MODERN TELEGRAPH PRACTICE

ALTHOUGH somewhat overshadowed by its telephone younger brother, the telegraph service has never ceased to play a most important part in the work of the Post Office and in the social and business life of the community, and its measure of usefulness and its scale of operations have been greatly enlarged since the re-introduction of a sixpenny tariff three years ago.

The title "Modern Telegraph Practice" raises the question what date separates modern from non-modern for the purposes of this paper. Telegraphy has had practically a century of active life and it may seem somewhat aggressive unduly to restrict the term "modern." I think, nevertheless, that there will be general acceptance for the view that "modern" in this connection may reasonably be interpreted as covering the last six or seven years. A further point to be settled is the general scope of the paper. Telegraph practice covers a wide field and offers a choice between intensive technical treatment of a few sections of the subject and a more or less general treatment of a larger area of the possible field. I propose to lean towards the latter alternative: and I am also regarding new services, tariff changes, surveys of traffic and efforts to stimulate demand, as embraced within the term "practice." In this way I hope to give a bird's-eye view of the present-day telegraph service. Those who are greatly interested in technical details will find their needs covered, in some measure at least, by previous Green Papers.

TELEGRAPH RE-ORGANISATION

The telegraph service has been confronted for many years by two major problems:

1. The continuous fall in traffic from 80 or 90 million messages per annum to 32 million in 1934–1935.
2. Relatively high cost of operation (predominantly staff costs) compared with revenue.

Something like a vicious circle seemed to be established, for it is always extremely difficult to make efficient arrangements on the service and cost sides simultaneously if traffic, and therefore revenue, are continuously falling.

The invention of a reliable, high-speed teleprinter instrument promised well both on the service and cost side, and, after the visit of the Simon Committee to the United States, it was decided to re-organise the inland telegraph service on the basis of teleprinter working on all circuits carrying as many as 150 messages a day and telephone working for all other telegraph transmission. Circuits with an average traffic of 70 messages or more an hour were to be individually staffed, those with 35 or less were to be equipped individually with teleprinters attended to by a "pool" of operators moving from circuit to circuit as the traffic required. Direct telephone-telegram circuits were provided when the traffic justified such reservation. The smaller telephone-telegram offices—the vast majority—gained access to the

A lecture to the Post Office Telephone and Telegraph Society of London on February 21, 1938. The illustrations are from photographs by the Engineering Department.

Published July, 1938

general telegraph system through the telephone exchanges.

Accordingly, during the past few years telegraph rooms have more or less completely changed, the teleprinter and telephone having replaced the varied assortment of different types of apparatus formerly in use. The subsidiary apparatus has been cleared off the tables and assembled in compact form in a separate part of the room. The tables have been replaced by others of new design, and at all large offices elaborate conveyor belt systems have speeded up circulation, with great reduction in noise and bustle. The aggregate effect of these measures is sometimes described as " mechanisation." This is, no doubt, warranted, provided that it is not implied that the machine has replaced the operator. I prefer to say that the operator has been provided with more efficient tools. Telegraphs have over a long period of years used some of the most ingenious mechanical devices ever invented by man. Green Paper No. 5 contains a good deal of information on this point. A teleprinter operator is not a machine-minder. He or she has to play an essential part in the signalling of every letter. What modern technique has done is to enable the operator to send and receive accurately many more messages than formerly in a given time, and with less physical effort. It has sometimes been implied that from a craftsmanship standpoint the introduction of teleprinting has had the effect of lowering the status of the telegraphist. It is true that morse working involves knowledge of the morse code and that the arm and wrist movements in morse sending are particularly exacting to some individuals, whereas with typewriting arms and fingers are given a somewhat free and natural motion. Surely there is much scope for skill in making really efficient use of a keyboard : skilled manipulation is certainly delightful to watch. While I can fully sympathise with the sentimental regret felt at the supersession of the specialised type of operating on which some operators had spent the greater part of their working lives, I should hesitate to subscribe to a view that keen present-day operators have not as much scope as their predecessors. Operators who were no longer young when they had to learn teleprinting may have felt at some disadvantage compared with recruits fresh from school, but they had the advantage of experience in telegraph matters generally, and a very large proportion of them can now turn out fine totals when necessary. Operators working teleprinters can retain a high degree of manipulative skill until a much later time of life than was generally possible with morse-key working, and no doubt many a fine morse craftsman has found in this a personal consolation for the supersession of the older instrument.

Steady progress had been made by 1935 in the provision of teleprinters, phonogram and telephone-telegram equipment and improved lines, and in staff training ; and, notwithstanding the difficulty of falling traffic, the reorganisation of the telegraph service may be regarded as having been reasonably successful. At any rate when exposed to the test set by the sudden expansion of traffic, which followed the re-introduction of a sixpenny tariff on May 31, 1935, the service showed itself well able, with the active co-operation of the staff, to cope with the situation.

THE SIXPENNY TELEGRAM

Indubitably the outstanding event of recent years in the British telegraph world has been the re-introduction of a sixpenny telegram on May 31, 1935. This bold step was the outcome of prolonged and anxious deliberation, and there was little encouragement in telegraph experience at home or abroad to support the advocates of a low tariff. In lowering the tariff Sir Kingsley Wood was largely moved by the desire to give the telegraph service and the

Figure 1.—Central Telegraph Office : Centre Gallery

Figure 2.—Central Telegraph Office : Main Circulation

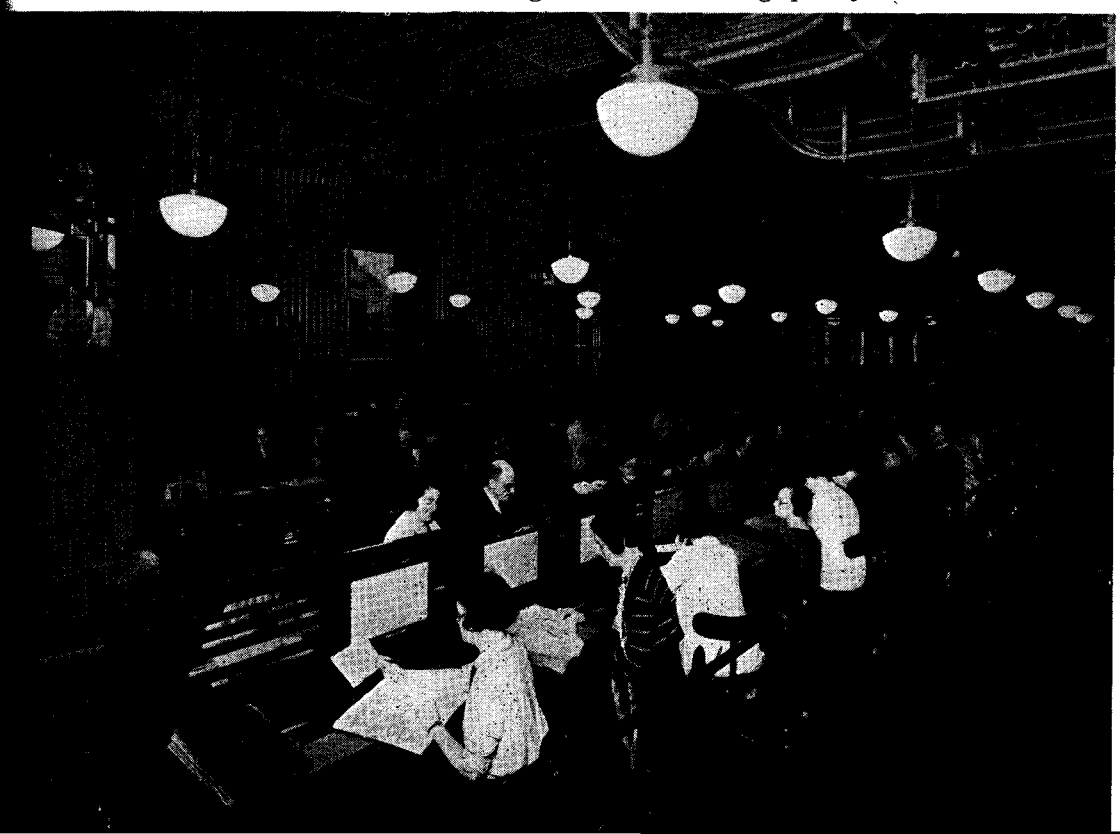


Figure 3.—Central Telegraph Office : Phonogram Room

Figure 4.—Central Telegraph Office : Addressing table

telegraph staff an opportunity to rehabilitate the senior telecommunication service in the public estimation.

The boldness of the step may be judged from the fact that the reduced tariff involved an immediate sacrifice of £600,000 on the then existing traffic, and the "telegraph deficit" already stood at something between half and three-quarters of a million pounds per annum.

The Postmaster General's judgment proved to be sound and there was a dramatic response to his gesture. Almost at once the traffic rose by 25 to 30 per cent. and continued to rise till the increase reached nearly 50 per cent. The rise of traffic is the more striking when one reflects that the traffic level would probably have *dropped* 5 or 10 per cent. but for the tariff change.

NEW SERVICES

In addition to tariff reduction, new telegraph services were introduced at or about the same time, notably the priority telegram and the greetings telegram; and the batch telegram was made more attractive. The night telegraph letter was freed from the then existing restrictions and the call-office fee of 2*d.* was abolished for telegrams handed in at telephone call offices.

In the upshot the revenue from new traffic rather more than replaced that surrendered, while the increased costs of operation were not grievous.

Naturally the subsidiary services—with the notable exception of the greetings telegram—do not offer the scope of the ordinary telegram, but there has been a healthy increase in night telegraph letters and telegrams from call offices. It would seem that the public do not find it necessary or even worth while to pay a sixpenny surcharge to get the quality of telegraph service they desire. At any rate only four out of each thousand telegrams are priority messages. Greetings telegrams are dealt with more fully later in this paper.

TRAINING STAFF

In the modern telegraph service (as also in other branches of Post Office work) great importance is attached to training of staff, and very great pains are taken to ensure the acquisition of a correct style of touch typing and the development of a proper rhythm. The administration realises very clearly that well-trained staff not only work accurately but also work easily in the sense of freedom from strain. It is almost a psychological platitude that those who have a full knowledge and mastery of their craft have assurance, confidence and poise, with beneficial results to themselves as workers, citizens and individuals, and to mind as well as body. A detailed account of the schemes of training carried out at the C.T.O. Telegraph School and the Telegraph Testing and Maintenance School is contained in Green Paper No. 33.

ACCEPTANCE OF TELEGRAMS

As regards acceptance at the counter, modern telegraph practice differs but little from that of a considerable time ago. We have, however, improved the lay-out and general appearance of the "A" form and we have simplified the counting procedure, notably in charging only one word for that part of the "proper address" which follows the name of the road, although in fact it may consist of several words.

The most marked change of recent times as regards acceptance has been the steady rise in the proportion of telegrams handed in by telephone instead of over the counter. The present proportion is about 40 per cent.

We have abolished the telephone fee on telegrams telephoned from public call offices, of which there are nearly 50,000, considerably more than half of which are kiosks open day and night, even when the counters of the

great majority of the 14,000 Post Office telegraph-accepting offices are closed. Add to these the 3,000,000 subscribers' telephones and it will be seen that there is little difficulty in handing in a telegram at any hour of the day or night.

Acceptance of telegrams by telephone has its drawbacks. Quite apart from phonetic confusion and dialect difficulties, the writing or typing of dictated messages is slow, while the necessity for not keeping the public waiting when desirous of dictating a message makes phonogram staffing relatively costly. Further, this traffic is liable to rushes somewhat difficult to meet. I think, however, all telegraph people would do well to realise that the level of telegraph traffic must largely be bound up with the extent to which the rapidly growing telephone-using public can be kept telegraph-conscious. From the subscriber's point of view, handing-in by telephone is generally much easier than visiting a post office ; and, further, a large proportion of telephone subscribers has some financial margin out of which to pay for telegrams of the non-necessary type.

The post offices to which telephone subscribers and call-office users are connected in order to dictate telegrams are called " appointed offices," and a few years ago there were 1,200 such post offices appointed to deal with phonogram traffic. In recent years the areas of appointed offices have been extended with the object of reducing transmissions and the number of appointed offices has been reduced to less than 250. Since the recent growth of traffic a few offices have been restored as appointed offices, the increased traffic having made it worth while to provide extra teleprinter circuits.

Under teleprinter-switching conditions (*see* page 14) each teleprinter office would have more or less equal facilities for the transmission of messages over the teleprinter network. There would consequently be no advantage from a transmission point of view in maintaining the concentration of phonogram and telephone-telegram traffic on present appointed offices, and a substantial increase in appointed offices is to be anticipated if switching is introduced. There are considerable advantages in having the appointed office fairly near the subscriber, notably that use of local knowledge is possible under such conditions.

In almost every case the appointed office is also the transmitting office (group centre) for telegraph offices situated within the appointed office area. Such an arrangement facilitates the segregation of " C " telegrams for subscribers in the area and unifies control. We have introduced very widely the use of the typewriter for telephone reception ; we have re-arranged the position of various items on the form to facilitate operating, and some of the subsidiary work is performed away from the circuit.

TELEPRINTER ANCILLARY WORKING

Perhaps the chief operating change made in the last two or three years has been the introduction of teleprinter ancillary working—a method of operating designed to provide a more convenient and economical method of handling small teleprinter circuit loads than is afforded by the pool-staffing arrangements. The circuits are multipled over panels resembling small telephone switchboards and the operators have access to the whole of the circuit field without moving from their teleprinters. Lightly-loaded circuits are connected to the ancillary for normal working throughout the day and other circuits can be operated on the ancillary at times when independent staffing is not necessary. Under this scheme there is a saving in the number of teleprinters, in the amount of space required to house the teleprinters at the central office and in staff, since the time involved in moving from one circuit to another is eliminated. Supervision

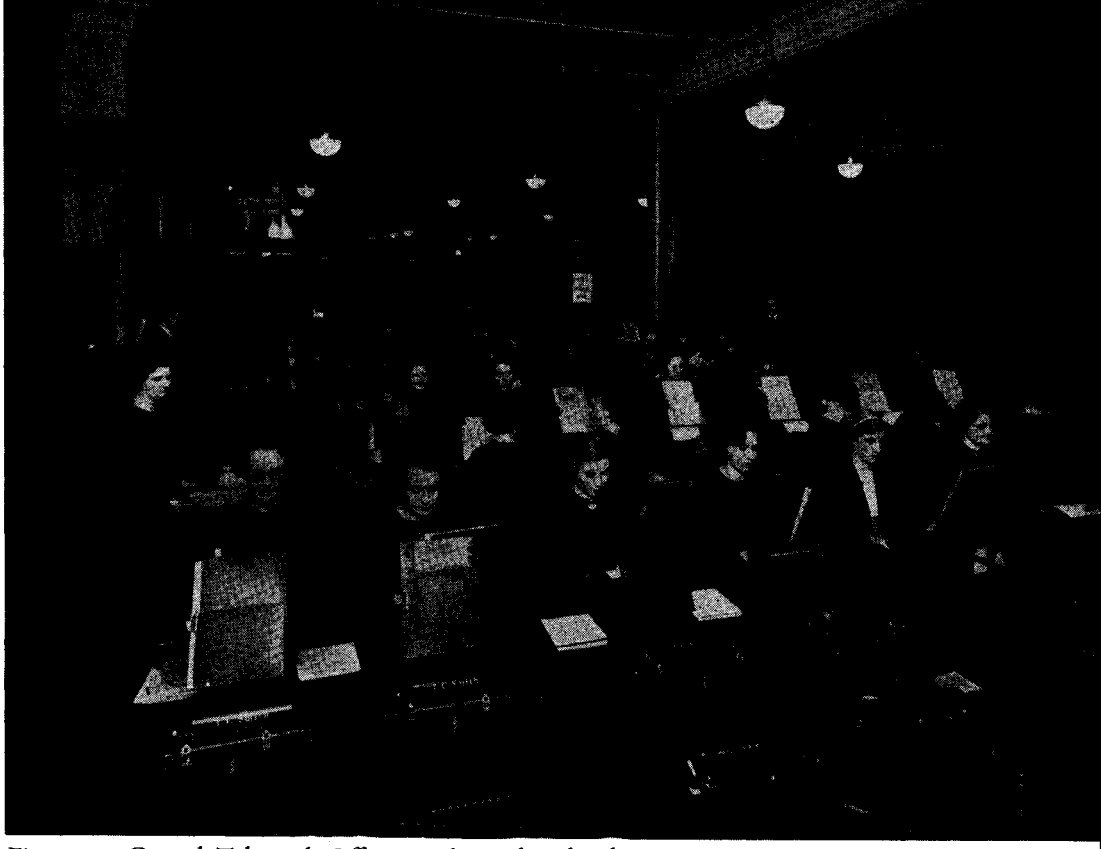
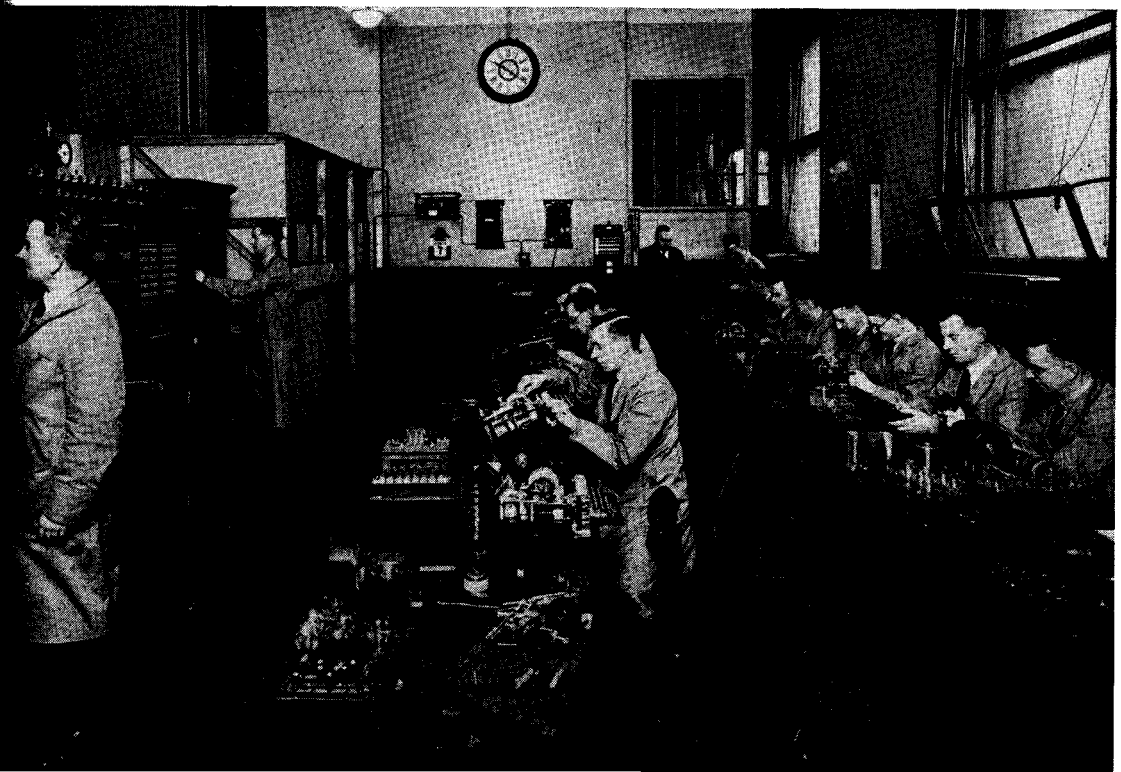


Figure 5.—Central Telegraph Office : Telegraph School

Figure 6.—Telegraph Testing and Maintenance School



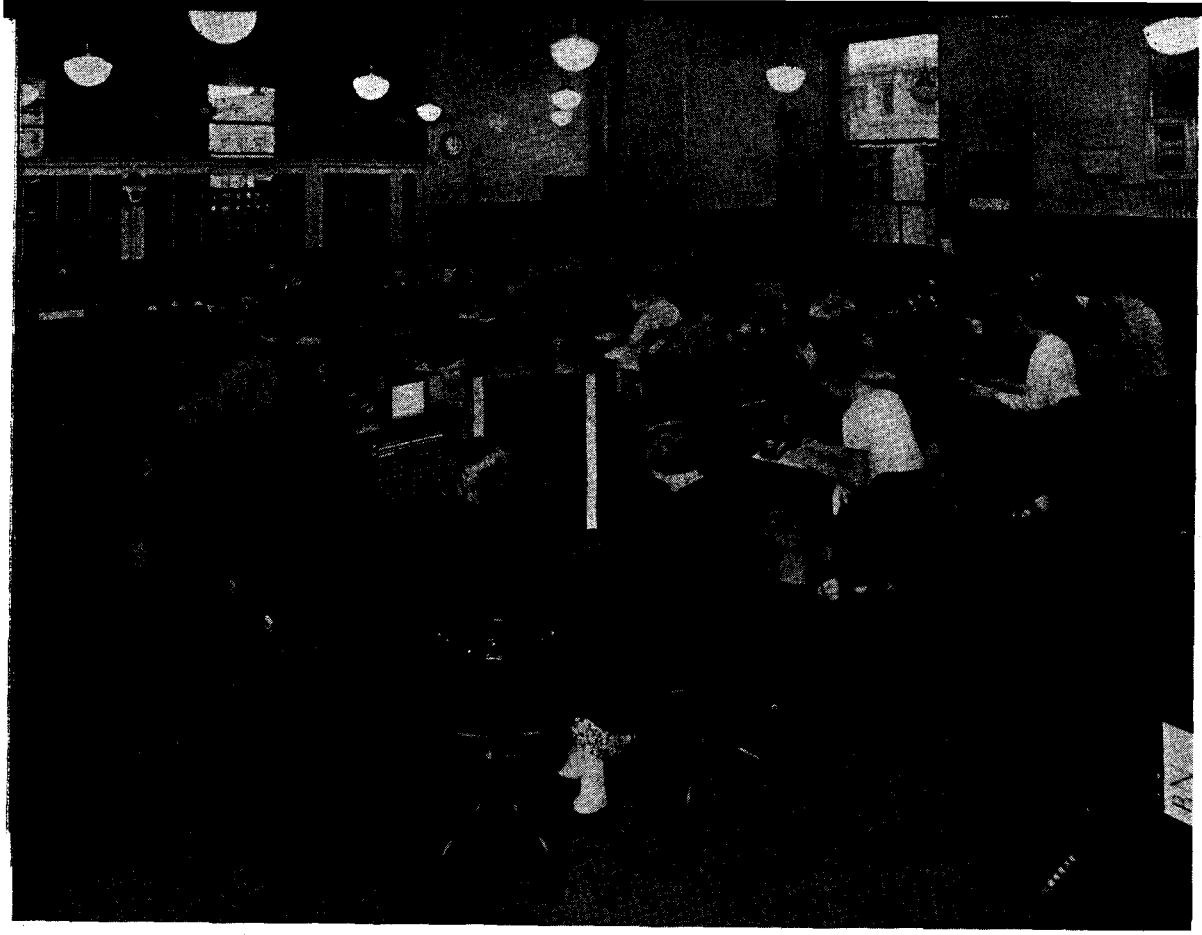


Figure 7.—Central Telegraph Office :
Teleprinter ancillary equipment

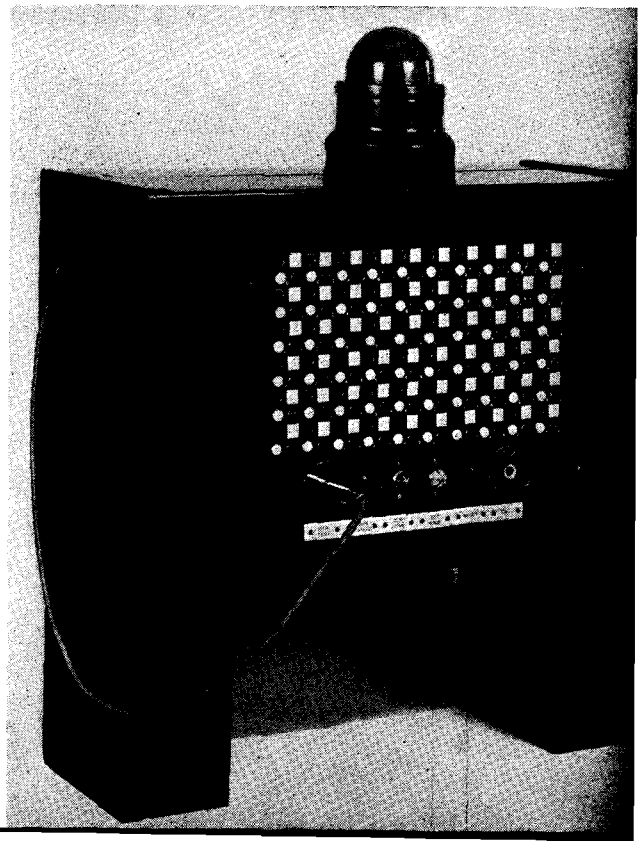


Figure 8.—Teleprinter ancillary equipment :
Operator's panel

also is facilitated and at the same time the working conditions permit of a steady output. Ancillary teleprinter working has played a big part in enabling the Post Office to cope with the increased traffic following the tariff reduction. Nearly 300 telephone-telegram circuits have been converted to ancillary teleprinter working, with great saving of time and labour ; and the reduction in the amount of telephone work has been very much welcomed by the telegraph staff themselves. Seventy-five new non-basic circuits have been provided—many of them in connection with the ancillary system with consequent reduction in transmissions.

VOICE-FREQUENCY TELEGRAPHS

Up to a few years ago the British Post Office maintained two line systems—telegraph and telephone. The telegraph line system was the growth of very many years and was made up of a variety of lengths, overhead and underground, of various gauges and materials. The telephone network, on the other hand, largely underground, was of more recent origin and constructed to meet the exacting requirements of the telephone service.

The present policy is to make a single Post Office system using the same underground routes to carry both telegraph and telephone circuits ; and the realisation of this policy is greatly facilitated by the adoption of voice-frequency working.

Voice-frequency working was introduced experimentally in 1926, when a Siemens-Halske system providing six channels was obtained and later put into service between London and Manchester. This was followed in 1928 by a six-channel General Electric Company's system which operated between London and Glasgow. It was not, however, until after the provision of a Standard Telephone Company's 12-channel system between London and Dundee, towards the end of 1931, that the extension of voice-frequency working on a large scale was accepted as the settled policy of the Department.

After some earlier experimental trials authority was given in 1933 to proceed with the North and North-Eastern scheme, which provided for the reconditioning of the main underground telegraph cable for telephone purposes and for the release of telegraph conductors in the North-Eastern telephone cable. The scheme provided for the appropriation for telegraph purposes of 33 four-wire circuits and for the installation of the same number of voice-frequency systems equipped to provide 510 channels. The entire scheme, including the Scottish section, was completed towards the end of January of the following year, by which date all the principal telegraph circuits between London and the North and Midlands, as well as the inter-zone circuits, had been converted to voice-frequency working.

The Western scheme, embracing Bristol, Cardiff, Exeter, Plymouth and Southampton followed, and was completed in the first half of 1934.

Since then numerous additional systems have been completed ; others have been authorised ; while a further programme has been included in the estimates for 1938–1939.

The signal from each teleprinter working on an installation consists of a train of interruptions of an alternating-current of a definite frequency, each channel having its own frequency. So far as the line is concerned there is a complex current wave resulting from the mixture of all the frequencies and varying with the number of teleprinters actually transmitting. Each frequency is filtered to its appropriate channel at the receiving terminal station.

With voice-frequency working the telegraph currents are of the same order as telephone currents, thus avoiding interference with the telephone circuits. The system works over

repeatered and loaded underground telephone lines with balanced electrical characteristics and with no distance limit to satisfactory signalling. Small currents only are necessary and the battery arrangements are simplified.

The voice-frequency circuits in this country are being arranged in most cases to provide 18 channels with frequencies fixed in steps of 120 periods per second, commencing at 420 periods and extending up to 2,460 periods per second. The frequencies are passed over a four-wire telephone circuit; one pair is used for sending in one direction, and the second pair is used for sending in the opposite direction.

In 1935 a system known as the "four-channel voice-frequency system" was introduced. In this system a two-wire circuit is employed and eight frequencies are utilised, four in the "go" direction and four in the "return." The system, which is economically advantageous on certain routes as an extension to the main voice-frequency network, was first used experimentally between London and Oxford with satisfactory results. The system has since been extended to a number of other routes, and further extensions are contemplated.

The multi-frequency generators, relays, filters, and valve equipment are located in some instances in the same building as the telegraph instrument room, but more frequently in the telephone repeater station, and are under the control of engineering personnel. In the telegraph instrument rooms control positions are introduced between the voice-frequency terminal equipment and the instrument table teleprinter position. A full account of voice-frequency working is contained in Green Paper No. 26.

The introduction of "demand" working in the telephone service and the consequent imperative need for additional telephone circuits gave an impetus to the development of voice-frequency working. It became possible to release telegraph cables for telephone purposes at a time when additional telephone circuits were much needed.

There are at the present time 91 voice-frequency systems with a total of 1,183 channels. Of the 1,183 channels 631 are allocated to public circuits, the remainder being in use for private wire circuits, reserves, and for speaker purposes. All the more important public telegraph circuits in the country are now working wholly or in part over the voice-frequency network.

One of the great advantages resulting from the introduction of voice-frequency working has been the marked improvement in the stability of the circuits as compared with physical line working. Duplex and other difficulties have ceased to trouble the telegraph supervision and the flexibility of the system renders the possibility of complete breakdown on any route a remote contingency. The total traffic time lost daily is less than a minute a circuit.

As regards the financial effect of the change-over to voice-frequency working, it is estimated that the saving to telegraphs in line costs due to the introduction of voice-frequency working runs well into six figures per annum.

It will thus be seen that the voice-frequency system has greatly added to the efficiency, convenience and financial soundness of the telegraph service and has also brought advantages to the telephone service.

TELEPRINTER REPEATER STATIONS

As already indicated, voice-frequency channels normally pass through telephone repeater stations, and accordingly separate telegraph repeater stations are no longer necessary. The telegraph repeater stations at Nevin and Bangor, which serve the circuits between this country and Ireland, are the last of such stations associated with inland circuits.

Figure 9.—Central Telegraph Office : Picture Telegraphy Section

Figure 10.—A picture telegraphed from Copenhagen

Figure 11.—Wireless cabin on board S.S. *Rangitiki*

Figure 12.—Direction finding apparatus on board S.S. *Rangitiki*

The opening of a voice-frequency telegraph system between Liverpool and Bangor in May, 1936, not only allowed a further step to be taken in the improvement of telegraphic communication between this country and Ireland but it made possible the closing of Llanfair Repeater Station and its replacement by a repeater station at Bangor. Prior to this date the circuits feeding Llanfair were routed overhead from Liverpool along the North Wales coast, and in consequence of the exposed situation were subject to interruption, particularly during the winter months.

At the same time arrangements were made to provide modern repeater apparatus more in keeping with the voice-frequency apparatus. Thus the duplex telegraph apparatus is panel-mounted on standard racks carrying complete equipment for three circuits.

The laying of a pargutta concentric-type telephone cable between Nevin and Howth in August last year has allowed of further progress in the telegraph communications between this country and Ireland to be arranged. It is anticipated that this year will see the working of circuits between London and Dublin on voice-frequency channels set up in the new cable and the eventual abandonment of the last two telegraph repeater stations at Nevin and Bangor used on the inland circuits.

ANGLO-CONTINENTAL SERVICES

Probably when the word "telegraphs" is mentioned, most people think of the inland service, but the Post Office carries on a large telegraph business with countries outside the United Kingdom, both by wire and by wireless, and also a ship and shore service between coast stations and thousands of ships. There are also the private telegraph services.

Taking the Anglo-Continental circuits first: as on the inland service, improved equipment and methods of working have been under consideration in the domain of foreign telegraphs, though their actual introduction is moving at a slower *tempo*.

Teleprinter working has now been adopted on all the Anglo-Dutch circuits except the London – Amsterdam Bourse circuit. These circuits are operated over the Anglo-Dutch telegraph cables, although voice-frequency working has been introduced between London and the Lowestoft Telegraph Repeater Station.

A 12-channel voice-frequency system is in operation between London and Paris and has allowed of this method of teleprinter working being used for a London–Geneva circuit and has improved the stability of the Anglo-French and Anglo-Italian baudot circuits.

All Anglo-Belgian baudot circuits have now been converted to teleprinter working.

The adoption of voice-frequency channels, both here and abroad, to provide the landlines serving telegraph cable conductors has thus had its influence upon the stability of international communications.

The setting up of international voice-frequency systems in telephone cables to provide telegraph channels has the effect of rendering certain telegraph cables redundant, and the recovery of the latter is in prospect.

The wireless services to the Continent provide direct communication between London and Prague, Danzig, Warsaw, Tallinn, Budapest, Rome, Riga and Bucharest. It will be noticed that the wireless services mainly serve the more distant countries. They have the advantage of not necessitating sharing of the revenue with any intermediate transit country, which is necessary when cables are used.

Several millions of telegrams are exchanged annually over the Anglo-Continental circuits and contribute a substantial part of the total telegraph revenue.

An interesting portion of the foreign telegraph work is picture telegraphy.

This service is used mainly by newspapers and press agencies for news photographs. The

Post Office picture machine works from London to centres in Austria, Denmark, Belgium, France, Germany, Holland, Italy, Czechoslovakia, Poland, Norway and Sweden. International telephone circuits are used. Several London newspapers possess machines of their own, with which they work over Post Office circuits to public or private stations abroad. The possibilities of obtaining traffic for the public service are therefore limited ; and the comparative rarity of events of special pictorial interest is also a limiting factor, but the service has been used for such purposes as the transmission of designs for lace. On Coronation Day the official machine transmitted 55 pictures—a record for one day. The tariff for this service was recently revised. There is a Green Paper, No. 17, on " Picture Telegraphy."

SHIP-SHORE SERVICES

The Post Office has 11 wireless stations around the coasts of the British Isles which are used for maintaining communication with ships at sea. The largest of these stations—operated at Burnham in Somerset through transmitters at Portishead—is equipped with both long and short waves. The long waves (2,479 metres, 2,100 metres and 2,013 metres) give communication with suitably equipped ships up to a distance of about 2,000 miles. The short waves (various waves between 17·81 metres and 47·02 metres) give practically world-wide communication. For ships which do not carry transmitting apparatus capable of working on these waves, communication in the direction *to* ship only is given through Rugby on 18,750 metres. All United Kingdom ships of 1,600 tons or over are required to be able to receive on any wavelength up to 20,000 metres. As the ships cannot reply to Rugby, telegrams are sent out by Rugby at pre-arranged times when all ships are expected to listen. There are about 4,000 British ships fitted with wireless apparatus and they contain at a given time perhaps a quarter of a million people.

The other stations—those to which the name of coast station is more particularly appropriate—have ranges normally of about 250 to 300 miles. Some of these stations have a substantial volume of traffic—for example Wick, working with trawlers in northern waters, and Land's End, which is well placed for working with ships in the Bay of Biscay. Their primary function, however, is to keep watch for the distress signal. These stations are equipped for radiotelephony in addition to radiotelegraphy. In trawlers and other small ships the use of radiotelephony is preferred, as it avoids the expense of carrying a skilled telegraphist. Except at the Humber (Cleethorpes) and Seaforth (Liverpool) stations, radiotelephony is used only for the purpose of passing telegrams between the ship and the shore station. At Humber and Seaforth apparatus is now available for linking the ship radiotelephone service with inland telephones. This service is available for passengers as well as for the ship's crew, but the type of ship concerned —trawlers, small coasters and ships voyaging in the North Sea and the Irish Sea—normally uses the service for conversations between the masters and the owners. The charge is 7*s*. for three minutes to or from any point in the United Kingdom.

An important safety feature furnished by ship-shore stations is the direction-finding service. At seven wireless stations round the coast equipment is provided to enable an operator, on receiving signals from a ship, to ascertain the direction in which the ship lies from his station. These bearings can be found with an accuracy of within two degrees.

The ship-shore service has recently given an interesting example of response of traffic to rate reduction. The standard rate in the service

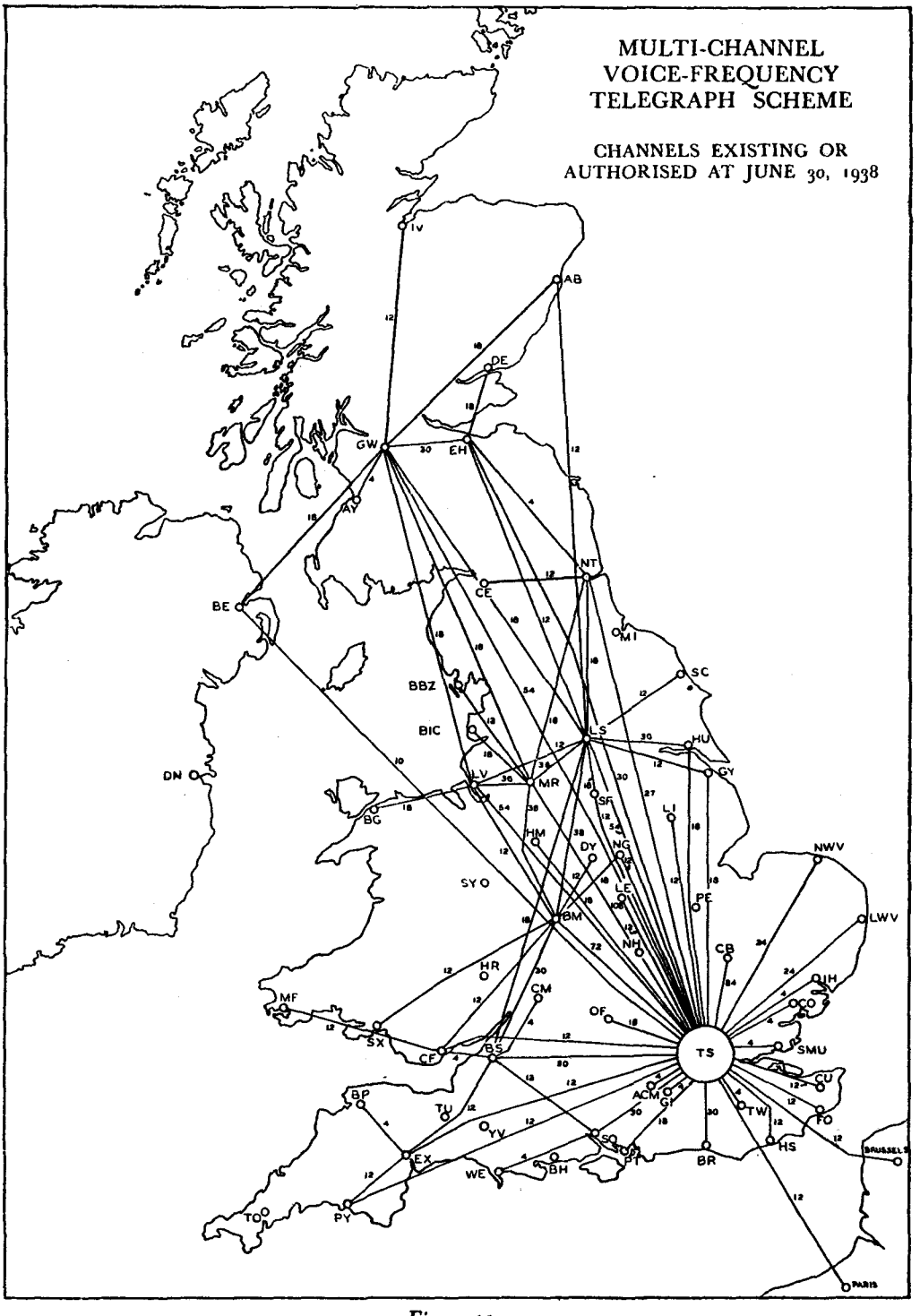

MULTI-CHANNEL
VOICE-FREQUENCY
TELEGRAPH SCHEME
CHANNELS EXISTING OR
AUTHORISED AT JUNE 30, 1938
IV
AB
DE
GW
EH
AY
NT
CE
BE
MI
SC
BBZ
BIC
LS
HU
GY
DN
LV
MR
SF
BG
LI
HM
DY
NG
NWV
SYO
LE
PE
BM
LWV
NH
CB
HR
CM
MF
OF
SX
CF
BS
TS
SMU
CU
BP
TU
ACM
GI
TW
FO
YY
SO
EX
WE
BH
BR
HS
TO
PY
BRUSSELS
PARIS

Figure 13.

had remained for many years at 11*d.* a word. During this period the range of transmission had been extended from a hundred miles or so to world-wide distances ; and reduced rates as low as 4*d.* a word had been introduced for the benefit of trawlers and short-voyage ships. Nevertheless, it was felt that the 11*d.* rate was too high ; and it was agreed between the Post Office and the ship-operating companies to reduce it to 8*d.* a word as from July 1, 1936. The response was immediate ; and within six months the traffic increased by 23 per cent. and the revenue by over 5 per cent. ; the reduction having therefore, in this short time, more than paid for itself.

Green Paper No. 12 deals with the ship-shore wireless service.

SPECIAL EVENTS

Special event arrangements are those which require the setting up of telegraph circuits at temporary offices where telegraph facilities do not normally exist, for example, race-meetings and so on.

The adoption of teleprinter working together with the introduction of voice-frequency telegraphy has enabled special event requirements to be met in a more satisfactory and efficient manner than under morse and physical line conditions.

Prior to the introduction of the teleprinter about 1928 it was necessary to install and wire specially for each event such morse telegraph circuits as were demanded by the importance of the event. Each apparatus set had to be specially wired and power supplies arranged. At the head office long-distance circuits were grouped to form a grouped or "YQ" circuit with telegraph repeaters inserted where necessary. All circuits were in those days made up of aerial or underground wires and a considerable amount of time was spent in setting up the connections. The long-distance aerial circuits were, of course, subject to interruption due to weather conditions, and the location of faults and the making good of such circuits was at times a lengthy process. The maintenance of the telegraph repeaters called for special attention.

The modern method of dealing with this type of traffic is very different. The change has been made possible by the use of the teleprinter and the replacement of all long-distance physical circuits by voice-frequency channels. A universal terminal unit fitted with keys has been designed to meet any circuit condition which may be required. The particular circuit condition required is obtained by the operation of keys. It is only necessary to connect the line and power supplies to their respective terminals and to plug a teleprinter into a socket on the unit. The assembly is such that a separate packing-case is not required, as a detachable cover is provided together with carrying handles. At the head office a combiner unit fitted on the control board replaces the telegraph repeater. The various circuits, voice-frequency or physical, forming the YQ circuit are connected to the combiner unit, thus providing the grouping of circuits.

PRIVATE TELEGRAPH SERVICES

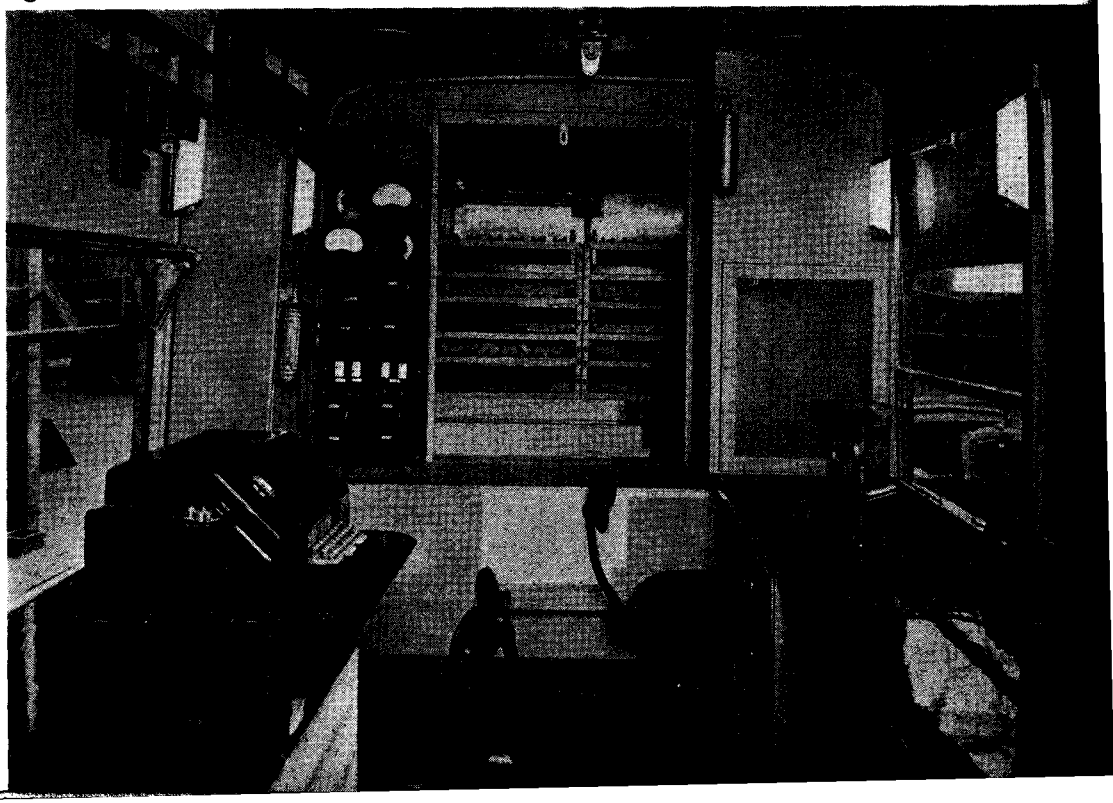
The provision of private telegraph services is probably one of the least-known sides of Post Office activity, but it is assuming quite considerable dimensions. Thus, during the last six years, the number of private simplex teleprinter circuits, known to the initiated as Tariff A, which is the cheapest and perhaps the best value for money of the private services, has increased to over 400 and is about 25 per cent. more than a year ago. These circuits were at first provided as a by-product of the main trunk routes, but more recently they have been voice-frequency circuits, and, as the number of voice-frequency schemes multiplies, it is

Figure 14.—Standard teleprinter double-table (Birmingham) showing (centre) " V " belt message-form conveyor between tables.

Figure 15.—A telegraph office at a Special Event

Figure 16.—Handing in telegrams at the Mobile Post Office

Figure 17.—Interior of Mobile Post Office showing teleprinter in left foreground



possible to establish additional Tariff A centres, of which there are now about 40, including most of the large towns. Tariff A service is not confined to premises terminating in these centres, for the voice-frequency links can often be extended by physical links, naturally at a somewhat higher rental. Private teleprinter services may vary from circuits 500 miles long to circuits between different parts of the same building, whereby orders given in one part of the building can be communicated in type to a distant part of the building with retention of a copy at the sending point. Some big business organisations have large networks of private wires. The police forces of the country make intensive use of such facilities, of which the blue kiosks so familiar in the Metropolitan Police area are an outward sign.

A Telex service is being slowly developed. Under this system, teleprinter-renting subscribers can be put through on the public trunk and junction circuits to inter-communicate by teleprinter. There has been some difficulty in obtaining fully reliable and accurate transmission over circuits taken at random, but the difficulty has been diminished by a recent change in the working frequency used, and further improvement is being effected by a process of examination and, where necessary, treatment of trunk circuits between zones and between zones and groups.

Private teleprinter service is very largely used for handing in telegrams, which are then termed printergrams. The Post Office in turn can deliver telegrams by teleprinter.

The annual revenue from private telegraph services already runs into a round half million pounds, a few individual renters paying tens of thousands of pounds; and there is still much scope for development. Indeed, some thoughtful people have expressed the view that private telegraphs may one day exceed the public telegraph service both as regards number of messages and amount of revenue.

RE-TRANSMISSION PROBLEMS

Just prior to the revision of the telegraph tariff, the telegraph service of the country was being carried on by approximately 14,000 telegraph offices, 80 per cent. of which were delivery offices; 350 were teleprinter offices, containing possibly 1,500 teleprinters, leaving about 13,500 offices served by telephone, of which probably a quarter were connected by direct telephone-telegram circuits, while the remaining 10,000 offices obtained access to other telegraph offices through the telephone exchange system.

This teleprinter-cum-telephone system provides for the expeditious treatment of telegrams at all stages, but it involves the lining-up of telegrams at transmitting centres, with adverse effects on overall transmission time and labour costs in multi-transmission. As regards telephoned messages, steps have been taken so far as possible to have them handed over to the main telegraph system at points selected with the object of reducing the number of transmissions, and, with the same object, arrangements are made to secure direct telephoning to the group centre in contiguous groups; but nothing very far-reaching is practicable in the direction of cutting down the number of transmissions by organisation methods alone.

TELEGRAPH ROUTING

It is, of course, quite impracticable to provide direct through-circuits even between all fairly large head offices, still less between all telegraph offices. For telegraph communication purposes the country is divided up into districts or zones which are sub-divided into areas and groups. Small telegraph offices known as minor offices have each a single circuit connecting them directly or indirectly with larger telegraph offices known as group centres, and group centres act as transmitting offices for the telegrams originated in or adjacent to the minor offices in their neighbourhood.

Similarly, a large office known as an area centre acts as a transmitting office for a number of neighbouring group centres and a still larger office known as the zone centre acts as transmitting office for a number of area centres. Direct circuits are provided between all the zone centres, 11 in number, with the exception of Belfast, the zone centre for Northern Ireland, which has direct communication with seven only of the zone centres of Great Britain.

Where the volume of traffic is sufficiently great direct circuits are provided between a zone centre and an area centre in another zone. For example, the C.T.O. in London is connected with all save one of the zone and area centres in the country : under this system the telegraph traffic is concentrated over well-defined routes, and it is thus possible to provide full loads of traffic for the high-speed apparatus installed on these routes. As already stated, the drawback of such a system is that so large a proportion of the traffic is subject to more than one transmission and as telegrams have to be lined up at each transmitting point they may suffer appreciable aggregate delay while multi-transmission involves line, apparatus and staff costs.

TELEPRINTER THROUGH-SWITCHING

Recent progress in dialling and switching technique on the telephone side has been turned to account to meet telegraph needs and over the last two or three years trials in teleprinter switching have been made which are definitely promising. At first the tests were more or less of a laboratory character, then dummy traffic was transmitted between distant offices and finally some 10,000 "live" messages were disposed of without any misadventure.

An experiment on a much larger scale is now under consideration.

The following details may help to give a clearer idea of the system.

The general layout has been designed so as to enable connection to be made between any two switching centres without using more than two main links in tandem. A large number of direct circuits between switching centres will, however, be necessary so that a high proportion of calls may be completed over one main link only. This has obvious advantages. The existing telegraph voice-frequency network provides a foundation for the switching routes, but the high grade of service demanded will necessitate an increase in the number of circuits.

Each operating position consists of a teleprinter and dialling set, the latter comprising a dial, a three-position key-switch ("send" "receive or clear" and "busy") and "engaged" lamps to show by a red colour that a position is engaged on an outgoing call and by a green colour that it is engaged on an incoming call. All that the operator has to do is :—

(1) refer to a visible index file in order to find the dialling number of the teleprinter office of destination ;

(2) move the key to the send position (at this stage the red lamp will glow) ;

(3) dial the appropriate number.

If the lines and terminal apparatus at the called office are disengaged and the call is routed correctly to that office, the telegraph code of the office will automatically be sent back over the line by the answer-back unit of the teleprinter at the called office and printed on the tape of the machine at the calling office.

If the code is correct, the operator will then send the message, and on completing signalling will depress the "who-are-you" key, whereupon the code of the called office will again be sent back over the line and received on the sending teleprinter. If it is received correctly, the operator will restore the key to the

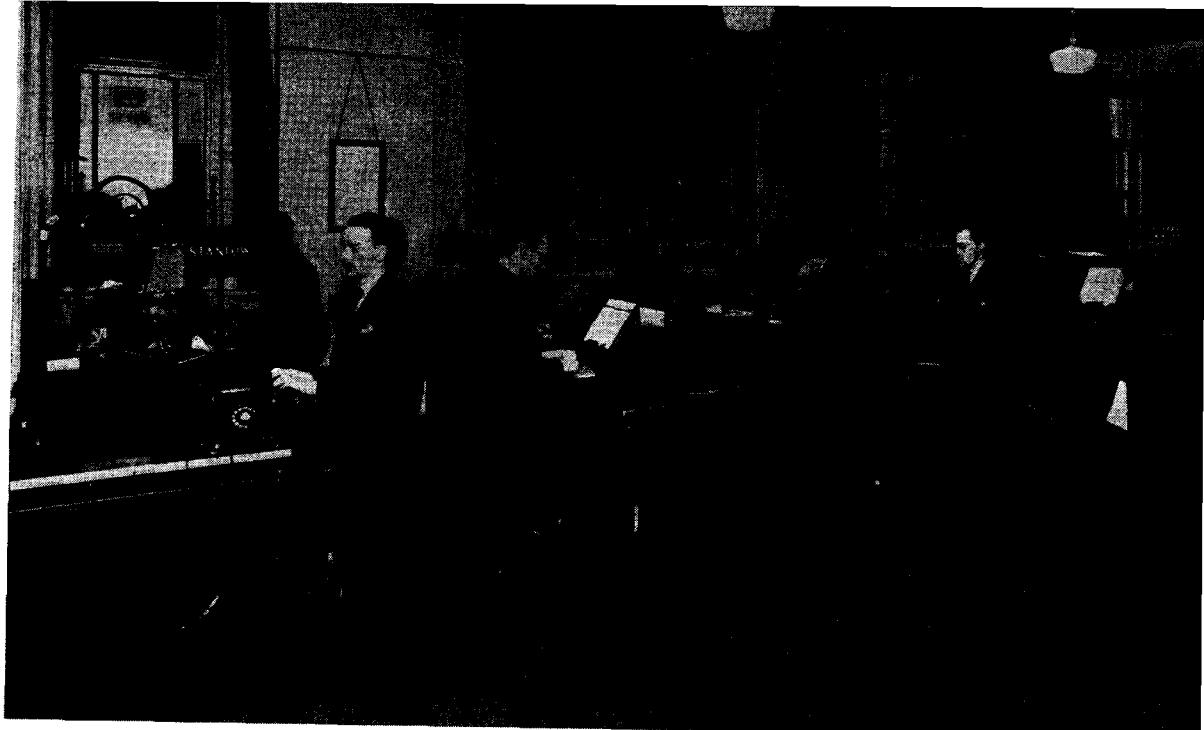


Figure 18.—Private Telegraph Services : Teleprinter installation in a commercial house

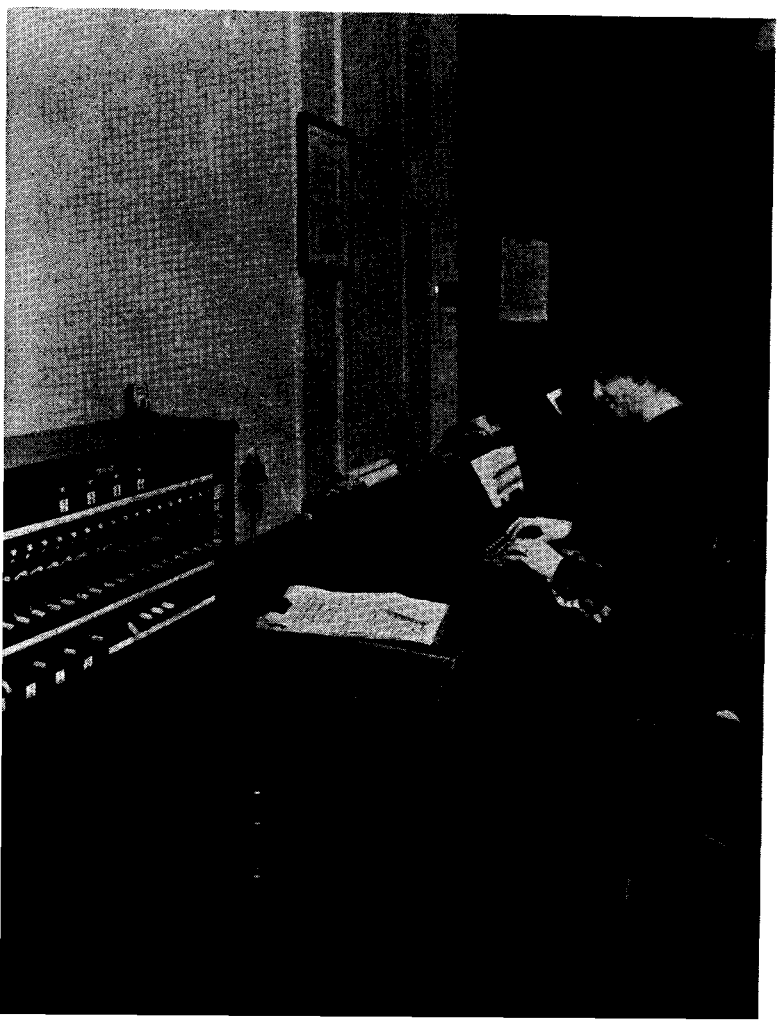


Figure 19.—Private Telegraph Services : Teleprinter broadcast installation at Ministry of Labour

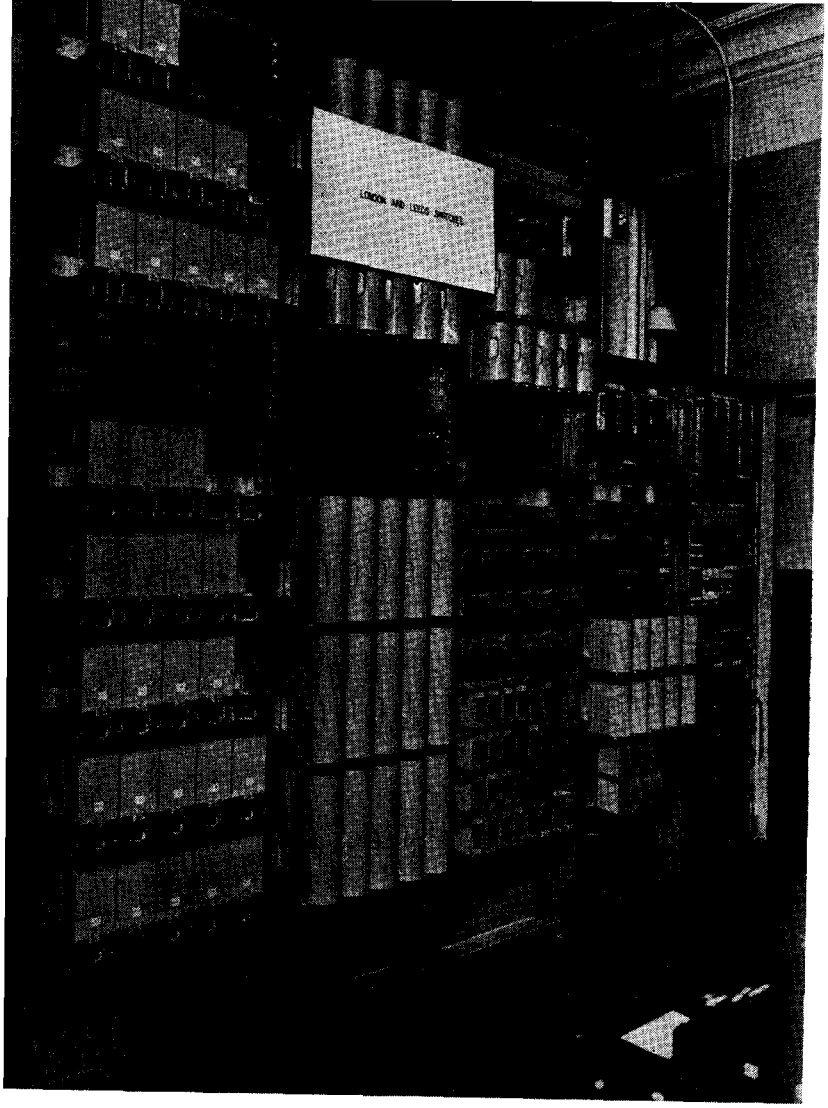


Figure 20.—Teleprinter through-switching: Switching equipment

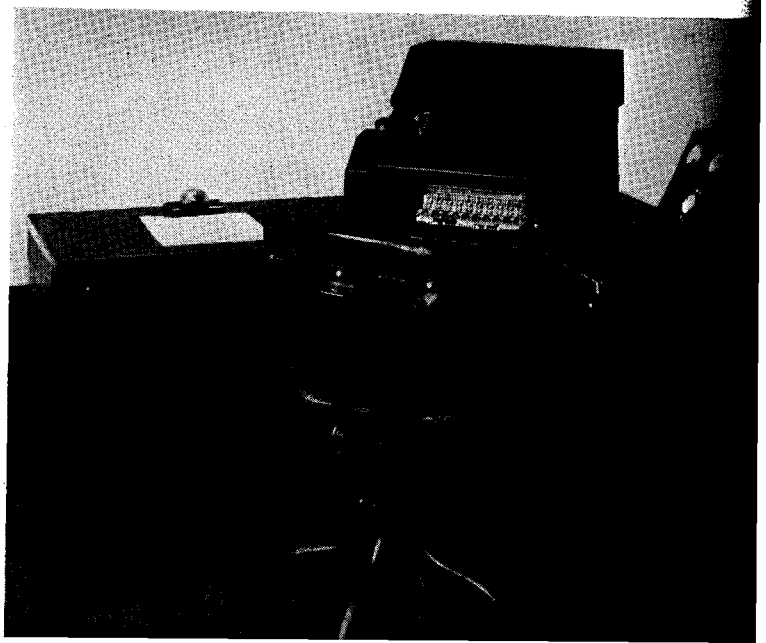


Figure 21.—Teleprinter through-switching: Proposed unit operating table

" receive or clear " position and will then be free to make or receive another call.

If all the teleprinters at the called office are engaged, the call will be held up to a maximum of 30 seconds, a signal (the erasure sign once every two seconds) being transmitted back meanwhile over the line and received on the tape of the teleprinter at the calling office. If, during this time, one of the teleprinters at the called office becomes free, the call will automatically be connected to that machine and be proceeded with as before. The provision of such a facility makes for economy in teleprinters, switching plant and lines, while the sending operator is held up to a limited extent only.

If, at the end of the 30 seconds, all the teleprinters at the called office are still engaged, the call will automatically be switched through to a teleprinter at the switching centre of the called office and the code of the switching centre automatically sent back to the calling office. The sending operator will, in this case, signal the message to the switching centre.

All messages diverted to a switching centre for offices in its area will, of course, have to be re-transmitted. It is essential, therefore, that the number of such messages should be kept at a minimum, and the basis of circuit provision aims at ensuring this.

If all the teleprinters at the switching centre are engaged—an extremely unlikely contingency—an engaged signal (the erasure sign once every half-second) will be sent over the line and received on the tape of the sending instrument. In these circumstances, the operator will clear the line and start again, after an interval, dialling the same number.

If all the circuits on any section of the normal route between the two switching centres are engaged, the engaged signal (the erasure sign once every half-second) will be received on the tape of the sending teleprinter at the calling office. The sending operator will then dial an alternative number which will route the call differently.

Incoming calls can be received automatically by a teleprinter without the intervention of an operator. When a teleprinter is seized by an incoming call the green " position engaged " lamp will glow and the code of the office will automatically be sent over the line by the answer-back unit and all signals transmitted from the calling office will be recorded automatically on the tape. When the " who-are-you " key of the calling teleprinter is depressed, the code of the called office will again be transmitted, and when the position key at the calling office is restored to the " receive or clear " position, then the receiving teleprinter will be set free to receive another call. Throughout the whole process no attention is required at the receiving office, the checking of the message and gumming up can be done subsequently, as convenient. If, however, an operator at the receiving office is able to attend to the call before it is completed, some advantage will be gained in that any inquiry which may be necessary can be made immediately without making a special call to the calling office.

All the teleprinters at an office will not necessarily be staffed. For example, with a battery of ten teleprinters, the last two or three " choice " machines might be staffed continuously and reserved for outgoing traffic, and some of the operators might attend to any of the teleprinters as the incidence of the received traffic demands.

The possibility of avoiding the loss of messages by paper failure is recognised as being of prime importance. Modifications to the paper guides were made as the experiments proceeded, and the likelihood of failure due to this cause appears to have been eliminated. Experiments are, however, being made with an alarm system which will indicate immediately to the sending operator any paper

failure on a receiving teleprinter even though this might not be staffed by an operator.

Special tests have already been made in order to ascertain whether the system would stand the strain of an unforeseen rush of traffic at a small office. With this object, two teleprinters at a small office were connected with the switching equipment and three series of tests were made. During each of the series these two teleprinters were subjected to six times the normal busy-hour traffic at that office, an increase far greater than is likely to be obtained in actual practice. This load was 164 per cent. above the maximum busy hour load for which two teleprinters would normally be provided. The results showed that the average transit time (from time of handing in to time of receipt) per message, was not more than 2·7 minutes in any of the series. The maximum delay on any one message was ten minutes, and that was on a message which had necessitated an inquiry.

The tests as a whole proved that a switching system will work, and that the danger of losing messages is practically negligible. It seems clear also that a considerable increase of traffic at any one office can be dealt with satisfactorily without any great deterioration of service. Manifestly a high standard of maintenance will be necessary, but the equipment used has all been thoroughly tested in practice either on the telegraph or telephone side and the attainment of this standard should not present difficulty.

In the nature of things it is not possible at the present stage to test whether the system could deal with an abnormal general increase of traffic, but if for some reason traffic should suddenly increase throughout the country to an altogether abnormal extent, the introduction of point-to-point working between switching centres would probably reduce congestion at terminal offices.

The economics of through-switching cannot be closely estimated, as they depend on factors whose weight cannot accurately be forecast at this stage. But it can be said that the estimates put the saving so high that very large abatements can be made while still leaving a substantial surplus. The essential justification for a through-switching scheme rests upon the improvement in the quality of service rendered to the public by the curtailment of transmission time.

DELIVERY

There have been few big changes in delivery these last few years, but delivery is highly important from the standpoints of both service and cost efficiency. The aggregate number of telegraph messengers is about the same as the number of the operating staff, and the cost of delivering telegrams is about half a million pounds per annum. We may devise and use the most wonderful apparatus and equipment for the speedy transmission of messages, yet all the benefit may be lost by bad management or bad work at the delivery stage. In the nature of the case we cannot hope to make such economical arrangements for delivering telegrams as are possible for letters or newspapers. We have, however, at the busy delivery offices a batch system under which boys are sent out at intervals of five minutes, say, to deliver messages within small sections of the delivery area. By careful choice of sections by staff familiar with the details of local topography and by careful timing of the boys a good quality of service can be rendered, which, however, can easily slip downhill if supervision is slack. Pedal cycles are used away from the centre of cities wherever road traffic conditions permit, and motor cycles where a case can be made out for them. Unfortunately motor-cycle delivery is somewhat expensive, and in many places there is difficulty in ensuring a continuous supply of messengers old enough and suitable in other ways for motor-cycle delivery. This has led in some cases to enlarge-

Figure 22.—Boy messenger accepting telegrams at a railway station

Figure 23.—A Greetings telegram form

POST·OFFICE
Greetings Telegram

OFFICE OF ORIGIN		SERIAL NUMBER
OFFICE OF RECEIPT		DATE

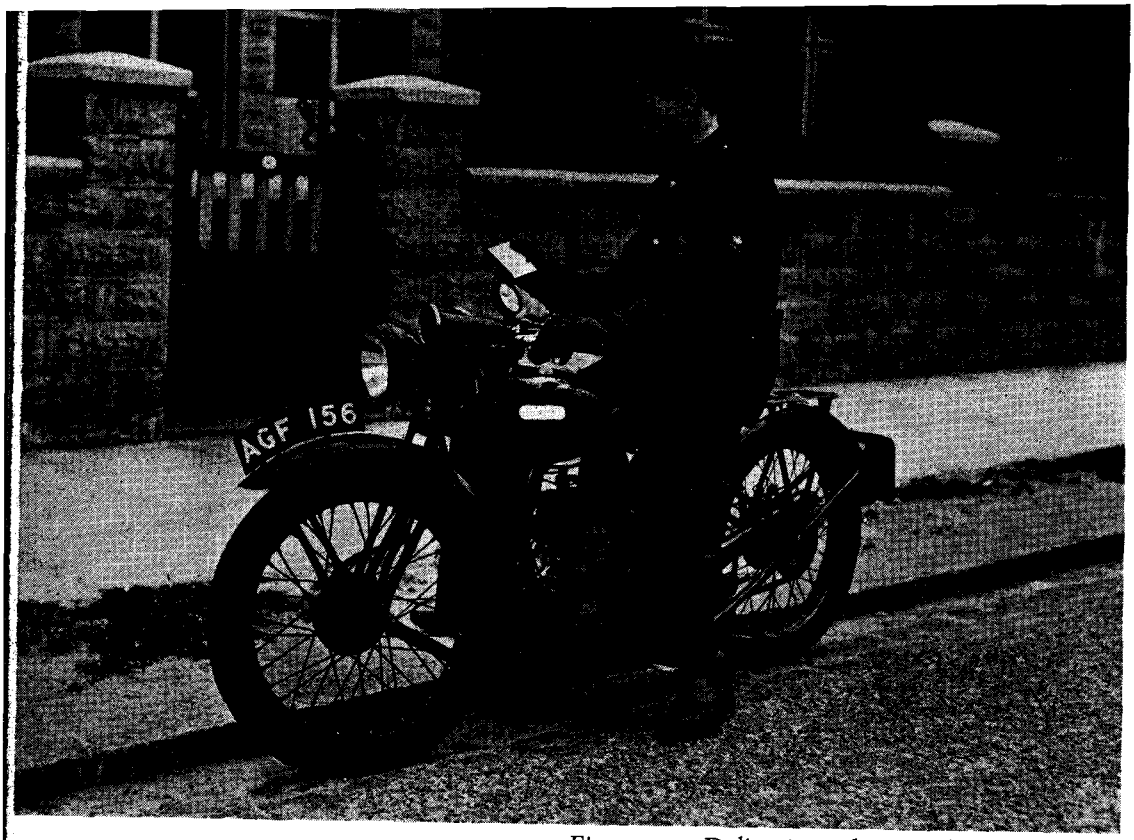
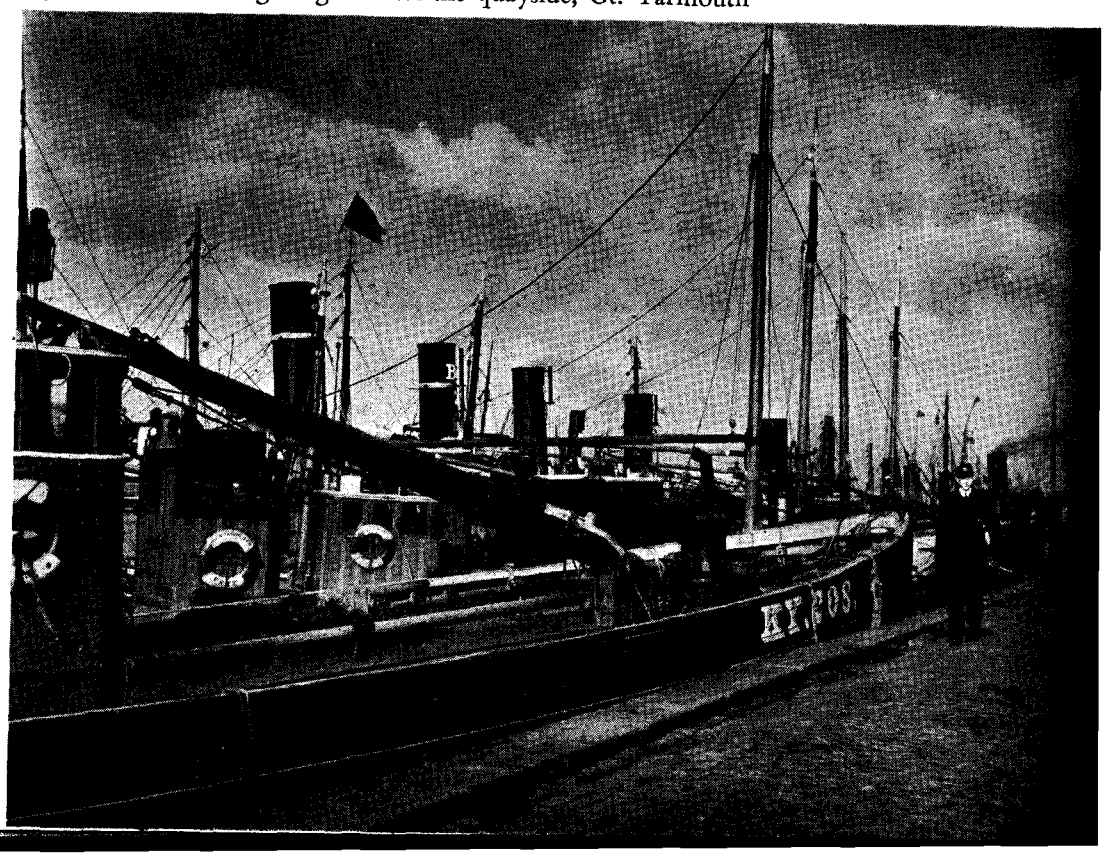


Figure 24.—Delivering telegrams by motor-cycle

Figure 25.—Delivering telegrams on the quayside, Gt. Yarmouth



ment of delivery areas in order to get a better unit for delivery staffing purposes.

Telephone delivery of messages has many attractions, some real and some illusory. For subscribers with good domestic or business staff the writing down of a message is fairly straightforward, but phonetic confusion or misunderstanding is always possible and the texts of some messages are better kept away from third parties. The phonogram staff often find considerable difficulty in getting a message accepted or accepted promptly, and a good deal of time is accordingly wasted on ineffective calls. The whole subject of telephone delivery is complex; and it needs and is receiving further examination.

FUTURE OF THE TELEGRAPH SERVICE

What is the future of the telegraph service, particularly as regards level of traffic? A few years ago the persistent and serious decline of traffic led to a somewhat pessimistic view being generally held. The telephone was clearly eating into the traffic, especially the short-distance messages, and the process seemed likely to acquire an accelerated pace. Experience abroad was very similar. Indeed, if anything, the decline of telegraph traffic in other countries has been even more serious than in Great Britain.

The recent big jump in traffic has given backing and encouragement to those who think that there is still a large sphere of usefulness for the telegraph service. The optimists in this matter do not deny that telephone competition will continue to take away a considerable part of the traffic now sent by telegraph, but they are hopeful of finding new and enlarged spheres of telegraph demand. There are many types of communication for which the telegraph is actually a more convenient method of communication than the telephone call. The telegraph service is sometimes spoken of as a residual service, the implication being that it only gets traffic which senders cannot very well send by telephone. I do not endorse this point of view myself. It is too narrow and too negative I doubt very much whether telegram senders always weigh up the pros and cons. I think it would be just as reasonable to say that nobody ever walks if buses or taxis are available. The point I wish to make is that telegraphs meet a need as real in itself as do newspapers, the postal service, the railway train or the steamship. It is an exaggeration to say or imply that all the older means of communication and transport are inferior alternatives only adopted reluctantly after resort to more recently-developed alternatives has been explored in vain. The question is not merely academic, for the point of view in such a matter must largely govern the psychology and policy of staff and administration. If one feels, as I do, that telegraphs have a special field of their own, it is natural to go out in a hopeful spirit to seek and develop the telegraph field which the telegraphs can hold on their merits.

When one is out to develop the demand for a service it is clearly essential to know as much as possible about the character of existing demand. It is not, however, at all a simple matter to answer satisfactorily the question, what are the reasons which determine the choice by the customer between the telegraph and telephone services for any given message?

We have devoted considerable attention to this question during the last three or four years. A market research investigation was conducted by the Public Relations Department during which a number of large users was interviewed in the endeavour to ascertain in what circumstances they normally send telegrams and the principle on which they decide to use the telephone rather than the telegraph and *vice versâ*. The results of this inquiry were not very conclusive. It produced, of course, a considerable number of opinions, but there was a

good deal of contradictory variety in those opinions.

Again, we analysed the whole of the telegrams sent during a week in October, 1934, a date prior to the re-introduction of the sixpenny telegram. Of the 605,000 telegrams examined roughly two-thirds were business and one-third social messages. Of the business messages the largest single category was "fish" telegrams, which amounted to nearly 9 per cent. of all the telegrams sent. The fish, meat, and fruit trades accounted for about 12 per cent. of the total telegraph traffic, and it is clear that the telegram plays a great part in the buying and selling of perishable goods. On the social side the usefulness of the telegram in making and breaking appointments is manifest. Less than 2 per cent. of telegrams conveyed bad news, whilst almost 4 per cent. of them carried congratulations; and congratulatory telegrams are longer than other messages.

When it comes to the distance distribution of telegrams we find that the average telegram "travels" about 150 miles—the telegraph service is primarily a long-distance service in contrast with the present telephone service. We find that social telegrams do not travel so far as business messages; thus, of all telegrams which travel less than 50 miles, we find that about 70 per cent. of them come into the social category, while of the telegrams travelling from 125 to 200 miles only about 30 per cent. come into this category. Conversely, whereas of all financial and shipping messages only 7 per cent. are sent 50 miles and under, 44·5 per cent. of the appointments telegrams and 44 per cent. of the congratulatory telegrams are sent distances of 50 miles and under.

Nearly three-quarters of all telegrams are sent by telephone subscribers or by people who have easy access to a telephone other than a public call office. Only half of social telegrams are sent by telephone subscribers, as against between 80 per cent. and 90 per cent. of business telegrams. In other words, it is in the social sphere and in the short-distance zone that the telegraph service has felt most the effect of telephone competition. Telegraphs thus deal largely with the longer-distance business messages and social traffic.

Many more details than I have had time to set out are contained in Green Paper No. 14.

In October 1935 we conducted a further census; this time, of course, upon the post-tariff-revision traffic. We found remarkably few changes as regards the distribution of traffic under the various headings. There was a slight fall in the proportion of business to social messages, a marked reduction in the bad news messages and an increase in congratulations. The most marked change was in the reduction of the average length.

A feature of post-tariff-revision traffic is the increase of Friday and Saturday traffic. Indeed, at many offices Saturday is the busiest day of the week in spite of the fact that the effective day is shorter, and this concentration of traffic constitutes a serious problem at many offices, even more on the delivery than on the operating side.

I think the telegraph census returns and other information referred to above show that for many business or social communications the telegram will continue to be very largely supported by the public. I do not think that the present large fish traffic, Stock Exchange traffic, the innumerable inquiries as to delivery of goods already ordered, messages seeking quotations, and so on, will all or even largely go over to the telephone side. Of course some business of this kind is already done by telephone and further transfers may take place, but it does not really suit fish merchants to have to line up scores of telephone calls during their short period of pressure, nor do their clients feel ready to give an order until they have obtained competitive offers. Congratulations

by telephone in connection with weddings and other social events would be impracticable, and intolerable if practicable. Picture the plight of the potential recipient of a score of more or less simultaneous telephone calls of congratulation. As regards many messages, it is most important to have a written record. The telegram clearly scores here. Again, short messages, such as those announcing time of return after a journey, are clearly much more conveniently sent by telegram. It would be easy to prolong the list, but I think careful consideration of the circumstances in which people send telegrams now convinces one that, granted a cheap and fast telegraph service, the telegram will hold its own at a high level.

GREETINGS TELEGRAMS

As regards possibilities of developing new traffic, the most hopeful example we have had hitherto is the greetings telegram, and I confess that I can see no limit to possible development of such traffic if only the public can be educated to become greetings-telegram-minded. Birthday anniversaries, engagements, weddings, and births are obvious occasions for greetings telegrams, but almost any happy occasion, for example a public or institutional dinner, a scholastic success, sporting event or success can equally furnish a legitimate occasion for a telegram of good wishes. Such telegrams are in no sense an annoyance, they undoubtedly add to the gaiety, cordiality and good feeling of the occasion. If cricket and football fans sent messages of encouragement to their side before the match we might on occasions even get too much traffic, but there is no need to worry about that yet. On the Continent confirmations give rise to a large greetings traffic. In Sweden, I understand that a full half of all telegrams consist of greetings messages. When one recalls that the population of this country is 45 millions, every one of whom has a birthday every year and nearly all of whom have *some* friends and relatives, the potential demand for greetings telegrams could clearly reach tens of millions per annum if the greetings habit really caught on. Already it is quite common to have 40 or 50 greetings telegrams at a single wedding. Over a third of a million greetings telegrams were sent in the fortnight including Christmas Day, 1937, and New Year's Day, 1938, and the number sent on St. Valentine's Day, 1938, far exceeded those on the two previous anniversaries. Greetings telegrams can take many forms. In some countries the message is mounted on a very elaborate card or parchment for which a somewhat high price is paid. Some countries offer a service of standard messages at a reduced rate. The Post Office has so far adopted a middle course as regards price and decorative treatment, and we frequently change the design, but we have the opportunity of experimenting if we so desire. I have dwelt at some length on greetings telegrams because I believe they have a big future before them, and because we have already achieved sufficient success in this field to make our speculations as to future possibilities more than mere talk in the air.

The Public Relations Department has done a great deal recently to make the public telegraph-conscious. Millions of leaflets have been distributed at post office counters, with telephone accounts and in other ways. A good deal of paid advertising has been put out. Postmasters and other officers of the Department in contact with the public have kept telegraphs in the forefront ; and the special services sales representatives have specially canvassed large users. Telegraph exhibits and literature have been prominently displayed at exhibitions and our Ministers have made important references to telegraphs in their speeches. Of course, the biggest tonic to telegraph demand has been the re-introduction of a sixpenny tariff. If through-switching is a success, possibly the improvement in the

quality of service will have a comparable stimulating effect.

I have tried to make it clear that the telegraph system is not a surviving antique dealing with a small traffic, most of which could just as well be telephoned, if only the senders could bring themselves to become up to date. I have indicated that, on the contrary, telegraph traffic is large and capable of much expansion, and that the telegraph is a basic fundamental service which meets the requirements of a vast number of telecommunications of various types and categories better than any other service. The telegraph service is cheap, efficient and convenient for the user ; while as regards equipment, methods and organisation it has shown itself adaptable and modern in a high degree, and this process is being pressed still further as in the through-switching experiments. In short, the telegraph is a fully up-to-date, vigorous, live service of high value to the public.

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by William Clowes & Sons, Ltd., London and Beccles.

(484) Wt. 11153—P3092. 19M. 7/38. W. C. & S., Ltd. Gp. 389.