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## CONTENTS.

	PAGE		PAGE
TRAINING AND SCIENTIFIC MANAGEMENT. By JOHN LEE ... ..	67	HIC ET UBIQUE ... ..	74
THE TELEPHONIC DEVELOPMENT OF THE WORLD AT DEC. 31, 1919.		CAUSE AND EFFECT ... ..	75
By W. H. GUNSTON ... ..	70	CORRESPONDENCE ... ..	75
TELEGRAPHIC MEMORABILIA ... ..	71	AUTOMATIC TELEPHONY IN LARGE AREAS FROM A TRAFFIC POINT	
LONDON ENGINEERING DISTRICT NOTES ... ..	73	OF VIEW. By M. C. PINK ... ..	75
FROM A FRAGMENTARY MSS. OF THE ARABIAN NIGHTS ... ..	73	THE BAUDOT.—XVII. By J. J. T. ... ..	80
EDITORIAL:—		REVIEW ... ..	81
THE CAMPAIGN ... ..	74	LONDON TELEPHONE SERVICE NOTES ... ..	81
		PERSONALIA ... ..	82

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### TRAINING AND SCIENTIFIC MANAGEMENT.\*

By JOHN LEE.

SCIENTIFIC MANAGEMENT is hardly well-named. It is a theory of what might better be called executive management. It belongs essentially to that section of management as a whole which is concerned with the immediate direction and control of staff, and it occupies itself principally with the detailed performance of work. Important though that is, we cannot agree that it covers the whole ground of management. It is curious that in America the more distant phases of management, as we may call them, the formulation of policy, the working out of the broad principles of production and of sale, are taken for granted. No one needs training or scientific method, apparently, to be at the head of half-a-dozen trusts or to manage the financial interests of various huge corporations. It is understood that the more immediate managers need this training, and it is for them that Scientific Management has been evolved. Whilst, however, I would protest that this conception of Scientific Management is far too narrow in its outlook, I believe that we have much to learn from it. Possibly I would apply its principles a little differently; certainly I would look a little differently both at its psychology and its economics. For all that it represents a vast amount of study, research, observation and comparison of all kinds of human work, of the mental operations or physical acts involved, of the methods by which stimuli are to be given and rewards allotted, of the methods by which staff can be interested both in their day-by-day work and in its eventual or corporate results. We must admit, whatever analysis to which we may subject Scientific Management, that this is a worthy aim. We have been woefully lacking in an appreciation of the human side of industrial operations; incidentally, I am not at all certain that the exponents of Scientific Management, with all their minute study and observation, have shown a true appreciation of the human side of individual operations. However, at this stage I am not presuming to analyse Scientific Management. I am only making for it the simple and, as I believe, the just claim that it has moved the focus of interest from the machine to the man, that it has given to the human side of industrial operations, at any rate, the tribute of minute study.

Scientific Management has come to us from America, where labour conditions in the sense of labour organisation to protect its own interests are far different from conditions in England. Consequently, it comes to us rather from the capital side than from the labour side of the long-continued issue, and justly or unjustly labour has looked rather coldly upon it. Yet it has succeeded in many industries, though in the main they have been industries rather of specialised types. It did not begin as an attempt to exploit labour. That charge has been made again and again. It began in what seemed to its

sponsors to be an effort to unite the interests of employer and worker; it formed as a basis many doctrines and theories which were a shock to the old-fashioned employer. It looked at the worker through eyes which had seen something of the truths of psychology and with a determination to be fair to the worker. Some of its exponents, while developing their schemes apparently chiefly from the employers' point of view, have been anxious for the up-rise of labour, and began their studies with the intention of helping labour. In fact, as I hope to show, labour has been a little foolish in standing aside, for out of the theories of Scientific Management something greater might have been evolved and the many inductions and observations and studies might have been put to good use. So in this paper I shall attempt to examine the principles of Scientific Management quite dispassionately and rather with the intention of discovering what better use could have been made of those principles if they were applied in what I would call a mutual spirit.

The origin of Scientific Management, or at least the earliest trace which I can find of it, appeared in 1867 in connexion with the United States Cavalry. In preparing the instructions which were issued to the men in connexion with the grooming of horses some careful study was given to the subject and the most precise results were obtained as to the way in which the grooming might best be done, not only to be most efficient, but also to involve the least expenditure of labour. Later on various labour operations were tackled in the same spirit. We have records of them in Taylor's books and Gilbreth's. Later still the psychologists entered into the same field and studied mental operations as precisely as the exponents of scientific management had studied physical operations. This of course carried the movement more widely afield, so that it included the methods of co-ordinating the supervision or the immediate management. Out of all this there grew up what are called Efficiency Engineers, and there has been a wonderful mass of writing on the subject. Let me say at once that three-fourths of the writing on this subject is the sheerest quackery. We shall try in our studies to keep to those writers who really have made a contribution of value in that they have given precise and careful study to this or that factor on industry. For the quackery is easily separated from the worthy research.

Englishmen generally think of Scientific Management as a means whereby a clever American decided which was the most convenient shovel for a gang of navvies to use. It is this—and very much more. It is really a minute system of detailed functional industrial process. It begins with planning, and planning is carried out to rigorous details. The task of each workman is carefully thought out; each motion is studied and considered, and he is taught that method of carrying out each operation which is easiest and is most effective. The planning is separated from the operation and is vested in a different person, an expert, so that the workman is relieved of a certain amount of intellectual operation in connexion with his physical operations. The actual physical operations are divided functionally on the ground that each workman will perform them more efficiently if he is a specialist. An elaborate system of instruction cards is introduced, and each workman is thus able to know what is expected of him and is graded for remuneration accordingly. All these processes are the subject of minute study; even the cinematograph is brought into operation to study the movements. There are time studies and motion studies. There are heaps upon heaps of records, in fact, Scientific

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Management comes near to the old Red Tape and literally pleads for more and more records. There are studies of fatigue. There are adaptations of psychological methods for the purpose of impressing the staff, and great care is taken to take the staff into full confidence after the methods have been adopted. Then superposed upon this foundation of elaborate detail there is a precise system of functional supervision—a separate "Speed Boss" a "Discipline Boss," a "Time Boss," and other officers who, being adept at the particular tasks, are called upon to give model exhibitions of the best way in which each task is to be done, and to co-operate in the further study and analysis of the operations. Thus in Mr. Gilbreth's studies of brick-laying, the time of each operation is recorded and summarised, and methods of laying so many bricks, each with its appropriate mortar, are not only suggested but insisted upon. Then there is a very complex and thorough method of training, and even men who have been a long time at work and have acquired imperfect habits are sent back for training. Added to this is what I regard as one of the most valuable features, the publication of data showing the costs of production at each stage. Mr. Crowther in "Common Sense and Labour," deals with this point admirably. "As far as the workers are concerned, industrial representation is of value in the degree that it makes them familiar with the processes of the business and incites the creative instinct." The final characteristic is the method of rewards and incentives which is based upon the principle that not only do they recognise and reward the highly successful worker, but they recognise the earnest efforts of those who are not so skilled and not likely ever to be so skilled. I have stated the position as fairly as I can, but I cannot refrain from saying that in my opinion, Mr. Zimmern is perfectly right when he sums up Scientific Management as meaning that the management is to do all the thinking and the workmen all the toiling.

This in outline is the system. Its enthusiasts make very inclusive claims for it, and they bring evidence of its popularity with the workers. There is other evidence, however, and it is not readily to be laid aside. It is claimed for it that it encourages greater interest on the part of the worker, that it produces better men as well as better work, that it rids the worker of that inertia of conservatism which we all know to be deadly, that it introduces a healthier spirit of co-operation and fellowship, that it gives exceptionally good chances of promotion to those men who have qualities for being teachers, or research students, or one of the functional "bosses" to which we have referred. All this is to be placed in the foreground if we are to do justice to the system, especially if we think, as I think, that it has some contribution to offer to the world of industry.

In coming to examine the principles it is to be questioned at once if any such system can succeed if it seems to be imposed from one side. It is not always the case that objective study can discover the best means for each individual of doing any particular task. Take for example the pen with which I write. It might be the case that if I point the pen to my shoulder and use it with two fingers comfortably I could write better and more easily. But that does not include all the factors. There are subtleties of the strength or the weakness of particular fingers and even greater subtleties of nerve centres, and one can hardly believe that long usage with a tool like a pen does not evolve, by the natural process of finding the least line of resistance, the best way for me of using the pen. Of course there are fundamentals. We must learn in playing the pianoforte to produce the notes by five fingers in that way which long experience has taught us is the best, but one could hardly tell Paderewski to sit 9½ ins. from the keyboard and hold his elbow half-an-inch above it. As in so many other things the expert, when he is expert, evolves his own rules and becomes independent of the processes through which he has passed to expertness. His expertness is independence. His experience leads him to change his posture from time to time and some of the postures to which he changes cannot be regarded as those which objective studies, even aided by the cinematograph, would decide to be the best.

A similar criticism may be urged from the psychological point of view. It may be efficient on the whole to take from the worker the mental operation of "planning," but if it means that we lose the mental effort by which the worker weighs up his task and considers the best means by which it is to be done it will not all be for advantage. I am reminded of a telling phrase in Norman Angell's "The British Revolution and American Democracy."—"The very fact that we do need more and more unity of action in order to make a large population with many needs possible at all, is the reason mainly which makes it so important to preserve variety and freedom of individual thought." The more highly organised and therefore the more closely-welded the social machinery becomes, the more important is the operation of individual thought and the more necessary is the widest freedom of thought. Already the development of industry has specialised the manual operations until the worker is given in many cases only a comparatively small and routine task. Adam Smith's account of the division of labour in respect of the making of a pin will be remembered. But it will be infinitely worse if the mental operations are equally specialised. Professor Marshall went shrewdly to the point when he said that it will "diminish the need of the operatives for resource and judgment in small matters." Nor is it quite true that mental operations are better performed if they are narrowed. The mind may become more efficient in respect of a particular operation if it is confined to that operation, but there is a false analogy between mental and manual operations. The mind needs variety in its work. It is not necessarily desirable that management should "eliminate other thoughts," for it may not be true that they have "a tendency to retard the work." There is something depressing in Dr. Wilson's article on the shell-shock men, where he says that the best man in the trenches was the man who had cut off all mental visions from the outside

world. It is not necessarily the case that the mind is more efficient from the lack of interfering interests. One of the best psychologists of the past generation always stated that he worked better amid distractions, that his mind was more alert when he had to bring it, by a deliberate act, from wandering. Extraneous aids, such as the banishment of other noises or allurements, do not help the mind as much as we suppose, and many of us have discovered that we can concentrate better where there are interruptions than where we are given what seem to be the perfect conditions of quiet. If every task is to be planned scientifically by an expert planner and then given to us to perform according to that set plan we lose a valuable mental exercise, and it is questionable if the ultimate apparent efficiency which follows is not at too great a cost.

Further, in the psychological realm, it is at least doubtful if we can banish all the traditions of past generations by a plan of operations, no matter how ably schemed. Research to-day seems to indicate that in the sum total of our minds the contribution of to-day is very small in proportion. I daresay you remember Mr. Kipling's "The Finest Story in the World" with its account of the man with the memories of the Greek galley-slave in his mind. We all have such memories. The long chains of traditional modes of thought have a strong grip upon us. We cannot begin *de novo* in each generation. It may be the case that Mr. Gilbreth's method of laying bricks is far more efficient, in the matter of brick-laying, than the methods which have come down to us, though there is this to be said for those methods that they cannot altogether be wrong as they are the result of generations of experience. In introducing the "packet" system, Mr. Gilbreth has to face this tremendous inertia. Consequently it might seem that the most scientific management would build upon the traditional foundations, would modify them here and there, rather than attempt a brand new method which may be violently opposed to the methods of the past. Evolution seems to me to point in a different direction.

Again, though it is true that Scientific Management does set out to consider the worker, it does not set out to ask the worker to co-operate in discovering the new methods. He does co-operate as an individual; he does make his own records of times and of motions, but those records are taken by the experts and turned into data. It is not conceivable that by these means we should re-introduce zest into work and it is zest which is needed. If it is to the interest of the worker that newer methods should be introduced it would also be to the interest of the worker that he should take some part in the adoption of those methods, and their introduction will have a greater momentum in their favour from having the stimulus of this consideration behind them. It is just at this point that Scientific Management has failed to carry the workers as a body. They feel that Scientific Management is imposed upon them. "Industrial efficiency," says Professor Jones in his "Social Economics," "depends largely upon the spirit of the workshop. Without the hearty co-operation of the workers the most powerful mechanical appliances and the most efficient organisation are of no avail. One of the most serious errors of many who advocate Scientific Management is to believe that men can be parcelled out like bales of cotton, the appropriate muscles being employed in the most economical manner without reference to the volition of the workers." There is a further danger, too, lest the elaborate methods used in finding what may seem, at the moment, to be the best way of performing certain functions, should, by their very elaborateness become concrete and rigid, this very elaborateness making us hesitate to change them. Moreover, it focusses attention on the actual physical process and to some extent diverts attention from more suitable methods of research. As Mr. Fleming puts it, "Development has been limited in many factories working under Scientific Management to increase in quantity of those things already manufactured." "The work of industrial research is not sufficiently stressed by efficiency experts." It is an odd irony that in spite of all that has been said as to the advances due to Scientific Management it should include a danger of such a firm establishment of a particular form of practice as to become ultra-conservative. We have learned to be so facile in the use of instruments that they have become a part of us. We speak of the machine as part of us thus: "I go on my bicycle"; I do not say that the bicycle goes. Scientific Management has the psychological disadvantage that it introduces a new hiatus between the man and the machine. It would bid the cyclist consider the exact position of the ball of his foot when he wants to enjoy the cycle ride.

The group-mind naturally regards Scientific Management as being part of this process, and there is no means of effecting any improvement in industrial method without carrying the group-mind with us. This initial psychological inertia which Scientific Management has to face may be due to prejudice or to ignorance, as its supporters would contend, but it is a very real and hard fact. Occasionally we owe it to one of the experts that a revelation is made. For example, one of them has said that "for the purpose of productivity a man who represents the ox in his mental make-up is the best." The instinct of the worker for all that is not naturally or normally opposed to easier methods, to more facile motions, to the elimination of wasteful effort. His instinct makes him wish to think, or, as Professor James puts it, "between all the details of his business, the power of judging will have built itself up within him." There is some sound psychological reason why efforts to discover easier methods and more facile motions are met with prejudice, and this reason can be found, I think, in the fact that before we introduce such methods we must have the group-mind with us, we must take long traditions into account. There is a last objection, and that is that Scientific Management pays far too little attention to what one might call the art of work. The instinct of a worker gives him a lack of respect for the mere product. There is a yearning for style or for beauty. There is truth in what Mr. Galsworthy

said, that if we go on producing without regard for beauty we shall go downhill. It is of no avail that we produce with minimum effort. Rather if what we produce is a matter for pride there is greater pride in the greater effort. There may indeed be truth in the criticism that there may be too much ease, too much facility, so much indeed as will lead to that dullness which is the breeding-ground of discontent. The truth is that human nature is too complex for the crude Scientific Management. It can focus many aims under the one aim, for all the contents of the mind are by no means revealed when we take observations, even by a cinematograph, of industrial operations. "Zola," says Professor Stout, "recalled odours with great ease and distinctness. For him almost every object had its distinctive smell." He did not cease writing in order to smell efficiently. In all these respects there is an amazing difference between individuals. Some men visualise words when they hear them. Many of us use the familiar sight of words to check our spelling. Many of us live with a flood of memories raised by the words which we use. Be the instruction card never so scientific it cannot include all that passes through the mind of the worker to whom it is given as a guide. The workers know that there are various "ways of writing tribal lays, and every single one of them is right." It was Montaigne who declared that one who viewed Mother Nature in her full majesty and lustre might perceive so general and so constant a variety that any individual and even the whole kingdom in which he happened to live must seem but a pin's point in comparison.

These may seem to be destructive criticisms, and yet it has to be said that there is much to learn from Scientific Management. It has revealed to us that there is an enormous waste of human operations. It has revealed to us that even the simplest task is capable of scientific study, that, in truth, there is no such thing as unskilled labour. Thus its primary value, I think, lies in the light which it has thrown upon industrial training. It is probably the case that training for every industrial occupation needs to be made far more scientific. In all callings we need a day-by-day study of human operations to see if improvements can be introduced in the training of the next generation. I would have a committee on training in every industry, reporting month by month on their observation of the working and setting out with the particular intention of improving the training. We can learn from Mr. Parsons' account of what is done in an American industry,—"All the work of new or unskilled operators is inspected after each operation. This tends to prevent large losses by pressing home to the unskilled worker that what he is doing is important enough to be given attention by those higher up. The same investigator always inspects the work of the same men, determines the cause of wastages, and works out a proper remedy." If we interpret this as losses both to the worker and to the employer we can see the advantages. Uncomfortable positions can be acquired by habit, wrong motions may be adopted, and the discovery of these defects may throw light on the methods of training. In some cases it will be quite possible, still having regard for the empirical results which long tradition has brought to proficiency, to introduce changes straight away. In other cases it will be frankly realised that such changes can only be introduced, and possibly then not completely, in the next generation. If we set out in this way to develop Scientific Management we need not apprehend the hostility of the worker. He will realise that these studies are being made directly in the interest of his calling. It will modify the whole doctrine of incentive. To increase productivity is that at which all would aim, and hostility to that course more frequently comes from economic fears than from any other reason. I may quote Dr. Taylor's description of the Towne-Halsey plan. "It consists in recording the quickest time in which a job has been done, and fixing this as a standard. If the workman succeeds in doing the job in a shorter time, he is still paid his same wages and in addition is given a premium for having worked faster, consisting of from one-quarter to one-half the difference between the wages earned and the wages originally paid when the job was done in standard time." This is objected to by the votaries of Scientific Management on the ground that it does not rest on precise scientific time study, and that as neither management nor men can guess what will happen it leads to bad organisation. This, to my mind, comes near to the truth, if by good organisation is meant organisation which is itself sound and carries the good-will of the main body of the staff.

This reaction of practice upon training will undoubtedly have its influence upon practice itself. The discovery of a new means of laying bricks, to take Mr. Gilbreth's case, cannot be adapted to the training of the bricklayers of the future without having some attractiveness to the bricklayers of the present, with the striking difference that they will adopt it because they like to adopt it and because the traditional inertia has been weakened by that attractiveness. If it is true that study and synthesis of bricklaying discovered a method which required only 1.75 motions to lay a brick instead of 18 motions then it does not need much persuasiveness to get the worker to adopt it. Thus we face one of the stumbling-blocks which are in the way of Scientific Management so-called. We set out on a course which will develop in time, and this is a thousand-fold better than a course which, with all the tenderness and tact in the world, is yet imposed suddenly. There is no limit to what might be done by motion-study and the like if it is done with the attractiveness of good-will behind it. Here we may quote from Mr. Gilbreth's book on "The Psychology of Management," "This giving of the 'why' to the worker through the system, and thus allowing his reason to follow the details, should silence the objections of those who claim that the worker becomes a machine."

Such a machinery as this might well take the place of the "Speed Boss" and the "Gang Boss" and the "Repair Boss" and the multitudes of Inspectors. I do not see how anyone short of being an archangel could bear the

official title "Speed Boss" and carry with him those who are to be speeded up. I am sure it is true that Scientific Management does not intend him to "speed up" at the cost of those who are speeded up, but evidence on this point is difficult to find and is not all in accord. It is intended that the "speeding up" shall be the result not of mere pressure but of easier and more facile operations. It is true also that universal standards are not drawn up, but it would be exceedingly difficult in a large industry to allow for all individual aberrations from the standard. The application of Scientific Management which I would favour would remove this danger, since it would operate from within and would develop by its own attractiveness. The "Speed Boss" would vanish and in its place would be a research and study committee always ready to guide and inspire the methods of training. But here again in the functional supervision there is much to learn from Scientific Management. It has put discipline on a new footing in allotting it to a functionalised officer, whose mission it is to encourage improvement rather than to penalise shortcomings. It has shown us light on vocational studies, in the selection at the outset of their careers of suitable persons for the tasks. It has taught us valuable lessons on organisation in the use of Instruction Cards, of carefully delimited responsibilities, of the encouragement of education both in the craft and in general knowledge, of the minute studies of fatigue and rest periods, of the use of leisure and amusement. We can afford to smile at its jests as the old type of management and at such stories as that which tells of the manager who came to the place where seven men were working and said "half of ye come along to another job."

But while we learn these lessons it must be from another point of view. Functionalisation may rob the employe of the most precious of all things—his initiative. I quote at this point a pretty little parallel from Mr. Graham Wallas' book, "The Great Society": "One sees the girls from an orphanage file along the street. Each girl walks by a companion, not chosen by herself with all the painful-delightful scheming of girlhood, but by the tired mistress, who gives a general order that the girls nearest to each other in height should walk together. They all wear clothes and boots and carry umbrellas of the same pattern. A uniform hat-ribbon may be necessary for recognition and discipline; but one feels that if each girl had chosen her necktie and umbrella, even from a dozen equally cheap patterns, both the choosing and the wearing would have been a source of positive happiness." We want rather to be passive encouragers of study and interest, of welfare and education, of leisure and amusement, rather than the initiators of it. In modern management there is the definite danger of trying to do too much. It is the heresy of to-day. It affects our methods of education, our charities, our politics, our economics. To this end we have devoted a rich wealth of study and research, and to this end we have ransacked the world for enlightenment. But we have brought this enlightenment up against the long tradition of inertia, vitalised by another long tradition, the tradition of having things done by others. The whole method of scientific planning, which is the characteristic of Scientific Management, is open to this criticism. Even scientific organisation runs this danger. It is possible to over-organise, leaving too little to the stimulus of individual spontaneity, and bringing men of varied abilities and temperaments too near to dead-level-dom. The highest organisation deliberately recognises what may be called its legitimate deficiencies and indeed leaves a certain place for gaps in its machinery, simply because its machinery is human and cannot be as complete as a system of belts and cog-wheels without robbing humanity of its most precious qualities. It is paradoxical, but nevertheless it is true, that a perfected organism calls for positively imperfect human units, and that as we improve the human unit in intelligence, we demand elasticity and adaptation in the organism. If we could make scientific processes in industry the occupation and the interest of those themselves who are the workers in industry there is no detail in the whole scope of Scientific Management which might not be brought into use, though into transformed use. Efficiency is an excellent aim, if the aim proceeds from within, and if it realises that true efficiency always looks back on itself and sees its inefficiency. It is of less value if it is superposed from above as a hard mould into which the individual must force himself. It is an odd thing that Scientific Management always ignores the higher management. In the sense in which I support it and advocate it the beginning must be made at the top. It is easy to overlook one's own deficiencies. It is perilously easy to sit in the seat of scornful criticism. If we are to cultivate efficiency from within, urged by an inner motive which will have the sanction of the collective consciousness of all within the industry, that efficiency must characterise the chief director as well as the humblest messenger boy. If it is to spring from an inner motive in the case of the messenger boy it must spring from an inner motive in the case of the chief director also. The day has long gone by when the head of an industry leads a life of gentle leisure, touching the industry now and again with finger tips. The day has gone by for anything in the shape of absentee control or occasional control, or distant control. It is not surprising that in America protest is most vociferous against this particular evil. The day is coming when science and method and psychology must be applied to the whole body corporate of industry, and that day will begin when the leaders realise that in their own methods they must find that efficiency which will inspire the methods of all whom they lead, that they must apply it with continuous zeal and steady and persistent effort, that they must manage themselves without being cumbered by detail, and have a clear mind ready for the just consideration of each problem. It is difficult to achieve, for there is the human factor in management as in other aspects of industry, but if it is achieved it will lead an example which is of more value than precept and will be able to bring the same spirit to bear in all the work of the industry. This, and this only, is the foundation of true Scientific Management,

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

By W. H. GUNSTON.

(Continued from page 53.)

**NORTH AMERICA.**

The number of telephones in North America reaches the enormous total of nearly thirteen and a half millions: of these 12,668,700 are in the United States. According to the 1919 report of the American Telephone and Telegraph Company there were:—

" Bell " owned...	...	...	7,739,159
" Bell " connected	...	...	4,056,588
Independent companies (not connected with the " Bell " system) about			873,000
			<u>12,668,700</u>

Over 90 cities in the United States have upwards of 10,000 telephones.

Canada has 724,490 telephones, of which 314,855 are in Ontario; 119,765 in Quebec; 58,379 in British Columbia; 70,256 in Saskatchewan; and 57,959 in Manitoba.

There are 75,033 stations in Toronto; 62,622 in Montreal; 34,397 in Vancouver, and probably well over 20,000 in Winnipeg, but recent figures for the last city are not available.

No recent information is available respecting Mexico or the various States in Central America and the West Indies, and recourse has been had to American estimated figures for these countries.

**NORTH AMERICA.**

	Telephones	Population (Millions)	Ratio
Canada	724,490	8.5	11.7
United States	12,668,700	103.5*	8.2
Mexico (estimated from American sources)	42,000	16.	381.
West Indies	27,000	—	—
Central America	7,000	—	—
	<u>13,469,000</u>	<u>131.</u>	<u>9.7</u>

\* For 1918.

**SOUTH AMERICA.**

The only information obtainable respecting this Continent is that supplied by the River Plate and Monte Video Telephone Companies. American figures for 1914 relating to the various States have therefore been adopted with slight increases in each case. The development of South America is in the hands of numerous private companies, and complete and accurate information is difficult to obtain.

**SOUTH AMERICA.**

Chiefly from an American Source (1914).

	Telephones	Population (Millions)	Ratio
Argentina (74,296)	85,000	—	—
Bolivia	2,500	—	—
Brazil (39,133)	45,000	—	—
Chile (19,709)	22,000	—	—
Uruguay (13,599)	15,000	—	—
Peru	4,000	—	—
Venezuela	5,000	—	—
Other States	6,500	—	—
	<u>185,000</u>	<u>38</u>	<u>208</u>

**AUSTRALASIA.**

Australia.—The number of stations in 1919 is as follows:—

New South Wales	...	88,963
Victoria	...	62,738
Queensland	...	27,210
South Australia	...	18,526
Western Australia	...	12,218
Tasmania	...	6,275
		<u>215,930</u>

Sydney has 54,831 telephones; Melbourne 44,003; Adelaide 14,023; and Brisbane 11,869.

New Zealand has 78,110 stations, of which 9,158 are in Auckland, 9,395 in Wellington, and 7,625 in Christchurch.

**AUSTRALASIA.**

	Telephones 1918	Telephones 1919	Population (Millions)	Ratio
Australia	197,610	215,930	5.5	25
New Zealand	—	78,110	1.2	15
		<u>294,040</u>	<u>6.7</u>	<u>23</u>

**THE WORLD.**

	Telephones
Europe	4,886,000
Asia	466,000
Africa	70,000
North America	13,469,000
South America	185,000
Australasia	294,000
	<u>19,370,000</u>

**THE DEVELOPMENT OF LARGE CITIES.**

Eighty-six of the cities of the world contain upwards of 20,000 telephones each. Of these 30 are in Europe, 2 in Asia, 2 in Australia, 1 in South America, and 51 in North America; or by countries, 47 are in the United States, 13 in Germany, 5 in Great Britain, 4 in Canada, and 2 each in Australia, Japan, Russia, Holland and Sweden; France, Denmark, Norway, Austria, Hungary, Poland and the Argentine have 1 each. The figures given for Petrograd and Moscow (those for 1916) are, of course, very questionable ones, but it is hardly likely that the number of telephones in those cities has gone below 20,000.

It would serve no useful purpose to calculate the ratio of inhabitants to telephones in each country. For one reason, the census figures are all old in Europe, whilst in America late estimated figures of population have been furnished; and for another reason, it is not known whether in foreign cities the telephone areas correspond with the Municipal boundaries.\* The results of the first 10 towns in the list are as follows:—

1 New York	...	8.5 inhabitants per telephone.
2 Chicago	...	5.4 " " "
3 London	...	23. " " "
4 Boston	...	6.5 " " "
5 Berlin	...	11. " " "
6 Philadelphia	...	9. " " "
7 Paris	...	20. " " "
8 San Francisco	...	4.5 " " "
9 Stockholm	...	3. " " "
10 Detroit	...	7.9 " " "

\* For example, the telephone development of the county of London is 270,000 stations or 1 to every 16.7 inhabitants.

LIST OF CITIES WITH UPWARDS OF 20,000 TELEPHONES.

New York ... ..	761,940	Liverpool ... ..	38,493
Chicago ... ..	504,428	Manchester ... ..	37,748
London ... ..	311,350	Leipzig ... ..	37,732
Boston, Mass. ...	246,594	Dallas, Texas ... ..	36,234
Berlin ... ..	187,982	Frankfurt-on-Main ...	35,003
*Philadelphia ...	180,133	Vancouver, B.C. ...	34,397
Paris ... ..	149,050	Cologne ... ..	33,764
San Francisco ...	134,043	Jersey City ... ..	33,409
Stockholm ... ..	126,961	Osaka (Japan)... ..	33,002
Detroit ... ..	118,533	Wilmsdorf (Berlin)	32,527
Los Angeles ... ..	121,945	Dresden ... ..	32,006
*Pittsburg ... ..	98,149	*Columbus, Ohio ...	30,571
*Cleveland, Ohio ...	97,223	Kristiania ... ..	29,788
Minneapolis ... ..	92,581	New Orleans ... ..	28,037
Washington ... ..	85,454	Amsterdam ... ..	28,157
Copenhagen ... ..	85,353	*Atlanta, Ga. ... ..	27,352
*St. Louis ... ..	83,880	Budapest (1913) ...	27,000
Cincinnati ... ..	80,746	Des Moines, Iowa ...	26,847
Hamburg ... ..	80,697	Salt Lake City ... ..	25,466
Vienna ... ..	79,858	Houston, Texas ... ..	25,343
Toronto ... ..	75,033	Breslau ... ..	24,821
Baltimore ... ..	74,704	Birmingham ... ..	24,528
Milwaukee ... ..	66,513	Stuttgart ... ..	24,315
Tokio (Japan) ... ..	64,250	Richmond, Va. ... ..	24,281
Seattle... ..	63,606	Dusseldorf ... ..	24,198
Petrograd (1916) ...	62,939	New Haven, Conn. ...	24,125
Montreal ... ..	62,662	Syracuse, N.Y. ... ..	23,699
Buffalo ... ..	59,422	Spokane Wash. ... ..	23,678
Moscow (1916) ... ..	57,358	Worcester, Mass. ...	23,630
*Indianapolis ... ..	56,496	Springfield, Mass. ...	23,591
Buenos Aires ... ..	55,761	Hartford, Conn. ... ..	23,144
*Portland, Oregon ...	55,453	Rotterdam ... ..	23,073
Sydney (N.S.W.) ...	54,831	Albany, N.Y. ... ..	22,735
Oakland, Cal. ... ..	53,888	San Diego Cal. ... ..	22,491
Omaha ... ..	46,887	*Toledo, Ohio ... ..	22,449
Denver ... ..	46,406	Warsaw ... ..	22,400
*Kansas City ... ..	45,270	Gothenburg ... ..	21,850
Melbourne (Victoria)...	44,003	*Rochester, N.Y. ...	21,760
Munich ... ..	41,504	Hanover ... ..	20,300
Newark, N.J. ... ..	40,981	Winnipeg ... ..	?
Providence, R.I. ...	40,977	*Louisville ... ..	18,882
Glasgow ... ..	40,963	*Memphis, Tenn. ...	18,675
Charlottenburg ... ..	39,693	*Dayton, Ohio ... ..	18,408

\* The figures for these cities are those only of the Bell Company. An addition of at least 10 per cent. must be made to allow for the Independent Companies' stations. They refer to the end of 1918.

Altogether there are 179 cities in the world each possessing upwards of 10,000 telephones. They are distributed as follows:—United States of America, 91; Germany, 21; Great Britain, 12; Canada, 9; Japan, 5; Australia, 4; Sweden, 3; Netherlands, 3; Switzerland, 3; France, 2; Italy, 2; Russia, 2; Austria, (Czecho-Slovakia, Hungary, Denmark, Norway, Belgium, Poland, South Africa, Brazil, Argentine, Uruguay, and Cuba, 1 each.

NOTE.—Since last month we have received official figures with regard to the Netherlands which had 146,416 telephones at the end of 1919, of which 28,157 were in Amsterdam, 23,073 in Rotterdam, and 19,831 in The Hague.

TRAFFIC SECTION DINNER.

A very pleasant evening was spent by members of the Telegraph and Telephone Traffic Section and their guests at the Holborn Restaurant on Jan. 12.

As this dinner was of the nature of a family gathering, the speeches were few and informal. Mr. John Lee proposed "The Telegraph and Telephone Services," which was acknowledged by Mr. Dalzell, and the toast of "The Ladies," proposed by Mr. W. D. Stewart, was replied to by Mrs. Trayfoot.

The remainder of the evening was spent in social intercourse, interspersed with a few songs and some "White Magic."

Practically every member of the Section was present, and the evening was voted to have been such a success that it was decided to repeat the experiment annually.

TELEGRAPHIC MEMORABILIA.

As one writes the daily press is full of the wonderful results of the Marconi Wireless Service between London and Paris *via* Witham and Chelmsford, and as a temporary expedient during a period of specially abnormal conditions where excellent means of cable communication are simply rendered nugatory by forces over which this country has little or no control, one can only congratulate the British and French public upon the feat. The writer may possibly be criticised for not receiving the announcement with unbounded enthusiasm, and the reasons for this lukewarmness are not far to seek. In the first place despite the success of this particular wireless installation to deal with a certain amount of traffic expeditiously, there yet remains to be seen the exact total of daily messages dealt with between the two capitals by this method. It is by no means an unique feat to exchange an individual message or two between two points a hundred miles or so apart in a matter of minutes. Both the private companies and the British administration have accomplished that feat repeatedly and are daily repeating the operation by means of their Atlantic cables. What, however, neither of them have yet been able to do, is to deal with a rush of hundreds and even thousands of telegrams without delays running into hours. In this direction wireless has its limits well within those which are available to both long and short distance cable telegraphy. One welcomes every advance of telegraphy in whatever direction developments may finally decide, but those writers in the daily press who lead the public to expect so very much from telegraphy without wires are more likely than not to severely discount their own value as prophets by reproducing but one side of the facts.

A temporary wireless communication was opened between this country and Italy, the home of Marconi, yet after transmitting about a dozen telegrams and waiting more than twelve hours London was informed that the Italian office had not received them, and they had to be re-transmitted. Up to the time of writing these lines, the daily results have been equally unsatisfactory. Improvements will most certainly come, but in the *Proceedings of the Institute of Radio Engineers*, August, 1920, it was stated in connexion with the possibilities of developing a large commercial traffic that "experience has shown that the most suitable wave-lengths for trans-oceanic communication lie between 12,000 and 17,000 metres," and that further, "This space in the ether has already been taken up by five first-class transmitting stations," viz., American two, and British, French and German one each. "By widening the wave-length range down to 10,000 and up to 20,000 there would be room for seven more first-class stations," or a total of twelve for the entire habitable globe. Mr. G. F. W. Alexanderson, who gave this interesting information to a meeting of the above institute, went on to say:—

"One advantage of such a station is that its message can be received all over the world, but this implies that for full utilisation it must have world-wide 'right-of-way' for its wave-length. The present rate of transmission from these stations is about 20 words a minute, thus it seems obvious that the capacity of radio is quite inadequate to handle any considerable portion of world communication. This, however, is a pessimistic view, and does not take into account technical possibilities of improvement, such as:— (1) Increase in transmission speed; (2) improved selectivity based on wave direction; and (3) closer spacing of wave-lengths permitted by (2)." Some recent progress on these lines is referred to, and it is stated to be probable that the average transmission speed will before long be 100 instead of 20, that selectivity for direction will quintuple the number of stations operable on one wave-length, and that 1 per cent. intervals in wave-length will be practicable instead of 7 per cent. as at present. Thus an optimistic outlook indicates a multiplication of present capacity by 175. "The transmitted wave must be a continuous wave without objectionable components outside the limits of  $\frac{1}{2}$  per cent., subject to certain fundamental limitations which are explained. . . . Closer spacing of wave-lengths has great possibilities. Selectivity with reference to wave-length can be greatly increased by several successive tunings in either the radio, the audio or some intermediate circuit. It is shown that high-speed telegraph signals assume to some extent the objectionable characteristics of a spark signal."

This interesting, well-balanced and scientific view is placed before the readers of the T. AND T. JOURNAL (through the kind medium of the *Technical Review*), not that my fellow-craftsmen should feel too complacently concerning the future of telegraphy by means of wires, but that an opportunity should be given of weighing up something of the real future possibilities of telegraphy *without* wires, its present limitations, the *pros* and *cons* as presented by competent engineers and the hopes and fears of these latter regarding their own particular speciality.

The disadvantages which at present militate against a more efficient cable service between this country and Paris would be inconceivable to anyone either inside or outside of the telegraph world, were they not in daily touch with the conditions obtaining. It is difficult definitely to locate the trouble, except that it is decidedly beyond the French submarine cable-head. At times London has actually worked better with Switzerland than Paris, though the same lines pass through the latter city. From private letters received, however, it is evident that the French administration is moving in the matter. Communications with Belgium, Holland and Germany have all materially improved, and approach more towards greater stability. There is something of cruel irony in the fact that communication with our nearest neighbour should lack that quality.

The annual meetings of the Eastern Telegraph Company and its associate company, the Western Telegraph Company disclosed some very interesting facts regarding these most successful private organisations.

The former company has expended £1,200,000 on additional cables between Aden and Bombay, and, while paying an excellent dividend to its shareholders, has not forgotten the social and other needs of its staff. The company has recently purchased "Meadowbank" at Twickenham as a club-house, together with 16 acres at Orleans Park. The latter as a recreation ground for the use of its personnel and their families, and the former specially, though not exclusively, for men home on furlough. The total cost amounts to over £50,000.

In addition it has taken over the whole of the liabilities of the Staff Pension Fund, and has contributed no less than £20,000 to assist and to place on an actuarial basis the Widows' Pension Fund, which had previously been run unaided by the staff itself.

The associated Western Telegraph Company has also been alive to future business. It has renewed about 1,000 miles of the original cable between St. Vincent, Cape Verde Islands and Pernambuco, and an order has been placed with the manufacturers for the renewal of the older portion of the Lisbon-Madeira cable. Additional cables are projected on the Brazilian coast between Pernambuco and Maranhão, Pernambuco and Maceio, Victoria and Rio de Janeiro, and Rio de Janeiro and Santos, while additional facilities are to be given in future to Santa Catharina and Rio Grande do Sul. All these developments and activities are particularly satisfactory, especially as these companies being "domiciled abroad" in certain instances are not unlikely to have been adversely affected by rate of exchange. Incidentally, there does not appear to be any sign of misgiving as regards the future competition of "wireless," probably because the technical advisers of these concerns are well aware that cable telegraphy has by no means reached its limit in inventive progress.

It is announced with the greatest satisfaction that a total sum of over seventy pounds has been subscribed to the Benenden Games Fund by the C.T.O., including a very welcome donation from "one of ours," now retired from the service.

As the months roll on one is compelled to add to the tale of good men and true who are retiring, or who have retired from the Telegraph Service. Sometimes it is the tale of a happy warrior who leaves us apparently unscathed by the storm and stress of our craft, sometimes one records with sympathetic touch the withdrawal from active participation before the officially allotted span has been covered, sometimes, alas, it is the younger and apparently more vigorous who leave us—called hence.

Of the latter type, none came as a greater shock than the sudden death of Mr. Griffin, of the Cable Room, who passed away quite unexpectedly after an otherwise very successful operation. As a very helpful assistant to the Censors at the Press Bureau during the war he had earned the very special esteem of those who came into daily contact with him, while his cheerful disposition as a colleague was a particularly outstanding feature of his nature at all times and in all circumstances.

To the first-named type of record more happily belongs the retirement of Mr. J. Field, Assistant Superintendent of the C.T.O. "Josh," if he will permit the familiarity, and knowing his kindly nature one feels one's self already forgiven, was never petty, and well understood that affection of one's colleagues, which frequently underlies honest jest and badinage. His friends were glad indeed to note that up to the last hour of duty he still showed that vigour and vim with which his name had long been associated. Mr. Field entered the service as a learner at Brighton in December, 1874, and was appointed to the then class of Third Class Clerk at Ramsgate in 1875, and came to London a year or two later, passing through the various grades up to that above recorded. "Josh" was a personality in the C.T.O., and one which will certainly be missed. We shall never see his like again. He leaves us all the duller now that his vivacious cloak-room histories of the past prowess of past telegraphists, and past superintendents will entertain us no more.

To T.S. Foreign we next descend to place on record the somewhat premature retirement of Mr. W. Meyers, Telegraphist, whose failing health compelled withdrawal from as faithful service rendered to the State as State could well desire, for the one outstanding feature of Mr. Meyers' career was this, that he unflinchingly gave of his best. The cleverest, the most assiduous among us could not do more. He was transferred from the late Submarine Telegraph Company in 1889 and leaves the Cable Room with a host of well-wishers behind him who placed on solid record, in the shape of a handsome clock, their keen appreciation of his worthiness.

Mr. G. W. Murdoch, of the old assistant superintendent's class, also left G.P.O. West towards the close of 1920. Of the North Country, concerning which he was always enthusiastic, he carried to the last day of duty something of the ruggedness of those latitudes, with a yearning for its rocks and hills. To Mr. Murdoch is accorded the kindest of thoughts of all who know him best. May rest from official trammels and increased facilities for breathing the free air of heaven go far to renew the lease of life of G. W. M.

The C.T.O. has not received quite so many seasonal greetings from offices as was her wont in pre-war times, but one or two are particularly worthy of note.

Much appreciated was a list of autographs from the Secretary's Office addressed to the Cable Room bearing the names of former cableites, who, it is refreshing to note, have not lost their affection for the "old show!"

Of continental greetings, Paris naturally was first in the field with the most courteous of hopes and wishes, Milan, Rome, Genoa, Zurich, Bale, Berne, Geneva, Amsterdam, The Hague, Wellington, N.Z., Siam and Warsaw, following, while Berlin and Hamburg greeted us with the old-familiar *froehliche Weihnachten*. From another portion of the C.T.O. came a curious note, wishing the staff "an offensive Christmas and an offensive New Year." A

somewhat meagre knowledge of Russian prevented an immediate appreciation of the kind spirit behind this attempt to compliment us in our own language. However, it was eventually decided that an "advancing" or "progressive" new year was the only desire of our well-wishers in the Arctic Circle. These same correspondents not long since, evidently by the aid of the same Anglo-Russian dictionary, requested London as follows: "Please repeat the threshold of the text of last message." A method of expression new to telegraphic lingo, but soon understood.

The engineers have not waited for the rebuilding of the Havre Office to complete the experiment of split Triple and Baudot duplex between Liverpool—T.S.F. and the French port, but have fortunately induced the latter administration, who have heartily co-operated, to transfer the trial to Paris.

With the latter city this trial has proved a complete success, so that there are now the following traffic channels working on the one wire between Liverpool, London and Paris:—

Liverpool—London = 4 channels.  
London—Paris = 4 channels.  
Liverpool—Paris = 2 channels.

The late chief of the Antwerp Office, M. Collignon, well-known to many friends both at G.P.O. North and West, has recently retired from the Belgian Telegraph Service owing to the age-limit. Our respected friend is not content to rest entirely, but is devoting a few hours every day to a society devoted to the care of the blind. May he long be spared!

Mr. J. Munro, late of the Foreign department, sends greetings to all old colleagues, with best wishes for 1921, from Cairo, the headquarters of his present appointment as Principal Inspector of the Egyptian Telegraph Service. Our friend could not long give up his old love for we find him busy running a Service Literary Society, himself contributing a paper on "Medieval Mystery Plays."

An experiment is being made in the Central Telegraph Office with what is called "functional supervision." It is not necessary to give the full details at the present moment, but the central idea is to have in addition to the floor superintendents, who are responsible for particular areas in the galleries, certain superintendents who would be responsible for all the functions, and would co-ordinate the general control in the separate divisions. The experiment is beginning in a small way, and a "Plant Superintendent" has been allotted, whose function it will be to be responsible for the plant generally, and particularly for the high-speed plant, multiplexes, Creeds, &c., to keep them under review and to study the various improvements which are suggested from time to time, and also to govern the allotment of spares at times of need. It will be interesting to see how this experimental venture will affect the general supervision, and if it fulfils expectations in relieving the floor superintendents of special anxieties, it may facilitate the general supervision by the latter officials.

It must have surprised our French friends to learn that, twenty-two years after the introduction of the Baudot into England, we were asking ourselves—and them—how to manipulate and how to train in manipulation. The tardiness of the inquiry was, of course, due to the fact that the expansion of the Baudot system in Britain is still a recent development, so that the need for co-ordinated methods of training and of manipulation has but lately made itself felt.

Within the past year or two, however, interested observers had remarked the differences in style to be found among the Baudotists of any large office and between the general style of one office and that of another; whilst observers who visited Paris returned with the news that French manipulation was not quite like anything to be seen in these islands.

The necessity for defining good manipulation and laying down the lines along which instruction should proceed thus became apparent; and it was obviously as much to the interest of the operator as to that of the department that this need should be met.

A small committee of London and Provincial experts was therefore formed, and a careful census of opinion was taken in London and at several provincial offices. The conclusions arrived at were then compared with the views of the foremost French experts.

The results of the committee's work will be embodied in an official guide to manipulation and training, which will be issued as soon as possible. The aim of the committee was not the discovery of a method of manipulation which should give greater output; it was to find and to make known the style best calculated to afford comfort to, and least likely to entail strain upon, the operator. How far they have succeeded Baudotists will soon be able to judge for themselves.

The features of the style now recommended are, ease of seated position, freedom of action, and avoidance of fine finger movements.

The most revolutionary of their proposals concerns the method of training, and here the practice of the French instructors is adopted. For some time the learner exercises upon a keyboard unconnected electrically, using the keys merely as an aid to the memorising of the combinations; the idea behind this being, that once the combinations are "in the fingers," their formation in time with a cadence becomes a simple matter.

How our French friends arrived at this method of instruction—whether by accident or by a singular scientific up-to-dateness—is not clear, but it is certain that their procedure corresponds exactly with the most modern theories of the teaching of music and eurythmics.

It is not suggested that Baudot signalling falls within the same category as the above accomplishments; but, although it cannot become a thing of joy, it should at least be devoid of most of its present terrors when a freer method of manipulation has been generally adopted.

J. J. T.

## LONDON ENGINEERING DISTRICT NOTES.

*Telephonic Development.*

Notwithstanding the serious delays which have taken place in the deliveries of stores by manufacturers, the District staff are able to look back upon the extension work carried out during the year 1920 with satisfaction. Actually, the number of direct exchange lines was increased by 14,372, which is equal to a 10.09 per cent. increase. These figures establish a record for the District, the previous highest numbers of added exchange lines having been 7,928 in 1913 and 10,931 in 1919.

*Institution Meeting.*

In the report of the Select Committee of the House of Commons on Telephone Rates a definite recommendation is made that the Research Branch of the Engineer-in-Chief's Office should be extended. From the tone of the report it is evident that the Committee was impressed with the value of the work done under somewhat difficult circumstances. All P.O. Engineers will heartily agree with the recommendation, and are glad to know that steps have already been taken to acquire a site and to erect temporary buildings in which the staff may be housed. There is no doubt that when the proper equipment is available and a sufficient staff of keen enthusiasts is employed on research there will be marked developments in telephone science. The results of their work will no doubt be made available to all P.O. Engineers through the medium of the I.P.O.E.E.

That much valuable work has already been done is evidenced by the paper on "Four-Wire Telephone Repeaters," which was read before the London Centre of the I.P.O.E.E. at the Royal Society of Arts by Messrs. C. Robinson, B.A., and R. M. Chamney, B.Sc., on Jan. 10.

The four-wire system is the outcome of experiments which have been made as a result of the application of the telephonic repeater to telephone circuits. It involves the use of one pair of wires for transmitting from the "Up" station and a separate pair from the "Down" station. At first sight this would appear to be a retrograde step, as hitherto one pair has sufficed for speech in either direction, and the tendency of late years has been to obtain as many channels as possible over one pair of wires. When, however, investigations were made as to the maximum amount of amplification that could be obtained by the use of repeaters in one pair of wires, the fact was revealed that the amount of amplification was limited by certain characteristics of the line and that if these limits were exceeded singing or echoing took place. A margin is also necessary in the amplification to allow for variation that may take place between the line and the compensating network, which is a feature of the system. This further reduces the permissible gain.

Experiments were, therefore, made to devise a system which would allow of greater amplification without the introduction of singing, and the four-wire system is the result. So far as the experiments have proceeded it appears that it is not economical to work in the four-wire system on circuits of less than 400 miles, but as the distance increases, especially if the wires are of small gauge, the advantage becomes apparent. A method of superposing a phantom circuit on a four-wire system was indicated. Considerable stress was laid upon the importance of providing lines which were absolutely uniform in their electrical qualities. The necessity for correct spacing of loading coils and the proper proportions of the windings of the transformers and other apparatus used was also emphasised. It is essential for the satisfactory working of telephonic repeaters that the conditions shall be quite stable, and it is evident that still greater attention will have to be paid in the future to every detail in the design, manufacture, jointing, testing, and maintenance of a cable system, and also in the design and manufacture of the apparatus to be used.

The authors described how the difficulties of signalling over such circuits had been overcome, although perhaps perfection had not been reached. In the subsequent discussion, Mr. Grinstead, of Messrs. Siemens & Co., described some interesting experiments which he had made in collaboration with Mr. Laidlaw in signalling over such circuits by using a frequency of 800 periods per second, while Mr. Ericsson, of the Western Electric Co., described some successful tests which had recently been made in America on circuits of 1,000 miles long, the conductors being of 20 lbs. copper. He ventured to prophesy that the time was not far distant when speech would be commercially practicable between London and Rome. No doubt the paper will be printed in due course, and it will be found to be worthy of close study by all those who are interested in the future of telephony.

The size of the audience and the close attention given to the paper and the subsequent discussion indicated how keen is the interest of engineers in matters relating to the improvement of speech over long distances.

*Denman Chess Club.*

An interesting tournament is now in progress, and some of the "experts" are having unexpected shocks. The leaders, at present, are Mr. Francis, "A" section, and Mr. Gardiner, "B" section. Two rounds of the "knock-out" competition have also been played. Interest has been well sustained, and the games are being keenly contested.

On Jan. 19 Mr. J. Kniager, of the Woolwich Chess Club, will give a simultaneous display against 15 players. Mr. Kniager, in a recent match in which Senor Capablanca met 40 players simultaneously, was the only one who succeeded in avoiding defeat by the champion, the result being a draw.

*Query.*

Will the officer in charge of the New Blackfriars Automatic Exchange be called a "Panel" doctor?

*Obituary.*

Many in the C.T.O., as well as in the Engineering Department, who knew Mr. A. E. Roberts, will hear with regret of his death which took place after a long illness on Dec. 9 at the early age of 48. Mr. Roberts left the Central Telegraph Office in 1900 and entered the Engineering Department as a Sub-Engineer. He was subsequently promoted to the rank of Second Class Engineer. His early engineering experience was spent in the Metropolitan Districts, and at the time of his death he was attached to the Test Section of the Engineer-in-Chief's Office.

*Presentations.*

On Jan 13 in the workshop at the C.T.O., the Superintending Engineer (Mr. A. Moir, O.B.E.) presented Mr. F. E. Holman with the Imperial Service Medal. On Jan. 14 at the Paddington Exchange, Mr. Moir presented a similar medal to Mr. G. H. Gilby, Skilled Workman, Class 1, of the North-West External Section. On both occasions the Superintending Engineer in making the presentations, gave some interesting particulars in connexion with the history of the decoration, and referred to the long and faithful service of the recipients. Mr. Holman recently retired from the mechanics' shop in the C.T.O. Section. His service in the department covered 45 years and he has been a witness of many remarkable changes during this period. He also served for many years as a volunteer in the Royal 4th West Surrey Regiment (The Queens). Mr. Gilby's long connexion with the Engineering Department commenced many years ago at Yarmouth. For some time prior to his retirement he was attached to the Metropolitan District, where he was held in very high esteem, both on account of his personal and technical qualifications.

## FROM A FRAGMENTARY MSS. OF THE ARABIAN NIGHTS.

and they lived together in felicity until their days were ended by the divider of friends and the terminator of delights. But, she said, that story is not so wonderful as the story of the Postmaster-General and the Ramp. And the king said: "What postmaster-general and what ramp?" And she said: "It has reached me, O happy king, that in ancient times and former days and past ages there was a merchant amongst merchants, a postmaster-general by his calling, and it befel that when owing to the dearthness of those times he found that he was not selling his merchandise at a profit, he said: "Ya Allah, I will raise my charges, even as the other merchants have done by reason of the hardness of these times." And he did so; but when the sheikhs of the merchants, and elders of the city, and emirs of trade heard of those charges they were enraged to the limit of enragement and frothed at the mouth to the limit of frothiness, and they said: "This is not merely a rise in charges—this is a ramp." And he said: "What then is a ramp?" And they said: "It is a deed of darkness done by a government department, but as to the deeds of private merchants in the same direction, they are the works of light." And he said: "But how then shall I prosper in my affairs and make a profit in my trading?" And they said: "Be that upon thee! Thy proposals are monstrous and out of measure \* thou art as a miser hoarding up treasure \* or a tyrant putting on the screw for pleasure \* " And he said: "I have increased my charges but by four-fifths, whilst ye and others have doubled yours." But they said: "Hast thou not read what the scribes say of the Telephone Iniquity and the Telephone Scandal and the Telephone Tyranny? Hast thou not felt just indignation's burning flame \* and art not overwhelmed with shame \* and knowest thou not that the Volume of Opposition is growing daily?" And he said: I have perused that volume, but it seemeth not to be the work of the well instructed \* but the dawn overtook Sheherazade and she ceased her permitted discourse.

But when it was the thousand-and-thirty-third night she said: "It hath reached me, O happy king, that when the postmaster-general said to the merchants: "it seemeth not to be the work of the well-instructed," the world became black before their eyes and, enraged, they cried: "O son of the basest of dogs, we are thy largest customers, and thus we are precisely those by whom thou lovest most heavily in thy trading. Wilt thou not therefore treat us with more consideration than the others?" And it is related that the postmaster was so struck by this appeal \* that he pinched himself to know if he were real \* and pondered their words some deal \* and descended from the pinnacle of his obduracy \* and repented of his contumacy \* but Allah knows more—And, she said, this story is not so wonderful as that of the Railway Companies and the Doubled Freights and Heavily-increased Rates, and the Trains Overcrowded to Excess, and the Degenerate Express. But the king said to his soul: "If she relates any more such stories I will certainly put her to death." And he said: "Relate to me rather some fantastic and marvellous story." So she began to relate the history of the Jurywoman who knitted Jumpers.

W H. G.

The  
**Telegraph and Telephone Journal.**

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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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No. 71.

### THE CAMPAIGN.

THE Press campaign against the Telephone Service has been conducted with passion and not without unscrupulousness. It has hurled its angriest epithets against us and it has not hesitated to include garbled statements of percentage increases in charges and unproven assertions as to alleged inefficiency. On the minds of some of us the crusade has had an effect very different from that which was intended. We had looked on in sorrow rather than in anger, for we have had the advantage on this occasion of knowing the facts, and that knowledge does not increase our respect for the newspapers, either as the custodians of public opinion or as the repositories of carefully-analysed information. Others of us have been indignant. We have itched to write an equally angry reply. Day by day we know that the service which we are giving is excellent in quality. We know that men and women of all types of mind, among the manipulative and the clerical and the technical and the administrative staffs, are proud to give of their best in the service of the public. We know that this organised campaign, which each member of the staff must withstand in silence, is based upon the particular self-interest of a small section of the telephone community. We know, too, that in defending our cause we always run the risk of seeming to defend nationalisation as a theory—a theory which, as public servants, is not our concern. We have had to go on, doing our best, and bearing, meantime, all sorts of misrepresentations. At one time we are told that our salaries and wages are four-fold what they were before the war; at another time we are held up to reprobation as being ill-mannered, or slack in attention, or heedless of admonition, or positively malicious.

It is this personal aspect of the crusade with which it is as well that we should deal in this place. At least it has had the advantage of binding us all together. If the charges are pointed

against those whom the staff regard as their leaders, in their implication they are inclusive of everyone in the service. The thousands who have come to us from the National Telephone Company are now included, though they must look back on the bitterness of campaigns in the 'nineties with something of a temptation to pinch themselves to see if they are awake. In those days, they are now told, they were marvellously efficient. To-day their souls are transformed. Of course, the writers of these angry articles and the proposers of fierce resolutions have not always thought out what they were saying. We live in "stunt" days, when strange opinions come from strange places, when one reputable institution demands that the telephones shall be handed back to private ownership and another demands that it is not necessary that the telephones should make a profit; when one writer says that the flat rate tends to keep down the number of engaged lines and another says that the advantage of the flat rate is the full loading of the line.

It is not pleasant to lose one's respect for newspapers, but we do not doubt that before that catastrophe happens the storm will have passed. The manufacture of public opinion is not so readily the result of "stunt" campaigns as is sometimes supposed. We counsel patience and trust, for the truth has a knack of making itself known, and usually these campaigns over-reach themselves. The public, being shocked daily, becomes at length too shocked to be shocked. It will find in the hour-by-hour efficiency and courtesy of the operators what, after all, is the best answer to the attacks. Each of us is the object of the campaign, and each of us has the weapon of defence. For every connexion of one subscriber to another conveys to the mind of the calling subscriber an impression either favourable or unfavourable to the service of which we are a part. In striving for scrupulous and detailed efficiency and for courtesy and consideration as the accompaniments to that efficiency, we shall be far more articulate than we suppose on behalf of the service. The reply to the campaign is in the hands of the staff.

### HIC ET UBIQUE.

*Apropos* of our editorial last month we learn from an extract from the *Electrotechnische Zeitung* that the German Administration has also had to endure repeated reproaches from the daily and technical press for its backwardness in the introduction of automatic exchanges. The Administration's attention was drawn to a small Strowger exchange at the Chicago exhibition in 1894, and although no automatic exchange was then working in America, they contemplated the opening of a small 20-line exchange. When it was known in 1898 that a 20-line exchange was working in America and that another small one was established in England, the German Administration decided on a larger experiment with an exchange of 800 lines, but great difficulty was experienced in obtaining the plant in America. A 400-line board was put in operation in Berlin in 1900.

In 1908, an automatic exchange was opened at Hildesheim. We remember the occasion well, for it was accompanied by much prophecy in the press of the early "disappearance of the hello-girl." Another was opened at Altenburg in 1910, and since then automatic exchanges have been installed at Posen, Dresden, Liegnitz, Leipzig local toll-line exchange, Halle, and some smaller places. Unfortunately, the extract does not inform us whether the whole system in these towns is served by the automatic exchange. A place



of the size of Dresden, for example, is probably served by several exchanges. At present automatic exchanges are under construction in Germany, which will serve when completed a further 50,000 lines.

THE telephone system of Warsaw, (like that of Petrograd and Moscow) was in the hands of a Swedish Company. We learn from the *Financial Times* that as a result of negotiations with the Polish Government, the concession for Warsaw has been extended for another twenty years, and in addition, concessions have been granted to the company for Lemberg and Lodz. The company will now supply service not only to the three largest cities in Poland, but also to the other principal towns. We understand that the State has an interest in the company.

THE *Spectator* says: "Every old subscriber looks back with regret to the days of the National Telephone Company, which gave the public a good service." Those numerous readers of ours who are old National men will agree that the Company gave a good service, but they will also remember that the Press of those days did not think so. The telephone service was then even more bitterly abused, if possible, than now. While the Press often forgets how many ex-National men are engaged in the present service; they also forget that many of them read the newspapers—and some of them have memories.

**CAUSE AND EFFECT.**

A CERTAIN evening newspaper boasts that it charged one firm £1,200 for one insertion of an advertisement. As the said firm advertises daily it can be readily understood that the cost of its goods to the public is artificially inflated by the newspaper ramp. The general public having to pay more for its necessities naturally demands higher wages, and in consequence the cost of goods purchased by the Post Office for its telephone system is increased. Its own labour bill is also increased in order that its employees may pay the prices demanded by shopkeepers which, as stated above, are unduly high on account of the immense sum paid in advertising. Incidentally, the public pays and has paid for some years 100 per cent. increase on pre-war rates for its daily paper. The P.O. faced with the increased costs of its labour and material purchases is compelled to call upon the users of the telephone service to pay more, but not 100 per cent. more, as in the case of the newspaper. The increased charges are to start two years after the Armistice and not two years before as in the case of the newspaper subscriptions. Incidentally, the following facts may be of interest:—

Old rates, 360 calls per annum—cost per call 4d.  
 New " 360 " " " " " 7d.

Less than 100 per cent. increase in cost. For a greater number of calls the cost per call is reduced until at 500 calls it becomes 5d.

**CORRESPONDENCE.**

**AUTOMATIC DEVELOPMENT.**

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

SIR,—In your leading article of the January number of the JOURNAL it is stated that "All the larger Automatic Exchanges in the United States serve only a portion of the system of the towns in which they are installed, while the systems in Leeds, Portsmouth and other British towns are wholly automatic." This is unfortunately not correct as far as Leeds is concerned, as there are in this city five Magneto Exchanges with 3,005 stations. It is a great pity that your statement is not correct, as we shall, of course, not be able to reap the full benefit of the Automatic Exchange in the centre of Leeds until the other exchanges in the city are made automatic also.

T. B. JOHNSON.

Leeds, Jan. 20, 1921.

[Although the word "wholly" is not strictly accurate as applied to Leeds, our statement is substantially correct. There are 9,552 stations connected with Leeds automatic exchange, and according to Mr. Johnson's showing 3,000 connected with magneto exchanges. Those, however, are suburban exchanges, and we think it may fairly be claimed that Leeds itself is worked automatically. This is very different from the case of Los Angeles with 34,670 automatic stations out of over 130,000, and Sydney with 26,000 out of 55,000.—ED., T. & T.J.]

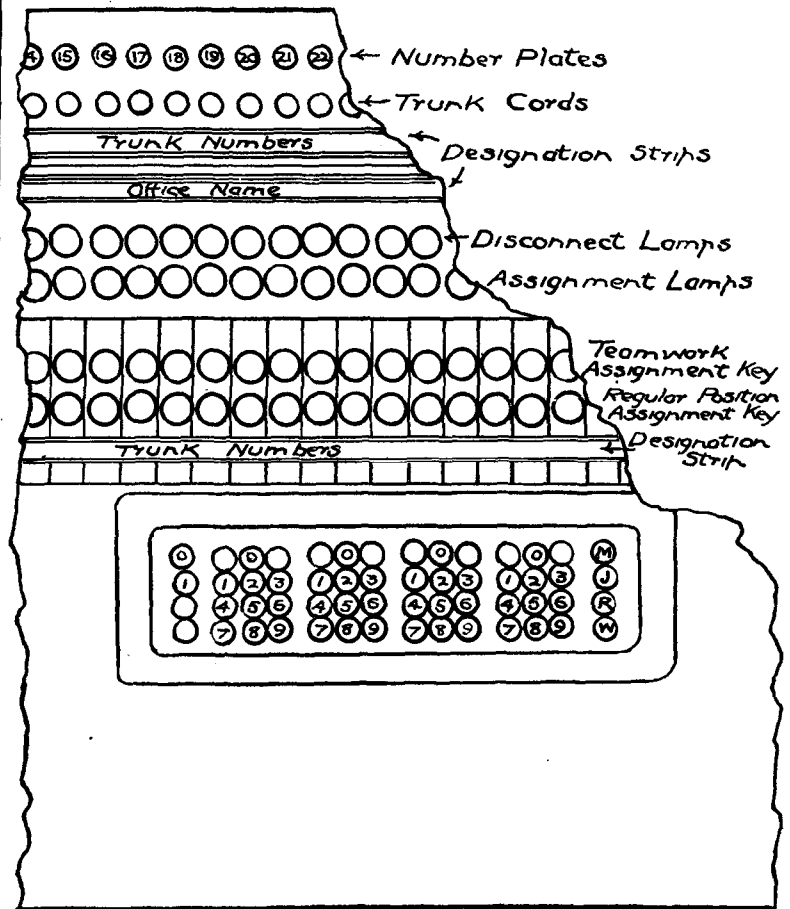
**AUTOMATIC TELEPHONY IN LARGE AREAS FROM A TRAFFIC POINT OF VIEW.**

BY M. C. PINK.

(Continued from page 60.)

The next diagram (Fig. 9) shows the switchboard arrangement on a call indicator position handling traffic incoming at a manual exchange from subscribers on an automatic exchange. It will be seen that there are four complete sets of digits (0 to 9) each one corresponding with one of the four digits of the required subscriber's number. There are some manual exchanges in America with five-figure numbers; and the additional figures on the left-hand side of the indicator are to provide for these in the special cases where they exist. On the top of the indicator (shown on a larger scale in

**SECTION OF KEYBOARD OF INCOMING POSITION EQUIPPED WITH CALL INDICATOR**



**FIG 9**

Fig. 10) is a ground glass plate under which the figures shown in the diagram appear. Under each figure is an individual lamp which, when lit, displays the figure to the operator. If an automatic subscriber requires connexion to, say, Holborn 1234, he dials HOL 1234. The impulses are stored in special apparatus at his own exchange, and this apparatus controls first the selection of a junction to Holborn, and then the storage of the subsequent figures, 1234, on apparatus which is automatically associated with the junction at the Holborn Exchange.

Assuming the junction to be number 16 in the diagram, the assignment (or calling lamp associated with that junction) lights, and the incoming operator at Holborn depresses her assignment key, which is the front key of the two shown. This act associates her position indicator with junction 16, and the figures which have been stored are then transmitted to and displayed on that indicator. The Holborn operator takes the plug associated with junction 16 and tests the number 1234. If she finds it busy she connects the junction to an engaged signal-jack. If it is free she plugs in. The ringing of the subscriber 1234 is automatic and the registration of the call is effected automatically in the same way as the registration of a call to another automatic subscriber.

CALL INDICATOR

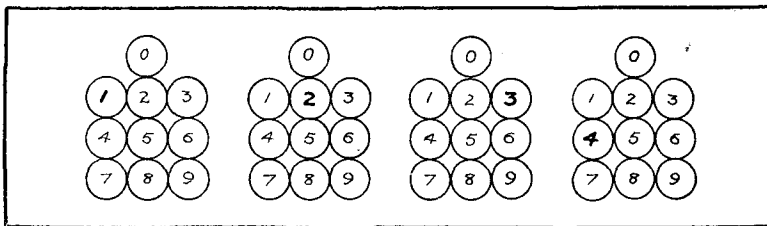


FIG. 10

When the caller releases the connexion a disconnect signal is received on the disconnect lamp indicated on the diagram 9. The incoming operator takes down the connexion and the junction is free to receive another call.

It will be seen from the diagram that a second key is associated with every junction. This key is to enable a neighbouring operator to associate her call indicator with the junction if the operator on the home position is otherwise engaged. This ensures a condition of team work which has not so far been introduced on normal plug-ended signal junction positions.

TANDEM CALL INDICATOR

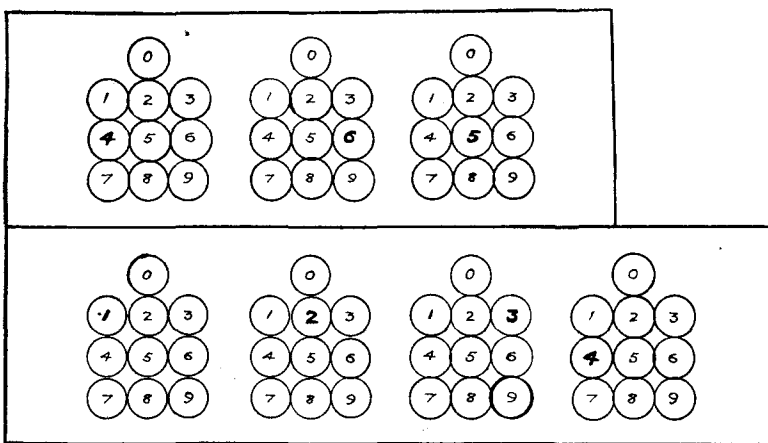


FIG. 11

In America the standard load for a terminal call indicator position without team work is 500 calls. With team work on a suite of positions a load of from 550 to 600 can be handled while ensuring a high grade of service. It remains to be seen whether similar loads can be worked to in this country.

Where the provision of direct junctions from an automatic exchange within the automatic area cannot be justified, the traffic for that exchange, together with that to other exchanges similarly situated, is aggregated and taken to a tandem call indicator position either at the home exchange or at some intermediate point from which the provision of junctions to the objective exchanges is justifiable.

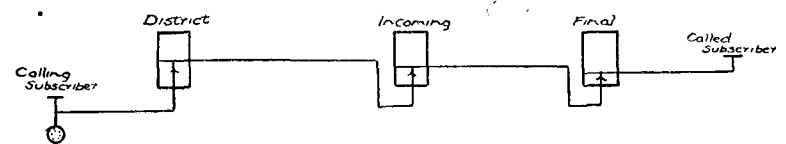
It will be clear that this intermediate exchange may be handling the traffic for several small exchanges, and, in order that the operators may know which exchange is involved on each call, a special call indicator has to be provided.

This indicator is shown in the next illustration (Fig. 11). It will be seen that the indicator is in two portions, one portion displaying a three digit number only. This number is the code number corresponding with the letters which the subscriber has dialled as the code of the objective exchange. The tandem operator translates the code number into the exchange letter code and name, and proceeds to obtain the required connexion to the objective subscriber over the junction group available from the tandem point. The exchange code is usually displayed in red and the required number in green.

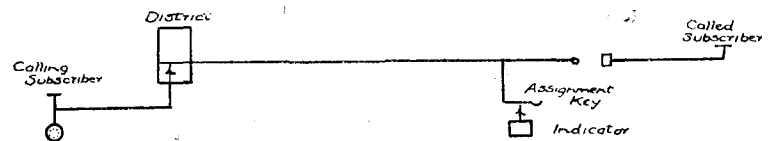
It is found in America that an operator at a tandem call indicator position can handle a load of 200 to 225 calls when the service from the "B" operators at the terminal exchanges is satisfactory.

MECHANICAL SYSTEM

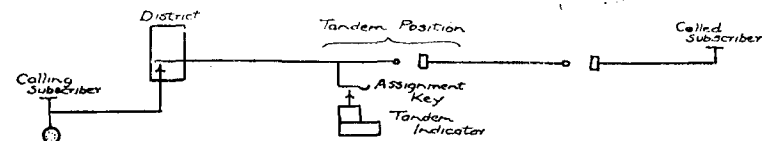
REGISTRATION CONDITIONS TO BE MET



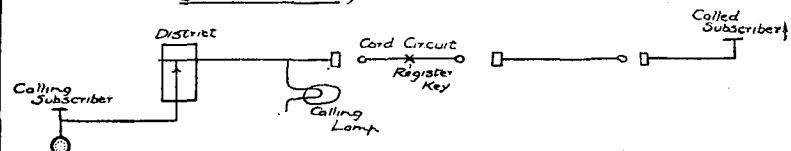
FULL MECHANICAL CALL  
(Registration condition prepared by answer of Called Subscriber)



TERMINAL CALL INDICATOR CALL  
(Registration condition prepared by answer of Called Subscriber)



TANDEM CALL INDICATOR CALL  
(Registration condition prepared by answer of Called Subscriber)



CALL PASSED VIA MANUAL BOARD - "O" - OPERATOR  
(Registration condition prepared by Manual Operator by means of register key)

FIG. 12

In London the intention is to locate tandem call indicators at each of the junction centres and to pass both the traffic terminal at the junction centre exchange and that to be tandemmed to distant exchanges to the tandem call indicator positions.

In order not to delay the tandem call indicator operator on difficult calls and so tend to increase the number of calls waiting at the tandem centre for treatment, it is proposed to arrange for a "helping out" operator to take over from the tandem indicator operator such calls as she is not able to pass forward to objective exchanges on an order wire basis.

It will be seen that the tendency throughout is to eliminate as far as possible the use of an operator with controlling functions. A controlling operator is naturally in a position to take charge of the work of accounting for a call which she controls. If a switching operator is substituted, and

her operating time is to be employed in the most economical manner, arrangements must be made for the accounting for the call to be provided for independently of the operator. This would, of course, be done by automatic registration. Various conditions under which automatic registration has to be provided for are shown in the next diagram (Fig. 12).

The first is on the full automatic calls, where the answer of the called subscriber prepares the way for the satisfactory registration of the call. The second case is that in which the call comes up on a terminal call indicator junction associated directly with the automatic exchange junction multiple. In this case, although the manual operator makes the connection at the objective exchange, she does not supervise the call, and the registration is dependent upon the answer of the called subscriber. The third case is that of a call handled via a tandem call indicator position. Here connections are set up both by the tandem operator at the intermediate exchange and the terminal operator at the objective exchange. Neither of these operators has any controlling function, and here again registration has to be provided for on the basis of the answer of the called subscriber.

The fourth case is that of a call passed by the originating subscriber to a manual position in the home exchange. This course is necessary if a call involving a junction fee is required or if a subscriber is himself unable to obtain a call and requires assistance from the operator. In this case the registration is under the control of the manual operator.

In connection with the first exchange in London it is the intention to utilise order wire junction groups outgoing from junction centres both for the calls originated by subscribers on the junction centre exchanges and for those arriving at the junction centres from the automatic exchange. It is most desirable that any facility enjoyed by the manual exchange "A" operators passing calls over the junctions thus jointly used should not be modified, e.g., control of the front supervisory signal by the answer or by flashing keys on service circuits at the objective exchanges, or by connections to the busy-back at those exchanges. It will consequently be necessary to provide specially wired service circuits, and probably special busy-back jacks also, for use in connection with calls received from automatic exchanges.

MANUAL EXCHANGE SUBSCRIBER TO MACHINE SWITCHING EXCHANGE SUBSCRIBER VIA CORDLESS B BOARD

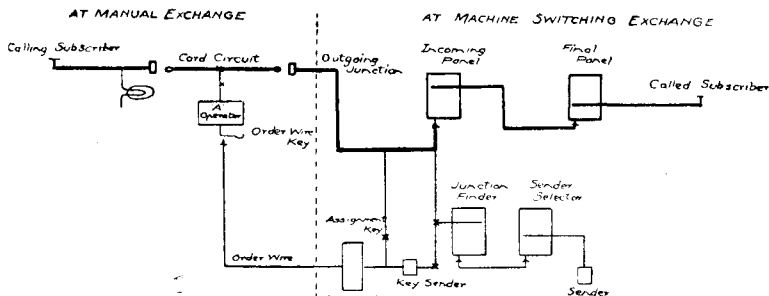


FIG. 13

- (1) Operation of Assignment Key causes Junction Finder and Sender Selector to operate
- (2) Key Sender passes impulses to Sender and is then cut out
- (3) Sender causes Selector on Incoming and Final Panels to operate, after which the Junction Finder and Sender Selector restore to normal

The advantage of enabling subscribers to hear ringing induction when a ring is actually going out to a called subscriber has been demonstrated in practice. It is the intention under automatic development conditions to arrange for this signal to be given to the caller in every possible case. It should ensure reduction in the number of complaints of "Don't answer" and in the verification of such complaints.

We now come to the methods to be followed in passing calls from manual exchanges to automatic exchanges. Three methods are available:—

- (a) Passage by order wire to "B" positions at the automatic exchange.
- (b) Dialling direct from the "A" positions at the calling exchange to subscribers on the automatic exchange.
- (c) The use of what is known as key indicator apparatus.

(a) The next illustration (Fig. 13) shows diagrammatically the arrangement employed at an automatic exchange for handling incoming traffic. The "A" operator passes demands to the "B" operator by order wire in the usual way and the "B" operator keys up the required operation. The "B" position (Fig. 14) has no plugs and cords and is generally referred to as a cordless "B" position. It is of desk type with the back portion containing the signals and

associated keys inclined at an angle of about 60°. Each position is fitted with a set of keys controlling the selection of the number required by the calling operator. The "B" operator seated at one of these positions has one or more order wires from manual exchanges connected to her headset in the ordinary way. On receipt of a demand for a number she allots a free junction and at the same time depresses the assignment key associated with that

## SEMI-MECHANICAL SWITCHBOARD

### SECTION OF KEYBOARD OF CORDLESS INCOMING POSITION

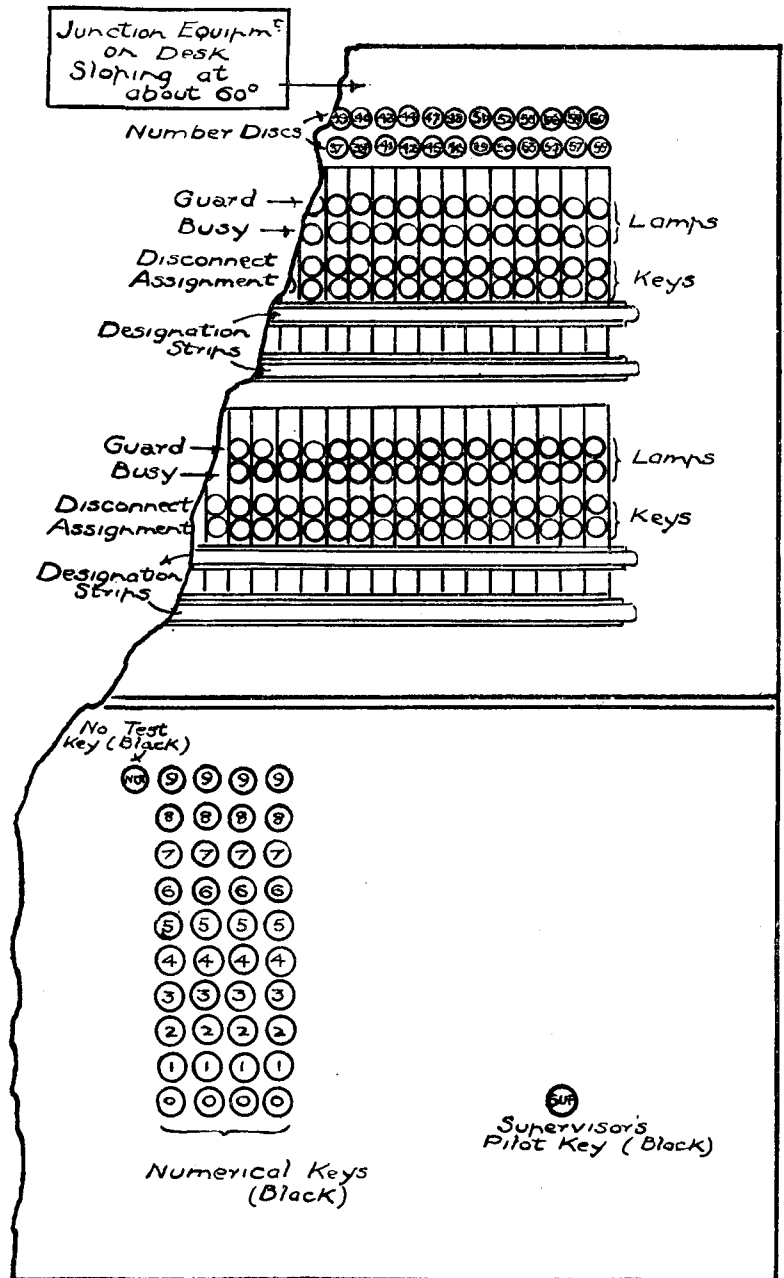


FIG. 14

junction, and she proceeds to set up the required number. Simultaneously with the association of her key set with the junction allotted, one of six "senders" is also associated. This is set for impulse sending by the depression of the keys, and takes over the function of transmitting those impulses.



makes a call for one of those services the connection will be diverted to a special group of lines terminating on the manual positions.

In addition to the handling of the traffic of the types mentioned, operators at the manual positions will have to be in a position to handle the ordinary work of information desks, including changed number work, guard signals, and the verification of cut-offs, "engaged" and "no reply" reports.

The manual positions supplied will be provided with double-ended cords with the usual two supervisory signals and speaking, ringing, register, dialling and flashing keys. Order wire keys will be provided on each position, mainly for the purpose of affording the manual operators direct access to the junction centres through which in many cases connections to exchanges outside the local area will be obtained.

In the standard Western Electric design provision is made for very complete records of traffic at various points throughout the exchange. Each group of switches and junctions is provided with a peg count register which operates every time a call is set up, and with an overflow register which operates when, with the whole group engaged, an additional call is received which cannot be connected. Each separate group of junctions on a cordless "B" position is equipped with an electrically-operated peg count register, which operates each time one of the assignment keys in the junction group is depressed.

In a typical American Exchange, designed to provide service to about 6,000 subscribers, with a busy hour calling rate of 2.16 and 50 per cent. junction traffic, the number of peg count and overflow registers provided would be as follows :-

PEG COUNT REGISTERS.		No. of Registers.
For:		
Special "A" positions	... ..	12
Junction groups at cordless "B" board	... ..	8
Line finders	... ..	89
Incoming junctions	... ..	42
Office selectors	... ..	3
Final selectors	... ..	56
OVERFLOW REGISTERS.		
Line finders	... ..	22
Senders	... ..	8
Junctions on the district panel multiple	... ..	14
Junctions on the office panel multiple	... ..	15
Junctions on the incoming multiple	... ..	56

The provision of traffic registers on a very complete basis is simplified under a system which makes each group of circuits individual and distinct and not subject to the interconnecting which is so frequently practiced in connection with plants of the Strowger type. It is common knowledge that as a group of lines increases, the number of calls which each circuit in the group can carry also increases. The increased carrying capacity is, however, not proportional to the increase in the number of lines. The rate of increase

## METROPOLITAN TANDEM EXCHANGE

### ARRANGEMENT OF KEYS AND ROUTING CHART

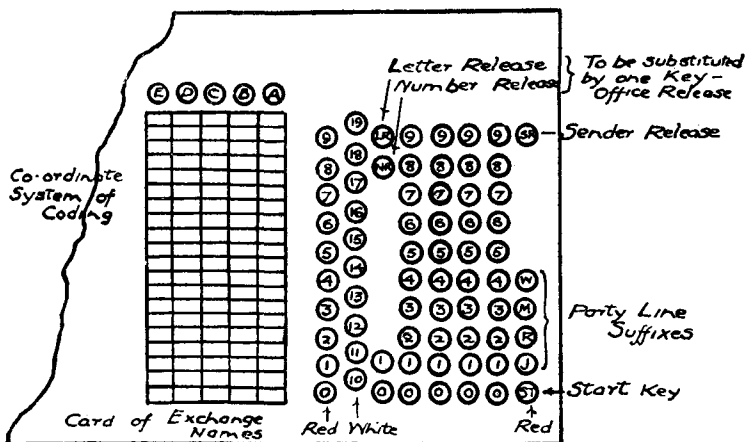


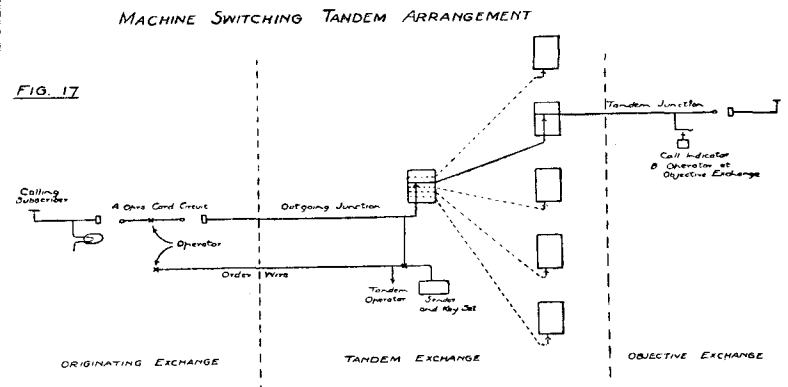
FIG. 16

in carrying capacity is large in the case of small groups, but comparatively small as the groups become larger. The panel system provides generally for the utilisation of groups which exceed in size those which are affected by a rapid increase in the carrying capacity, whereas the 10 terminal limitation experienced with plant of the Strowger type provides a much wider field for the utilisation of any device which offers some advantage from the increased line capacity point of view. There may be some cases in the panel system which justify a use of overlapping sections of a junction group, but it would be obvious that the study of traffic fluctuations in the system would be much more complex under such conditions and it is doubtful whether the effect that such a course would have on the provision of registers and the use of register readings would be justified.

An interesting possibility arising out of the flexibility in junction routing with panel apparatus and translators is the utilisation of machine switching equipment for working through what is known as a "tandem" exchange. Under existing conditions in London a large number of small junction groups are in use—many of them working on the signalling basis, which involves a distinct drag on the time of the "A" operators. With a machine switching tandem exchange large groups, working on an order wire basis, can be established between each local exchange and the tandem exchange. In the case of a call to an exchange with which an "A" operator has no direct communication, she passes the exchange name and number of the objective subscriber on the tandem order wire. The tandem operator is provided with a key set which enables her to select automatically a junction to the objective exchange and to pass on the subscriber's number automatically to a call indicator operator at that exchange.

The diagram (Fig. 16) shows the arrangements of the key shelf at the tandem exchange. The names of the exchanges reached via the tandem operator appear on the card shown adjoining the keys. It will be seen that each name is associated vertically with a lettered key and horizontally with a numbered key. The operator has junction keys similar to those on a cordless "B" position. She allots a junction for each demand passed to her, and immediately presses, first the lettered and numbered keys co-ordinate to the name of the required exchange—thus selecting automatically a free junction to that exchange—then, the numerical keys corresponding to the called subscriber's number—and finally the start key.

Fig. 17 shows in a skeleton manner the inter-relationship between the calling and called exchanges. The order wire to the tandem centre, the position of the key set, the selection of the junction group required and the path taken to the call indicator at the objective exchange are all shown.



The same panels and junctions can be used eventually for full mechanical calls in order to economise in the establishment of direct junction routes; and during the transition period an exchange of this type should be of immense value to local manual exchanges. The details of an exchange of this type for London are now being worked out. A mechanical tandem exchange was brought into use in New York on April 17 last.

In conclusion, I would emphasise the fact that many matters must have special study if the development of automatic conditions is to be satisfactorily carried out in London. They include :-

- The psychology of the subscriber.
- The psychology of the operating and supervising staff.
- The adequate education of engineering and traffic staffs.
- An expert and well-informed publicity campaign.
- The parallel development of plant, traffic design and service aspects of the new system, with the closest possible co-operation of distinct and clearly defined functions.

And may I urge that adequate provision be made by the Administration for the proper study of these matters, as the every-day work of well trained men who, so far as the detailed study officers are concerned, are free from the distraction of executive duties.

THE BAUDOT.—XVII.

By J. J. T.

Figs. XLIX and L are diagrams of the impression or printing wheel  $V^1$ , the teeth of which are engaged by the cam  $Ca$  (Figs. XLVIII and LI). The details of this wheel and its appendages will be dealt with in another chapter. In the meantime, having taken a general view of the mechanical action which results in the engagement of  $Ca$  with  $V^1$ , action which finally results in the printing of any

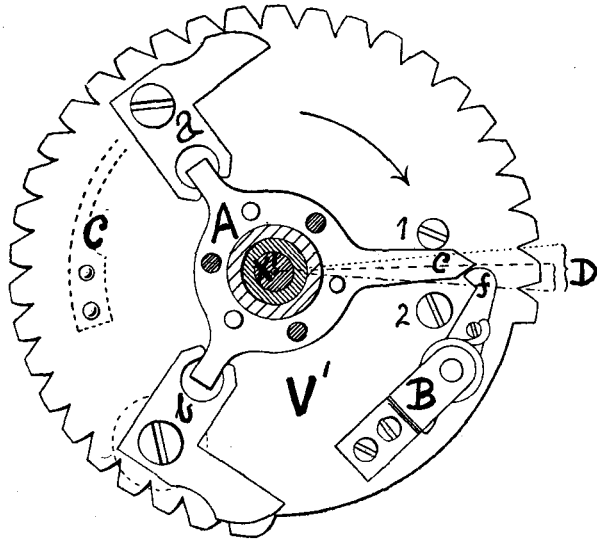


FIG. XLIX.

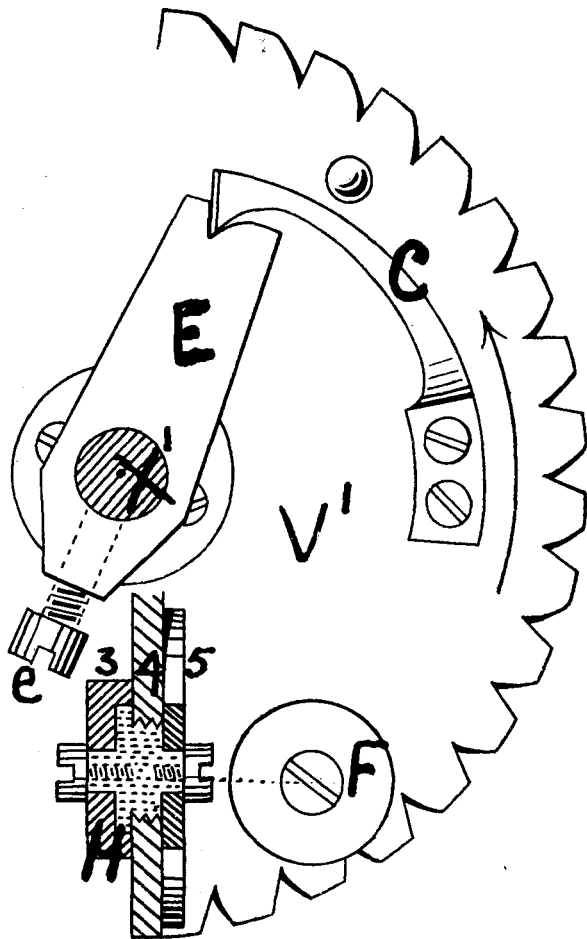


FIG. L.

letter or sign signalled, it will be time and space well occupied if we study a little more closely the details of that portion of the mechanical movement which we examined last month. Figs. LI and LII, especially the former, will help us to do this. Fig. LII shows the retaining end of the click  $C$ , together with an upper spring  $Q$ , not shown in Fig. XLVIII, which spring firmly engages  $C$  with  $Ca$  until released by the action of the hammer-head  $H$ . Fig. LI gives the positions in which the propelling rod finds itself in the cycle of movement consequent on the printing of each letter.

We know that when any combination of signals is received the selector levers take up certain positions over the *rest* and

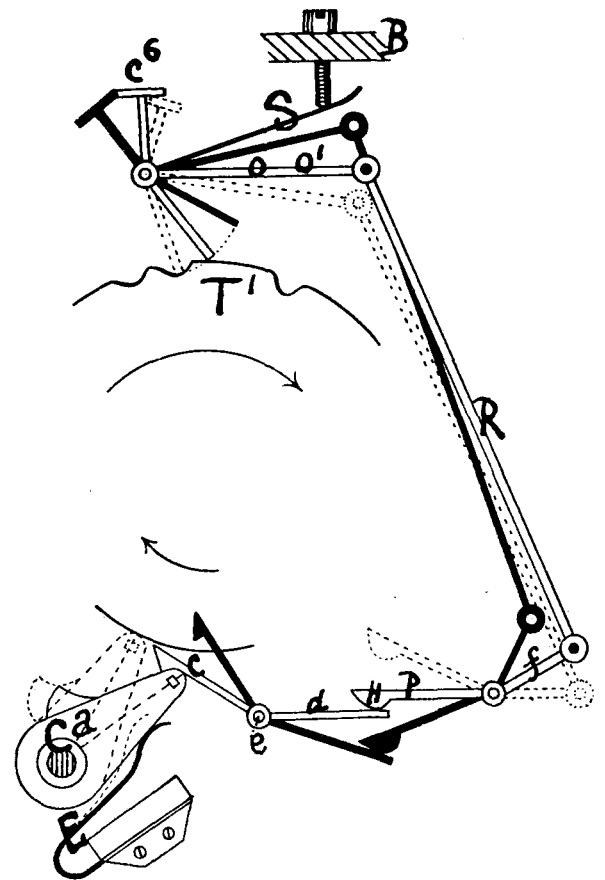


FIG. LI.

working tracks of the discs  $T$  and  $T^1$  (Figs. XLIV, &c.), and that the pressure of the spring  $S$  (Figs. XLVIII and LI) acting upon the propulsion lever  $OO^1$  and its appendage  $C^6$  conveys that pressure to the selector levers  $C^1$  to  $C^5$ , as all six ( $C^1$  to  $C^5$  plus  $C^6$ ) from part of the same arc. This pressure is exerted in the direction from left to right, *i.e.*, viewing the Baudot receiver from the front.

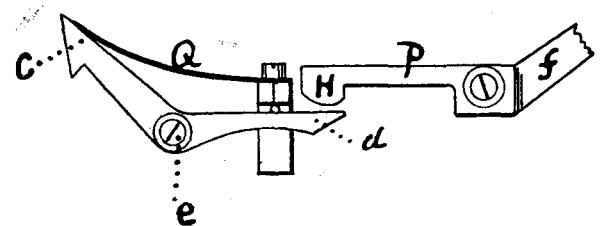


FIG. LII.

When the combiner wheel brings round the combination of slots and blanks which correspond with the letter to be printed, the pressure of the spring  $S$  acting upon  $C^6$  forces the selector levers into their selected slots. This first impulse results in a slight movement of the pedal  $P$  as represented by the dotted lines (Fig. LI). The speed of rotation of the combiner wheel, however, immediately

throws the selector levers out of these slots, causing a rebounding action, which has the effect of changing the position of R in the reverse direction and of placing C<sup>6</sup>, R, P, and the retaining click C in the positions shown by the blackened lines of our diagram. It will, therefore, also be noted that it is in this position that the release of the printing or impression cam Ca is effected, permitting the latter to engage with the teeth of V<sup>1</sup> underneath which it is located. The third, outlined and lettered positions of the propulsion lever, rod and pedal are of course the positions of these parts when no printing is taking place.

(To be continued.)

## REVIEW.

"Telegraphy, Telephony, and Wireless." By J. Poole, A.M.I.E.E. Sir Isaac Pitman & Sons, 3s. net.—This little book is an admirable example of intelligent compression. In the compass of little more than a hundred pages, Mr. Poole contrives to give a clear outline of the technicalities of telegraphy, telephony, and wireless telegraphy and telephony. The explanations are especially suitable as a foundation for further study. In respect of wireless we are given a good account of the history of its development, bringing it down to the latest inventions, including the thermionic valve. It is not a technical text-book, but it is more than a handbook for the general reader, in that it gives a sufficiently clear outline for the many of us in the service who need to know something of the technical side of the subject for our day-by-day work. It would be an obstinate reader who would master this book and not gain from it a desire for a fuller knowledge. We should say ourselves that in respect of radio-telephony, Mr. Poole is a little on the optimistic side. "Not only," he says, "is wireless telephony feasible under such circumstances, but it is much better in quality than any wire telephony could be if transmitted a long distance by cable, if that were practicable." To us that seems to be a little extreme, but of course there is no evidence to the contrary. However, we are not criticising the book on this ground. On the other hand, we welcome it as being particularly useful to the service at this moment.

## LONDON TELEPHONE SERVICE NOTES.

**Miss Ralph's Retirement.**—A familiar figure in the telephone world passed out of it when Miss Ralph retired on Dec. 31. She had been connected with telephones since 1882, when she entered the service of the United Telephone Company. When that Company was absorbed by the National Telephone Company, Miss Ralph continued in the service of the latter, and in 1884 became the Clerk-in-Charge of Deptford.

In 1889 the first telephone training school was opened at London Wall, and Miss Ralph was appointed the school-mistress with two assistant teachers. It is quite true to say that she was the first telephone school-mistress in the world. At the transfer of the National Telephone Company to the State, Miss Ralph retained her position as head of the London Wall School and remained there until a year ago. During her last year of service, Miss Ralph has supervised the three training schools and given special attention to the post training of learners in exchanges.

It was felt by those who had been associated with her for such a long period that some practical expression should be made of the esteem and respect in which she is held, and a very pleasant little ceremony took place on Jan. 13 in the great hall of the Sunday School Union, Old Bailey, E.C. Speeches were made by Mr. Stirling and Mr. Edmonds, Assistant Controllers, by Miss Newman, Supervisor of the Avenue Exchange, and by Miss Turner, Telephonist, all expressing the regard which Miss Ralph has won for herself in her long years of service. Mr. Preston, the Controller, in a very happy speech, recounted some of the incidents in Miss Ralph's career, and ended by presenting her with a War Loan Certificate for £178 10s., the gift of her many friends, both in the Service and out of it. Miss Ralph takes with her the good wishes of all who knew her in the Telephone Service for good health in which to enjoy her retirement.

To those who were unable to be present at the presentation, Miss Ralph sends the following message:—

Friends and Comrades.—On an occasion such as this, it is most difficult to find words adequately to express my appreciation of the great honour conferred on me this evening. That it is an honour, I am well aware, but I have but done my duty, and that could not have been carried out were it not for the help of a loyal staff—you all have helped—therefore the honour reflects on you and should be shared. In March next I should have been 39 years in the Telephone Service, having commenced with the United Telephone Co. in 1882. They have been happy years—in spite of difficulties—especially this last year when I have been able to visit all the London Exchanges and meet old friends whom I had not seen for some years, as well as seeing many who left me from the school little more than school girls and who are now taking responsible positions.

I began by stating how difficult it was to express oneself adequately. Will you look up yourselves the choicest words you can find and would have me to say—take and frame them together and accept them as the expression of my warmest heartfelt appreciation and thanks for your generous gift and the honour which you have conferred on me. May I take this opportunity to thank all who have written such kindly expressions of good will and comradeship, but to whom it would be impossible to write individually.

The London Telephonists' Society celebrated the opening of 1921 by a New Year's Dance, held at the Bishopsgate Institute on Saturday, Jan. 1. There was a keen demand for the tickets, every one of which was sold, and the room was filled without being packed. The Dance Committee were congratulated on all hands for the excellence of the arrangements; the refreshments, always a matter of consideration, being appetising in quality and abundant in quantity. The M.C.s, Mr. Guy Buckridge and Mr. Beck, with their stewards, were assiduous in securing the comfort and convenience of all, whilst Mr. Skinner's orchestra, as ever, provided music that for anyone who might, could, would or should, at any time dance or contemplate dancing, was simply irresistible. One thing there was that marred the complete happiness of the gathering, and that was the entire absence of the "chiefs"—yet the heart cannot always be worn on the sleeve, and so those present hid their griefs, and it is doubtful if the visitor from without the magic circle of the L.T.S. ever realised the aching void left by these absences.

Miss Heap read her paper, recounting her holiday in Italy, before a large audience in the great hall of the Sunday School Union on Jan. 13. The enthusiasm of Miss Heap's explanations and descriptions of the pictures thrown on the screen told of the enjoyment of such a holiday. Miss Heap undoubtedly expressed the wish of her hearers when she hoped that they would have an opportunity of making the journey personally at some future date. It is unlikely, however, that such good fortune will come to many of the audience, and the rest are glad to have heard of Italy's charms on this occasion.

The next meeting takes place on Feb. 2, when the competition papers will be read.

**The Langham Choral Society.**—The next work to be presented is Mendelssohn's "Elijah." The performance will take place at the Queen's Hall at 7 p.m. on Friday, Feb. 18, and the previous successes are leading to a large demand for tickets. The following eminent vocalists have been engaged:—Mme. Elsa Stralia, Miss Lucy Nuttall, Mr. Ivor Walters and Mr. Robert Radford. Enquiries concerning tickets, &c., should be addressed to:—Miss W. M. Nurse, West District Traffic Office, L.T.S., 11/12, Norwich Street, E.C.4.

**Headquarters.**—The Cenotaph continues to be well supplied with wreaths and floral tributes. Prior to the Christmas festival the staff of the Controller Office purchased a fitting wreath, which was taken to the Cenotaph by representative ex-Service men and women as a tribute to those no longer with us.

Sympathy with the ex-Service men unemployed at the festive season was expressed in a practical manner by means of a collection at Headquarters, which secured £26 for the unemployment fund of the Discharged Soldiers' and Sailors' Federation.

**The Trunk Exchange.**—Caxton Hall, which has associations over long years with the movement for the advancement of women, was thronged on Monday, Jan. 10, by a host of enthusiasts of the gentler sex. Their enthusiasm was engendered by the anticipations of a social and dance, but it was fanned to a flame of white heat by their desire to do honour to one woman. That one was Miss Beaumont, and those enthusiasts were members of the Trunk Exchange staff, congregated to express to her, without the trammels of standard expressions or official parlance of any kind, their unbounded regard for her, their appreciation of all she had done for them, and their high hopes for her future happiness and advancement. All this they expressed at an interval in the proceedings when Mr. Kennedy on their behalf handed to Miss Beaumont—as an outward and visible sign of their feelings—a ring set with a large ruby in a cluster of diamonds. Hardly had the sound of Mr. Kennedy's voice ceased when Miss Chaplin, on behalf of the local representatives of the U.P.W., presented Miss Beaumont with a solid silver vase, this being followed again by Miss Temme, who gave a fountain pen as a memento from the Swimming Club, whereafter Miss James placed in Miss Beaumont's hands a bouquet of orchids, pink malmaisons and lilies of the valley. Is it any wonder that Miss Beaumont's voice trembled just a little as she acknowledged these gifts? Is it any wonder that the whole of those present burst into cheers, finally joining vigorously in an adaptation of that ancient melody of praise "For she's a jolly good fellow?" If it is a wonder to you, reader,

it is clear you know nothing of Miss Beaumont, and less of the Trunk Exchange. It was a fine tribute, well paid and richly deserved. The musical programme was of a high quality and the dances were things of life as dances should be. Of course the gathering had to break up, but then life is just like that, which is one reason why the Railway Companies always print the times of the last trains in heavy type.

#### Telephone and Telegraph Society.

A very interesting paper on the subject of "Wireless Communications" was read by Lt.-Col. C. G. G. Crawley, R.M.A., Deputy-Inspector of Wireless, at the January meeting of this Society. There was a large audience, but few members from the telephone side were present. We were glad to welcome Sir Andrew Ogilvie, who, in his remarks, expressed the purpose of many present—namely, to hear something of the work and progress of our colleagues in other branches of the Post Office. It will be news to many to learn that the staffs at the P.O. wireless stations have definite responsibilities in connexion with the safety of lives at sea. Although wireless telegraphy may be regarded as dating, from a commercial point of view, from 1896 or 1897, it is still, judging from some of the sallies which passed, far from that degree of efficiency towards which it is common knowledge that Officers of the P.O. aim. Col. Crawley was optimistic concerning the future of wireless telephony, which, having its birth during the war, is still a very small infant, yet it promises to rival its wireless brother (or is it sister) in certain respects. He explained that it is quicker than telegraphy, seeing that it requires no transcription of signals, and consequently it has the advantage of not requiring a skilled signaller. On the other hand, it cannot yet be made so secretive, nor has it so long a range for a given power. It is interesting to learn that communication by wireless telephony is in force between a point in California and a neighbouring island, a distance of about 30 miles.

From what we heard we may conclude that before many weeks are passed there will be a regular wireless telegraph service between this country and Germany, outwards from Stonehaven to Berlin, and inwards from Berlin to the Central Telegraph Office.

At the meeting to be held on Feb. 21, Mr. T. C. Cook, of the Accountant-General's Dept., will read a paper entitled "Studies in Whitleyism."

#### Telephone Repeater Demonstration.

Readers of the JOURNAL have no doubt seen the notes published from time to time regarding the progress made with telephone repeaters. These repeaters depend upon the principle of the "thermionic valve" and the use of "valves" will inevitably play as important a part in the development of wire telephony as it has in the development of "wireless"—both telegraphy and telephony. We watch with interest the progress of the various underground cable schemes, and hear of the completion of new "repeater" stations here and there for telephone purposes, as these are signs that we are keeping pace with the developments at which other progressive countries are also aiming—developments which may assist in forging the bonds of international understanding and unity.

But few of us have been fortunate enough so far to see these wonderful repeaters in operation. There is, therefore, great interest for every telephone enthusiast in the demonstration circuits and apparatus established by the Western Electric Company, at 62, Finsbury Pavement, and all who are able should arrange, by appointment with the Company, to see the repeaters in operation and hear from an expert the many wonders to be told of them.

Two circuits are installed, one a two-wire circuit with one repeater station, the other a four-wire circuit with two repeater stations. The latter circuit is of particular interest, as it involves such a complete departure from our previous conception of what a telephone circuit should be. The two circuits can be connected together to produce a circuit of which the standard cable equivalent is well over 100 miles. Without repeaters it is of course quite impracticable to speak over such a circuit, but with the repeaters in circuit the speech equivalent is brought down to a point well below 20 miles of standard cable.

We hope and expect the time is not far distant when repeaters will be established not only throughout the British Isles but also on main continental routes, which will bring Rome, Copenhagen, &c., into as easy reach of London telephonically as Manchester and Liverpool are to-day.

#### The "Telephone Ramp."

Newspapers placards announce "A Telephone Ramp."

Oh, startling confession!  
Unheard of remorse!  
Which each of our readers  
Will gladly endorse.  
The press, with a candour  
Where truth sets its stamp,  
*Admit*, they're conducting  
A Telephone Ramp!  
Ingenuous placards.  
We know it too well,  
(Though why you confess it  
It's harder to tell).  
Whether tardy regret,  
Or a traitor in camp—  
The *press* are conducting  
A Telephone Ramp!

#### An Open Letter to:—

THE EDITOR,  
Daily Telegraph.

You gave a wrong number, Mr. Editor, to millions of subscribers on New Year's day. In accordance with your index they were connected to page 10 for that most vital of all communications "Telephone Charges" only to find that the number was a wrong one. They heard no sympathetic "Sorry you have been troubled," and after searching through sixteen pages (it used to be many more), for which you have increased the charge 100% in spite of protests, the correct number was found to be 7. Apparently you had not turned over enough "new leaves." The error is not an isolated one. It was repeated on the 17th idem, when your contribution to the same subject appeared on page 9 instead of on page 12 as announced in the index. The British press is the most inefficient in the world! Why do you not learn from your American contemporaries how to run a newspaper efficiently?

Yours &c.

*Regent Exchange.*—On Saturday, Jan. 15, Regent entertained their protégés at Gifford House, Roehampton, to a special New Year's tea and concert. In addition to the truly royal spread provided at tea-time, each guest was presented with a useful gift. The concert which followed included interesting and talented items, which were so much appreciated by the men that they declared they "were not a bit sorry they had missed seeing Chelsea play." What greater tribute can a man give?

## PERSONALIA.

### LONDON TELEPHONE SERVICE.

Mr. J. A. RENWICK, Clerical Officer, attached to the Accounts Branch of the Controller's Office, has been promoted Second Class Clerk, Investigation Branch, Secretary's Office.

The following officers have resigned on account of marriage:—

Miss L. WHEATLEY, Asst. Supervisor Class II, of Paddington Exchange.  
Miss A. L. BARRATT, Telephonist, of Avenue Exchange.  
Miss A. A. BROWN, Telephonist, of East Exchange.  
Miss M. McMURPHY, Telephonist, of East Exchange.  
Miss C. BUNCE, Telephonist, of Holborn Exchange.  
Miss M. E. LOFTS, Telephonist, of Holborn Exchange.  
Miss A. SOLLY, Telephonist, of Hornsey Exchange.  
Miss E. BOTTOMS, Telephonist, of Museum Exchange.  
Miss D. E. GREEN, Telephonist, of Trunk Exchange.  
Miss B. M. SHONE, Telephonist, of Victoria Exchange.  
Miss L. M. SMITH, Telephonist, of Victoria Exchange.  
Miss D. F. GARDNER, Telephonist, Victoria Exchange.  
Miss E. A. BANKS-FAY, Telephonist, of Victoria Exchange.

### OBITUARY.

#### MR. ROBERT McLEAN.

We greatly regret to record that Mr. Robert McLean, for 20 years Manager and Engineer of the Guernsey States Telephone Department, died suddenly, Dec. 30, 1920, at his residence, Hermes, Castel, Guernsey; Mr. McLean, who was exceedingly well known in Telephone circles, was born in 1869 at Musselburgh; apprenticed to the National Telephone Company, Edinburgh, 1885; Chief Inspector, Mutual Telephone Company, Manchester, 1890; Chief Inspector, New Telephone Company, London, 1892; Local Manager with National Telephone Company at Cardiff and elsewhere, 1894; appointed to Guernsey, 1900. Under his care the Guernsey Telephone System increased from 679 stations in 1900 to 2,700 at the end of 1920, and obtained a great reputation for good and economical service and administration. Mr. McLean, who leaves a widow and a wide circle of friends, was accorded a semi-public funeral at Castel Church, in recognition of his long and faithful service.

### BIRMINGHAM.

The first annual dinner of the Telephone Cricket Club took place at the White Horse Hotel on Dec. 2. A capital dinner was served and an excellent musical programme rendered. The Toast list was as follows:—

The King, proposed by the Chairman.

The Telephone Cricket Club, proposed by Mr. C. W. Piggott and responded to by Mr. G. F. Findley (captain).

The Post Office Sports Club, proposed by Mr. Wiggins and responded to by Mr. H. Blackmore and Mr. R. Smith (secretary and assistant secretary respectively).

The Artists, proposed by Mr. Rhodes and acknowledged by Mr. Thomas. The toast of the chairman was in the hands of Mr. Llewellyn.

A résumé of the Club's achievements during 1920 was presented by Mr. Price (secretary). Mr. H. Bristow presided, and the proceedings throughout were acclaimed by all to have been an unqualified success.