institute Examinations in Telegraphy. It contains over 600 useful diagrams and illustrations and over 1,000 pages. It is a useful compendium of information on the subject, as evidenced by the many editions and reprints which have been disposed of since 1906.

WESTERN DISTRICT CONTRACT OFFICE.

The second annual dinner of the Western District Contract Office took place on Wednesday, Nov. 17, at the Dean Hotel, Oxford Street, W.1.

The Chair was taken by Mr. W. V. Pegden, the District Contract Agent, who was supported by Major G. F. Preston, C.B.E., the Controller, L.T.S.; and Messrs. W. A. Valentine, Deputy Controller; J. Stirling and J. F. Edmonds, Assistant Controllers; W. F. Taylor, Superintendent of Contracts; W. R. Bold, Superintendent of Accounts; P. T. Wood, A. J. Sharpley and F. J. Phillips, London Engineering District.

The programme consisted of the usual toasts, interspersed with vocal and instrumental items contributed by the following members of the staff—Messrs. Horlock, Barnard, Child, Swain, Bradshaw, with Mr. H. Neil at the piano.

Mr. W. F. Taylor, in proposing the toast of the Western District Contract Office, compared himself with a nervous divinity student who had to preach on the subject of Zacchaeus. He commenced thus: My friends, Zacchaeus and I have many similar points. Zacchaeus was a small man; so am I. Zacchaeus was up a tree; so am I. Zacchaeus came down again; so will I. Mr. Taylor gave figures of the great progress made by the Western Contract Office, the largest in the country. Mr. W. V. Pegden, in replying, spoke of the loyal co-operation of the staff which had worked with him during seven years. Mr. P. T. Wood, in proposing the toast of the London Telephone Service, referred to the abatement of the Press campaign. Mr. G. F. Preston, the Controller, responded, and was moved by the anecdote of Zacchaeus to tell of a speaker at a Church congress who said that all sermons should be like a lady's dress—long enough to be decent and short enough to be interesting. Referring to newspaper criticism, Mr. Preston said that he did not object to jokes, but he did ask that criticism should be of a fair character. Mr. W. A. Valentine replied to the toast of "The Visitors," and remarked on the good effect of such gatherings in bringing colleagues together. He mentioned that the London Telephone Service was sending through on an average 1,300,000 calls a day. Mr. J. F. Stirling proposed the toast of the Chairman, and expressed his admiration for District Contract Agents generally and their way of getting things done. The speeches concluded with Mr. Pegden's response.

THE TELEPHONES.

A series of prominent special articles appeared in *The Times* attacking the Post Office management of telephones. It was followed by a series, contributed by a Post Office engineer in defence of the Department—published unfortunately after considerable delay, in smaller print. A rejoinder followed this second series, finding itself also in the larger print and on the prominent page. To this rejoinder a reply was sent and it appeared as a letter to the Editor, but with the omission of the portion, indicated in brackets [, which follows the first paragraph.

I had not intended to make any further demand on your space in defence of the Post Office management of the telephone system, but I hope you will allow me to call the attention of your readers to an article on long distance telephony in your issue of the 14th inst. which, with your editorial comments thereon, is calculated to mislead. The article deals with the notable results which have followed the invention of the thermionic valve, and its adaptation for use as a telephone relay, and, in its announcement as a great and new American solution of the problem of long-distance telephony, it is easy to recognise the well-known voice of the American propagandist, which has recently been allowed to echo from the excellent sounding board provided by the columns of *The Times*. Your editorial notice comments on the fact that this device "has now been applied to long-distance telephony by the Western Electric Company and goes on to say: "We hope that the General Post Office will display some of the celerity which we should expect from a commercial company in taking up a development promising economy and efficiency. But we have our doubts. State Control does not promote prompt adoption of novelties." It is good that your readers should be told of these "magical valves, with their invisible streams of regulated electrons," but it is a pity that the desire for another stick with which to thrash the Post Office should lead to the promulgation of the idea that the valves, and the telephone repeaters in connection with which they are used, are foreign products. To begin with, the "electric valve," as a master patent covering all subsequent developments, is due to the work of Professor Fleming of London University. In the application of valves to the long-sought solution of the problem of the telephone repeater, the British Post Office was as early in the field as any other body of workers. The first valves made in this country were constructed in the workshops of the Post Office Research Department. Their trial as telephone speech amplifiers was commenced in 1913, and, although the idea of immediate commercial development was extinguished when war broke out, research and construction were continued on a reduced scale, for want of staff, in view of their probable utility on military telephone circuits. Telephone repeaters using thermionic valves were subsequently manufactured and were fitted on military and other lines in this country, and supplied to the Army in France, where in many cases they did valuable service, enabling communication to be maintained in conditions which, without them, would have made it impossible. In those days, the possibility that the British Army might lose the Channel ports was always in mind. Had this unfortunately happened, and our Armies had to retire on Dieppe as a base, everything was in readiness to establish a number of telephone lines between London and Dieppe, using quite light copper conductors. Such a scheme was only made possible by the availability of the thermionic valve as a telephone repeater. The economies in line construction which could be effected by the use of telephone repeaters were foreseen by the Post Office from the commencement, and on the resumption of long distance telephone cable construction after the war, the whole of the new cables were designed for use in conjunction with such repeaters. Many of these are now approaching completion. A scheme for the provision of repeater stations on a very large scale throughout the country has been worked out, and buildings are in course of provision at several places. Some of these stations are among the largest projected by any telephone administration in the world. The effect is that whereas the existing long trunk cables contain conductors using 300 lbs. of copper to the mile, the new trunk cables have conductors weighing only 20 lbs. to the mile. The thermionic valves used in this country were developed entirely by co-operation between British manufacturers and Post Office engineers, and the telephone repeater system, as in use here at the present time, was

developed entirely by the Post Office. This was mentioned in my previous article in *The Times*. It is common knowledge in electrical circles, and has been the subject of many lectures and communications to the technical press by Post Office Engineers. Even your critical special correspondent, in the "rejoinder" to my article, states that "the Post Office has taken up the valve with enthusiasm and it is a good sign," although it apparently suits his purpose to ignore it now.

[Since I have mentioned this rejoinder, perhaps you will allow me space for a few words about it, as it is certainly not the practice of *The Times* to lend itself to the exaltation of foreign countries at the expense of England. Under the cheerful title of "Our Archaic Telephones," and with the large type heading "Official Reply Exposed," it proceeds to pour forth a further string of general statements and mis-statements, without dealing with a single one of the arguments which I had put before your readers. Your correspondent now says that the London to Liverpool trunk cable, completed in 1916, "did not talk for a year or two." There is not a shadow of foundation for this statement. The cable was brought into use for general purposes immediately on completion, and from that day to this there has not been an interruption of communication on a single one of the many circuits it contains. He says "it is a fact notorious to telephone engineers that the American Bell system has always been far ahead of the Post Office system in the use of telephone cables, both for local distribution and for trunk lines." The telephone engineers he refers to will be surprised to hear it! Here are a few figures which I happen to have by me:—

Associated Bell Co.'s (1917) percentage of underground conduit to total miles of telephone route	2.65	per cent.
British Post Office, local system (1917) percentage of underground conduit to total miles of telephone route	18.6	"
Bell Co.'s long lines Dept. (1917) percentage of underground conduit to total miles of telephone route	2.3	"
British Post Office, Trunk System (1917) percentage of underground conduit to total miles of telephone route	19.6	"
Associated Bell Co.'s (1920) percentage of underground wire mileage to total wire mileage	60	"
British Post Office (1920) percentage of underground wire mileage to total wire mileage	80	"

In response to my claim that the British Post Office system includes a larger proportion of subscribers served by automatic telephone exchanges than that of any other administration, he retorts, somewhat obscurely, that it is easy for the Post Office to "dabble in automatics," whereas the Bell Co.'s have made a prolonged and careful study before embarking on the policy. My reply is that the Post Office also made a very careful study, the proof of which is that every automatic exchange installed in England has been an acknowledged success and has given obvious satisfaction to the subscribers. Can he say the same of America, where several automatic exchanges have failed to hold the field and have had to be taken out of service when they were comparatively new? His explanation of the reasons for the deterioration in the American service after the War is a somewhat amusing repetition of the considerations which I ventured to put forward in explanation of our own present short-comings. And he expresses them so emphatically as to suggest that anyone who would expect any other result must be ignorant of the effect of war conditions! Yet we are all well aware that the "jolt" which American industry received by the War was not one-tenth part as serious as that suffered by Britain. He sticks to his assertion that the American service to-day is much superior to ours. Yet, if your space allowed, I could produce a long string of testimony to the contrary, not only from statements in American newspapers, which he would contend are coloured by contrast with the very fine service they enjoyed before the War, but by the utterances of returned Britishers and of American visitors to this country, who

deliberately state that the present service in England is superior to that given in America.

I demolished the foundation of his story that the Post Office in the infancy of the telephone pronounced it to be a "scientific toy." He now "makes the Post Office a present of that story" and as a new catchword invents "the telephone a luxury" as an expression of the Post Office attitude. Believe me, this one is equally fantastic and nonsensical.

He says the supply of telephone facilities in Britain "will never catch up with the public demand. I do not believe it can be done." I could give you figures of the projected output of British manufacturers of telephone plant which would effectually refute this similarly fantastic statement.

I cannot, of course, compel his assent to the reasons I gave as contributory to the great development of the use of the telephone in America as compared with Britain, although it is easy to prove, and it has been proved, that the possible development in this country up to the present time, is not, and never has been, in the same ratio as the relative populations. On my parallel of the use of motor vehicles in the two countries, so fatal to his case, he makes no comment. He says "there are many square miles of houses in every big English city where a telephone, or perhaps two or more telephones, could be placed in every house." I hope that the future may prove him right in this, but if, at the present moment, he were to make a close inspection of two areas, one in England and one in America, what could he find? Fewer telephones in the English area undoubtedly. But he would also find a far greater proportion of the American houses equipped for central heating and for electric lighting. Many more of them would be fitted with electric cookers, electrically driven washing machines, knife cleaners, carpet cleaners, and other labour-saving devices. He would also find that the average income in recent years has been much higher in the American area than in the English one. There are, and must be, real causes for these differences, and the same causes have contributed largely to the difference in the degree of telephone development.

I suppose I must thank him for his tribute to the personnel of the Post Office Engineering Department, although it is clear that it is only expressed as a reason for further railing against the administration. The Post Office is not to be divided by patronage of a section. The Engineering Department is a part of the whole. It is loyal to the whole and it has reason to be so. It receives all the support it could wish for from the administrative "bureaucrats" both in finance and policy. Your correspondent makes the somewhat cryptic remark that the war "quenched the spirit of service in civil life" in America. Well, it has not done so here.

He claims for his statements the authority of 40 years' experience of telephone work. But antiquity in telephone matters is not in itself very impressive and the claim would carry more weight if he could show that he had ever been vested with technical or administrative responsibility. In his renewed attack he still harks back to the alleged sins of the Post Office thirty or forty years ago, and draws his main weapons from that era. Since then we have had a long succession of Postmasters-General in control, of all shades of political opinion and grades of experience. Is anyone nowadays really interested in this antideluvian standpoint? All I can say as a Post Office Official is that it does not interest me. I want to "cut the cackle and get on with the job."]

A POST OFFICE ENGINEER.

IDENTIFICATION BY ANALOGY.

Mr. Atkins, recently demobbed, wanted to get on to a friend at Ealing by 'phone, and on being asked to repeat the name of the exchange gave it in the approved Army style, thus: "E, for 'Erbert; A, wot 'orses eats; L, we're yer goes w'en ye're dead; I, fer ingin, them things in front of trains; N, wot lays eggs; G, for Gorbliney. 'Ave yer got it naow?"

A CHRISTMAS FAIR.

ONE of the most notable and successful functions in the annals of the London Telephone Service took place during the month of December, when the staff held a Bazaar and Christmas Fair, the object being to secure the endowment of a bed in the South London Hospital for Women.

The idea was originally conceived by Miss Heap, who, in her capacity of Superintendent of the Female Exchange Staff, is well aware of the many cases of hospital treatment which inevitably arise among so large a staff, and of the difficulty which the South London Hospital experiences in adequately meeting the demands made upon its resources. The project, daringly ambitious though it seemed, was one which appealed to us all; even the men became demoralised, and devoted their leisure time to planning magnificent stalls and executing designs for the decoration and embellishment thereof; while the feminine members of the staff sewed furiously at blouses, &c., and knitted with such hearty goodwill that every infant in London must surely now be provided with a woollen coat and hat, and every mother a jumper!

Some there were who had experienced hospital treatment and worked for the sake of the institution itself, knowing its pressing need; and some—the older ones—recognised in the scheme a further opportunity; to them it offered a channel, however inarticulate, of expressing in a practical form devotion to a Chief whose example and ideals have been an inspiration to so many, and they counted it an honour to give their time and labour to the cause—but this is a digression.

The Bazaar, which was held at the Memorial Hall, Farringdon Street, was opened on the first day by Viscountess Cowdray and on the second by Mrs. Preston, and proved to be an unqualified success.

The Memorial Hall is not the easiest building in the world to transform into a place of light and colour and beauty; there is a certain air of gloomy dignity about it which repels all such attempts; it takes itself very seriously in fact; and yet, when the stalls had been erected and dressed with their beautiful merchandise, when the Christmas Tree had reared its glittering head upon the platform, and the "Lavender Ladies" with their dainty gowns and sweet-smelling wares tripped in and out of the crowd; when the solemn looking galleries had been draped with flags and the wonderful sweet-stall, disguised as a cottage complete with red roof and cat balanced perilously on tiles, had been installed in the centre of the Great Hall, the architect himself would scarce have recognised his handiwork.

And we all enjoyed ourselves amazingly! August gentlemen whose exalted rank causes us in normal times to utter their names in tones of reverence and awe, recklessly bought books and beads, cushions and caramels, dolls and d'oyleys with the utmost impartiality and goodwill, and cheerfully expended limitless sixpences on raffles for articles, the ultimate possession of which was bound to cause them the greatest embarrassment and responsibility during the journey home. There were many doctors there, too, women who had laboured all the day to relieve suffering humanity sacrificing their precious leisure to wish us well at the outset, and then—because they are women and the staffs were alluring—remained to buy as enthusiastically as the rest of us.

Refreshments were served in the Library by chintz-clad maidens and were worthy of all praise, and the professional manner in which these amateur waitresses discharged their orders and collected their tips was the envy and admiration of all beholders. The side shows, too, were a source of endless attraction; three fortune tellers were kept fully occupied, mystics who cast one's horoscope, disentangled one's love affairs and promised innumerable letters from abroad all for the sum of one shilling. There were concerts also and dramatic entertainments, and, last but not least, a lucky tub, which had every appearance of being inexhaustible, yielded intriguing parcels to eager hands with all the fascination of its kind.

We are proud to record the fact that royal interest was evinced in the affair, for Her Majesty the Queen graciously presented a picture which realised £93, and the Princess Mary also sent a large parcel of gifts, the sale of which brought in a further considerable sum. The total result exceeded our wildest hopes, for, at the close of the second day the momentous announcement was made that the Bazaar had achieved its object; as the result of the voluntary efforts of the workers the sum of two thousand guineas had been raised and the staff of the London Telephone Service will thus have the privilege of endowing not one but two beds in the South London Hospital for Women for all time.

E. B.

(Illustration on page 66.)

We present our readers this month with a picture supplement giving the portraits of the Postmaster-General, Assistant Postmaster-General, and the chief Officers of the Telegraph and Telephone Service.

Tbc

Telegraph and Telephone Journal.

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

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		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 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.

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JANUARY, 1921.

No. 70.

AUTOMATIC DEVELOPMENT.

WE have referred before to the vague ideas which are current in the Press regarding the relative development of automatic telephony in this country and abroad. We have no desire to underestimate the great progress which this system has made, nor the still greater part which it will undoubtedly play in the future of telephony. Important developments are, as our readers know, about to take place in London; and New York, we understand, has definitely decided on an automatic system. These, however, will be its first appearances in cities with upwards of a million inhabitants, except Chicago, where the automatic system was—and is not. In fact the cities with over 100,000 inhabitants which possess automatic telephones do not number much above a dozen. Whilst we admit that automatic telephony flourishes in numerous medium-sized cities in America and elsewhere, we rather object to the frequent assumption of newspaper writers that it is well established in every country but our own. We are told that this or that country has “adopted” it, the impression conveyed being that the manual system is about to be abolished in the country in question, when the fact generally is that the automatic system is being introduced into one or two provincial exchanges.

Now we have *Electricity* complaining that the Post Office has dallied with the question until it is too late. “Colonial and foreign administrations have made up their minds long ago, and huge developments are in progress in various parts of the world.” Huge developments are in progress, and this country is bearing part in them. Having “made up their minds,” these administrations proceed to instal automatic exchanges here and there—France at Orleans and Nice, Australia at Sydney, Geelong, Malvern and

Brighton, and Canada in several small cities, while New Zealand is installing four exchanges with between 1,000 and 2,000 lines.

But no country outside America has a greater number of automatic exchanges than this country, and even in the United States there are only about 400,000 stations out of 12,668,000 connected with such exchanges—a proportion of 1 to 32. This 40,000 represents telephones “ordered to date” at the end of 1919; it is by no means certain they are all installed. Moreover, the bulk of these telephones are installed by separate companies in separate towns, and not by the policy of any one great administration. It is further to be noted that while the largest American system, Los Angeles, has (or will have) 34,670 stations, the total number of stations in that city is probably well over 130,000, just as in Sydney (the largest automatic exchange outside America) there are 26,500 automatic stations out of a total of 55,000. In fact all the larger automatic exchanges in the United States serve only a portion of the system of the town in which they are installed, while the systems in Leeds, Portsmouth and other British towns are wholly automatic. In this country about one exchange station in 31 is served by an automatic exchange. *Electricity* says: “There are many full automatic exchanges in the U.S.A. besides which Leeds, our present largest effort, would be dwarfed.” The American telephone system dwarfs our own in many respects, but it will be seen that the proportionate difference between the two countries in automatic development is slightly in favour of Great Britain; and it would not surprise us if Leeds alone had as many automatic stations as there are connected with all the European full automatic exchanges put together.

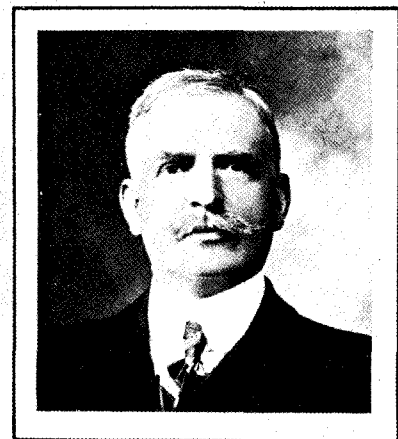
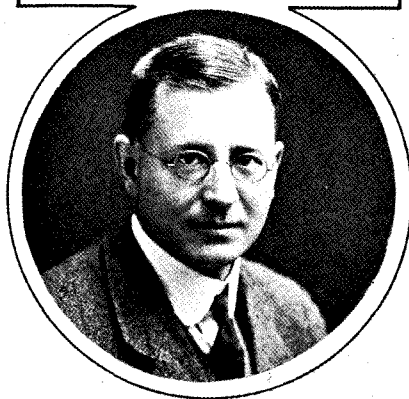
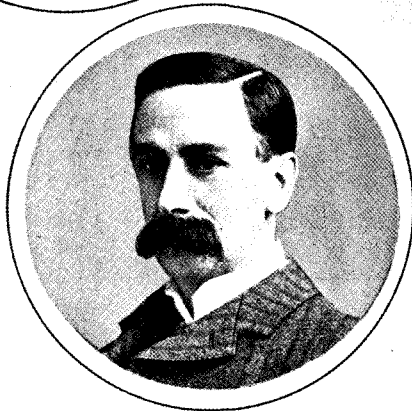
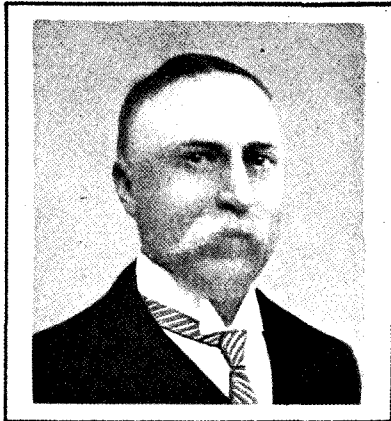
HIC ET UBIQUE.

THE *Electrical Review* points out that Johannesburg has 13,130 telephones, or one for every 11 white inhabitants, as against 1 to 25 in London. We have never attempted to compute the black population of London in connexion with telephone statistics and doubt if the effort would repay the trouble. But the comparison of the two towns seems to us uninteresting. The reason the black population is excluded from the Johannesburg calculation is presumably that they are not and are never likely to be telephone users. There are many in London who are not and are never likely to be telephone users and their exclusion from the figures of population would very materially improve the ratio of inhabitants to telephones.

The *Electrician* has the following two paragraphs:—

Telephone Reform.

The *Times* is still plugging away at the short-comings of our “archaic telephones,” animadverting on the policy of drift and muddle that exists and laying all the blame both for real and supposititious sins of the system at the door of the Post Office administration. Except that it makes good copy we wonder what the object of it all is, and what result is expected to accrue from the mass of statistics and evidence that had been so copiously poured out. One unexpected result it has had, however. The original articles have caused the Post Office authorities to reply pointing out that they are not so black as they are painted, and that even if they have not reached the high ideal set them by their critics they have at least done as well as could be expected. Now, in two further articles the critic replies reiterating his accusations of neglect, and pointing out how many more telephones there might be than there are if only the Post Office would adopt business methods. But what is the good of advertisement if you can't supply the goods, and what is the good of starting on a great scheme of telephone development when the cry is all for economy? No doubt it could be done, and no doubt the Post Office are not the people to do it, but could anybody do it just at the moment?



MR. F. J. BROWN, C.B.E.
(Assistant Secretary, Telegraphs).

SIR WM. NOBLE
(Engineer-in-Chief).

MR. R. A. DALZELL, C.B.E.
(Chief Inspector of Telegraphs and Telephone Traffic).

MR. G. F. PRESTON, C.B.E.
(Controller, London Telephone Service).

SIR EVELYN MURRAY, K.C.B.
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(Postmaster-General).

THE RT. HON. H. PIKE PEASE, M.P.
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SIR HENRY BUNBURY, K.C.B.
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(Assistant Secretary, Telephones).

MR. W. H. ALLEN, O.B.E.
(Controller, Post Office Stores Department).

MR. JOHN LEE
(Controller, Central Telegraph Office).

MR. A. MOIR, O.B.E.
(Metropolitan Superintending Engineer).

The Postmaster-General, the Assistant Postmaster-General, and the principal Officers of the Telegraph and Telephone Service wish the readers of "The Telegraph & Telephone Journal" a prosperous New Year.

Photograph of The Rt. Hon. A. H. ILLINGWORTH, M.P., by Walter Scott, Bradford; of The Rt. Hon. H. PIKE PEASE, M.P., by Elliott & Fry, Ltd.; of Sir E. MURRAY, K.C.B., by Lafayette, Ltd.; of Mr. KIDNER, by Langhler, Ltd.; of Sir WM. NOBLE, by Swayne; of Mr. ALLEN, O.B.E., by Martin & Sallnow; of Mr. LEE, by Abernethy, Belfast;

American Development No Guide.

As regards what the Post Office has done, as Mr. Atkinson truly pointed out in his Presidential Address, the number of telephones per head of population is not a fair basis of comparison between this country and America. Here if we want to communicate with a neighbour we go across to his house a few yards away. But in large tracts of America the nearest neighbour may be miles distant, and "running across" is not therefore possible—hence first the telephone and then all these statistics. But a comparison of messages per telephone would doubtless tell a different story, and is therefore kept carefully in the background, while the annual cost of a telephone (another point of argument), is fallacious in a comparison unless the number of calls made on it is also given. For this reason we are sorry and not a little surprised to find *The Times* correspondent, whose identity is an open secret in electrical circles, upholding a flat rate system in contradistinction to other more economic methods of charging.

As regards the comparison of the number of telephones and of messages per telephone a close analogy could be found in railway statistics in the comparison of the mileage of line and the number of passengers carried in two given countries. For example, Russia possessed before the war over 40,000 miles of railway and the British Isles 23,910; yet the former carried 125,446,000 passengers and the latter 1,240,000,000 (exclusive of season ticket holders), or with something like half the mileage 10 times the number of passengers. We do not, of course, suggest that there would be anything like this disparity between the British and American rate of calling on the telephone, but the example is instructive of the different bases of comparison which can be adopted in dealing with statistics.

THE telephone rates in New Zealand have been materially increased of late, and now for a business telephone within one mile of the exchange the charge is £9 10s. per annum; within two miles, £12; within five miles, £21; and within ten miles, £34. Private telephones pay £6 within the first mile of the exchange, £8 10s. within two miles, £18 within five miles, and £30 10s. within ten miles. This is an increase of about 33½ per cent. in the case of most business 'phones and of about 20 per cent. in the case of private 'phones, and is the result of the increase in wages and cost of materials.

Automatic apparatus, says the *Telegraph and Telephone Age*, will be installed in the principal centres of the country at as early a date as the material can be secured. It is of American manufacture and is expected to reduce the cost of operation of the telephone system.

CORRESPONDENCE.

"A RETROSPECT."

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

Dear Sir,—I write from memory, but venture to think that the appended list is a more accurate rendering of the titles and numbers of the old London Exchanges than that made use of by the writer of the article in the December issue of the JOURNAL.

Coleman Street	1—500
Leadenhall Street	501—1000
Cornhill	1001—1500
Queen Victoria Street	1501—2000
Mincing Lane	2001—2500
Chancery Lane	2501—3000
Westminster	3001—3500
Heddon Street, generally known as Regent ...	3501—4000
Avenue	4001—4500
Hop	4501—5000
Eastern	5001—5301
Shadwell	5301—5400
Stratford	5401—6000
Victoria Docks	6001—6500
Smithfield	6501—7000

Yours faithfully,

A. C. GREENING.

Sectional Engineer Office, 82, Victoria Street.

AUTOMATIC TELEPHONY IN LARGE AREAS FROM A TRAFFIC POINT OF VIEW.*

By M. C. PINK.

THE object of this paper is to review the conditions which have to be met in a large telephone area—embracing a considerable number of exchanges already installed and working on a manual basis—and to describe the traffic features of a system which will permit the substitution of machines for human agency for the performance of the more mechanical portions of telephone operating.

During the process of conversion, and in the machine-switching system as finally developed, it is desirable to retain in as high a degree as possible the more elastic features of a manual switching system and to cover, as far as is possible by mechanical means, the powers of line selection and traffic routing, which a manual system, employing an operator for call control, affords.

Under a manual switching system the operator acts as the agent of the Administration in selecting that portion of the switchboard before her in which, for the time being, the Administration desires to locate a particular group of circuits. She also knows the desires of the Administration regarding the means by which any particular exchange in the system is to be reached, and if the Administration desires to alter the method of reaching any particular exchange, the operator is able to follow and carry out the intentions of the alteration without affecting in any way the acts of the calling subscribers. The more nearly any switching system can reproduce directive powers which are normally vested in a manual operator as described, the more closely is that system likely to meet the ultimate requirements of a large area.

Outstanding features of a large system of intercommunicating exchanges are: (1) the number of external circuit groups necessary to link up all exchanges into one system, and (2) the size of the groups of such lines which have to be developed. Under manual conditions the "A" operator can obtain for any call access to any junction on even the largest route. The more nearly the automatic system, considered as an alternative, can meet this condition so far as any originated call is concerned, the more efficient the system will be. The magnitude of this aspect of the case will be obvious so far as the London area is concerned when it is stated that the number of junctions provided for intercommunication between the various exchanges is approximately 20,000, and is rapidly increasing.

It will be obvious that in a large area at any time the number of exchanges which are approaching the end of their economic life is comparatively small and that the majority of exchanges will be fairly new. The present conditions in London are shown in Fig. 1. The capital represented by these exchanges is very considerable, and depreciation charges will have been calculated on the assumption that the exchanges would not be replaced until their economic life has been completed. Any modification of this policy would affect considerably the cost of conversion to automatic working even if it were possible to obtain automatic plant at such a rate as to permit of its installation much before the end of the economic lives of the substituted exchanges. It follows, therefore, that any scheme of adoption of automatic conditions must contemplate the gradual introduction of automatic exchanges into the area, with very complete facilities for handling efficiently both the traffic from automatic exchanges to the manual exchanges and the traffic incoming at the automatic exchanges from the manual exchanges. In handling such traffic there might be a considerable danger of setting up conditions which would duplicate one or more stages of the switching of a call, such, for instance, as the utilisation of a complicated series of switches in order to obtain access to the same type of control operator as would be obtained under manual conditions by the subscriber simply lifting his receiver.

In order to avoid such duplication, full advantage has to be taken of the possibilities of eliminating manual switching and affording the automatic subscribers on each new exchange, as it is brought into use, the fullest possible facilities for communicating their requirements direct to other exchanges.

Facilities have also to be afforded to operators in the manual exchanges still in commission to obtain connection with automatic subscribers either direct or through manual positions involving a minimum amount of operating work.

Furthermore, the fact must be kept well in mind that although the designation of a subscriber working on an automatic exchange must be of such a type that it can be signalled without any hesitation or doubt by another automatic subscriber, it must also be of such a type that it can be passed by a manual subscriber on the system to his manual operator without introducing on the manual portion of the line any disadvantage as compared with existing conditions. Both types of subscribers will be using the same Telephone Directory, and each entry in the Directory must appear in such a way that it is perfectly clear to either a manual or an automatic subscriber how a call to the number should be passed.

As a result of the various press notices which have appeared from time to time during the past few months it must be generally known that arrangements are being made for the installation in London of a trial automatic exchange of what is known as the panel type, and I believe the principal reason which caused your Committee to put down automatics as one of the subjects

* Paper read before the London Telephone and Telegraph Society.

to be dealt with during the session was to enable a little more information to be given regarding the panel system and the reasons why it is being installed for the first automatic exchange in London.

I had hoped to deal in this paper with the more detailed considerations of the problem in its earlier stages, but I find my time is too limited for this. I will, however, make a brief reference to junction routing under the systems so far experimented with in this country.

STATEMENT SHOWING LENGTH OF TIME EXISTING LONDON EXCHANGES HAVE BEEN IN SERVICE.

No. of Years.	No. of Exchanges.
Under 1	4
1—2	—
2—3	—
3—4	1
4—5	—
5—6	2
6—7	3
7—8	—
8—9	11
9—10	1
10—11	6
11—12	4
12—13	11
13—14	6
14—15	7
15—16	4
16—17	6
17—18	2
18—19	5
19—20	—
Over 20	3

FIG. 1.

All systems in which the junction routing is directly dependent upon the signals dialled by the subscriber contemplate the grouping of exchanges in regions. With such grouping the provision for each region of some conveniently situated switching centre is generally contemplated—all calls for the region being passed in the first instance to this switching centre.

REGIONAL DISTRIBUTION

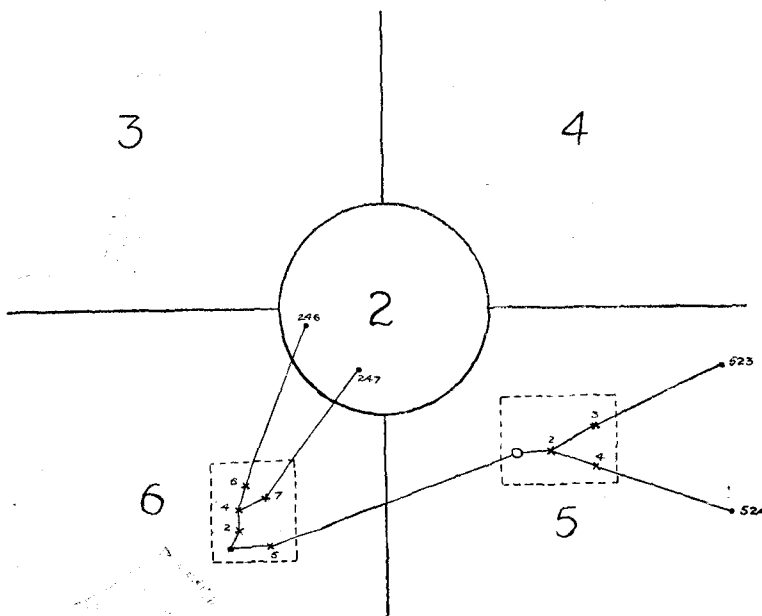


FIG. 2.

In the diagram in Fig. 2, it is assumed that exchanges are designated by 3 figures. Exchanges in region (5) are obtained through a switching centre, but it will be clear that all traffic for the region from any one calling exchange must be similarly routed. It is possible to give direct junction service as in the case of region (2), but if this subdivision, which concentrates three selector switches at the home exchange, is followed, all exchanges in the region have to be supplied with direct junctions.

The next diagram (Fig. 3) shows the junction arrangements possible with the panel switching system. With this system the junction routine

is not finally dependent on the impulses sent by a subscriber on exchange A, but by the impulses arranged for by a translator, which can be set in such a way as to vary at will the routing to any exchange corresponding to the impulses actually sent by the subscriber. Junctions can be associated directly with terminals on the first selector switch, or they may be obtained through a second selector switch, which is practically a subsidiary junction switch provided to carry the traffic on the smaller outgoing junction routes. Alternatively impulses may, if required, be retransmitted to exchange C, either for the purpose of obtaining a subscriber on that exchange or in order to gain access to a further subsidiary junction multiple at exchange C which will provide access to a subscriber on exchange G.

DIAGRAM SHOWING FLEXIBILITY OF JUNCTION ROUTING ARRANGEMENTS WITH THE PANEL SYSTEM INCLUDING THE TRANSLATOR DEVICE.

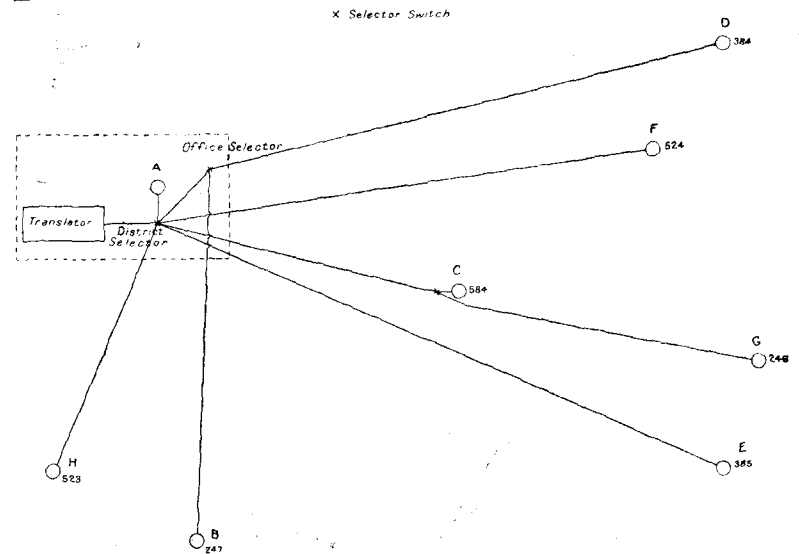


FIG. 3.

The American authorities have devoted considerable study to the problem of naming or numbering exchanges in large areas under automatic conditions. It was found that some 70 per cent. of numbers given by subscribers are passed from memory. It was also clear that the retention of an exchange name would be of assistance to subscribers in memorising numbers in a multi-exchange area, but it was found that where numbers consisting of not more than five digits would serve any area, exchange names were unnecessary. It was, therefore, decided only to use exchange names in the larger areas which would require numbers of six or seven digits to meet the requirements of automatic workings; and that where names were retained or introduced, some of the letters of each name should be used in conjunction with the subscriber's number in transmitting the automatic signals. It will be clear that the subscriber's memory would not be aided to any considerable extent unless the letters selected were consecutive and were those with which the name commenced.

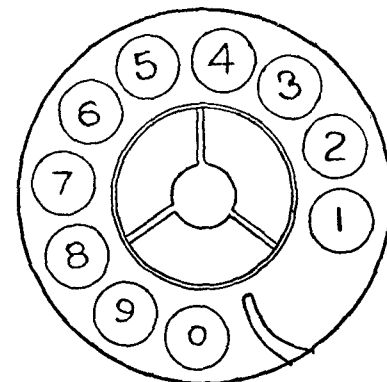


FIG. 4.

The normal automatic dial will only send 10 different sets of impulses, one in association with each hole. Fig. 4 shows the face of the dial at present in use in this country. I think you all know that the set of impulses relating to a particular digit is transmitted to the selecting mechanism by inserting a finger in the moveable plate opposite the digit required, turning the plate as far as the stop, and releasing it.

The next illustration (Fig. 5) shows the dial adopted for the larger areas in America and to be utilised for the first panel exchange in London. The numerals on the dial plate are engraved in red and the associated letters in black.

With the availability of these 24 letters it is possible to take the first letters of each exchange name as dial signals—2 or 3 letters according to the requirements of the particular area to be converted to automatics. In London three letters will be used. For instance, to call a subscriber Dalston 1234 with a dial of this type, the subscriber would first dial D representing the digit 3, then A representing 2 and then L representing 5, followed by the numbers 1234. It will be seen that if under manual conditions another exchange existed in the area, the name of which started with EAL, such as Ealing, the three initial letters would produce the same impulses as above, viz., 325, and one or other of the exchange names would have to be altered before automatic working could be introduced.

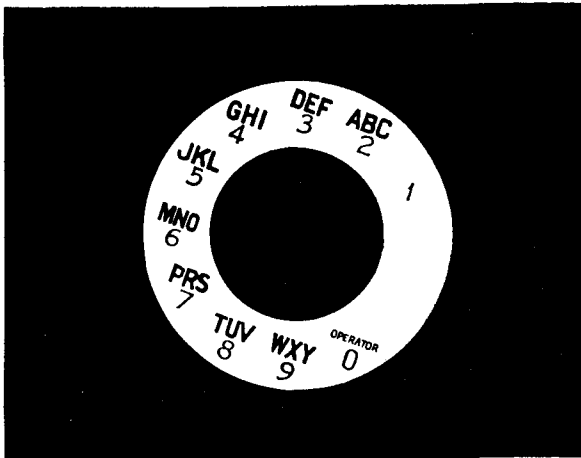


FIG. 5

There are, however, few such cases in actual practice. In that portion of the London area which will be the unit fee area under the new rate proposals, there are only 8 exchange names which clash in this way under the three-letter coding system. They are shown in the following diagram, (Fig. 6). Some of the changes at least will be made next April or October in conjunction with the issue of the Directory. Although these changes will inevitably cause some irritation on the part of the subscribers at the exchanges involved, it is thought that the reasons for which they are being made will appeal to the public and that no real difficulties will be experienced.

EXISTING EXCHANGE NAMES WITHIN THE TEN MILE RADIUS FROM OXFORD CIRCUS WHICH WILL HAVE TO BE CHANGED UNDER THE AUTOMATIC SCHEME.

Existing Names.	Letter Codes.	Equivalent Dial Figures.	Existing Names which necessitate the Changes.
Bromley ...	BRO	276	Croydon
Ealing ...	EAL	325	Dalston
East Ham ...	EAS	327	East
Hammersmith ...	HAM	426	Hampstead
Hornsey ...	HOR	467	Hop
Stratford ...	STR	787	Streatham
Kingsbury ...	KIN	546	Kingston
Woodford ...	WOO	966	Woolwich

FIG. 6.

In connection with the installation of the panel exchange in London, it is also necessary to arrange that every exchange number of less than 4 digits shall be signalled as the equivalent of 4 digits by the interposition of ciphers between the exchange code letters and the number proper. For example, Western 12 will have to be signalled by an automatic subscriber as Western 0012. The American authorities are proposing to introduce these ciphers in the Directory in all cases. Fig. 7 shows a portion of the specimen Directory sheet prepared in connection with the modification of the New York Telephone Directory. It will be seen that the letters used for signalling purposes are printed in capitals and that any ciphers necessary to bring a number up to the equivalent of a 4 digit number have been inserted. In the London area it is not proposed at the outset to print the ciphers in the Directory in this way. 1, 2, and 3 digit numbers will appear as at present, but the subscribers on the panel exchange will have to be instructed to insert the ciphers for themselves as they make their calls.

In proceeding now with a description in greater detail of some of the traffic points of the panel type of exchange, I shall make no attempt to describe the mechanical and electrical characteristics of the plant. These characteristics, which have recently been described generally by Sir William Noble before the Institution of P.O. Engineers and also in an article in the *Electrician*, will no doubt be described more fully by one of our engineering friends in another place. It will, however, be necessary to use a few plant terms here and there in these notes.

The Western Electric type of automatic exchange is referred to as the *panel* type because the multiple fields, instead of being of cylindrical form, as in the case of all the automatic exchanges at present installed in this country, are flat, and the multiples are built up in panels one above the other. The selecting switches operate in a vertical straight line over the panels. Each selector can obtain access to one of 500 lines, but the mechanical arrangements are such that the portion of the selecting mechanism which actually establishes communication need only select over a maximum of 100 lines.

For the purpose of establishing originated calls each subscriber's line is multiplied over specially-arranged panels of 300 subscribers' lines.

*Designates Private Branch Exchange System.

MANHATTAN AND THE

*A-RE Co Court. Apts So bldg & Westchester st. INT rale 4400	*Arida Michael N. Kimonos, 118W22. CHE lsea Annex, 30 W 22. GRA mrey 0759	Arluck S. Printz & Arn David, Ins. 1
A-RE Co Pharmacy, 1020 Westchstr st. INT rale 3263	Arida S N. & Bro, Kimonos, 35 Wash. ... BOW ltrn 9349	Arma Engineering Co, Armand Co, 18 W 5
Arena Automobile Co, 130 W 52. CIR cle 1018	Arissoha Mrs S. r. 72 W 88. SCH yler 2382	Armand Mrs Philippo Armands, Dresses, 26
Arena Auto Paints & Repr Co, 136 W 52. CIR cle 5825	Arisson & Moore, Jewls, 208N Bway. ... COL mbus 5085	Armani Jerome, Groc Armas Bolton, 2 Sto
Arena Auto School, 151 W 54. MAD sq 1909	Arion Iron Works, 370 So bldg. MEL rose 4751	Armatys & Floro, Ct
Arena Building, 38 W 32. MAD sq 1909	Arion L. S. Corsets, 966 3d av. PLA za 9166	Armas Bolton, 2 Sto
Arena Fire, Concrete Wk, 304 E 117. HAR lem 6265	Arion M. Ladies Tir, 1163 Amstom st. MOR aside 5284	Armas Bolton, r. 105
Arena Garage, 231 W 54. CIR cle 1123	Arion Shirt Co, 434 Bway. CAN 3 9430	Armatys & Floro, Ct
Arena John, Drugs, 2153 Bathgate av. FOR dham 3859	Arion Sweets, 226 W 72. COL mbus 8831	Armbow Operating Armburst F. Statary
Branch, 2157 Arthur av. FOR dham 5554	Arion John J. r. 133 W 95. RIV rside 8971	Armburst & Frittle, Armburster Mrs S. r.
Arena Dr John, r. 2156 Bathgate av. FOR dham 4141	*Arivovitch I Co Inc, Furs & Skins 104 W 27. FAR ragut 5771	Armedaiz Bro. Com Armedaiz Joaquin, C
Arena Theatre, 623 8th av. BRV ant 5409	Arison Theo, Music Store, 52 W 116. ... HAR lem 0733	Armedaiz Jose, Armenia Catering Co
Arend-Ernest, A. Archt, 105 W 40. BRV ant 3231	Arista Chemical Co, 82 Duane. WOR th 2997	Armenia Press, 217
Arend F J, 165 Bway. COR lland 0940	Arista Trading Corp, 1 Madison av. ... GRA mrey 6411	Armenian Boarding H Armenian Free Labor
Arend F J, r. 813 5th av. PLA za 4226	Aristo Cigar Co, 4 Spring. SPR ing 5165	Armenian Goal Benvir Armenian Importing C
Arends Katharine, MD, 178 W 97. RIV rside 0570	*Aristo Hosiery Co Inc, Under, 19 E 24WAD Sq 3017	
Arendt E. r. 156 W 86. SCH yler 2861	*Ariston Bone Co, 25 W 45. BRV ant 9527	
Arendt Edwd & Son, Leaf Tob, 151 Water. JOH n 1635	Ariston Hat Mfg Co, 220 5th av. MAD Sq 1188	
Arendt Ellis, 151 Water. JOH n 2635	Aristhyle Co, 35 W 39. VAN dbrlt 5746	
Arendt Simon, r. 29 E 129. HAR lem 4202	*Arizona The, Apts, 508 W 114. CAT hadr 7650	
Arendt Co, 21 W 4. SPR ing 7224	Arizona Copper Belt Mfg Co, 25 Broad. ... BRO ad 0260	
Arens A, Leaf Tobacco, 182 Water. JOH n 4747		

FIG. 7.

The next illustration (Fig. 8) shows in diagrammatic form the switching points involved in establishing calls. It will be seen that if the calling subscriber wishes to make a call to another subscriber on the same exchange the call is established:—

(1) By a line finder and selector switch, the actions of which are equivalent to the "A" operator plugging in to answer on a manual exchange and then finding a junction in the junction multiple field. In this case the multiple is termed the *district* panel multiple.

(2) An incoming panel, which is generally specially arranged to carry traffic passing within the exchange. A selector operating over the multiple of the incoming panel obtains access to the terminal of a junction to the particular group of 500 subscribers in which the required subscriber is located; and

(3) The lines from the incoming panel lead to a selector switch which passes over the final panel until it reaches the terminals of the required subscriber. When these terminals are reached the subscriber is rung if he is not engaged.

If a junction call is made to a subscriber on another automatic exchange, the group of junctions to that exchange is found by the selector operating over the district or a subsidiary panel multiple. At the distant exchange an incoming multiple similar to that shown in Fig. 8 is reached, and through that multiple access is obtained to the particular group of lines in which the required subscriber's number is located.

If the automatic subscriber makes a call to a manual exchange, which is reached by direct junction from the district multiple, the answer of the distant manual operator by depressing the key in association with the junction on which the call is required, causes the number dialled to appear on a visual indicator in front of her—a feature which I will refer to later.

Where the panel multiple is utilised for subscribers' lines 500 numbers can be accommodated as one group, and it will follow that in a 10,000 line exchange there will be 20 groups of 500 subscribers and consequently 20 final multiple fields; that is the multiple terminals used for the connection of calls incoming to the subscriber. The natural sub-division of each 500 group is into 5 main sections of 100 and 10 subsidiary sections of 10 terminals in each section. The treatment of the multiple field is somewhat different when it is used for the accommodation of outgoing junctions. The unit for sub-division is taken as 10, but it is necessary to allot one additional terminal to each group of 10 working terminals. The functions of this additional terminal are:—

1. To ensure that if all the lines in the group are engaged an engaged signal is given to the calling line and the traffic overflow register is operated.

2. To ensure that in a case where two or more adjacent groups are used for a group of outgoing junctions in excess of 10, or any multiple of 10, the selecting mechanism shall continue its search for a line from the first group to the second group until the whole of the main junction group has been tested before an engaged signal has been given.

Many exchanges would be quite unable to accommodate all their outgoing junctions on a multiple field which was limited to 500 terminals of which only 455 could be utilised for actual junctions owing to the requirements just referred to. Where therefore the number and size of the junction groups, and of the groups of service lines, on an exchange exceed the capacity of 500 terminals it is necessary to provide a subsidiary junction multiple. In very busy exchanges, with a large volume of junction traffic routed over many direct routes, it will even be necessary to provide two or three subsidiary junction multiples. The multiple field which is first available to the selector associated with a line finder is termed the *district* multiple. Large direct junction groups are connected as far as possible to this district multiple and all connections on those groups involve the use of one selector only at the originating exchange, in spite of the fact that the selection of the group is dependent upon the sending of three sets of impulses from the subscriber's dial. If a subsidiary multiple is necessary this is termed an *office* multiple, and if more than one subsidiary group is required the different multiple fields are designated Office Group 1, Office Group 2, &c.,

It will be obvious that a separate set of selectors must operate over each office multiple field provided. Access to the selectors is obtained via terminals on the district multiple field. The number of selectors required for an office multiple will be based upon the total amount of traffic in the busy hour outgoing to the exchanges working on the office multiple. As the circuits between the district multiple and the office selectors are purely internal it is not so necessary to secure the full availability of the office groups of lines on the district panel. The American practice is to allocate on the district multiple such terminals as can be spared for office multiple switching and to divide the group of office selector lines into two or more parts distributed over various district multiple panels.

It is interesting to compare the size of the junction groups worked under manual conditions and those which can be worked under panel multiple conditions but I am afraid time will not permit of any detailed examination of this point in this paper.

The multiple on the incoming panels consists of the standard 500 terminals, and if access is to be gained to any one of 20 groups of 500 subscribers each it will be obvious that only $500 \div 20$, i.e., 25 terminals, can be allocated on any incoming multiple panel to lines outgoing from the incoming panel to the final multiple panel, or *choice* as it is called. One terminal to each choice has to be reserved for service purposes, mainly the giving of an engaged signal if all the lines to a particular choice are engaged and to record on a register the fact that the engaged signal has been given for that choice.

It will be obvious that the amount of traffic to any group of 500 lines in an exchange will exceed by far the carrying capacity of 24 lines. It is necessary, therefore, to distribute separate groups of 24 lines, multiplied to a limited extent, over the incoming panels in such a way as to ensure that the total carrying capacity of the various groups of 24 will provide, on a predetermined service standard, for the total amount of traffic which is likely to come at any one time to any 500 choice.

From what I have said it will be clear that throughout the automatic switching plant alone, quite apart from the questions involved in the service relations between automatic and manual plants, a considerable number of traffic problems present themselves. If we are to satisfy ourselves that an exchange is going adequately to perform all the functions required of it, the determination of matters such as the following must be the subject of traffic investigation and calculation:—

The maximum number of lines in an average group of 300 subscribers' terminals which will be simultaneously engaged on originated calls.

The extent to which there will be variations in the calling rates in the various groups of 300 lines in spite of the best use of cross connexion facilities.

The number of sender equipments necessary to ensure that a sender becomes available for every call with a minimum of delay from the time a subscriber lifts his receiver.

The number of junctions required outgoing to every other exchange in the system in order to meet the peak load to that exchange without entailing the loss of more than a predetermined proportion of the calls passed over each route or originated for each route.

The most efficient layout of district junction multiples and, when they are required, office multiples.

A knowledge of the extent to which, when the outgoing traffic has to be sub-divided over two, three or more multiple fields, the traffic passed to either multiple field varies from day to day.

The fluctuations on incoming junction traffic and the best method of making the most economical use of the selectors on the final multiples which are available on the incoming multiple field.

The variations in the incoming calling rates which will have to be legislated for in practice in the various groups of 500 subscribers' lines.

The adequate provision of registers showing the amount of traffic passing over various portions of the switching equipment.

The organised study of the register readings for the purpose of securing the maximum efficiency combined with reasonable economy.

Turning now to the question of inter-communication between automatic and manual exchanges, it will be well to consider in detail the means which, under Western Electric panel conditions, will be employed for establishing each type of call.

Calls will be originated by subscribers on the panel exchange for:—

- (a) Other subscribers on the same exchange.
- (b) Subscribers on exchanges which will be reached over junctions outgoing direct from the district or office multiple.
- (c) Calls to exchanges which are in the automatic area but have not sufficient traffic to justify direct circuits outgoing from the panel multiples.
- (d) Calls to exchanges outside the automatic area.

PANEL SELECTOR
SCHEMATIC SHOWING ORDER OF SELECTION

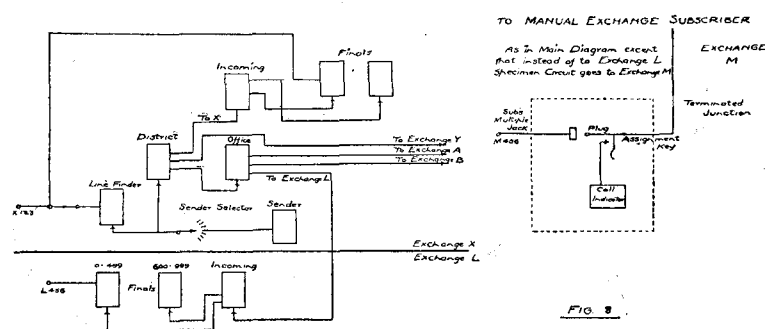


FIG. 3

The treatment of full automatic calls to other subscribers on the same or to other similar exchanges has already been dealt with.

In the case of calls outgoing direct from the panel junction multiple to manual exchanges, the automatic subscribers will dial the full particulars of their call.

The exchange code portion of the call, e.g., HOL if the call is for a Holborn number, will select one of the junctions in the direct group from the automatic plant to the Holborn Exchange. A special piece of apparatus known as a call-indicator will be provided, which will display, by means of lamps, the four digits of the required number in front of an operator.

(To be continued.)

TELEGRAPHIC MEMORABILIA.

"Where do flies go in the winter time?" may seem an all too frivolous question for the sober columns of even a quasi scientific journal, but, guided by electrical experts, one is authorised to state that these unwanted insects hide and die underneath the overhead telegraph and telephone insulators! Further, as contributory evidence, it was recently stated by *Electricity* that during the month of November last they were so numerous "as to constitute a nuisance from the standpoint of insulation maintenance." Our contemporary suggests as a cause for the little pests seeking these earthenware shelters as a winter resort the possibility of the under side of insulators being warmer than the surrounding air, as is known to be the case with the inverted cup of a snowdrop.

Waiting for a subscriber on the telephone recently, wafted over the wires came this curious piece of conversation which at first puzzled me. "Are you Shaw?" to which came the delphic reply, "Yes, and I have mumps." Then the less enigmatic voice of my correspondent came in circuit, we proceeded to business, and closed the case well satisfied with the efficiency of our national Telephone Service. By a remarkable piece of good fortune only a day or two later an official pamphlet—single sheet printed both sides, as becomes these economical times—came to hand bearing the Oldham post-mark. This leaflet announced that "A telephone call office is now available to the public at the MUMPS Post Office" and that for the sum of twopence speech could be obtained with Middleton, Oldham and Shaw. Relief at the knowledge that after all there was no oversight on the part of the authorities regarding the use of the 'phone by an infected official may well be imagined.

The list of retirements from the C.T.O. is fast adding to its numbers. On Nov. 24, Mr. T. R. Bennett, Assistant Superintendent, said good-bye to us upon reaching the three-score limit. His well-wishers, a veritable host, follow him with the kindest of thoughts and the happiest of memories. That he may find on the Essex shore that rejuvenating quality of ozone which is more to be desired than any thyroidic treatment extant is but one of the sincerest wishes which all hope to see realised in the continued life of our respected friend. On Nov. 27, Mr. "Joe" Gunter, of the same rank, also passed through the trying ordeal of parting with a department of the Civil Service which he has faithfully served for four decades. "Joe" was one of the early students of the technical side of our craft before the days of "double increments" and undoubtedly added his quota towards the efficient working of more than one phase of modern telegraphy. Among his office activities, he represented the C.T.O. on the committee of the T. and T. Society, and for many years acted in a similar capacity on the Civil Service Lifeboat branch of the National Lifeboat Institution.

Yet one more and that Mr. Harry Oakman, who left us on Nov. 30, flower in buttonhole, alert, debonnaire bearing lightly his three times 20 years, and leaving behind him a record of well over 40 years' pensionable service. His personality also leaves pleasant memories and nothing but the best of the best may be assigned in the way of hopes and wishes to these telegraphers of the eighties.

While in congratulatory strain one cannot do better than to direct one's pen to Mr. Barrance, a more junior member of the C.T.O. staff, who has recently left the Cable Room for the Foreign Office, consequent upon examination before a "Pool" committee. The tact, alertness of mind and diplomacy displayed by our friend at the psychological moment during certain international pourparlers, added to his excellent knowledge of the French language and a thorough adaptability to rapidly-changing circumstances, together with his general *savoir faire*, have quite rightly led to his removal to higher spheres of usefulness. His promotion, while robbing the Telegraph Service of a most promising member, reflects no small amount of credit upon a department which is able to produce an officer of this type. To the Foreign Office or any other of the higher branches, it may be permissible to add with due modesty, that there are many more eggs of similar high quality in the C.T.O. basket should the need arise.

A reader of these columns has been good enough to forward an interesting addition to "hobbies of the Service." A well-known cable repeater officer has built himself a two-manual organ and with such special ingenuity as to be able to obtain the full power and range of an instrument of this type from a form of construction which admits of unique structural condensation. By this means the entire apparatus may easily be contained in the parlour of an ordinary country cottage. The design and decidedly new features have attracted some attention in the musical world, amongst others the organist of one of our cathedrals having taken a personal interest in the arrangement.

Music, it is by no means strange to relate, has been very closely associated with the crafts of both telegraphy and telephony, and many friends of the writer, whose interests are more specially allied to the engineering views of matters, are ardent musicians. Hughes, the telegraph engineer and inventor, was also a professor of music and that before he discovered the microphone.

Interesting items are always coming to hand concerning the first telegraph days in this country, and a young correspondent recently handed me an old cutting from the *English Mechanic* which placed on record the fact that Mr. W. H. Hatcher, manager of Price's Candle Co., Battersea, was an ardent assistant to Mr. Cooke in the introduction of the telegraph, and before the formation of the Electric Telegraph Co. One wonders how the maker of candles and the user of electricity came together. From the same excerpt is also taken the information that during the experimental tests by Messrs. Cooke and Wheatstone, "the semaphores of the Admiralty and Portsmouth were working side by side in the same rooms in a struggle for supremacy."

It is gratifying to note that the subscriptions to the Flower Fund—a fund raised to supply the C.T.O. War Memorial Bed in Bartholomew's Hospital with flowers each week—has exceeded the sum necessary to ensure this supply for at least two years.

Other notes of thanks reach us from the Secretary of the Benenden Sanatorium Recreation and Games Fund for liberal donations from many quarters. If, as has been stated, some measure of the success of the appeal has been due to the publicity given in these columns then the editors can only express their intense satisfaction at having been of the slightest use to our less fortunate colleagues of the Post Office Service as a whole.

Slowly but surely the new system of illuminating the C.T.O., aided by something in the way of innovation as regards the mural and overhead decorations, has been creeping from one division to another with its decidedly improved influence upon all those who come under the healing atmosphere thus created. Whatever may be the ultimate verdict upon the lighting system for special conditions such as those where transmission implies a fixed position for the telegram, the general effect of the entire system is undoubtedly excellent. The murky atmosphere of London's winter months is our worst enemy, for we are still far away from those fog-less cities which were promised—how many decades ago? Neither have we yet reached that advanced stage dreamed of by John Galsworthy, who recently stated at Liverpool, "Why should not the best painters and sculptors to-day be asked to decorate schools, colleges, hospitals, workshops, even the public-houses and railway stations?" The Antwerp Central Telegraph Office had obtained something of this high standard prior to the war, and let it be added without a single protest from the entire Belgian press on the score of the "terrible waste."

One is moved at times to write upon the "little things of telegraphy" and what they mean in the larger issue of general efficiency. The failure of a Morse dot, the minuter "failure" or "extra" of "Baudot," "Western" or "Murray" signals, and in machine printing telegraphy distortions of a merely fractional character, whether electrically or mechanically produced, add very materially to the sum total of a day's troubles. When one has watched such distortions, say at a repeater office, and has noted that the margin has yet proved sufficient to produce the correct letter or figure it has been a real cause of wonder and admiration for the inventors' art, the constructor's mechanical production and the mechanic's maintenance. Yet the day, the hour or the moment of small things will not be neglected by the watchful *dirigeur*. Dirty contacts in Baudot keyboards will be avoided, blunted or minutely out-of-gauge perforations on Creed or Western or Murray or Siemens circuits will be keenly watched, and at the first sign of weakness remedied.

Then there are other little items. The incorrect date on a telegram, for example, and where "numbering" of the traffic is in vogue indistinct figures. These two together with the omission of a.m. or p.m. are amongst the most proficient of time-wasters when it comes to secretarial or other inquiry regarding a telegraph message, especially if this be of foreign origin.

It was thought that when type-printing telegraphy came to stay all ambiguity regarding a letter, figure or character would be at an end. This has been by no means proved to be the case, simply because of the neglect of little things, and sometimes, let it be added, by the institution of so-called "little economies." Letters or figures that cannot be read off at once with certainty all detract from the high water mark of efficiency, all tend to slow down the general output, to cause non-deliveries and to add to unremunerative service correspondence. The public here at times are by no means blameless as regards certain typed telegrams.

Students of "wireless" may not all be aware of the remarkable properties of silicon and germanium, which exhibit the two highest thermo-electric powers.

It is also a curious fact that silicon is either strongly electro-positive with respect to copper or electro-negative, according to the method of preparation, and by combining the positive and negative varieties thus obtained, we can construct a thermo-electric couple displaying the enormous differences of potential of 1,000 microvolts per degree centigrade. The small quantities of impurities, such as iron, which are always found in silicon, diminish the thermo-electric power without, however, changing its sign. By crystallising the silicon in aluminium to purify it, we obtain a strongly positive product; by crystallising it in silver or in tin, in each of which it is less soluble, we arrive eventually at an electro-negative product. Experiments with germanium demonstrate that this body presents the highest thermo-electric power next to silicon. These two substances also resemble each other in other respects, in particular, in their remarkable power of rectification with respect to the Hertzian oscillations.

The Siemens system of high-speed type-printing telegraphy experiments are still proceeding, and as we go to press have reached the point at which traffic has been possible between London and Berlin, utilising two wires for one installation. Duplex on one wire, it is anticipated, will be the next development.

The Telegraph and Telephone Department of the German State has been directing its energies to experiments on the use of high-frequency currents in wires for the transmission of several simultaneous sets of telegraphic or telephonic signals, or both.

According to the *Elektrotechnische Zeitschrift* studies have been made in methods of connexion, filtering out at the receivers, speech amplifiers, &c.

Since October, 1919, the line between Berlin and Hanover (300 km.) has been in operation for threefold telephonic conversations, while it is

possible for subscribers in the two towns to converse together with their normal instruments. A similar installation is in use between Berlin and Frankfurt, a distance of twice the length. The high-frequency currents, it is stated, are generated by Telefunken oscillation valves and may be adjusted to have wave lengths between 200 and 20,000 metres.

This same journal states that the following developments have been attained along the less well explored fields of multiplex telegraphy: "The first practical tests were carried out on a line 600 km. in length between Berlin and Frankfurt/Main. The signals are given by negative current pulses, while the positive current is used for disconnecting.

The pulses are not sent directly into the line, but actuate a relay that throws the high-frequency generator on and off the line in step with the signals. At the other end of the line the high-frequency currents are amplified and admitted to the receiver. The installation has been operating on duplex work since last December, and in 8 to 9 working hours handles up to 2,000 telegrams, or 30 per cent. of the total service between Berlin and Frankfurt. Recently the system has been used for six-fold telegraphy on a line carrying in addition one ordinary telephone conversation. This corresponds to a speed of 4,000 letters per minute, or in 8 hours 16,000 telegrams of 10 words, with an average of 6 letters, assuming that only half the total time is actually used for transmission.

A few weeks ago a 150 km. circuit between Berlin and Magdeburg has been used for transmitting two simultaneous telegrams by high-frequency currents and Hughes' apparatus, in addition to an ordinary telephonic conversation.

How some of the every-day systems, machinery apparatus and processes may strike the uninitiated "outsider" as on the marvellous side may easily be imagined even by those of us who are constantly in touch with a multitude of electrical and mechanical devices. I was, however, somewhat surprised recently to read in the sober columns of a highly-technical publication a *propos* of the developments of high-speed multiplex telegraphy in the U.S.A. that one of the remarkable features of the system appeared to the writer of the description to be that "by means of a switch the system may be immediately turned from multiplex to Morse." Wonderful maybe, but not exactly the most modern feature of twentieth century telegraphy!

The December gales have been rather unkind to some of the Anglo-Continental telegraph communications, so that one longed for extensions of the underground system to our East and South Coasts. There would then be no need to call upon the village postman to make crosses at test boxes while he, poor fellow, was puzzling his head as to which was "Up" and which was "Down" side, and wondering too whether he would finish his "Parcel-despatch," while, incidentally, the metropolis was impatiently waiting to obtain a wire or two with the other shore of the North Sea.

A recent visit to the premises of the Western Electric Company proved a very interesting experience, and an opportunity for which one would like to place on record an expression of grateful appreciation. There was no mistaking the thoroughness of the demonstration and the whole-hearted enthusiasm of the demonstrators.

The latest developments exhibit some excellent features, notably the new type-writer receiver which is capable of simultaneously printing-off a dozen carbon copies of any telegram straight from the telegraph wire. It is a sturdily built machine and the laboratory test to which the apparatus was subjected included the printing of over two million words without an error. This portions of the machinery appears to be rather noisy, although it is only fair to add that the company's engineers are hoping to reduce this special disability in time.

The arrangement by means of which a number of channels may be forked off to private subscribers, the synchronism being completely controlled by a distributor which may be situated two or three miles away is particularly ingenious. The possibilities of this scheme are great, but at present the system is likely to be confined to the United States, where a number of these particular sets are apparently on order. The method of synchronising by means of a movable plate of segments capable of rotation through 360° also presents new facilities, and a speed correction which checks both fast and slow movement forms an extremely interesting feature.

Particularly interesting, too, and especially to those who have seen the French method of "repeating" on long distance multiplex type printing circuits, is the retention of "rotatory repeaters" instead of the British system of ordinary fast speed (Wheatstone) repeaters for the purpose.

The system of transmitting from the distributor *through a relay* which repeats the pulsations to line has been adopted, a system which has been utilised by German engineers for some years both in "Baudot" multiplex and Siemens' automatic.

One thing only was lacking and that a practical trial on a wire of some length, say, London to Rome. The opinion is expressed in advance that such a trial would prove the superiority of the present Baudot type of installation for lines of the unstable nature quoted. Upon circuits where stability was the outstanding feature, such for example as any of the long main lines of Great Britain, the perforated typewriter slip system would be quite suitable. Here again, however, there are other queries. Would not the maintenance cost of so complicated a piece of mechanism as the Western Electric printer far exceed that of the present Baudot receiver with the more than equal sturdiness and the decidedly simpler mechanism of the latter, not to speak of the heavier prime cost of the former?

There is still a shyness on the part of certain continental administrations to the duplexing of Anglo-foreign lines. In some cases circuits which worked

wonderfully well before the war by this economical method, no longer yield the traffic output of which they were then electrically possible, or else relapse into "simplex" day after day. It may be agreed that post-war standards as regards continental land lines cannot at present be demanded, but it is to be hoped that something approximating thereto may not much longer be delayed.

Unfortunately for the British Post Office the British public, as also a certain public on the other side of the Atlantic, are too easily inclined to attribute the consequent heavy delays to the "ineptitude of British State Telegraphs," a charge not *maliciously* ignorant, but certainly ignorant and most decidedly unfounded.

Meanwhile the British Engineering Department is keeping well in view all possible means of assisting our foreign correspondents, and the extension of a high standard underground system of wires to the North Sea coasts and to other submarine cable-heads may be anticipated. That the early realisation of such a scheme may be practicable and thus definitely set at rest any doubts as regards the insulation of the British coastal routes that may still be in the minds of continental administrations is the constant petition of all those whose fortune it is to work or to be in any way responsible for continental telegraph communications. Such a system radiating to all coastal cable landing points would place the British telegraphs in its correct setting of a well-nigh impregnable standard.

Mr. John Lee's paper on "Scientific Management" drew a very considerable audience at River Plate House on Monday, the 13th ult. The lecture was in concentrated form as regards the matter it contained, and, to those who heard for the first time a dissertation on the subject it proved a veritable lesson in careful and attentive listening.

When the lecturer had finished, there was a census of opinion that "we will hear thee again of this matter," for it was not possible to thrash out in one brief hour the pros and cons of a subject which touches on a question so vital to the interests of our plagued and tried human nature. Upon the human side of this matter Mr. Lee made a strong appeal for due consideration of the development of the soul of mankind, its higher self. With a charm of pleading manner he asked whether it was really worth while to plan and scheme and measure and calibrate human effort and to "organise" it out of its individuality till it became standardised and stunted.

Mr. Lee, with the poetic expression and emotion of three or four generations behind him, was at times inclined to sway one off one's reasoning balance in his laudable appeal for the humanites. Other speakers suggested "co-operation" as an alternative to "scientific organisation," but co-operation surely needs "organisation" and "organisation" simply belies its name if it be not accurate and scientific.

A scientific management at its best, could surely be devised which would teach us how to do things the better way without breaking the heart or spirit of man. Need scientific management rob a man of his individuality?

Scientific management might teach a man the easiest way to hold a Morse key—with or without his "thumb well under"—according as the expert might after experiment decide; he might teach us the smallest number of motions necessary to gum Creed or Wheatstone or Hughes slip, the easiest way to manipulate the latter keyboard or to touch-type with our type-writer, and yet without destroying individuality. One questions even the possibility of reducing the human mind to uniformity. There are no two finger prints alike!

J. J. T.

LONDON TELEPHONE SERVICE NOTES.

A Happy and Prosperous New Year.—Here is a "standard expression" used so freely at this period of the year by people of all classes and professions, even by the critics of the oft-repeated phrases adopted in telephone operating. Like all formal expressions its value depends on the degree of sincerity conveyed by the speaker as well as on the fitness of the expression to the occasion. Individually we all look forward to a just measure of happiness and prosperity in the year just commenced. A large portion of our time will be spent pursuing the profession we have adopted, and that thought gives rise to the question whether the season's greeting is fitting to our official life. Reviewing some of the achievements of the past year we find satisfactory progress has been made on all sides. The "service," which engages the attention of the majority of our readers, perhaps more than any other item, shows an immense advance. The speed of answer which stood at 8.6 seconds for the month of December, 1919, has improved by approximately 3 seconds, so that it is now closely approaching the standard at which the Administration aims. Similarly the average time taken to clear local connections is now in the neighbourhood of 5.5 seconds. The percentage of operating irregularities has dropped to a figure better than that obtained prior to the war. Confirmation of the improved quality of the service may be held to exist in the fact that the ratio of written complaints to subscribers' lines is now less than in pre-war days. These figures of course apply to the London Exchanges as a whole. The number of exchange lines in the London Telephone Area has increased by about 18,000 during the past year and the highest volume of 24 hours' originated traffic so far recorded was reached. Progress has, therefore, been achieved in all directions and is, moreover, being maintained. In the current year we are to have several new exchanges and extensions to existing exchanges. A definite advance will be made in the application of machine switching to London, and the opening of the new Toll exchange will mark a considerable improvement in the handling of provincial traffic.

In so far as prosperity is measured by income, material advances can be recorded even if they are not yet to the entire satisfaction of the staffs of all grades. The foregoing factors, together with the harmonious working in the London Telephone Service of the Whitley machinery, justify the repetition of the wish "A Happy and Prosperous New Year."

St. John's Ambulance Association.—Among the various institutions to which the women of the London Telephone Service give their support during their leisure hours perhaps the one least known is that of the Post Office Ambulance Corps. The London Telephone Service has a branch of the Corps known as the G.P.O. South (Telephones). From that branch a team entered the fourth annual competition held on Nov. 17 last for the women's trophy and were successful in winning it. Teams competed from The Accountant General Department, G.P.O. South (Telephones), G.P.O. West (C.T.O.), Money Order Department, and Saving Bank Department. The former holders of the trophy were the G.P.O. West (C.T.O.) branch, the team from which took second place on this occasion. Our team comprised:—

Miss A. Drewe (CQ), Leader,	} Trunk Exchange.
Miss E. Drewe	
Miss F. E. Foster	
Miss B. L. Webb	

We congratulate them heartily on adding to the many laurels gained by the staff of the London Telephone Service.

The Post Office Ambulance Corps is an unofficial and voluntary organisation, which has for its objects the assisting of officers to become certified in "First Aid" and "Home Nursing" and efficient in "Ambulance" work generally. It provides a trained body of men and women in the office capable of rendering assistance in cases of accident or sickness. A further object is the recruiting of members for the No. 58 (London Post Office) division and the No. 28 Nursing Division, Prince of Wales Corps, both of which have been formed to enable members of the Corps, should they so desire, to perform ambulance duty on public occasions and to obtain hospital training.

Lectures and practices are arranged, and the next course in connection with the G.P.O. South Branch commences during this month. New members are urgently required to enable the work to be carried on and extended, and any members of the staff who would like to go through either of the courses will be welcome. The Secretary of the G.P.O. South Branch is Miss E. Mulvany, of the London Trunk Exchange, and she is anxious to receive applications for membership or to answer any questions concerning the classes. The Controller is a patron of the Post Office Ambulance Corps, and Miss Heap is the President of the local branch. Miss A. Drewe is a member of the Nursing Division, and in that capacity performed service in Egypt during the late war.

The Christmas Fair.—It is no mere form of words to say that the Christmas Fair which took place early last month was an immense success. The Memorial Hall authorities express the view that it eclipsed anything of its kind previously held in the building. Visitors streamed up the broad staircase unceasingly and at times it looked as though another individual could not squeeze into the hall. The army of helpers at the stalls, in the refreshment room, at the doors and in the corridors directing the visitors worked untiringly. Telephonists and Supervisors as waitresses, Assistant Superintendents of Traffic as showmen, vied with each other to achieve perfection in their new calling (or shouting). Donations, which were greatly appreciated, were received from colleagues in various parts of the country. The amount—two thousand guineas—raised in the two days is some indication of the work of the whole staff in London in preparing articles for sale. The concerts under the direction of Mr. Pounds and the two dramatic parties were well patronised, and an appreciable sum was thus added to the proceeds. A fuller account will be found elsewhere in the JOURNAL.

We were glad to welcome among others Mr. Pike Pease (the Assistant Postmaster-General) and Mr. A. R. Kidner (Assistant Secretary-Telephones).

The London Telephonists' Society.—The November meeting of the Society, at which Mr. M. C. Pink read a paper entitled "My Impression of London Telephones" by Sadie Worth, telephone operator, New York City, was very successful. The paper consisted of a series of letters from Sadie to Poppy and was the more interesting on account of the original style in which it was presented. Notwithstanding that Sadie was having what we should call colloquially "a busman's holiday" and was writing such a lot of shop, she introduced an amount of humour which made her letters quite pleasant. In contrasting the general conditions of service of the exchange staffs in this country and the United States, the advantage seemed to lie with the telephonists of the British Post Office, but our readers will no doubt have the opportunity of judging for themselves when space for the letters can be found in this JOURNAL. Mr. Pink received a very enthusiastic vote of thanks at the conclusion of the meeting.

An additional meeting has been arranged for the month of January, to be held on Thursday, the 13th, at 6.30 p.m. at the Sunday School Union in Old Bailey, E.C. On that occasion Miss Heap will read a paper entitled "A Little Holiday in Italy before the War." The paper will be illustrated by lantern slides, and both the subject and author are sufficient recommendation to ensure a large audience.

The membership of the London Telephonists' Society was never in a more favourable position as regards numbers than now. At the time of writing these Notes the roll contains the names of 950 members, and there is every indication that by the time the notes appear in print the number will be increased to 1,000 or more. The President and Committee are to be congratulated on this result, which has, no doubt, been achieved largely through the

excellence of the papers which the Society has secured. So far the attendance at the meetings has been no larger than has comfortably filled the dining room at Museum, but with the membership now existing larger attendances are looked for and a return to the hall of the Sunday School Union may then be necessary.

The Telephone and Telegraph Society.—It was unfortunate that the December meeting coincided with a meeting of the Institute of P.O. E.F.'s., for a number of members found some difficulty in deciding whether to attend to hear Mr. John Lee's paper on "Scientific Management" or to accept the invitation to hear the paper on the subject of "Wireless Developments in Telegraphy" read by Mr. Shaughnessy. The attendance at both meetings suffered, but nevertheless Mr. Lee had a large audience. His paper was greatly appreciated from the fact that he urged the need for adequate consideration of the worker and the enlistment of the worker's co-operation in all schemes of scientific management. These factors have not always been accorded their proper value by all past students of the subject, but here are indications that the tendency of the age will secure for them greater prominence. In this respect the paper may be regarded as an argument in favour of the Whitley movement.

Why is the Society called The Post Office Telephone and Telegraph Society of London?

Why is the JOURNAL entitled The Telegraph and Telephone Journal?

Was he of the sister service who last month in the leader headed "Automatics for London" referred to the London Telegraph and Telephone Society?

Is the author of last month's L.E.D. Notes who referred to the Post Office Telegraph and Telephone Society "officient?"

The London Telephone Service, Whitley Committee.—It is interesting to read the first annual report of the work of our Whitley Committee, and to read in its concluding paragraph: "So far as the London Telephone Service is concerned harmonious and satisfactory utilisation of the Whitley machinery is proceeding. The discussions which have ensued so far have been informative, and should prove of value from both the official and staff point of view."

The distribution of the seats among the Associations representing the various grades of officers in the London Telephone Service is as follows:—

Union of Post Office Workers	...	...	...	...	5
Controlling Officers' Association	...	...	...	...	1
Association of Civil Service Women Clerks	...	...	...	...	1
Association of Civil Service Writing Assistants	...	...	...	...	1
Association of Traffic Superintendents	...	...	...	...	1
Association of Civil Service Clerical Officers	...	...	...	...	1
Association of Contract Officers	...	...	...	...	1
L.T.S. Supplementary Clerks' Association	...	...	...	...	1

This arrangement will continue throughout the ensuing year. Six meetings of the Office Committee have been held during the period under review. An indication of the variety and range of the subjects discussed is obtained from the list of items given below:—

Matters affecting mainly the Headquarters Staff; conditions under which officers might be allowed in exceptional circumstances to commence duty at a different time from the normal hour of commencement of duty; redistribution of senior clerical officers; paperkeepers' duties; registry accommodation; effect on staffing arrangements of introduction of new telephone rates and change in system of accounting; need for appointment of Supervising Sorting Assistant on Directory Section; Writing Assistants—compulsory overtime and promotion to Women Clerks' vacancies; various matters relating to Girl Probationers and the Male Messenger Staff, e.g., overtime, duties and status of Assistant Head Messenger.

Questions affecting mainly the exchange staff:—Overcrowding in the London Trunk Exchange; Staffing conditions at Directory Centre Exchanges: a recommendation by the West Traffic District Whitley Committee for an increase in the tea relief at Exchanges; possibility of transferring Night Telephonists and Call Office Attendants to Coin Collectors' positions; possibility of placing on permanent staff temporary full time night telephonists engaged during the War; medical attendance arrangements for night telephonists; press announcements concerning increases of pay to exchange staff.

Two Sub-Committees have been appointed, with the terms of reference quoted below:—

- (1) "To consider the question which would arise as a result of the introduction of new telephone rates and any change in the system of accounting."
- (2) "To consider and report upon the conditions obtaining at Directory Centres and the best means of improving the arrangements for dealing with Directory enquiries."

Neither of these sub-Committees has yet concluded its sittings.

The District Committees are also in active operation, and have already discussed a number of matters of interest within their district.

To our Whitley Committees we repeat the wish "A happy and prosperous New Year."

LONDON ENGINEERING DISTRICT NOTES.

An interesting ceremony took place on Nov. 16 at St. Martin's le Grand. The occasion was the presentation to the Engineer-in-Chief of a book containing the signatures of a very large proportion of his staff, as a memento of their good wishes on the honour of Knighthood being conferred upon him. The book was richly embellished and enclosed in a handsome casket.

Mr. A. J. Stubbs, in making the presentation, referred to Sir William Noble's valuable services to the State and the esteem in which he is held by all who know his sterling worth. He likened the dignity that had been conferred upon the Engineer-in-Chief to the snow-cap on the mountain's top, which, though not increasing the greatness of the mountain, does emphasise it.

Sir William assured those present that he valued his knighthood not on his own account, but because it conferred distinction on the whole engineering staff.

Before this number of the JOURNAL is in print Mr. J. E. Taylor will have started his duties as Superintending Engineer of the South Midland District in place of Mr. Robb, who brought his official career to a close on Dec. 31. Although Mr. Taylor's stay in the London Engineering District was not a very long one, yet it was sufficient to enable him to endear himself to his colleagues, who regret his departure and offer him their best wishes for success in his new sphere of activity. The vacancy at Denman Street has been filled by the transfer of Mr. R. A. Weaver from the South Eastern District. The change has involved a rearrangement of duties of the London Assistant Superintending Engineers. Mr. Greenham is now responsible for those matters formerly attended to by Mr. Taylor, and Mr. Weaver for matters relating to Internal Construction.

It is hoped ere these notes are in print to have completed extensions of the Hornsey and Victoria Exchanges, and, if certain long outstanding stores come to hand, to have cleared up a number of other smaller extensions. In the February number it should be possible to report the opening of a new C.B. Manual Exchange at Harrow, to replace the No. 9 switchboard hitherto in use. The work on the various relief exchanges is being pushed on with all possible speed. Langham will be the first to open and Chancery the second. The remaining two—Grosvenor and Minorities—happen to be in different sections, and the Sectional Engineers concerned are each determined to complete his first. The loser is to buy and wear a Sandringham hat as a punishment.

A little while back an article on the Electrophone Service appeared in this JOURNAL. The number of subscribers to the system is still increasing rapidly. In order to make it possible to meet all demands for exceptionally popular entertainments it has been found necessary to employ thermionic valve amplifiers. The experimental installation of these has proved so successful that it has been decided to equip a greater number and in a permanent manner. At times there have been as many as 220 subscribers connected to one music line.

A similar system of amplifiers is to be introduced shortly in connection with the L.T.S. telephonists school. A whole class of students will be enabled to listen simultaneously to one working telephonist. Is the Post Office behind the times? The answer is in the negative.

The lecture room of the Royal Society of Arts, John Street, Adelphi, was crowded on Wednesday Nov. 17 when the Chairman of the Society, A. Campbell Swinton Esq., F.R.S. gave his inaugural address.

The subject chosen was that of "Wireless Telegraphy and Telephony," and it was illustrated by working demonstrations of apparatus.

Standing among those crowded in the doorway of the lecture room and unable to get inside, we were impressed by the large number of very elderly people present.

Some appeared to be early Victorian scientists returned to earth in order to see some of the latest developments of applied science. There was one dear old lady in the front row gazing with awe on one of the latest thermionic valve receiving sets.

The lecture itself may be described as a very fair epitome of the latest practice so far as wireless work is concerned. The principal feature of the demonstration was the exhibition of some up-to-date Creed telegraphic apparatus. Wireless messages were received *via* an aerial fixed on the roof of the Society's premises and were rendered audible to the audience on a loud-speaking telephone receiver. The signals were also received on the Creed receiving apparatus. The latter operating the perforating mechanism prepared a special tape for the printer by means of which the message was reproduced in Roman letters. It was finally exhibited on the screen through an optical lantern. Messages in this way were dealt with from Portsmouth and Paris, that from the latter being a special message from the Eiffel Tower Station by the courtesy and permission of General Ferie, Head of the French Wireless Administration. A demonstration of wireless telephony was also given, spoken messages, whistling solos and gramophone selections being clearly reproduced and audible throughout the lecture room.

The lantern slides were excellent. The only general criticism that one can offer is that far too much time was spent on receiving and reproducing the

messages, which were unduly long. The time left for explanation of the diagrams and general principles was thus so curtailed as to be of little value for the purpose of gaining information.

It would be interesting to know what percentage of surplus war stores has been put to useful purpose since peace was declared. Those who take notice as they move about the streets of London will have observed a new type of Post Office Engineer's truck with wire spoke wheels and flat solid tyres. These same trucks were not so very long ago Hotchkiss gun ammunition wagons and were used for destructive instead of as now for constructive purposes. The Post Office saved a great deal of money by purchasing a quantity of the wagons very cheap and converted them at small expense into serviceable trucks for external linesmen.

Talking of taking notice reminds one of the following lines culled from one of Sir Oliver Lodge's books:—

"The ordinary run of men live among phenomena of which they care nothing and know less. They see bodies fall to the earth, they hear sounds, they kindle fires, they see the heavens roll above them, but of the causes and inner workings of the whole they are ignorant, and with their ignorance they are content."

The work of the Engineering Department is so many-sided, and demands such constant study of technical and scientific literature, that its members are not likely to fall into the unthinking condition referred to. Scientists are producing more and more evidence that life is a form of electric energy, and the originator of the expression "live wire," to denote a keen-witted and active person, probably had this theory in mind.

There is no lack of "live wires" in the Post Office Telephone Department

In America much greater use is made of motor vehicles as an aid to telephone engineering than in this country. This is not because the Post Office is backward in adopting time and labour-saving methods, but because the conditions on the other side of the Atlantic are more favourable to their use. In New York apparatus is despatched to the subscriber's premises in advance of the fitters' visit, and it is claimed that much time is saved by such an arrangement. Experiments in this direction were made in London many years ago and it was proved that the conditions were not favourable, and the scheme was abandoned on financial grounds. The conditions now have changed in some respects and further experiments are being carried out with a view to seeing just how much the progress of the work can be hastened by the employment of motor vehicles. Anyone who knows the congested state of the streets within a mile of the Mansion House will readily understand that in that area more time may be lost than gained through vans being blocked for long periods in narrow streets. This, added to the fact that fitters can reach most of the subscribers premises on foot or by using the many facilities for rapid transit and carry the necessary stores with them, puts out of court the idea of doing the whole of the delivery work by van. The heavier items must, of course, be delivered in this way.

In addition to the motor vans now in use there is quite a little fleet of motor bicycles with side cars for the use of travelling supervising officers. These have proved a great boon, permitting as they do works in progress in remote parts of the district to be more frequently and thoroughly inspected.

A GALLANT ACTION.

It is with great pleasure that we publish details of a very plucky deed on the part of one of the Department's officers.

On Nov. 17 a horse attached to an unattended laundry-van in Queen's Avenue, Muswell Hill, took fright at a passing motor lorry and galloped towards The Broadway, causing great commotion among pedestrians in the vicinity.

Seeing the possibilities of danger, Mr. H. W. Spiers (N.E. Internal Section) who was passing, clambered into the van. He was able to rein up the horse, which he brought to a standstill within a few yards of The Broadway.

There is no doubt that Mr. Spiers' presence of mind and prompt action averted what might have been a serious accident.

One of the Headquarter's Engineers has a small boy of an enquiring turn of mind and a coffee grinder. Many great discoveries have resulted from performing the same experiment on a number of different substances. The small boy in question recently ground up a packet of "Lux," and, as his father says, next morning for breakfast he was regaled with Café de Lux. A position in the Research Section has been earmarked for the budding scientist.

At the invitation of the Western Electric Co. a few of the District Headquarters staff recently attended the company's City Offices for a demonstration of the latest developments in Western Electric machine telegraphy and telephone repeaters. The already well-known Western Electric "start-stop" printing telegraph apparatus, so called from the fact that its distributor is in operation only during the transmission of a signal, was shown in operation. Like the Baudot, on which it is based, it utilises a combination of five impulses, but these are originated in the transmitter by means of a perforated tape prepared on a perforator with typewriter keyboard. The reception is in the

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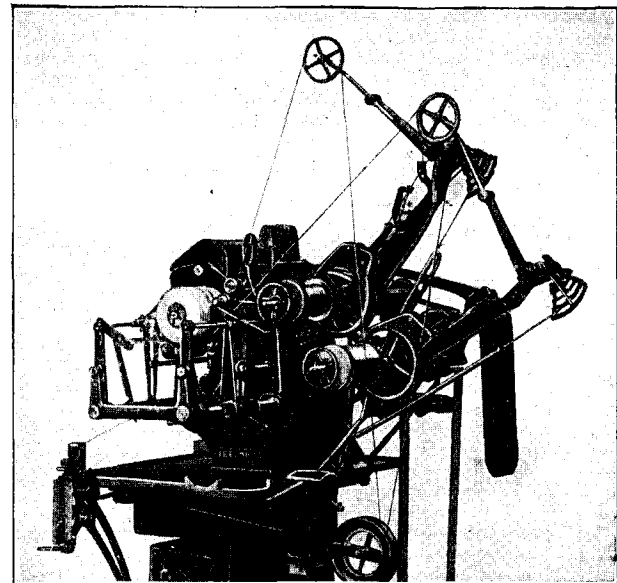
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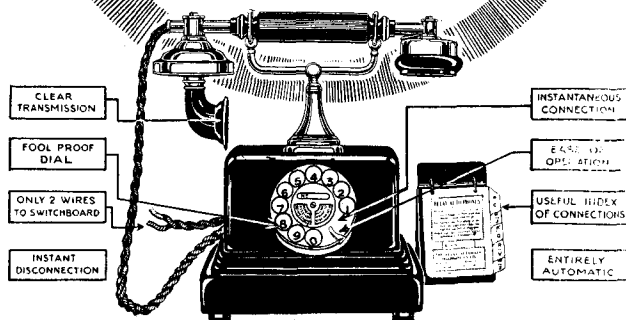
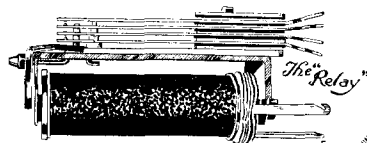


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form of page printing, and as the apparatus can readily be duplexed the transmitting operator seated at the keyboard can see the reception, which is in full view. The apparatus is capable of fifty words per minute, and a case was cited in the States where an operator capably handled the entire duplex working at one end.

The Western multiplex printing telegraph, with several important improvements, was also exhibited. It is an exceedingly compact apparatus with all parts conveniently arranged for adjustment or replacement, particularly in regard to the distributor. One novel feature is the arrangement of small signal lamps provided as a direct visible means of regulation.

The Western Electric telephone repeater was represented by two demonstration circuits, one two-wire of 38 standard miles which was reduced to 12 by means of two repeaters and the second, a four-wire circuit of 72 standard miles equivalent, reduced to the same figure by the repeaters. The transmission was excellent in both cases. An interesting development was a test panel, which, in addition to the usual repeater testing arrangements, enabled the testing officer to ascertain on direct reading instruments the repeater gain in terms of standard miles. The tendency for improved transmission on very long trunk lines is towards the 4-wire system using cable with small gauge wire—four 20 lbs. wires are more effective than one pair of 40 lb. wires. Instructive charts were exhibited showing possible arrangements of the repeaters. One, a map of the United States, indicated the transcontinental circuit between the Atlantic and Pacific, extended to Los Angeles, a total distance of approximately 4,000 miles. Transmission was obtained through the repeaters and the circuit thereby improved to the equivalent of 12 standard miles.

An interesting lecture was given by Mr. E. H. Shaughnessy, O.B.E., M.I.E.E., Staff Engineer, at a meeting of the Institution of Post Office Engineers held on Dec. 13. The subject was "The Development of Wireless Telegraphy." Mr. Shaughnessy is an ideal lecturer, having a facile delivery and the knack of making an abstruse subject seem simple to his hearers. He traced the development of the apparatus that is now employed in the various commercial systems, dwelling principally on the Poulsen Arc, the high frequency alternator and the valve oscillator as the basis of transmission systems. The lecture was illustrated by a number of excellent lantern slides and some successful experiments, including the Dudell singing arc, the singing valve, high speed reception and the Post Office wireless call device. Mr. Shaughnessy would have extended his lecture beyond the allotted period had not the hall been engaged for another meeting the same evening, and his audience would have gladly sat all night and listened to him. He promised that others in the Wireless Section of the Engineer-in-Chief's Office should follow his example later and give the members of the Society the pleasure of hearing more about this fascinating subject. This promise must be redeemed.

TELEPHONE TARIFFS.

As we go to Press we have received a copy of the Report of the Select Committee on Telephone Charges. The Committee have accepted the Post Office proposals for the abolition of the unlimited service and measured rate tariffs and the adoption of a uniform message rate for all classes of service, and they approve the proposals for quarterly accounting in respect of all rental fees and charges.

The quarterly rental payments will be as follows:—

London	£2 2 6
Birmingham, Glasgow, Liverpool, Manchester	£2 0 0
Elsewhere	£1 17 6

Each originated local call, 1½d.; no charge for incoming calls.

"TAYLOR O' MANCHESTER" RETIRES.



MR. WM. TAYLOR.

The reputation of some men become almost inseparable from the places in which they have done notable work, and so we have among eminent preachers "Robertson of Brighton," Spurgeon and his Tabernacle. There are too in the English telephone world three notable Telephone Taylors, to wit:—"Taylor of Brighton and 'Brum.," "Contract Taylor of G.W. and L.T.S.," and "Taylor o' Manchester."

The last-named officer, Mr. William Taylor, having attained the 60 years necessary to qualify for a first-class retirement while serving as District Manager at Lancaster, was the recipient on Nov. 30 of several concrete gifts from his colleagues past and present testifying the high regard in which he is held by those who know him. A silver tea service and umbrella came from the local staff, past and present, and a gold curb watch chain from his co-District Managers.

At the request of the Lancaster staff the presentation of the tea service was made by Mr. T. A. Prout, of the Telephone Branch of the Secretary's office, who recounted his long personal and happy experience of the recipient.



THE LONDON TELEPHONISTS' CHRISTMAS FAIR, see p. 55.

For over 26 years Mr. Taylor was second-in-command at Manchester, and there are few men in the city better known than this telephone Taylor, who is a veritable "Manchester man."

He is a thorough-going Telephone Encyclopedia and what he does not know about telephones in Lancashire is not worth knowing, and what he does know would form the basis of an interesting article for our JOURNAL.

Notwithstanding nearly 40 years strenuous telephone service he retires clean-shaven with a debonair moustache as indicated by his latest photograph looking younger than he did with the side-whiskers of middle age. He tips the scale at 14 stone and will give the best bowlers of Blackpool many a hard game, and let us hope keep it up for many years to come.

Mr. Taylor was gratified to receive on the morning of his last day a kind letter of congratulation and thanks from Mr. A. R. Kidner, the Assistant Secretary, who conducts the Telephone Branch of the Secretary's Office.

PERSONALIA.

LONDON TELEPHONE SERVICE.

PROMOTIONS.

The following have been promoted Assistant Supervisors, Class II:—

Miss A. WRIGHT at Paddington.	Miss E. K. FOOT at Trunks.
Miss M. L. E. BLUNDINE, at Gerrard.	Miss A. M. CLEMENTS at Hop.
Miss G. M. HAZELTINE at Gerrard.	Miss A. C. WALLACE at Trunks.
Miss M. E. LINES at Hammersmith.	Miss W. CHANTER at City.
Miss A. L. POWELL at Paddington.	Miss M. M. HARDING at City.
Miss K. M. BLACKMORE at Trunks.	Miss G. M. SCOTT at Avenue.
Miss E. B. SANDFORD at Kensington.	Miss E. HANST at City.
Miss G. D. REEVE at Avenue.	Miss E. E. GOODACRE at Central.

Miss V. L. WELSH at Paddington.

The following telephonists have resigned on account of marriage:—

Miss G. A. ACKERMAN of Museum Exchange.
Miss R. E. BALL of Victoria Exchange.