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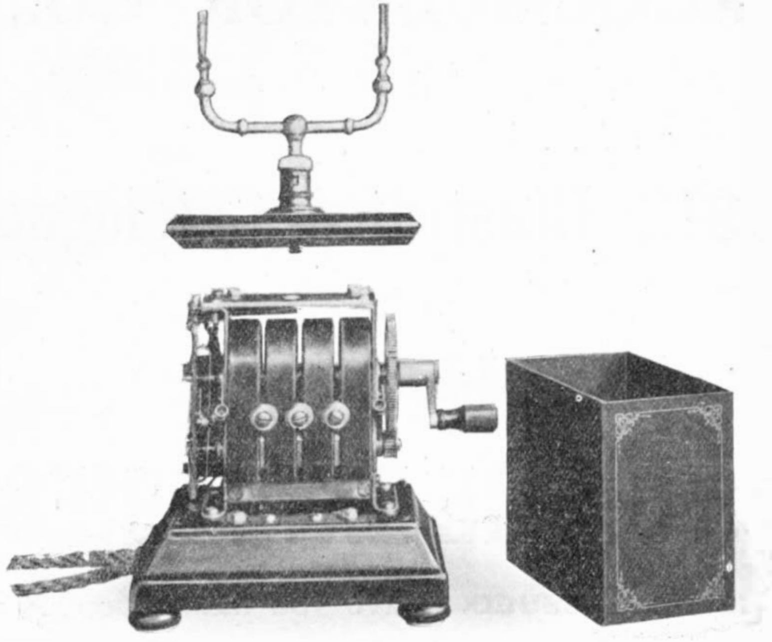

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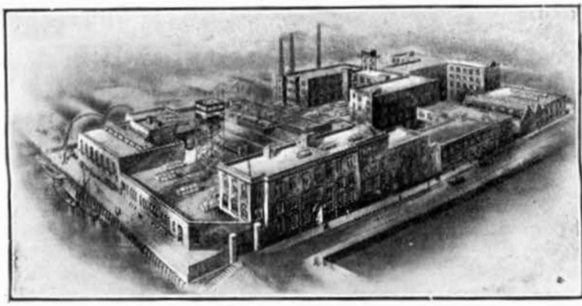

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Diversion Work at Kew Bridge. South Side. Showing Pipes before Removal. Part of Old Footpath in Foreground. Hooks on Hoarding are to Suspend Tramway Cables.

THE
Post Office Electrical Engineers' Journal

THE DIVERSION OF UNDERGROUND PLANT.

By J. E. GIBBONS,
Construction Engineer, Metropolitan South District.

THE never-ending alterations to thoroughfares in the Metropolitan Districts consequent upon street improvements, reconstruction of bridges, laying down tramway tracks, etc., impose upon the Post Office a considerable amount of work in moving and adapting existing plant to suit the new circumstances.

The number of these operations has been magnified by the vast increase in underground routes since 1900, when the telephoning of London was put in hand. So much is this the case that, it may be said, the diversions of pipes and cables has for some years been a continuous feature in the duties of some engineers, and is likely to remain so.

Unfortunately a request for a description of some diversion work at Kew came too late to permit of our obtaining photos of the active operations, yet by the courtesy of the Brentford Gas Co.'s Engineers, sufficient views, it is thought, have been procured to make matters clear.

The methods of dealing with alterations of this nature are many and varied, depending entirely upon the circumstances, and careful consideration by the engineer in charge of the work is very necessary before starting it. He should obtain all the drawings he can, ascertain how many cables exist and their description, together with the number of wires working and spare.

Primarily two aspects present themselves : firstly, where pipes and cables must be taken bodily away, and secondly, where the pipes and cables may be pushed over from one position to another. The former case may be further subdivided into (*a*) where the working wires can be temporarily diverted to another route between any two convenient points, and (*b*) where what are termed interruption cables are brought into use. These are generally flexible cables hung on tramway standards, on scaffold poles placed in barrels filled with earth, on the fronts of houses and shops, on trees, on fences, laid in the gutter, or on railway embankments, whichever is best, safest, and most convenient. Occasionally 14/20 (seven-pair) lead covered cables

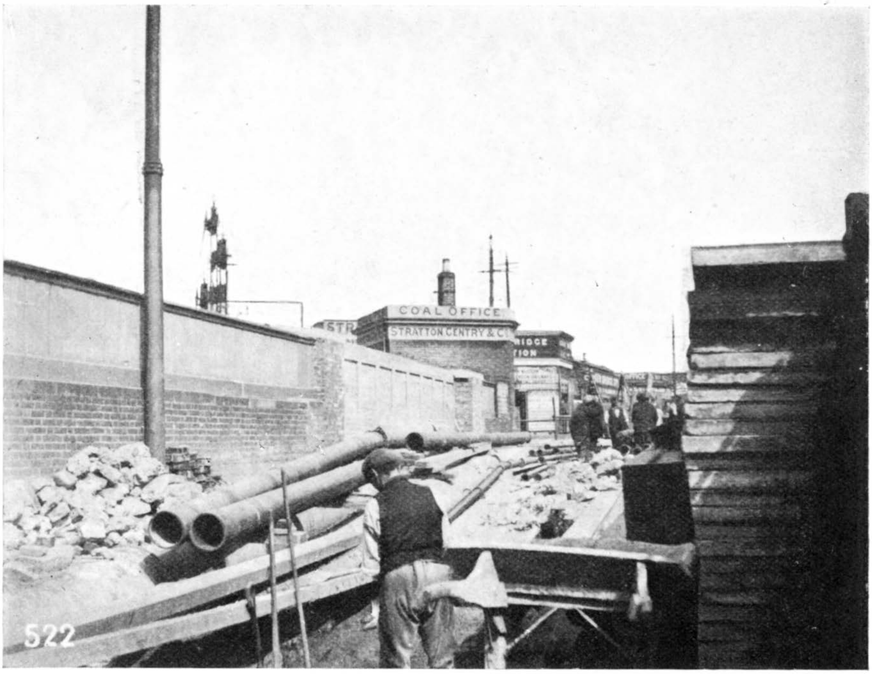
I.—North Side. New Pipe may be Discerned at the Foot of the Wall in Left Foreground. The Second is Underneath it. Remainder may be seen in Distance.

have been suspended, but generally one or more are drawn into other pipes to bring up the number of spares available for the diversion.

As regards the second method, in which the pipes and cables are pushed over bodily, the determining factors are the types of cables and possible elongation of the pipe line.

With 14/20 and similar small cables the matter is of little moment ; not only are such cables readily obtained but there is generally some slack to play with. But where a main cable is affected, and the prospect of a new length having to be specially manufactured owing to elongation of the section is involved, a serious question presents itself. The main work may be held up for months; moreover it is highly desirable that the temporary interference with working wires shall be of minimum duration. No effort should therefore be spared to utilise the existing cable.

The case recently dealt with, brought about by the reconstruction and widening of two adjacent railway bridges at Kew, is noteworthy in so much as the three methods mentioned were brought into play. As will be seen from the photos, a very complicated state of affairs existed and does exist.

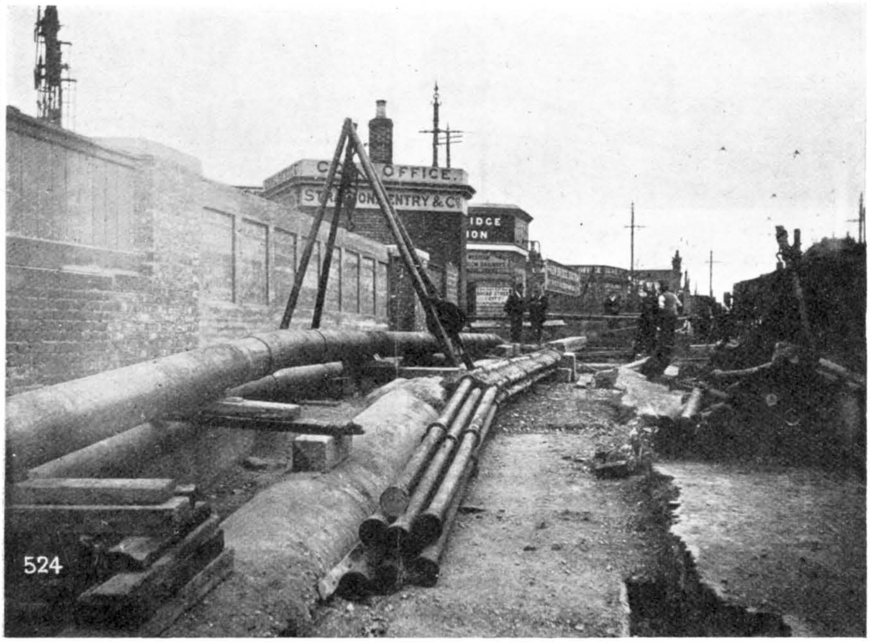


2.—North Side. Shows the Seven New Pipes in the Background in Process of Laying.

The northern foot-way was first dealt with, and it was speedily realised that the reconstruction could not be effected until the whole of the pipes and mains were removed entirely. The department had two pipes on this side, an empty $3\frac{1}{4}$ in. against the parapet, designed to carry a main cable, and an old 3 in. pipe near the kerb, carrying 4 seven-pairs, one of which turned off down the road (Lionel Road), which divides the two bridges, to serve a few local subscribers.

As regards the $3\frac{1}{4}$-in. empty pipe the removal was, of course, a simple affair. Such of the working wires in the other pipe as were "through" were diverted to the pipes on the south side, while a seven-pair from the nearest box was suspended on the tramway

3.—North Side. Interruption Cable was Suspended from Top of Coal Office to Farther Tramway Standard.

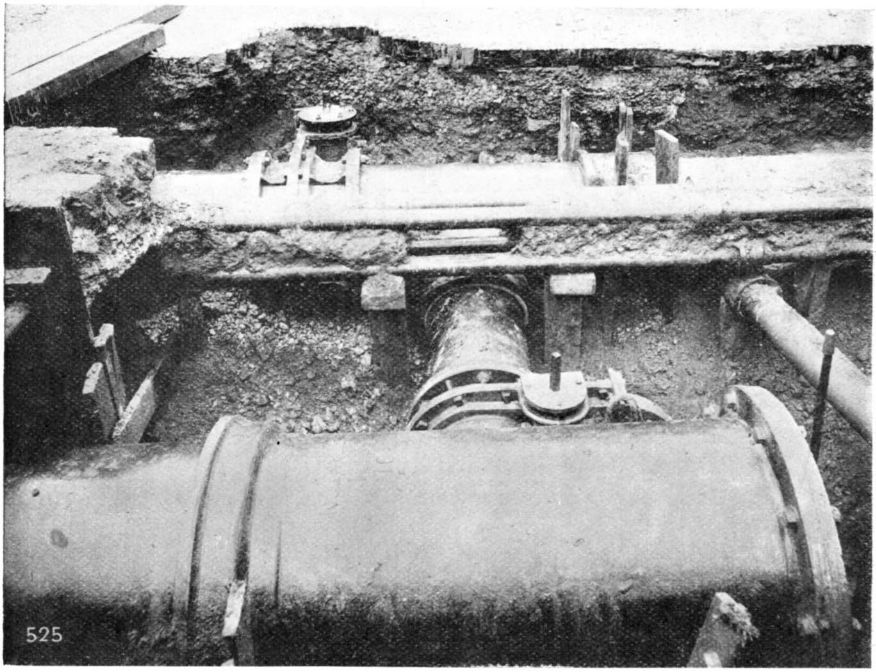


4.—North Side. A Nearer View of the Nest of Seven Pipes.

poles, and accounted for the locals in Lionel Road. The old cables were then withdrawn and the pipe recovered.

It is a good rule, when operating in a congested thoroughfare, especially when every inch of ground is eagerly sought after, to take advantage of the opportunity to lay additional pipes, and in this case authority was obtained to bring the number up to nine.

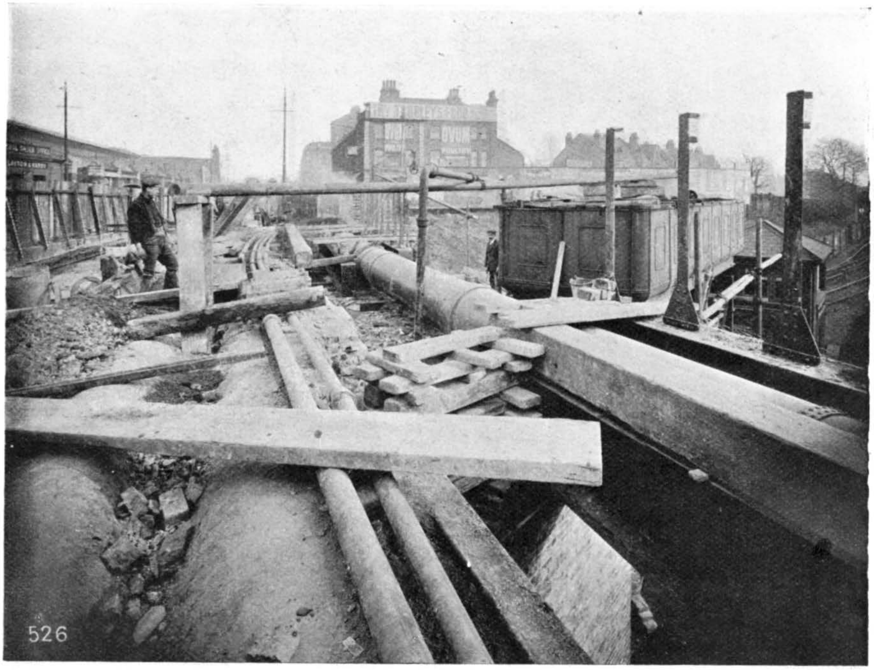
The gas and water mains having been replaced, operations were resumed. The original two pipes had to be relaid against the parapet because a huge bend on a water-main interposed between



5.—South Side. Shows Department's Pipes and Part of Gas Company's New Plant. The Pipes were Lifted over the Near Main.

the pipe line and a junction-box which it was necessary to reach. The remaining seven pipes were laid under, or near, the kerb, and may be seen in the photographs. New manholes were built at both ends of the combined bridges, and the nine pipes were led into them. No more pipes or mains can be laid across these bridges.

It will thus be seen that the operations on the north side were comparatively easy. The south side called for more attention, as will appear later. The bridge was widened on this side to admit of a new footpath being formed, and the old one was converted to roadway. Here the Department had three pipes, one carrying a main trunk cable made up of $\frac{32}{200}QP + \frac{10}{200}T + \frac{32}{200}QP + \frac{16}{100}T =$ 90 wires, the second a subscribers' main cable of 800/10 wires, while the third contained sixteen 14/20 cables = 224 wires. At first everything looked rosy. The pipes were hard against the parapet of the old bridge, and, on the principle of leaving undone those things we need not do, it was calculated that the pipes, if undisturbed, or if slightly lowered, would lie against the new kerb, and consequently removal would not be necessary. A consultation on the ground with the



6.—South Side. Shows Pipes before Removal. Intermediate Box Near Vertical Water Pipe.

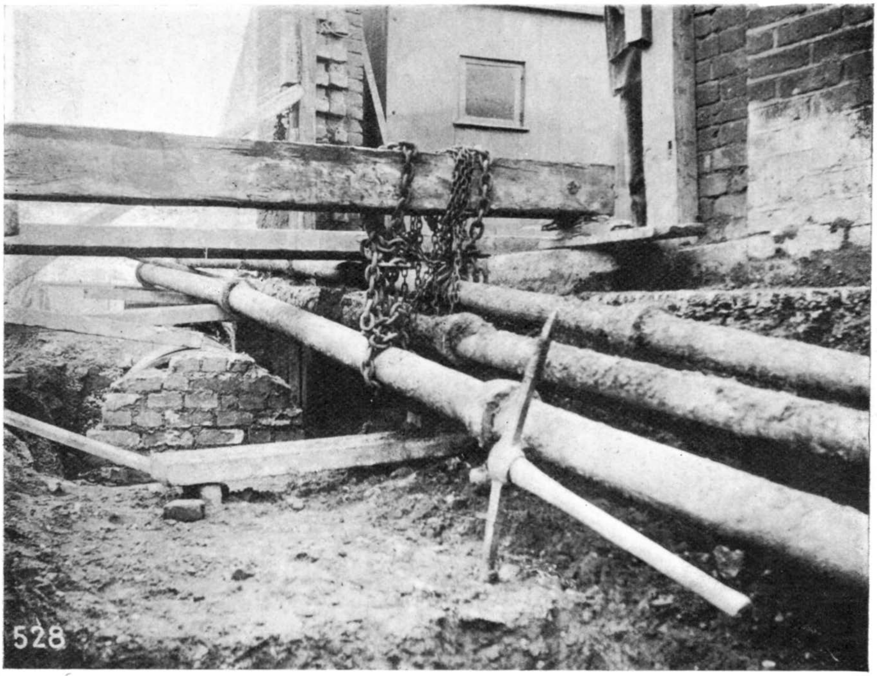
engineers of the various authorities affected led to this idea being adopted.

Then the trouble began. The Gas Company had made a series of expensive castings to connect their old plant to the new. It was found that one piece could not be put in so long as the Department's pipes remained in their old position. Arrangements were being made to slightly raise the Department's pipes and let the Company's main pass underneath, and a satisfactory solution had just been reached, when it was announced that the Railway Company were about to construct a " draw in "* across the footpath, at this very

* A crossing in the line of the footway to enable carts to be drawn in across the pathway.

spot. This meant that by substituting 5-in. sets on 6-in. concrete, for 3-in. York, the precious headroom above the main disappeared.

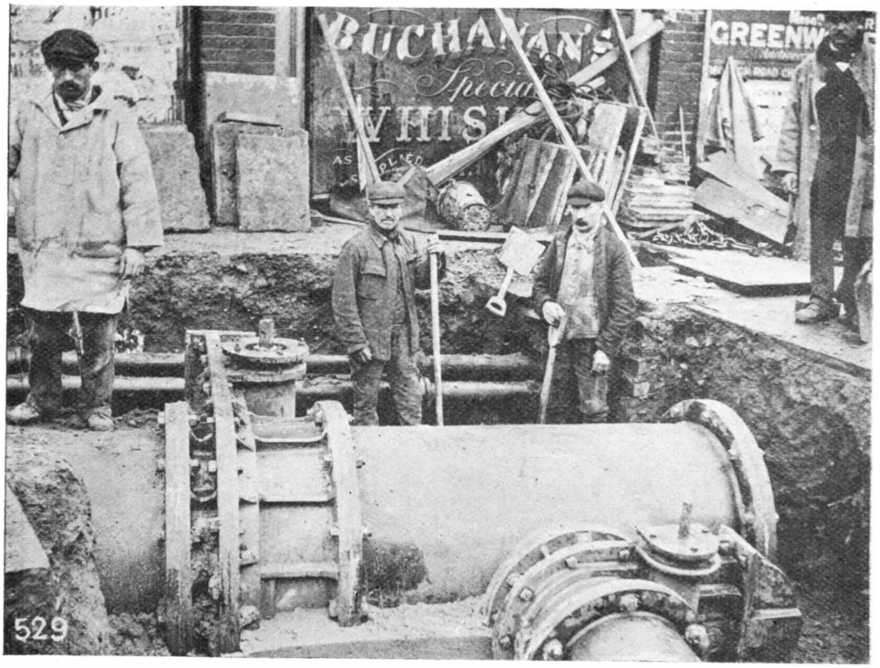
Finally, a local movement created a further difficulty. The old footpath was of abnormal height to provide cover for the large gas and water mains. It was guarded on the kerb by railings to protect the public from inadvertently stepping into the deep roadway. Now these railings were largely made use of by the leisured classes of Brentford and neighbourhood to lean against and discuss things, and they had become an eyesorrow to those of the citizens



7.—South Side. Pipes before Removal.

who had to contribute to the upkeep of the railings. Influence was brought to bear on the authorities, and although the railings had been replaced on the north side, they were torn up again and those on the south side abandoned. The substitution of steel tubes without sockets made the lowering of the footpath possible, but it did away with the chances of letting the pipes remain, especially as the new kerb was to be stepped. There was nothing for it but to move them to a new site. The vicinity of the new parapet presented the best ground and was adopted.

It will be evident that in works of this kind, where there are so many interests concerned, there is a risk of friction between the men of one contractor and those of another, and with the best intentions in the world it sometimes happens that one impedes another and causes disagreements. Moreover, the work is of a spasmodic character ; first one firm, then another, has to take the field, so that the transport of men from a distance to carry out what may be work of an hour's duration is expensive and wasteful. A system which has largely obtained in this District, and works well, is to obtain prices on a time and material basis from the contractor who is doing the main work. He, having the labour constantly on the ground



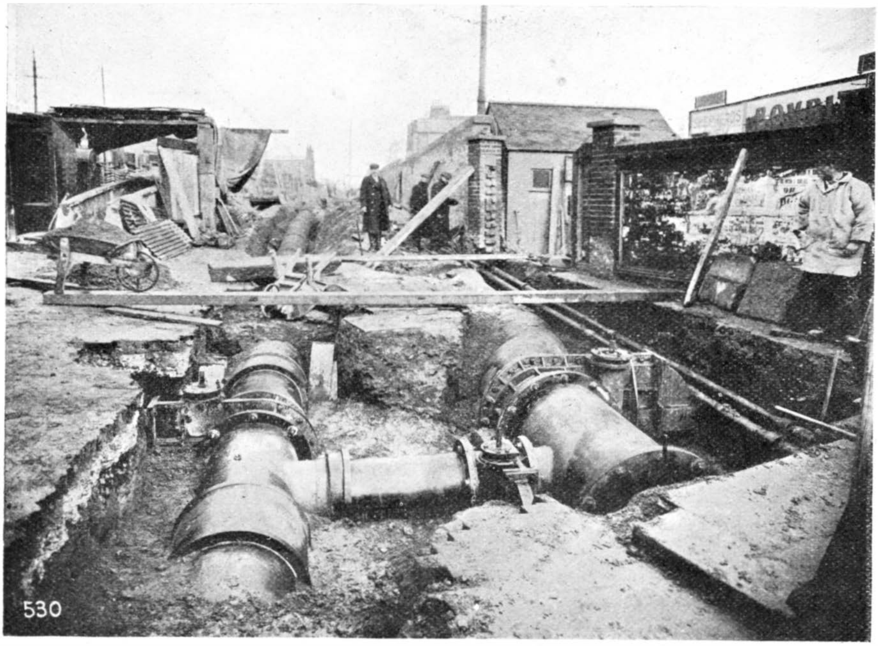
8.—South Side. Pipes after Removal, Same Site. The Man with the Spade has his Back to the Department's Manhole.

as well as materials, can generally carry out work at a moment's notice by detaching men from, say, bridge work to pipe work, and *vice-versâ*.

Such an arrangement was come to in this instance, and a start was made.

The pipes were laid bare all the way, and a measuring tape passed along them. The ground to be occupied was next measured and disclosed a gain of about 2 ft. No elongation here.

A joint box situated about midway in the section contained a joint which had a history. When the main trunk cable was being drawn in, in 1905, the men who were paying-in at the manhole allowed the cable to jam against the edge of the pipe and it was not until the sheath had been torn and buckled up that they called attention to the mischief. About two thirds of the cable length had then been drawn in. By a little irony of fortune it was the last section of an urgently wanted cable. There was the prospect of two or three months' delay if a new length was to be made, so it was decided to attempt to make the cable serve if possible. The torn portion was cut out and the ends sealed; the drawing-in was proceeded with while the balance remained on the drum. Sweep's rods were next pushed into the pipe until the sealed end was encountered. The rods



9.—South Side. Pipes after Removal. The "Draw-In" was Constructed where the Gateway is Seen.

were withdrawn and measured. The box in question was then cut in at the spot indicated by the rods and the balance of cable drawn in.

Now the Department's practice in ordering main cables is to allow two yards extra on each length for waste and joints.

This surplus had been sadly diminished by the accident, and consequently the new intermediate joint had to have all the wires jointed in one place instead of distributed as in a standard joint. A short stumpy arrangement resulted. So long as it was undisturbed it acted efficiently, but it was considered it would not be safe to put the slightest strain upon it in connection with the diversion now being described.

10.—South Side. Shows Pipes after Removal with Bends Cut Out. The Mixing Board Covers Approximately the Original Site.

11.—South Side. Shows New Intermediate Box. Frame of Old Box can be Seen on Old Site. Tramway Interruption Cables in Background.

A flexible joint was therefore determined upon.

Sufficient 14/20 cables of suitable lengths were procured to take up the full number of wires in the trunk cable; the joint was then opened, and, the 14/20 having been slung over the plank supporting the upright water-pipe shown in 6, the wires were teed on in the usual manner. The completed joint was carefully rubbered and was then ready.

The next point for consideration was at the western end of the bridge where the "draw-in" previously mentioned was subsequently constructed. Here were three bends, one on each pipe. It was

12.—South Side. Shows Pipes being Concreted in.

necessary these should be cut away, because the new route was a straight one, and as this was the tightest corner in the whole affair it was decided to substitute a double junction box for them, to give greater facilities for handling the pipes, and because a sudden dip made couplings unmanageable. The whole run of the pipes having been cleared, as was said, and the vertical water-pipe temporarily removed, together with a tramway standard, the brickwork of the manholes was loosened and all was in readiness. Planks were placed across at close intervals between the old position and the new, and men with crowbars worked the pipes along, while other men, with rope slings, raised them to facilitate the movement. At each manhole and opening, wherever the cables were exposed, a skilled man was stationed to watch carefully the effects upon the cables and call attention to any sign of mishap.

One by one and inch by inch the pipes were successfully moved across to their present abiding place.

As each pipe reached its destination the pipe joints were examined and the lead knocked up. One pipe, which broke owing to a defect in the casting, had the fracture cut away, and a split coupling fitted.

Attention was then directed to the cables. The flexible joint was cut away, and in consequence of the gain in length a good sound permanent joint replaced the old stumpy one. The slack of the 800/10 was distributed between the two manholes and the intermediate box, and the "seven pairs" were regulated.

When the boxes had been built and the manholes made good again the job was finished.

In a run of 260 feet the pipes had been moved horizontally over a maximum space of 8 ft. and an average of 6 ft.

On the north side 56 wires had to be handled, and on the south side 1114 wires. It is a satisfaction to record that though the operation extended over a period of nine months not a single fault on a working wire was reported.

THE DECAY AND PRESERVATION OF TIMBER.

By W. H. Matthews, B.Sc.

(*Continued from p.* 251.)

III. Methods of Preservation.

It occasionally happens that wooden objects remain intact through great lengths of time although bearing no traces of artificial preservatives, but in such cases the surroundings in which they have been placed have been of a nature to prevent the growth of fungi. Continued submersion in water or ice, or, on the other hand, freedom from moisture, is antagonistic to decay, and where such circumstances prevail, as in the case of bridge piles sunk in river beds, or of the roof timbers of well-ventilated buildings, many centuries may elapse without any noticeable change taking place. In poles planted in the ground the zone of the vulnerability is practically restricted to that portion between the ground line and two feet below it, unless radial cracks are present, which, of course, offer excellent opportunities to enterprising spores.

Long before anything was known about the mechanism of decay it was recognised that well-dried wood lasted longer than that which was left unseasoned, and that decay might be retarded or prevented by the application of certain oils and bituminous substances.

The great wooden effigy of Diana of the Ephesians was anointed with spikenard in order to ensure a permanence consistent with its alleged miraculous origin, and many archæological relics, mummy-cases and so forth, bear testimony to similar methods of treatment.

For most practical purposes oil of spikenard is now superseded by the more economical, if less fragrant, oil of tar (creosote), and to some extent by other preparations.

SEASONING.—A necessary preliminary to the application of any of these materials is a prolonged exposure of the timber to the drying action of air-currents, often followed, or replaced, by exposure to "live" steam. This process is called "seasoning."

The actual changes that take place during seasoning are not thoroughly understood, but the most important effects are the elimination of water, involving the death of the living matter in the cells, and the increased permeability of the wood.

Air-drying is the most satisfactory method of seasoning, but is one which must not be hurried. For its successful operation the timber should be stacked in open piles as soon as possible after it is stripped of its bark, and should be exposed for the full period which experience shows to be necessary for the class of timber in question, —a period of from six to nine months in the case of telegraph poles. Care has to be taken to remove not only the thick outer bark, but also the thin inner layer, for any patches of the latter remaining tend to prevent the subsequent penetration by preservatives.

Good illustrations of Post Office poles undergoing these processes are shown in Mr. Gibbon's article in Vol. 3 (Part 3) of this Journal.

Steaming or dry-heating cannot be efficiently substituted for the slower method of natural seasoning, but they are effectively employed subsequently to the latter and prior to injection in many of the various preservative processes.

IMPREGNATION PROCESSES.—For light articles, such as laths and planks used in fencing, the more or less elaborate processes of injection are not actually necessary, simple immersion or painting with some antiseptic fluid being sufficient; but for heavier timber such as poles, sleepers and mine-props, one or other of the methods described below is usually adopted.

METALLIC SALT SOLUTIONS.—Several chemical salts have been used in watery solutions for the impregnation of timber, different names being given to the process according to the salt employed, *e. g.* *Kyanising* (corrosive sublimate), *Boucherising* (copper sulphate), and *Burnettising* (zinc chloride). Of these the chief survivor is the last-named, which is extensively employed in the United States, the fluid being forced in under pressure after the timber has been seasoned, steamed for several hours, and subjected to vacuum treatment. In the *Ferrell* process the fluid, a mixture of sulphate of aluminium, the chlorides of sodium and calcium and other salts, is forced in through the *ends* of the timber.

The great disadvantage of watery solutions is naturally their tendency to leak out. Various methods for overcoming this objection have been devised, of which the following are examples:

The *Hasselman* treatment consists of boiling timber for some hours in a solution of the sulphates of copper, iron, and aluminium, with a little kainite. This is supposed to result in the combination of these salts with the cell-walls of the wood to form insoluble compounds.

The *Wellhouse* process meets the difficulty by mixing a little glue with the zinc chloride, and, after forcing the mixture into the timber, applying a solution of tannin, which combines with the glue to form an impervious "leatheroid" which blocks up the cell-openings.

In the *Allardyce* process the timber is impregnated first with zinc chloride and then with creosote, both under pressure. The creosote thus occupies the outer layers only.

In the *Card* and *Rütgers* processes an emulsion of creosote and zinc chloride is forced in, the chief distinction between the two methods being that in the former the emulsion, which is unstable in character, is kept swirling by means of a centrifugal pump, in order to prevent the two fluids from separating out. Claims have been put forward for the use of certain fluorine compounds for preservative purposes, and some of them have given very favourable results.

CREOSOTE.—In K. B. Miller's 'American Telephone Practice' appears the following: "In some quarters a process termed creosoting is meeting with favour for preserving telegraph and telephone poles." This is what one might describe as "putting it mildly"!

In this country nearly all wooden telegraph and telephone poles are creosoted before erection, and the use of creosote and other tar products for the preservation of timber in general is probably greater than that of all other timber preservatives. Both coal-tar and wood-tar yield creosotes on distillation, but that obtained from the former is the most important. Coal-tar is a by-product of coal-gas manufacture, and on re-distillation yields, in addition to pitch, a series of oils lighter than water, and another series heavier than water, the so-called "dead oils" or creosote. The chief constituents of coal-tar creosote are the *phenols* or "tar-acids" (*e. g.* carbolic acid), and aromatic hydrocarbons (naphthalene and anthracene). Unfortunately the value of some of the phenols for other purposes results in their removal from most modern creosote, thus somewhat impairing its preservative efficiency. Wood-tar creosote, with similar

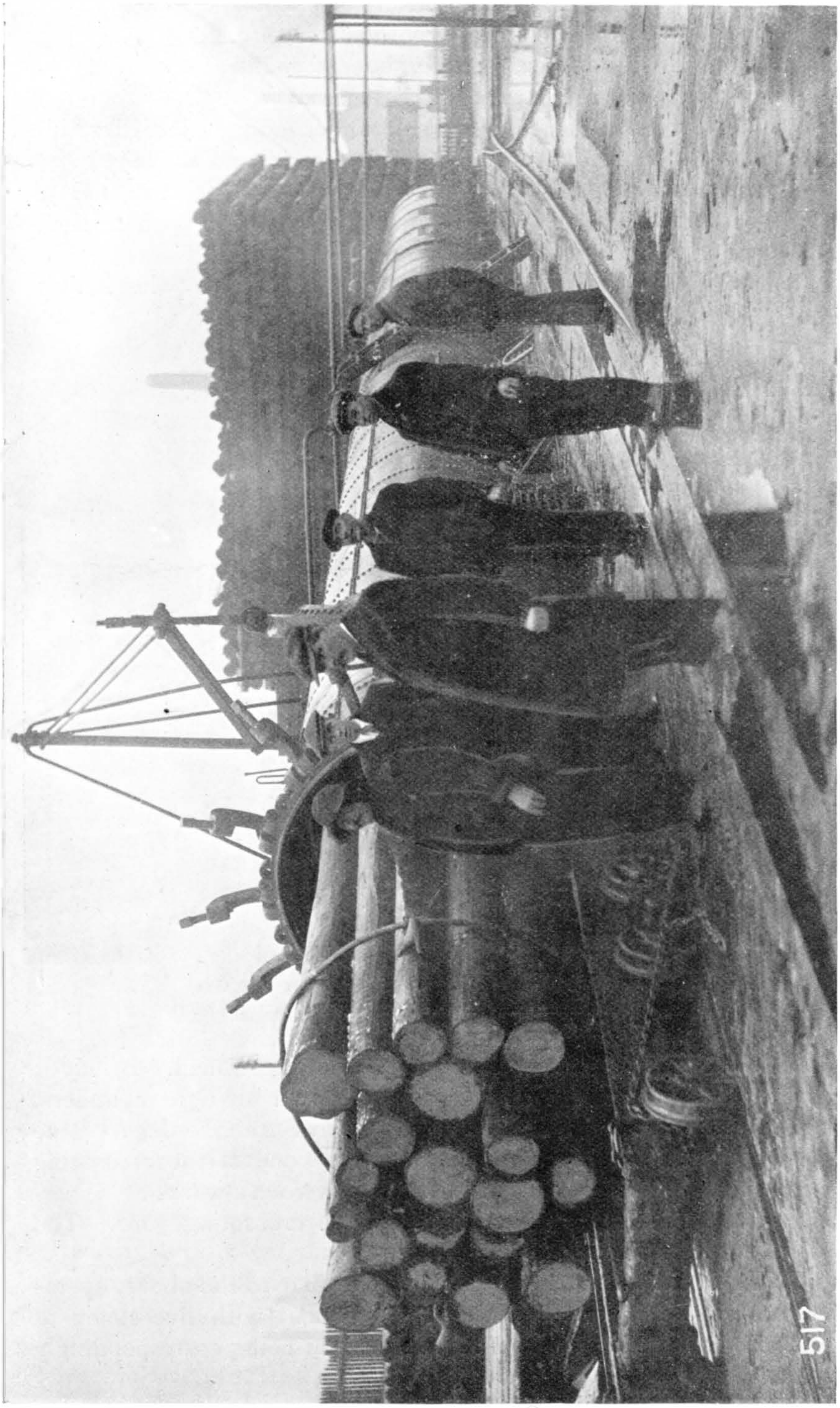


FIG. 19.—POLES BEING INSERTED IN CREOSOTING CYLINDER.

properties, but consisting almost entirely of phenols, is also used for preserving wood. Petroleum-tar creosote, a by-product of water-gas manufacture, is rarely used alone, but is mainly employed for adulterating coal-tar creosote.

Many other tar derivatives are sold under more or less descriptive trade names, such as *carbolineum*, *antigermin*, and *antipolypin*.

The methods adopted for the injection of creosote vary mainly with regard to the means for securing (1) depth of penetration, (2) economy of creosote.

The process usually employed in the case of our poles is that

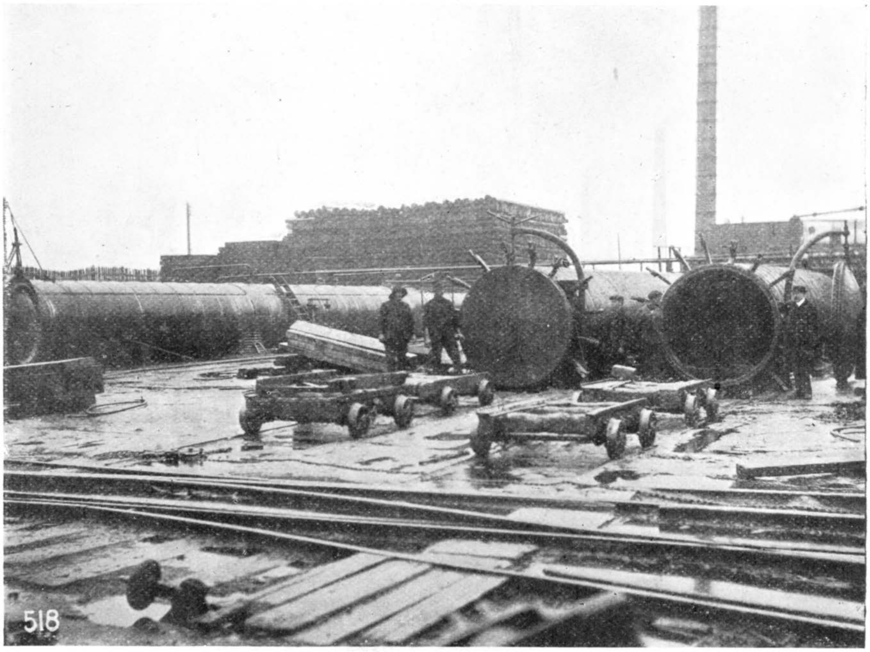


Fig. 20.—General View of a Creosoting Yard.

described by Mr. Gibbon in the article above mentioned. Briefly it consists of extracting the air from the poles in air-tight cylinders, then admitting the creosote and applying pressure in order to force it well in. **19** shows some poles entering one of the creosoting cylinders at Messrs. Burt, Boulton and Haywood's works at Silvertown, and **20** shows a general view of the creosoting yard. The pressure pumps are seen in **21**.

In the *Bethell* process, which is very similar to the above, operations are preceded by several hours' treatment with live steam at about 20 lb. pressure, the subsequent vacuum being correspondingly protracted.

The *Boulton* process, which is carried out in the cylinder shown in **22**, was devised with the object of saving time by eliminating the preliminary seasoning, that is to say, it is a "green timber" treatment. The timber is placed in creosote at a temperature slightly exceeding 212° F. for a few days. The moisture of the wood and the lighter portions of the creosote pass off as vapour and are led by means of the 6-inch pipe to a condenser. The small cylinder is for the purpose of retaining any of the heavier oils which may be driven

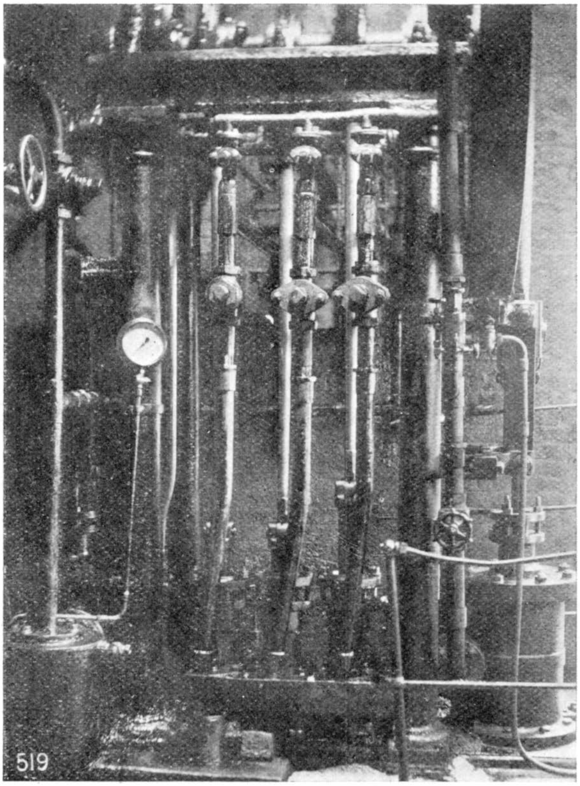


FIG. 21.—INJECTION PUMPS.

out of the main cylinder. When the timber has been sufficiently dehydrated pressure is applied, after which the fluid is run off. Post Office poles have occasionally been treated by this process.

An economy in creosote, with a proportionate lightness in the treated timber, is effected in the so-called "empty-cell" processes by sucking out some of the creosote immediately after injection, thus coating the walls of some of the cells without filling up their cavities.

The *Rüping* process is one of the most widely known of these.

After seasoning, air is forced in at a pressure of about 75 lb. to the square inch. Creosote is forced in under greater pressure, and then an air pressure of about 225 lb. is applied, thus driving the oil in to a considerable depth. When the pressure is released the compressed air in the interior of the wood drives out some of the creosote—an effect which is sometimes augmented by applying vacuum.

The *Lowry* and *A.C.W.* processes are very similar, but in the former there is no pneumatic pressure previous to the injection, the surplus oil being abstracted by powerful suction pumps, whilst in

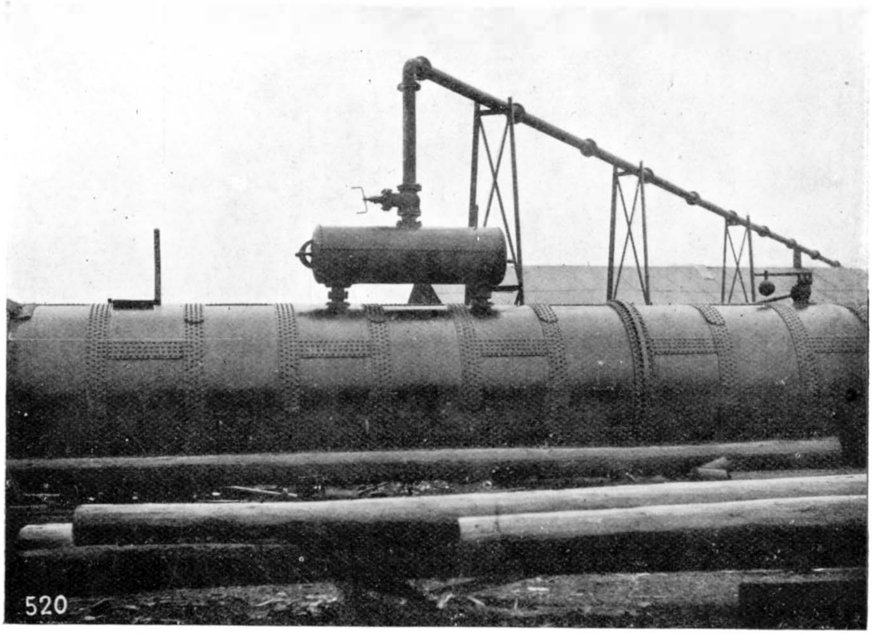


Fig. 22.—Injection Cylinder used in "Boulton" Process.

the latter there is a preliminary steaming and an air-pressure is applied after the oil is run off. In contrast to all these "pressure" processes are the open bath treatments, in some of which, *e.g.* the *Guissani* process, a certain amount of atmospheric pressure is utilised by first heating the wood, either in an oven or in a hot fluid, and then plunging it into cold creosote.

At the Paris Conference in 1910 a paper was contributed by a Hungarian delegate describing a method adopted in Hungary for aiding penetration of the oil, in the case of pitch-pine poles, by stabbing the poles spirally by means of a suitable machine.

For injecting paving blocks a mixture of resin and creosote is often used, dry heat being applied before the injection under pressure takes place. Creosoted timber is never subject to organic decay, but it may be worn away by mechanical means. The explanation of the occasional occurrence of fungi in creosoted poles is that the oil rarely penetrates much beyond the sapwood. Thus, if spores gain entrance to the heartwood by means of pole slots or cracks formed after injection, they may germinate and in time destroy the heartwood.

In such cases, however, as Mr. Henley pointed out at the Paris Conference, the creosoted ring of sapwood usually possesses all the necessary strength and stiffness.

TREATMENT OF INFECTED TIMBER.—It is, as a rule, safest to reject a piece of timber which on being sawn shows the red stripes which denote the presence of the dry-rot fungus, but a thorough seasoning may prevent any further development. Even when the presence of destructive fungi is discovered in wood which forms part of a building, it may not be necessary to replace any part of the structure if the decay has not advanced very far, for in the early stages the fungi can be destroyed by heating or by the application of carbolic acid or some other strong antiseptic. A temperature of about 40° C. maintained for an hour or so is fatal to most fungi, including that of dry-rot, but there are a few that can resist much higher degrees of heat. When decay has reached an advanced stage it is necessary to remove every piece of infected or suspected timber and to treat all the neighbouring woodwork with a strong antiseptic. Thorough ventilation should also be secured if possible. It is usually noticed that wood adjoining the walls of buildings or reposing upon "pugging" (deadening material) is the first to be attacked. This is owing to the favourable conditions for the germination and growth of fungus spores provided by the moisture and calcium bicarbonate from the mortar and by the lack of ventilation. It may be mentioned that washed gravel is a much better filling-in material than cinders, inasmuch as it retains far less moisture.

MISCELLANEOUS NOTES.—*Harmless fungi.*—When timber has been stored in yards for some time there often appear on it species of fungi belonging to the groups known as "moulds" and "mildews," some of which may cause black or blue stains. These fungi live upon the contents of the cells, but do not attack the substance of the cell-walls.

Thus they do not cause any real injury to the timber, although they may lessen its selling value.

Bacteria.—These minute organisms have many characters in common with the fungi, but are all of microscopic dimensions. Some of them are always found associated with the decay of other organisms, and it is probable that some species are to a certain extent concerned in the decay of timber, but they have not yet been specifically determined. At any rate the damage caused by them is negligible in comparison with that due to fungi.

Eremacausis.—This word was introduced by *Liebig* in the early part of last century to denote that decay which he took to be a process of slow combustion, independent of living organisms. It was long ago shown that his view was untenable, as the process in question is arrested by antiseptics, but the term still finds place in a certain standard text-book of telegraphy.

Winter felling.—The department specifies that its poles shall be felled in the winter months. It is often stated that timber felled in winter "when the sap is down" is less liable to dry-rot than that felled in summer, and a long controversy was waged involving many learned and ingenious arguments as to the reason for this, until it was finally demonstrated that the assertion was contrary to fact. Wood felled when the sap is up of course takes longer in seasoning because it contains more moisture, but when properly seasoned it is no more liable to attack than that felled in winter.

Selected literature.—The best English summary of recent years on the destruction of wood by fungi is the paper in 'Science Progress' for January, 1909, by A. H. R. Buller, who has also published several important papers in the 'Journal of Economic Biology' and elsewhere.

The United States Department of Agriculture has devoted particular attention to the subject and has brought out a fine series of bulletins, many of which are profusely illustrated and all of which are extremely useful.

Those of particular interest are Bulletins 6, 13, 22, 41 and 78 of the Forestry Division and No. 14 of the Bureau of Plant Industry.

The English Board of Agriculture issues *gratis* a small pamphlet (Leaflet No. 113) on the dry rot.

Good introductory books on the decay of timber are those by Hartig ('Text-book of the Diseases of Trees,' English translation, 1894) and Marshall Ward ('Timber and some of its Diseases,' 1897), whilst some of the engineering books on timber, *e.g.* Laslett's, contain interesting chapters on the subject.

'Le Bois,' by J. Beauverie (Paris, 1905), goes into the matter pretty fully, as do several German works, some of which treat the question of dry rot from its botanical, chemical, architectural, biological, hygienic, and even legal aspects!

That by Dr. Carl Mez (Berlin, 1908) gives a full classification of all known domestic wood-destroying fungi and is well illustrated. B. Malenković (Vienna, 1907) treats the subject of wood preservation in an exhaustive manner, particularly from the chemical aspect.

A useful illustrated summary by three German professors was published in Berlin in 1910 under the characteristic German title, "Der Hausschwamm und die wichtigsten Trockenfaüleschwämme vom botanischen, bautechnischen und juristischen Standpunkte."

With regard to the antiseptic treatment of timber, Sir S. B. Boulton's paper, read before the Institution of Civil Engineers in May, 1884, is still a standard classic, and was reprinted, together with the full discussion and an introduction by the author, in 1910.

The present article is merely an introductory sketch, but it is hoped that it will arouse interest in some of the more elaborate and original works enumerated above, the perusal of which will dispel any suggestion that the study of the decay of timber is entirely a matter of "dry rot."

My thanks are due to Mr. G. Morgan, I.S.O., Controller of Stores, and to Messrs. Burt, Boulton and Haywood, Ltd., of Silvertown, in connection with the photographs reproduced in the present number.

INDUCTANCE OF TELEGRAPH APPARATUS.

ALTHOUGH values of the electrical constants of the apparatus used by the Post Office have from time to time appeared in various publications, it is found that owing to the adoption of new types of circuits and other modern developments, further and more exhaustive measurements are now desirable, and accordingly the Research Branch of the Engineering Department of the Post Office has undertaken the work.

The measurements of the inductance of telegraph apparatus have been completed, and the results are given herewith.

The method used is that shown in the diagram, generally known as Anderson's method.

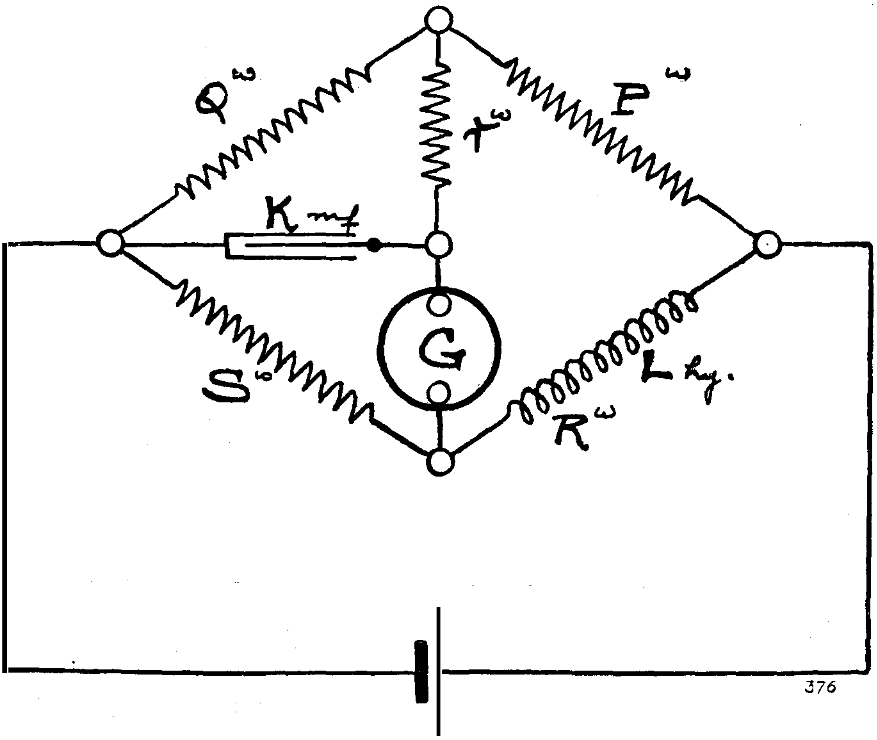
The bridge is first balanced for resistance in the ordinary manner. The battery and galvanometer keys are then depressed in the reverse order, and K and r varied till no kick is produced on the galvanometer. When this condition has been obtained the inductance is given by the following formula:

$$L = \frac{K}{10^6} [r(R + S) + RQ].$$

The proof of this formula will be found in 'Electrical Laboratory Notes,' No. 47, and also in 'A Handbook for the Electrical Laboratory,' vol. ii, p. 192, both by Dr. J. A. Fleming.

It will be observed that the inductance of any particular instrument is not constant, but tends towards a maximum. In several cases the maximum has been passed, and the inductance thereafter decreases as the current is increased. This is due to the permeability of the iron cores decreasing when the flux becomes large; in fact, the permeability and the inductance vary together.

It will also be noticed that the inductance obtained with differentially wound instruments, when the coils are joined in series, is always about four times that obtained with the same instrument when the coils are joined in parallel. With the coils in series the effective number of turns is twice that when the coils are in parallel,



ANDERSON'S METHOD OF MEASURING INDUCTANCE.

and since the inductance varies as the square of the number of turns the above result follows at once.

The fact that the inductance with the coils in series is not exactly four times that with the coils in parallel is due to the presence of the iron cores and also to magnetic leakage.

Attention is drawn to the change in inductance produced by the movement of the armature of sounders and similar instruments.

It would be very instructive to reproduce the curves which have been plotted from the results given, but unfortunately space does not permit.

Apparatus.	Current (milli-ampères).	Inductance (henrys).	Remarks.
Relay Standard A, 200^{ω} + 200^{ω}; coils in parallel	10	·78	—
	20	·83	
	30	·87	
	40	·89	
Relay Standard A, 200^{ω} + 200^{ω}; coils in series	5	3·12	—
	10	3·36	
	15	3·46	
	20	3·55	
Relay Standard B, 100^{ω} + 100^{ω}; coils in parallel	5	·72	—
	10	·79	
	15	·80	
	20	·83	
	30	·86	
	40	·90	
	50	·91	
	60	·92	
	80	·95	
	100	·95	
	120	·95	
	140	·97	
Relay Standard B, 100^{ω} + 100^{ω}; coils in series	5	3·32	—
	10	3·50	
	15	3·62	
	20	3·74	
	30	3·80	
	40	3·87	
	50	3·92	
	60	3·92	
	80	3·92	
	100	3·92	
	120	3·92	
	140	3·92	
Relay N.P.B., 200^{ω} + 200^{ω}; coils in parallel	20	·76	—
	40	·78	
	60	·79	
	80	·80	
Relay N.P.B., 200^{ω} + 200^{ω}; coils in series	10	3·00	—
	20	3·16	
	30	3·20	
	40	3·24	
	50	3·29	
Relay N.P.C., 100^{ω} + 100^{ω}; coils in parallel	20	·74	—
	40	·75	
	60	·77	
	80	·78	

Apparatus.	Current (milli-ampères).	Inductance (henrys).	Remarks.
Relay N.P.C., 100$^{\omega}$ + 100$^{\omega}$; coils in series	10	2·97	—
	20	3·05	
	30	3·08	
	40	3·11	
	50	3·11	
Relay N.P.C., 500$^{\omega}$ + 500$^{\omega}$; coils in parallel	20	4·47	—
	40	4·71	
	60	4·75	
	80	5·02	
Relay N.P.C., 500$^{\omega}$ + 500$^{\omega}$; coils in series	10	17·75	—
	20	18·19	
	30	18·96	
	40	19·76	
	50	19·87	
Relay Baudot, 200$^{\omega}$	5	1·14	—
	10	1·21	
	15	1·23	
	20	1·26	
	30	1·26	
	40	1·28	
	50	1·31	
	60	1·33	
	80	1·33	
	100	1·33	
	120	1·33	
	140	1·33	
Relay I.N.P., 500$^{\omega}$ + 500$^{\omega}$; coils in parallel	2	1·17	—
	4	1·46	
	6	1·52	
	8	1·54	
	10	1·57	
	12	1·60	
Relay I.N.P., 500$^{\omega}$ + 500$^{\omega}$; coils in series	2	5·18	—
	4	6·17	
	6	6·44	
	8	6·70	
	10	6·79	
	12	6·79	

Apparatus.	Current (milli-ampères).	Inductance (henrys).	Remarks.
Relay I.N.P., 10^{ω} + 10^{ω}; coils in series	20	·214	—
	30	·220	
	40	·224	
	50	·227	
	60	·230	
	80	·232	
	100	·230	
	120	·227	
	140	·225	
	160	·225	
Relay P.I.B., 500^{ω} + 500^{ω}; coils in parallel	2	1·27	—
	4	1·39	
	6	1·50	
	8	1·58	
	10	1·64	
	12	1·67	
Relay P.I.B., 500^{ω} + 500^{ω}; coils in series	2	5·60	—
	4	6·31	
	6	6·58	
	8	6·94	
	10	7·12	
	12	7·39	
Receiver Wheatstone, 100^{ω} + 100^{ω}; coils in parallel	5	·70	—
	10	·76	
	20	·84	
	30	·89	
	40	·92	
	50	·94	
Receiver Wheatstone, 100^{ω} + 100^{ω}; coils in series	3	2·99	—
	5	3·23	
	10	3·54	
	15	3·65	
	20	3·78	
	30	3·90	
Sounder, 20^{ω}; armature up	60	·15	Gap between armature and magnet cores = 16 mils.
	80	·18	
	100	·18	
	120	·18	
Sounder, 20^{ω}; armature down	60	·24	Gap between armature and magnet cores = 9 mils.
	80	·24	
	100	·24	
	120	·24	

INDUCTANCE OF TELEGRAPH APPARATUS.

Apparatus.	Current (milli-ampères).	Inductance (henrys).	Remarks.
Sounder, 900^{ω} ; armature up	10	16·67	Gap between armature and magnet cores = 16 mils.
	20	18·28	
	30	18·29	
	40	17·11	
Sounder, 900^{ω}; armature down	10	23·51	Gap between armature and magnet cores = 9 mils.
	20	23·11	
	30	20·31	
	40	18·75	
Sounder polarised A, 100^{ω} + 100^{ω} ; coils in parallel	10	·65	Inductance the same for equal values of marking and spacing currents.
	15	·67	
	20	·69	
	25	·72	
	30	·73	
	40	·74	
	50	·75	
Sounder polarised A, 100^{ω} + 100^{ω} ; coils in series	5	2·61	Inductance the same for equal values of marking and spacing currents.
	10	2·86	
	15	2·92	
	20	3·04	
	25	3·10	
	30	3·16	
Sounder polarised D, 100^{ω} + 100^{ω} ; single coil, armature up	2·5	·34	Inductance the same for equal values of marking and spacing currents. Gap = 16 mils.
	4	·35	
	6	·36	
	8	·36	
	10	·37	
	15	·40	
	20	·41	
Sounder polarised D, 100^{ω} + 100^{ω} ; single coil, armature down	2·5	·36	Inductance the same for equal values of marking and spacing currents. Gap = 9 mils.
	4	·36	
	6	·37	
	8	·39	
	10	·40	
	15	·43	
	20	·45	
Sounder polarised D, 100^{ω} + 100^{ω} ; coils in series, armature up, spacing current	2·5	1·37	Gap = 16 mils.
	4	1·44	
	6	1·54	
	8	1·60	
	10	1·64	
	15	1·78	
	20	1·85	

Apparatus.	Current (milli-ampères).	Inductance (henrys).	Remarks.
Sounder polarised D, 100^{ω} + 100^{ω} ; coils in series, armature up, marking current	2·5	1·37	Gap = 16 mils.
	4	1·44	
	6	1·52	
	8	1·56	
	10	1·61	
	15	1·73	
	20	1·80	
Sounder polarised D, 100^{ω} + 100^{ω} ; coils in series, armature down, spacing current	2·5	1·47	Gap = 9 mils.
	4	1·54	
	6	1·64	
	8	1·70	
	10	1·78	
	15	1·92	
	20	2·05	
Sounder polarised D, 100^{ω} + 100^{ω} ; coils in series, armature down, marking current	2·5	1·47	Gap = 9 mils.
	4	1·51	
	6	1·61	
	8	1·68	
	10	1·76	
	15	1·90	
	20	2·00	
Sounder polarised D, 500^{ω} + 500^{ω} ; single coil, armature up	2·5	1·80	Inductance the same for equal values of marking and spacing currents. Gap = 16 mils.
	4	1·90	
	6	1·95	
	8	1·98	
	10	2·02	
	15	2·07	
	20	2·12	
Sounder polarised D, 500^{ω} + 500^{ω} ; single coil, armature down	2·5	1·98	Inductance the same for equal values of marking and spacing currents. Gap = 9 mils.
	4	2·10	
	6	2·17	
	8	2·22	
	10	2·27	
	15	2·34	
	20	2·35	
Sounder polarised D, 500^{ω} + 500^{ω} ; coils in series, armature up	2·5	7·68	Inductance the same for equal values of marking and spacing currents. Gap = 16 mils.
	4	7·77	
	6	8·04	
	8	8·13	
	10	8·31	
	15	8·49	
	20	8·49	

Apparatus.	Current (milli-ampères).	Inductance (henrys).	Remarks.
Sounder polarised D, 500^{ω} + 500^{ω} ; coils in series, armature down	2·5	8·31	Inductance the same for equal values of marking and spacing currents. Gap = 9 mils.
	4	8·84	
	6	9·02	
	8	9·20	
	10	9·39	
	15	9·66	
	20	9·74	
Sounder polarised D, 2000^{ω} ; armature up, spacing current	2	12·83	Gap = 16 mils.
	5	13·84	
	10	14·65	
	15	15·26	
	20	15·45	
Sounder polarised D, 2000^{ω} ; armature up, marking current	2	12·83	Gap = 16 mils.
	5	13·50	
	10	13·98	
	15	14·05	
	20	14·05	
Sounder polarised D, 2000^{ω} ; armature down, spacing current	2	14·05	Gap = 9 mils.
	5	14·83	
	10	15·87	
	15	16·48	
	20	16·48	
Sounder polarised D, 2000^{ω} ; armature down, marking current	2	14·05	Gap = 9 mils.
	5	14·47	
	10	14·96	
	15	15·26	
	20	15·26	
Sounder polarised D, 4500^{ω} ; armature up, spacing current	2	18·36	Gap = 16 mils.
	4	19·46	
	6	20·58	
	8	21·22	
	10	21·90	
	15	23·20	
	20	23·88	
Sounder polarised D, 4500^{ω} ; armature up, marking current	2	18·36	Gap = 16 mils.
	4	19·25	
	6	19·90	
	8	20·58	
	10	20·79	
	15	21·68	
	20	21·90	

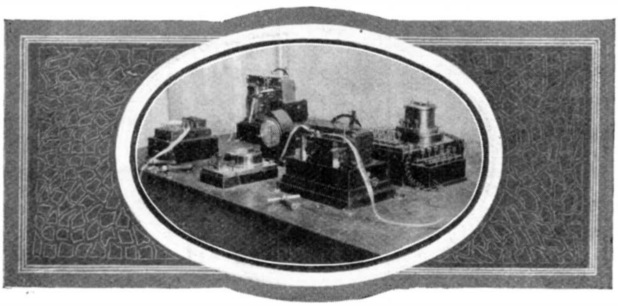
Apparatus.	Current (milli-ampères).	Inductance (henrys).	Remarks.
Sounder polarised D, 4500^{ω}; armature down, spacing current	2	17·70	Gap = 9 mils.
	4	21·22	
	6	22·11	
	8	23·20	
	10	24·10	
	15	25·63	
	20	26·75	
Sounder polarised D, 4500^{ω}; armature down, marking current	2	17·70	Gap = 9 mils.
	4	20·80	
	6	21·45	
	8	22·10	
	10	22·52	
	15	23·20	
	20	23·41	
Sounder polarised, relaying, 500^{ω} + 500^{ω}; coils in parallel, armature up, spacing current	10	1·46	Gap = 12 mils.
	20	1·64	
	30	1·72	
	50	1·80	
	70	1·83	
	100	1·86	
Sounder polarised, relaying, 500^{ω} + 500^{ω}; coils in parallel, armature up, marking current	10	1·46	Gap = 12 mils.
	20	1·55	
	30	1·61	
	50	1·64	
	70	1·64	
	100	1·66	
Sounder polarised, relaying, 500^{ω} + 500^{ω}; coils in parallel, armature down, spacing current	10	1·58	Gap = 7 mils.
	20	1·75	
	30	1·83	
	50	1·95	
	70	2·03	
	100	2·08	
Sounder polarised, relaying, 500^{ω} + 500^{ω}; coils in parallel, armature down, marking current	10	1·55	Gap = 7 mils
	20	1·64	
	30	1·69	
	50	1·75	
	70	1·75	
	100	1·78	

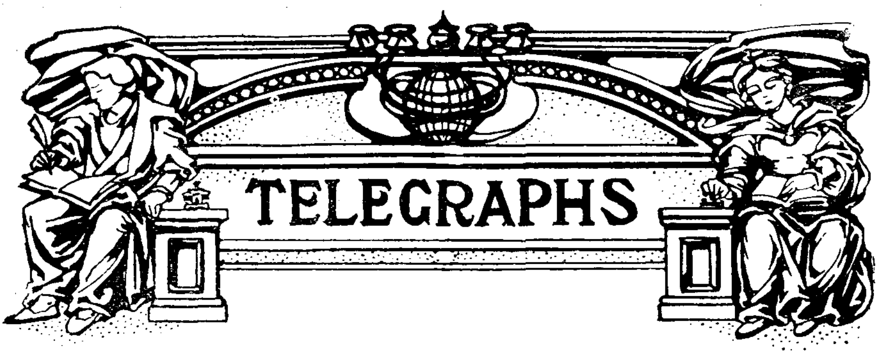
Apparatus.	Current (milli-ampères).	Inductance (henrys).	Remarks.
Sounder polarised, relaying, $500^{\omega} + 500^{\omega}$; coils in series, armature up, spacing current	2	5·08	Gap = 12 mils.
	5	5·64	
	10	6·12	
	15	6·44	
	20	6·60	
	30	7·00	
	40	7·08	
Sounder polarised, relaying, $500^{\omega} + 500^{\omega}$; coils in series, armature up, marking current	2	5·00	Gap = 12 mils.
	5	5·48	
	10	5·80	
	15	6·04	
	20	6·12	
	30	6·20	
	40	6·36	
Sounder polarised, relaying, $500^{\omega} + 500^{\omega}$; coils in series, armature down, spacing current	2	5·40	Gap = 7 mils.
	5	5·96	
	10	6·44	
	15	6·84	
	20	7·16	
	30	7·40	
	40	7·80	
Sounder polarised, relaying, $500^{\omega} + 500^{\omega}$; coils in series, armature down, marking current	2	5·32	Gap = 7 mils.
	5	5·80	
	10	6·20	
	15	6·36	
	20	6·60	
	30	6·68	
	40	6·68	
Transformer, 7-terminal, primary P	10	·327	—
	20	·346	
	40	·379	
	60	·432	
Transformer, 7-terminal, primary P1	10	·362	—
	20	·397	
	40	·527	
	60	·573	
Transformer, 7-terminal, P and P1 in series	10	1·67	—
	20	1·77	
	40	2·10	
	60	2·22	

Apparatus.	Current (milli-ampères).	Inductance (henrys).	Remarks.
Transformer, 7-terminal, secondary	10	2·95	—
	20	3·49	
	40	4·09	
	60	4·33	
Transformer, 7-terminal; all coils in series and assisting each other magnetically	10	9·68	—
	20	11·79	
	40	12·79	
	60	11·68	
	80	9·66	
Transformer, 7-terminal; all coils in series, but secondary coil opposing the primary coils magnetically	10	·402	—
	20	·402	
	40	·459	
	60	·574	
Transformer, 7-terminal; mutual inductance between secondary coil and both primary coils	10	2·32	—
	20	2·85	
	40	3·08	
	60	2·77	
Coil bridging, type 2, 3000^{ω}	2	3·90	—
	5	4·94	
	10	5·92	
	20	6·30	
	30	6·30	
	37	6·06	
Coil bridging, 1000^{ω}	5	12·68	—
	10	15·35	
	15	15·55	
	20	15·10	
	40	11·94	
	60	9·81	
	80	7·61	
	100	6·75	
Bell magneto, 100^{ω}	2	1·96	—
	5	2·28	
	10	2·52	
	15	2·68	
	20	2·84	
Bell magneto, 1000^{ω}	2	11·99	—
	5	14·23	
	10	17·36	
	15	19·15	
	20	19·60	

INDUCTANCE OF TELEGRAPH APPARATUS.

Apparatus.	Current (milli-ampères).	Inductance (henrys).	Remarks.
Indicator N.P., 100ω	5	2·93	—
	10	3·25	
	20	3·62	
	30	3·78	
	40	3·94	
Indicator N.P., 1000ω	2	2·86	—
	5	3·62	
	10	4·16	
	15	4·40	
	20	4·49	
Indicator A. B. C., 500ω + 500ω ; coils in parallel	2	2·57	—
	5	3·34	
	10	4·36	
	15	4·90	
	20	5·16	
Indicator A. B. C., 500ω + 500ω ; coils in series	2	14·21	—
	5	18·45	
	10	20·45	
	15	21·57	
	20	21·77	





FAST-SPEED WHEATSTONE WORKING ON UNDERGROUND CABLE CIRCUITS.

By A. Fraser.

In these days of type-printing telegraph systems it may seem somewhat incongruous to place in competition with them again one system which has of late years fallen much into neglect, but which, with the conditions that now obtain, will emerge from its comparative obscurity and re-assert itself as the most effective agent in dealing with the great mass of the inter-urban traffic of the Kingdom.

To avoid its use hitherto, a large number of channels, worked at low speeds, have been brought into use. But this increase in the number of channels must stop somewhere, and to-day difficulty is already being experienced in obtaining spare wires in the underground cables. Obviously, therefore, if the number of channels remains constant and the need for more increases, the slower outlets must be shut down and the work confined to a fewer number of fast-speed circuits with suitable staff to meet the requirements.

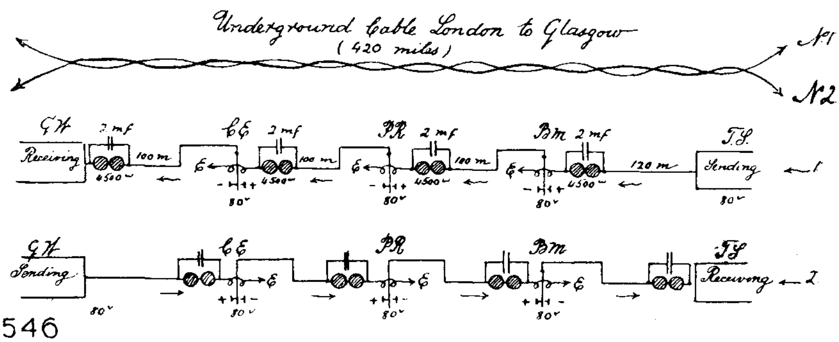
Unfortunately, however, the electrical conditions that obtain in underground cables are unfavourable to fast-speed working ; so much so, that on a direct London-Glasgow circuit it is doubtful if a higher speed than forty words a minute could be obtained.

In a paper recently contributed to the Journal, some interesting details were given showing to what extent the system enabled existing circuits to be dispensed with. But essential to all fast-speed working is the presence of a complicated repeater at some point in the underground circuit, which is not only costly in itself, but also requires frequent—at times continuous—attention from an experienced officer at the place where it is installed.

Now it occurred to Mr. C. C. Vyle—to whom the Department is already indebted for many contributions to practical telegraphy—

that the present type of repeater on underground cable wires could be greatly modified without lessening the advantages of fast-speed working, with the result that he devised a method which for simplicity and efficiency it would be difficult to improve upon. Briefly put, his idea is to divide the circuit into approximately equal lengths, and at each point of division introduce an ordinary standard relay for repeating purposes associated with a polarised sounder and condenser for local reading. Instead of using a loop he confines the "sending" to one of the wires forming a pair, and the "receiving" to the other, the two independent lines forming virtually one duplex circuit (I).

Having outlined his system and proved its practicability on experimental loops, arrangements were made for a working trial on a London–Glasgow circuit having repeaters at Birmingham, Preston, and Carlisle, the working voltage at each point being 80 volts and



I.—Skeleton Diagram of Circuit with Repeater Stations.

the current 14 milliampères. When the repeaters had been installed at the several points of this long circuit (420 miles of underground), it was found that a satisfactory speed of 200 words per minute simplex (with the means of stopping the sending station when necessary) was obtainable between London and Glasgow.

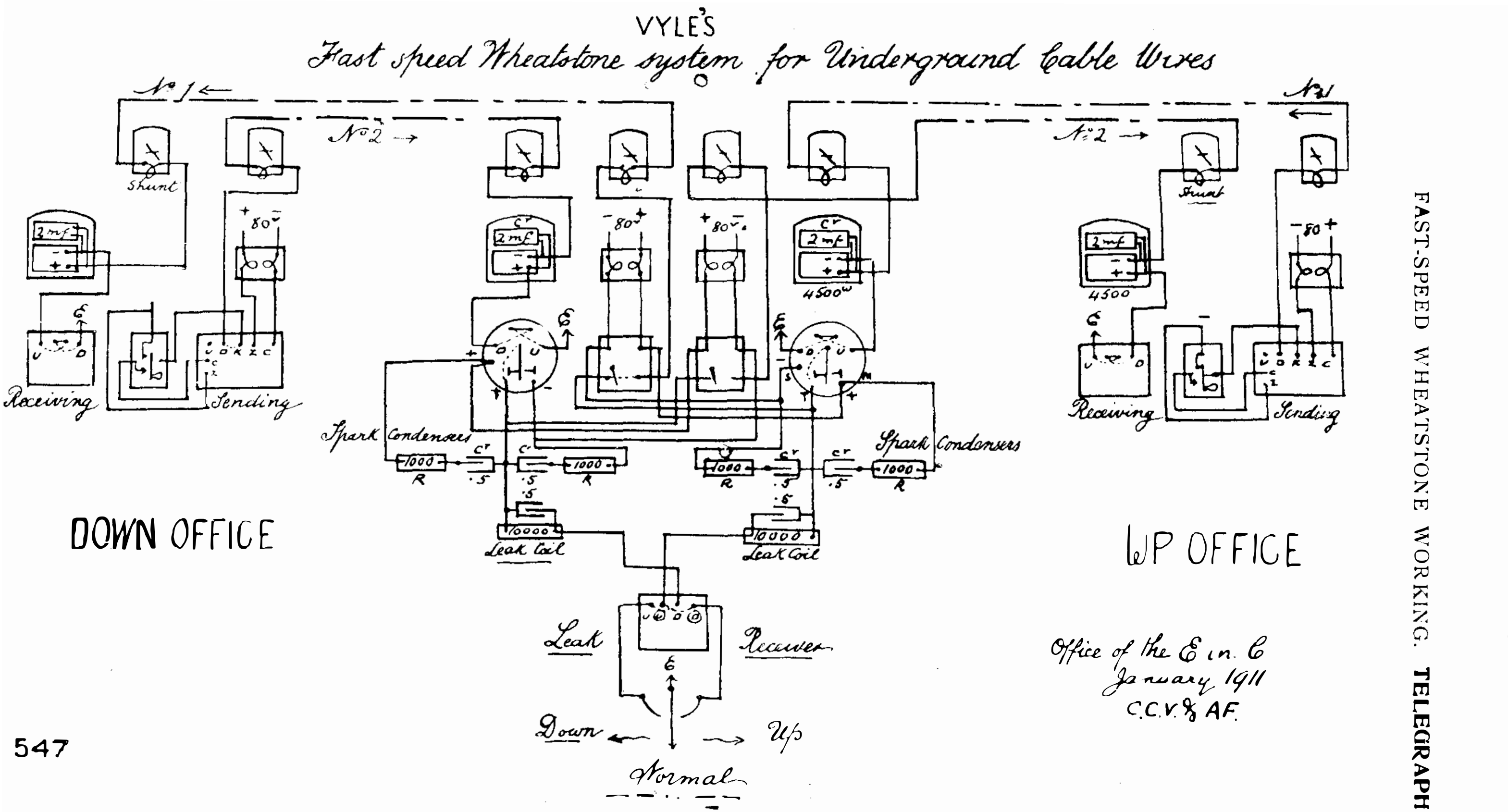
When the arrangements for the Glasgow–London circuit were completed an agreement was arrived at between the Controller of the C.T.O. and the Chief Superintendent at Glasgow for the circuit to be utilised entirely by London on one day from 10 a.m. to 4 p.m., and by Glasgow on the following day for the same period.

The results of the trials were as follows :

London to Glasgow . . .	1742 messages.
Glasgow to London . . .	1789 messages.

Tablet check sheets were kept at Glasgow for the purpose of recording the delay on the work, and a record was also kept of the number of repetitions required.

Of the total number of messages sent by London, 3·3 per cent.



2.—CONNECTIONS OF SIMPLIFIED FORM OF REPEATER.

repetitions (generally wrong numbers) was required, the percentage required by London on the following day being 2·4 per cent., while 79 per cent. of the messages dealt with at Glasgow were within the 10 minutes period.

On the whole the trial was a memorable one, and showed what can actually be done on our underground cables with the Wheatstone system of working.

Another trial between London and Glasgow was arranged for, in which the two offices worked up and down in batches of nine each way. What was the result? Simply this, that practically all the London–Glasgow channels were shut down and almost the entire volume of work between the two greatest cities in the Kingdom was carried by the pair of wires forming a single "Vyle circuit."

It is not the intention of the writer to draw comparisons between this system and the others which to-day are struggling for supremacy, but it is interesting to recall the remark spontaneously uttered by a shrewd and capable officer at one of our largest centres, who, after watching it in continuous operation for over two hours, remarked: "Yes, this is a stable system and one that may be relied upon." The implication is sufficiently obvious.

When the conditions for "equivalent duplex" have been secured the ideal of the harassed supervisor will have been attained. No more balancing in the mornings with all its attendant worries and delays. Simply a "rub up" of the relay contacts at the various repeating points and the circuit is ready for the day.

This is a great advance, and only those who have had experience in balancing and getting standard speed fixed on busy wires can fully appreciate its value.

So much then for the system as one which will certainly have to be reckoned with in the very near future. Let us now consider it in conjunction with what has come to be known as "systematic" Wheatstone working, in which the white slips bearing the Morse signals are gummed to the blue sheets of paper and distributed to the circuits in the same manner as ordinary "B" messages.

This "systematic" working, which will probably supersede the older manual method of writing up, owes its inception, the writer believes, to Mr. Wm. Noble, the Superintending Engineer of the Central Metropolitan District, who many years ago, when in charge of the Aberdeen section, put forward the suggestion through the local authorities. It may be contended that the slips are not so easy to read from in the process of transmission as in the case of the written-up forms; but this is surely a question of sufficient practice. As an actual example of what can be done by it, the writer, when in Birmingham recently, was informed at 9 o'clock one morning that during the previous hour 416 messages had been received and gummed up by one operator on the Milford Haven circuit. Is any further argument needed to justify its retention and extension?

The possibilities of the "Vyle" circuit (to give it the name by which it is known in the C.T.O. and provinces) must not be supposed, however, to be exhausted when the terminals are enabled to work to each other at 200 per minute. The TS–GW circuit could be utilised by TS to BM or PR or CE individually, or YQ, if the exigencies of the work required it; and its utility in this respect was amply demonstrated recently, when Carlisle used it as a channel to TS for a quantity of press work which, at the restricted time available, could not have been got rid of on the ordinary TS–CE channel.

And, lastly, it may be mentioned that an experimental circuit was made up between Sheffield and Aberdeen *viâ* London and Glasgow, comprising:

Sheffield to London . . .	160 miles	aërial,
London to Glasgow . . .	420 ,,	underground,
Glasgow to Aberdeen . .	160 ,,	aërial,

or altogether 740 miles in length. The simplex speed between SF and AB was 200 w.p.m., and the quality of the signals was such that had the trial been made between one end of the Kingdom and the other, with the entire stretch of underground thrown in between, a similar result would have been obtained.

PUTNEY TELEPHONE EXCHANGE TRANSFER TO NEW PREMISES.

By J. L. Taylor.

It is some years since the need for additional exchange equipment became an urgent matter at Putney. In consequence of various difficulties in connection with the acquisition of the site, it was not found possible to complete the new exchange building until this year. In the interval the cabling arrangements at the old exchange manhole had become little less than chaotic, due primarily to the fact that the main distributing frame facilities in the old test-room could not be extended, because of the lack of floor space; and secondly, to the impossibility of drawing up additional cables in the existing cable chutes between the manhole and the test-room. It was found necessary therefore to terminate a number of main cables in cable distribution heads in the manhole and to lead a limited number of pairs from each main cable up to the test-room. The cables that could not be fully utilised comprised three 1200/10 and two junction cables 24/100–400/20. The cables terminating on the main distributing frame in the old test-room included seven main junction cables, three subscribers' main cables, and nearly 100 14/20 cables, and as all of these were supported on a single cable-bearer in the limited space available in a 6 ft. by 4 ft. manhole, the task of evolving a workable scheme for extending the circuits to the new exchange was by no means a light one.

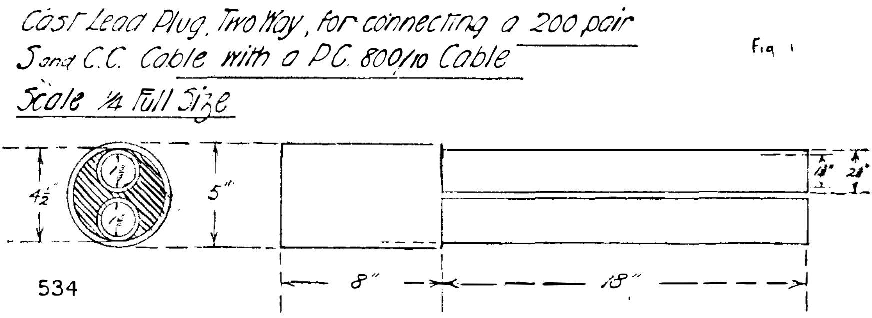
The manhole at the old exchange consists of two manholes connected by a brick tunnel. The original manhole is the 6 ft. by 4 ft. structure already referred to as containing the cable-bearer, whilst the second portion containing the main cables terminated in cable distribution heads is a 7 ft. by 5 ft. manhole. In view of all the circumstances it was agreed that the following scheme would best meet the requirements.

(1) Extend the three 1200/10 cables in the 7 ft. by 5 ft. portion of the manhole to the new exchange and divert the subscribers' circuits to these 1200/10 cables, which serve three different routes.

(2) Insert cable distribution heads on the subscribers' cables in the 6 ft. by 4 ft. portion of the manhole, in order that the working circuits might be extended to a teeing point.

(3) Provide an additional 800/10 subscribers' cable from a point near the junction for the new exchange in High Street, Putney.

(4) At the old exchange nearly 900 junction circuit pairs were terminated on the M.D.F., and in addition to these 600 junction pairs terminated in cable distribution heads in the manhole. These junction circuit cables comprise main junction cables from London, each of which is distributed to main and other junction cables to the Thames Valley exchanges. In view of the large number of through junction circuits it was decided that only two junction cables should



I.—Dimensions of Joint.

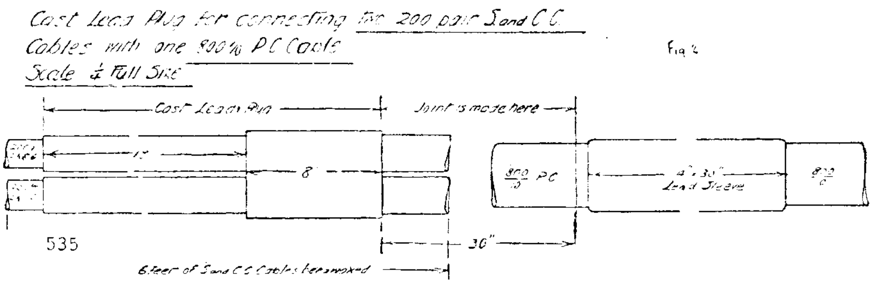
be extended to the new exchange, to carry only the circuits required for Putney exchange. It was necessary, therefore, to insert cable distribution heads on the main junction cables led in at the old exchange and to provide a means of cross-connecting between the various cable distribution heads.

It is satisfactory to record that in spite of the difficulties due to the congested condition of the cabling arrangements and to the restricted space, the work of diverting the majority of the 1300 subscribers' circuits to the three 1200/10 cables, for extension to the new exchange, of cutting out nearly 1500 junction cable ends and of extending 200 junction pairs to the new exchange was done with a minimum of interference to the existing circuits, notwithstanding the fact that a large amount of diversion work in connection with the Putney cabling development scheme had to be dealt with in the same manhole at the same time.

After the completion of the diversions to the cables that were extended to the new exchange, it will be understood that the actual operation of teeing the circuits was a simple one, the tee in every case being made in a cable distribution head.

In the arrangements for transferring the working circuits to the new exchange the use of a change-over frame was dispensed with, as there was no accommodation for the apparatus or cables at the old exchange. Each circuit was therefore extended direct to the new exchange. On the M.D.F. at the new exchange the glass tube fuses were not inserted in the fuse mountings of the subscribers' cables until the whole of the work, both inside and outside, had been completed and tested, and the circuits had been insulated at the line and cut-off relays. The junction circuits were insulated at the heat-coil strips until brought into use.

Experimental trials of the usual method of insulating the subscribers' circuits at the line and cut-off relays by inserting a microscope glass between the contacts of each relay showed that at least 50 per cent. of the glasses failed to drop when a peg was inserted in



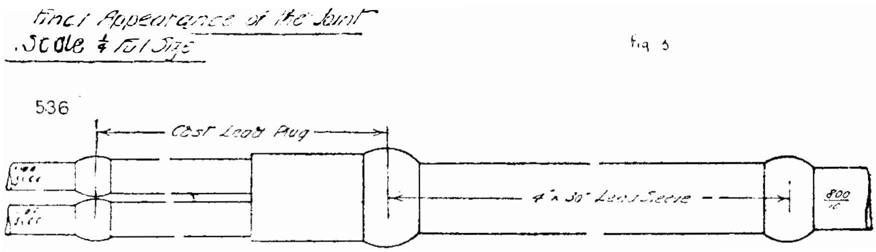
2.—DIMENSIONS OF JOINT.

the corresponding jack, and that any alteration made to the springs of the relay in order to permit of the glass dropping gave rise to disconnections, which at the change over would have caused considerable trouble. This difficulty is due to a slight difference in the construction of the relay contacts as compared with the older form of this type of line and cut-off relay. As the time occupied in getting the whole of these relays into proper adjustment for the circuit arrangements had extended over a number of weeks, it was considered necessary to find a method of temporarily insulating the circuits which would avoid any interference with the contacts, and which would enable the circuits to be joined up to the new exchange without undue loss of time. The method adopted was the insertion of a small wedge-shaped piece of wood between the armature and the body of the coil of each line and cut-off relay, thus operating the contacts without touching them. Through a small hole at the free end of each wedge was slipped a length of twine for each strip of ten relays. On the receipt of the change-over signal the wedges were pulled out, after which the operators commenced the tests for "no glows." It will be seen this method obviates the need for the preliminary pegging in at every jack by the operators in order to energise the cut-off relays.

With regard to the junction circuits the usual practice was adopted of transferring about half the working lines shortly before the change-over, which was arranged to take place at a time when half the junctions would be sufficient to carry the traffic. All the working junction circuits were teed through to the new exchange precisely in the same way as the subscribers' circuits, and were left disconnected at the heat-coil strips until brought into use. In every case preliminary tests were made with the exchanges concerned.

Prior to the change-over the following alterations were made:

Subscribers' Circuits.—(1) The receivers were tested in order to ascertain whether the polarity assisted the 24-volts common battery, and, where necessary, the connections on the receiver were reversed. The nature of the tests made is indicated in diagram 3 on page 206, vol. i, of this Journal.



3.—Completed Joint.

(2) Exchange circuits with one extension having intercommunication (diagram C.B.S. 5).

In order to prevent a permanent ring on the trembler bell when the extension is put through to the C.B. exchange the connections of the local bell circuit were modified, as shown in Diag. 1, page 205, vol. i, of this Journal.

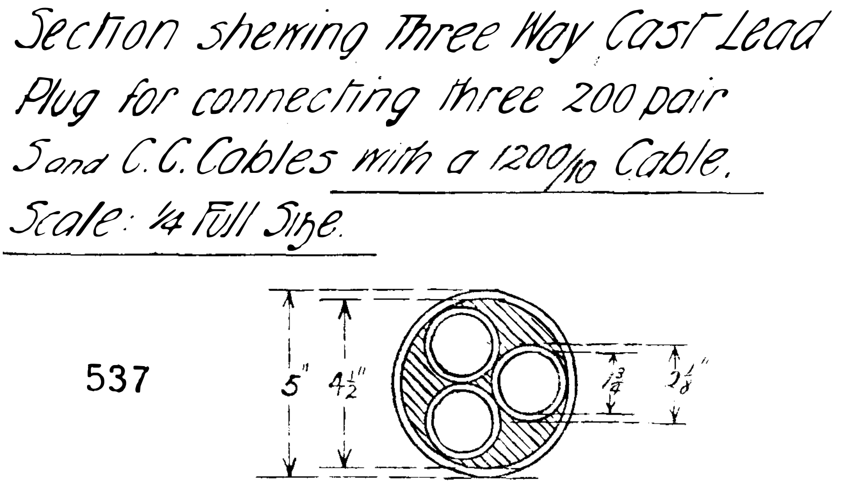
(3) Heat coils B. (28·5$^{\omega}$ to 31·5$^{\omega}$) at subscribers' premises were replaced with heat coils A. green (4·5$^{\omega}$ to 5·8$^{\omega}$) in order to give a higher striking point, and also to reduce the resistance of the circuits to the lowest possible figure.

(4) Where C.B.S. switchboards were installed a spare jack was short-circuited in order to provide a means of holding the exchange while the attention of an extension was being obtained.

Alterations at the New Exchange.—As there is neither a four-volt tap on the twenty-four-volt battery nor party-line ringing at the new exchange, the only alteration necessary, in order to permit of the C.B. exchange working to C.B.S. stations, is in the ringing circuit of the "B" boards. The object of the alteration is to prevent the tripping relays being actuated by the earth on the A line at the subscribers' instrument. The tripping relays were therefore removed from the generator lead and placed in the ringing return. 5 shows the alterations made.

ALTERATIONS AT THE OLD EXCHANGE.—The earth "commons" were disconnected from the Ericsson main distributing frames in order to avoid putting earth on the "teed" lines when the heat coils were withdrawn at the time of the change-over.

The method of leading in the cables from the cable-chamber and terminating them on the M.D.F. is, perhaps, deserving of mention. A typical case is that of a 12●●/10 P.C. cable. The M.D.F. is of the vertical type, *i.e.* the cables are laced out vertically on both sides of the frame. Each vertical accommodates 2●● pairs. Hence



4.—SECTION OF THREE WAY PLUG.

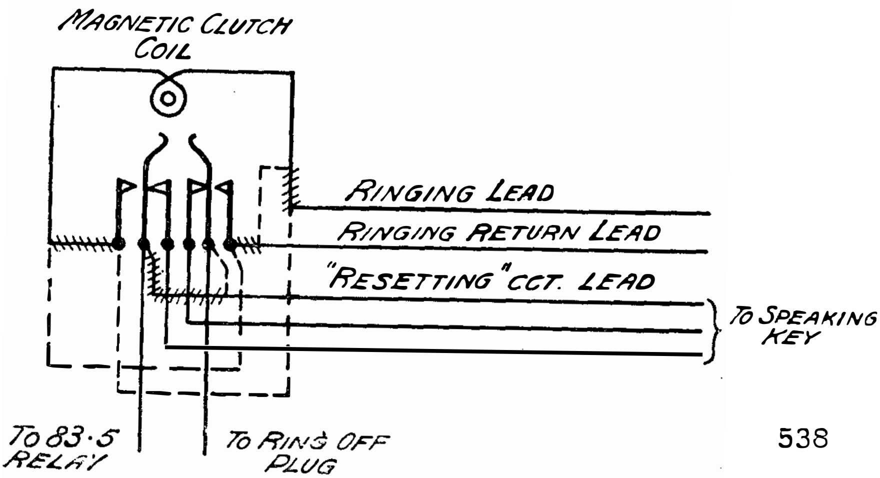
for a 12●●/10 cable it is necessary to lace out the pairs on three verticals. In practice the P.C. cable terminates in the cable-chamber, and is extended to the M.D.F. by means of three 2●●-pair S. and C.C. cables. One three-inch pipe per vertical connects the floor of the test-room and the ceiling of the cable-chamber, and one cable per vertical is drawn up through each pipe. As these cables require to be laced out from the bottom to the top of the verticals it is necessary to "re-f●rm" each cable, so that the first twenty centre pairs may be laced out on the bottom fuse mounting, there being ten such groups per vertical.

The reasons that led to the adoption of a modification of the usual joint between the S. and C.C. and P.C. cables at Putney were as follows:

(1) The isolated position of the new exchange building rendered it essential that in the event of a fire occurring, the cables could, if

required, be extended to the ground at the rear of the exchange. A numbered-through joint on each cable was, therefore, necessary in the cable-chamber. It may be stated here that a numbered-through joint on each cable was also made at the junction for the new exchange in High Street, Putney.

(2) Experiments made with beeswaxing S. and C.C. cables by means of the apparatus ordinarily used for compounding-solid joints, show that if the process of beeswaxing these cables is done before the lead covering is stripped off, *i. e.* before the S. and C.C. insulation is exposed to the atmosphere, the loss of insulation usually associated with this type of cable is prevented. For these reasons the S. and C.C. cables were treated with beeswax, which had been heated by means of a compound melting-pot, and which was forced into the cable under a pressure obtained from a



5.—ALTERATION TO RINGING ARRANGEMENTS.

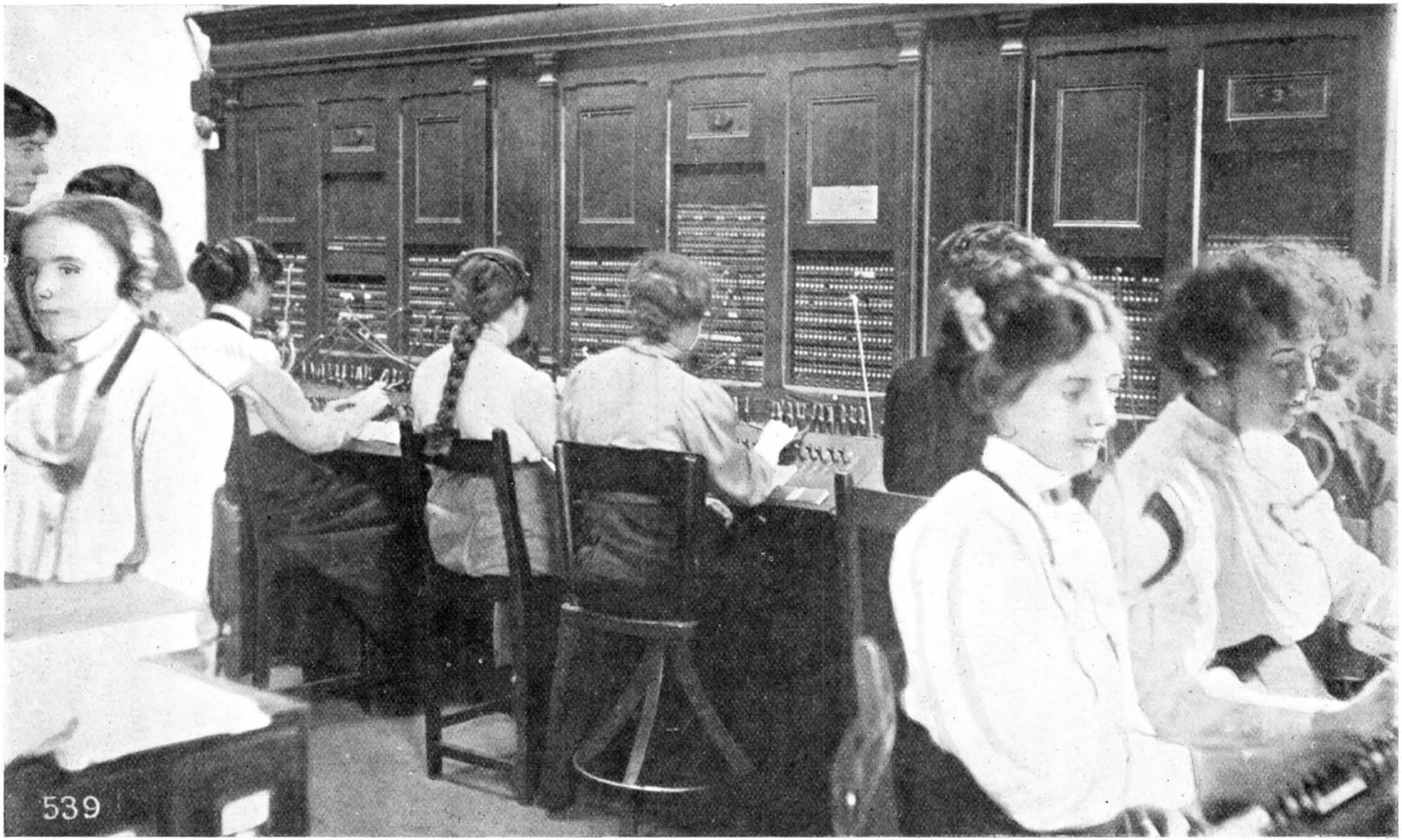
motor desiccator. At one end of the cable a length of about 18 ft. requires to be treated for lacing out on the M.D.F., and at the other end about 6 ft. for the joint between the P.C. and the S. and C.C. Upon the end of the cable under treatment is "wiped" an air nozzle, and at the extremity of the length required (either 18 or 6 ft. distant) an outlet hole is made in the sheath of the cable. The boiling wax is forced into the air-nozzle until it travels through to the outlet hole. Insulation tests made after the cables had been so treated and laced out indicate that it is possible to obtain readings of from 500 to 1000 megohms.

In order to make an air-tight joint between the S. and C.C. cables and the paper core the following expedient was adopted:

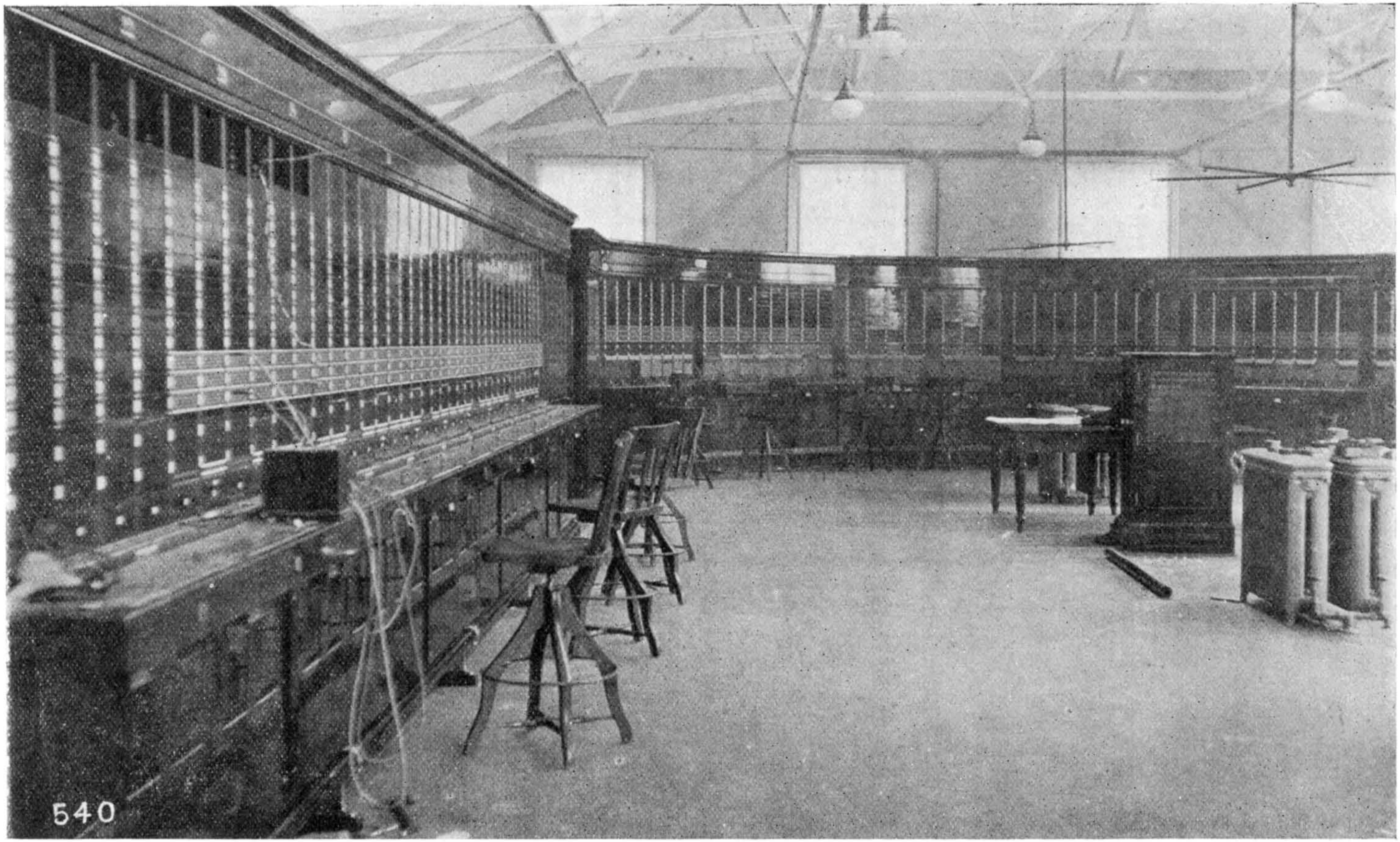
The S. and C.C. cables were terminated in a cast lead plug which for a 1200/10 cable is three-way and for 800/10 cable is two-way.

From the accompanying diagrams 1, 2, 3 and 4, it will be seen that

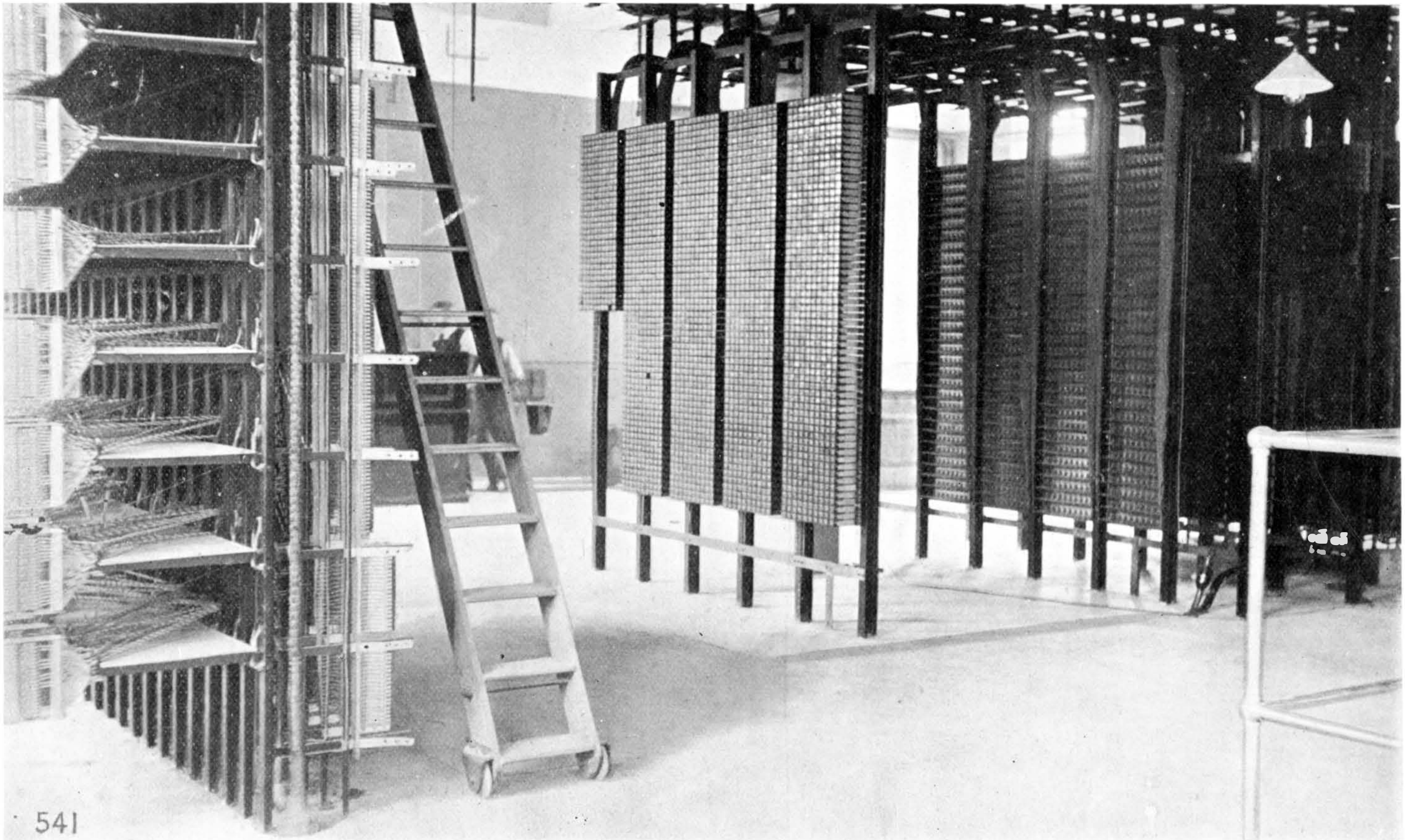
PUTNEY TELEPHONE EXCHANGE.



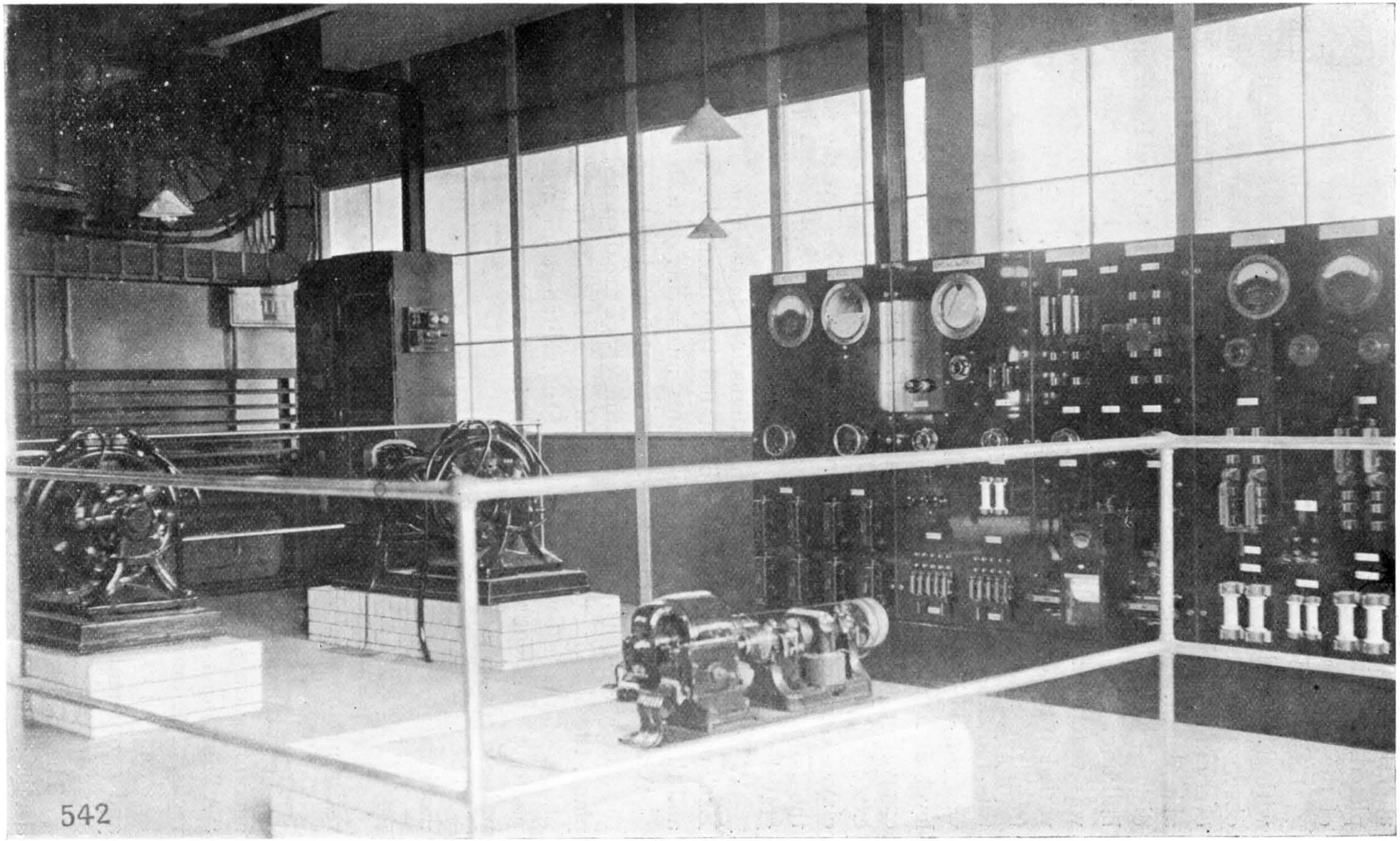
6.—Switch-room, Putney Old Exchange.



7. - Switch-room, Putney New Exchange.



8.—Test-room, Putney New Exchange.



9.—Power Board, Putney New Exchange.

after the joint between the S. and C.C. and the P.C. has been completed, the 4 in. lead sleeve is slipped into the 4½ in. diameter crown of the cast-lead plug, and plumber's " wipes " made at each joint.

EXCHANGE " EARTH."—While the excavations in connection with the foundations of the new Exchange were proceeding it was observed that the soil consisted of very fine gravel, and as there was every indication that a good earth could not be obtained at a reasonable depth, arrangements were made to dig out the rubbish from a disused well which existed in the yard attached to the Exchange building. On clearing out the well it was found that water level was reached at a depth of 20 ft., and that the depth of water varied to the extent of three feet with every tide. As the distance from the new Exchange to the River Thames is about 300 yds., this indicates the extreme porosity of the soil. One earth plate was buried in the disused well, and a second plate at the water level at a point about 15 ft. from the Exchange building. In excavating for the second earth plate it was found that fine gravel extended down to the water level (20 ft.), there being no trace of clay. Great difficulty was experienced in shoring up the sides of the hole, as the action of the tides tended to drive out the fine gravel at the bottom.

Without entering into an exhaustive description of the new Exchange equipment, it may be stated that both the switch-room and the test-room are spacious rooms measuring 70 ft. by 40 ft.

A small portion of the test-room is partitioned off to accommodate the secondary cells. In the remaining space are disposed the power, plant, the M.D.F., the I.D.F., the Meter and Relay racks, etc. Two photos of the test-room and one of the switch-room are shown. A photo of the switch-room at the old Exchange is reproduced for the purpose of comparison.

The new Exchange is of the C.B. type No. 1, with the following modifications:

(1) No party-line ringing is provided.

(2) A non-inductive resistance on the line relay replaces the lamp resistance on the " B " line.

(3) There is no 4-volt tap on the 24-volt battery.

The exchange is equipped for 2700 subscribers. The building can accommodate 5400 subscribers with the addition of the necessary " A " sections and the extension of the multiples and apparatus racks. The building has been designed so that the switch-room may be extended to double its present length, and the multiple, cable-runs and equipment can accommodate an ultimate capacity of 10,800 subscribers.

The scope of the installation may be gauged from the following details:

SUBSCRIBERS' SECTIONS.—Six eight-panel sections, three operators' positions per section, maximum load per operator per position 180 subscribers, 2700 nine-panel subscribers' multiple, 240 six-panel junction multiple, one operator's test position, and the usual equipment for call wires, busyback, cord testing, operators' speaking, etc.

JUNCTION SECTIONS.—The incoming junction boards comprise 1 three-panel section for the electrophone distribution and 4 nine-panel sections. The nine-panel sections have three operators' positions per section, and each position accommodates twenty-six junctions. The six-panel outgoing junction multiple as well as the nine-panel subscribers' multiple is available.

ACCUMULATORS.—Two sets of eleven cells in lead boxes suitable for an ultimate maximum discharge of 1200 ampère-hours at a nine-hour rate, but fitted at present with plates for 600 ampère-hours at a nine-hour rate, and one 30-volt meter battery of 15 cells for 60 ampère-hours at a nine-hour rate.

POWER.—The four-panel power-board provides the necessary switching and indicating arrangements in connection with the two charging motor-generators, one ringing motor-generator driven from the 205-volt mains, one ringing motor-generator driven from the 24-volt battery, the two 24-volt batteries, the 30-volt meter battery, etc. Both a Watt-meter and a recording ammeter are included in the equipment.

A supervisor's desk is fitted in the switch-room, whilst in the test-room there is a two-position wire chief's desk.

The plant has been manufactured and installed by the Western Electric Company.

Accommodation for the staff has been provided on the same ample lines as in the case of the equipment. For the operating staff there are large rooms to be used as cloak-room, dining-room, and rest-room. The kitchen and appurtenances are the best of their kind. The same remarks apply to the linemen's room, kitchen, etc. One large room is allocated to the inspector's class, whilst another is used by the exchange manager.

An engineer's section stock is accommodated in a suitably designed stores-room in the basement.

The whole building is lighted by electricity and heated by means of a hot-water system of pipes and radiators.

AN AUTOMATIC COUNTER FOR SUBSCRIBERS' EFFECTIVE CALLS.

By P. V. CHRISTENSEN.
Engineer of the Copenhagen Telephone Co.

THE simplest way of counting connections is by counting the number of calls made by each subscriber. This may be done automatically by connecting the subscriber's signal or lamp to an electro-magnetic counter, which shifts a figure every time the subscriber's signal drops or his lamp glows.

The number shown by the counter will include: (a) effective calls; (b) ineffective calls; (c) false signals.

Part of the "c" counts may be eliminated by connecting the counter to the subscriber's answering jack instead of to the signal or lamp; the counter will then shift a figure every time an answering plug is put into the subscriber's answering jack.

In order to eliminate the remaining "b" and "c" counts an additional arrangement is introduced. The counter is connected to the answering jack as above said, but, besides inserting the answering plug, a second condition must, however, be fulfilled before the counter shifts a figure. In certain C B exchanges this second condition is fulfilled when the called subscriber takes off the receiver. It would seem that in this way the highest perfection of an automatic counter had been reached. Special arrangements for each pair of cords are, however, required, and it is difficult to arrange such counters in C B exchanges already working, and it cannot be done in magneto exchanges.

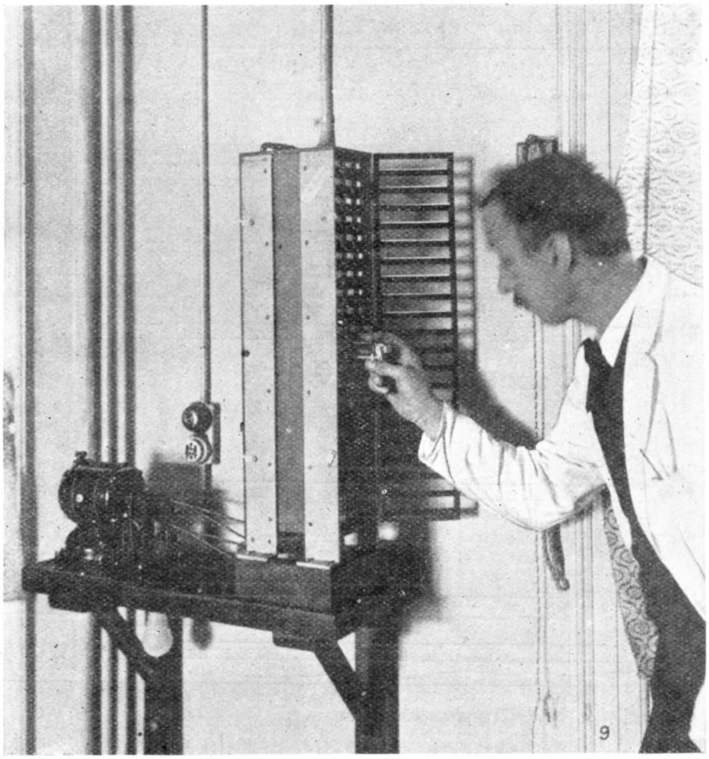
In Copenhagen it was desired to arrange a fully automatic counter in the C B and magneto exchanges already working.

As second condition the time "T," in which the answering plug remains in the answering jack, was taken into consideration.

In the case of "a" counts mentioned above, "T" is considerably greater than in the cases of "b" and "c" counts. The counter is constructed so that it separates the greater values of "T" from the smaller values of "T." The limit is made 30 sec., as "a" is deemed to correspond to "T" > 30 sec., and "b" and "c" to "T" < 30 sec.

The automatic counter described here is constructed so that it only registers the calls for which the time is "T" > 30 sec. The counter is worked by an electric motor, and it must be noted that an alteration of "T," for instance of between 15 and 45 sec. does not require a differently constructed counter, but only an alteration in the transmitting gearing between counter and motor.

1 shows a cabinet containing sixty counters and the electric motor, which may be used in joint connection with a larger number of cabinets. The dimensions of the cabinet are 175 × 138 × 663 mm., so that in the case of larger constructions 650 counters may be had per square metre. Each counter may be removed by loosening a screw. On the glass door the subscriber's telephone numbers are fixed in the framework. The counters are arranged in three vertical columns, with twenty in each column. Behind each column is a



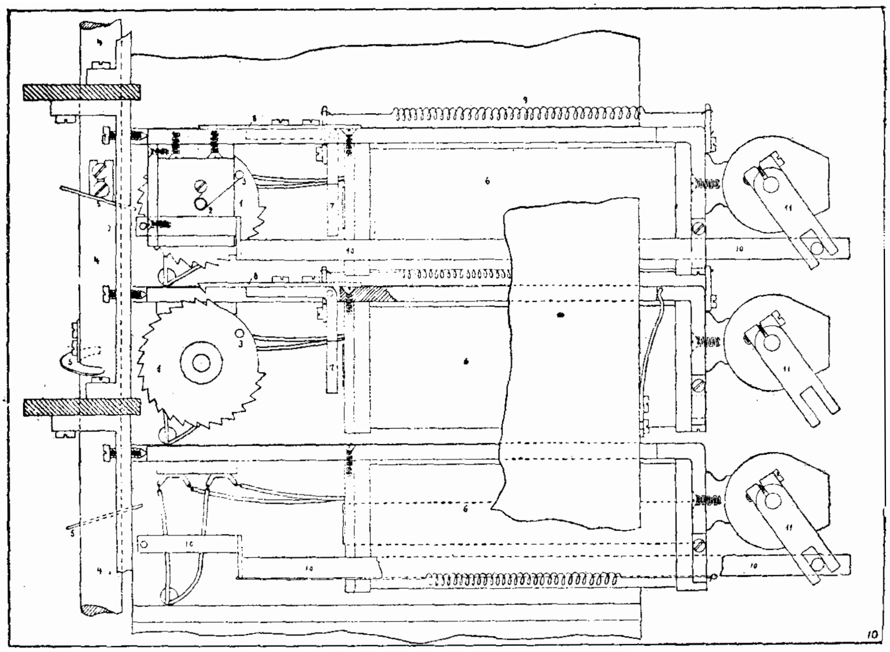
I.—Cabinet with Sixty Automatic Counters.

vertical shaft which is kept permanently rotating by the electric motor.

2 shows the details of construction. *11* is a "Veeder counter," the lever of which is worked by the rod (*10*). An electro-magnet (*6*) carries the armature (*7*). The armature is drawn away from the magnet by means of the spring (*9*). The armature carries a pawl (*8*). When the electro-magnet attracts the armature the pawl (*8*) engages a ratchet-wheel (*1*). This ratchet-wheel is carried by two pivots, and is held at rest by the spring (*2*). At the left is seen the

rotating shaft (*4*), on which is fixed a slanting blade (*5*) (screw sector) for each counter. The blade (*5*) engages a ratchet of the wheel (*1*) and moves it upward during the one-half revolution of the shaft (*4*), during the other half revolution of the shaft the ratchet-wheel is disengaged by the blade, and is brought back to its former position by the spring (*2*).

When no current passes through the electro-magnet (*6*) the ratchet-wheel will permanently have a forward and backward motion with thirty oscillations per minute. The electro-magnet (*6*) is connected to the subscriber's answering jack in such a way that

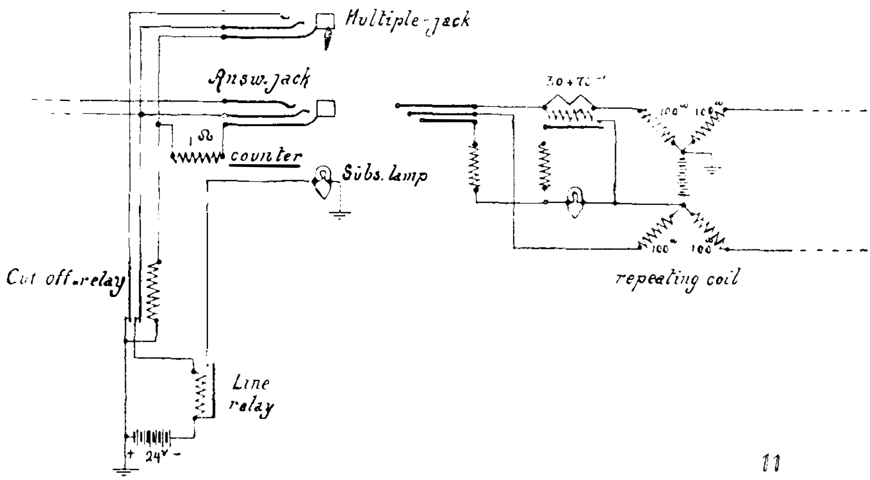


2.—Details of Automatic Counters.

current continually passes through it when there is a plug in the jack. The moment the answering plug is inserted the electro-magnet will attract its armature, and the pawl (*8*) will engage the ratchet-wheel. The oscillating motion of the ratchet-wheel will now become a progressive motion, as the backward, but not the forward, motion of the ratchet-wheel is retarded by the pawl. After some time the ratchet-wheel will have turned so far that the tap (*3*) engages the knee of the rod (*10*). During the further motion of the ratchet-wheel the rod (*10*) will travel in a horizontal direction, and will move the lever (*11*) of the counter.

When the ratchet-wheel has turned yet more the last ratchet of the wheel will have passed the blade (*5*), and the wheel will then remain in this position whilst the lever of the counter will be drawn completely back. When the plug is withdrawn from the jack the electro-magnet (*6*) is demagnetised, the spring (*9*) removes the pawl (*8*) from off the ratchet-wheel and the wheel is turned back by the spring (*2*), while another spring (shown only on the lower counter) moves the rod (*10*) and the counter lever forward again. By this operation the counter shifts a figure. If the plug was withdrawn from the jack at an earlier stage ("T" < 30 sec.) the counter lever (*11*) would not be drawn completely back, and would consequently not move the figures of the counter.

3 shows the arrangement of the counter for the Western Electric Co.'s central battery system. The counter for this system has a resistance of 1 ohm, therefore consuming about 25 milliwatts. In



3.—Western Electric Co.'s C.B. Subscriber's Line with Automatic Counter.

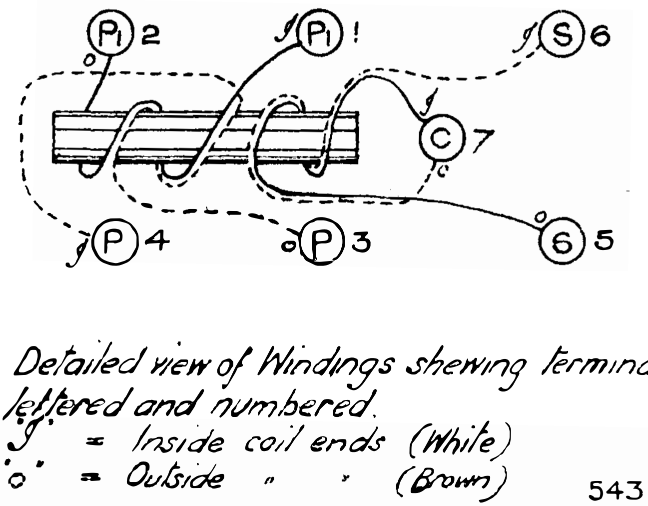
connection with other systems, for instance magneto-systems, it is of importance that this counter can be regulated to a very small consumption of current down to 10 milliwatts.

NEW IDEAS.

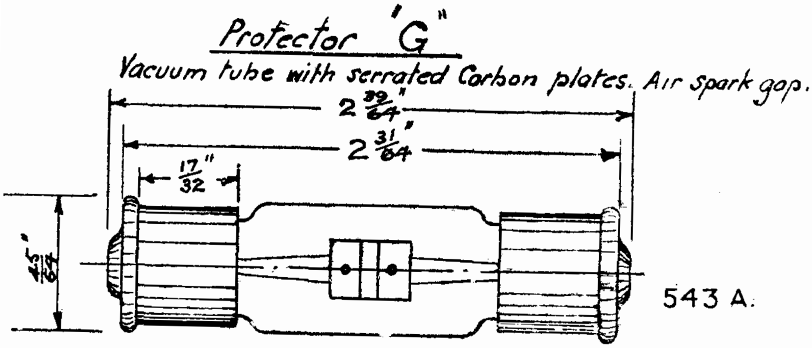
Protection of Transformers in Pole Test-boxes.

The use of seven-terminal transformers fitted in pole test-boxes for the superimposed working of telegraph channels on telephone lines has given rise to much maintenance trouble owing to the ingress of moisture. To obviate this trouble transformers completely enclosed in wooden cases $6\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by 3 in. have been brought into use with a large measure of success. The coils are baked and

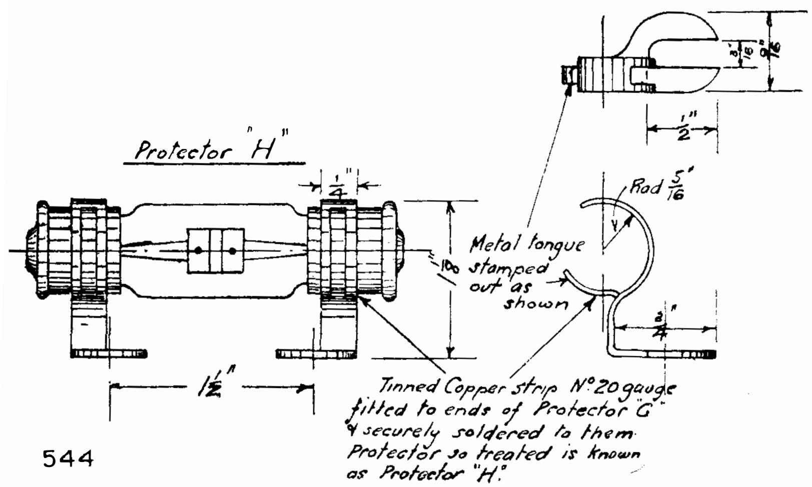
NEW IDEAS.



I.—Connections of 7-Terminal Transformer.



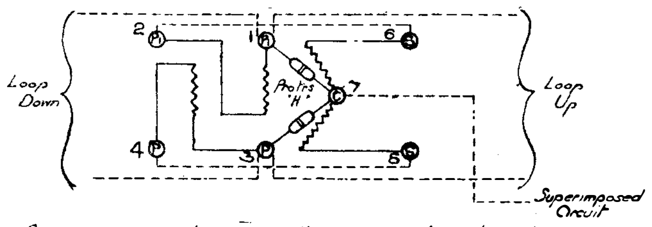
2.—Vacuum Protector.



3.—Protector Clips.

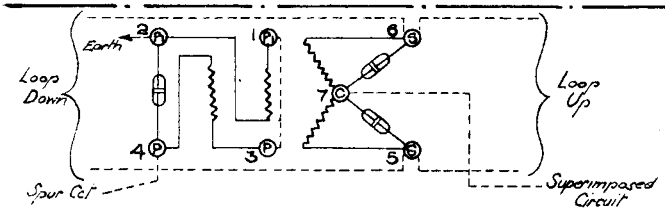
 NEW IDEAS

treated with paraffin wax *in vacuo* before they are fitted in the case, and the remainder of the space is then filled with wax, thus forming a solid mass well calculated to resist the entry of moisture. Apart from the trouble due to moisture there was reason to fear that a considerable number of faults were due to lightning discharges, and



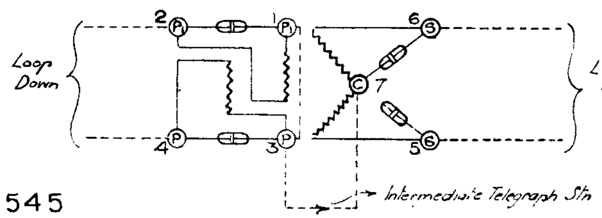
4

Superimposed single wire Circuit connected to metallic loop at Intermediate point Transformer used as Bridging Coil 2 Protectors 'H' fitted to protect Coils from lightning



5

Superimposed Circuit and Transformer spur Circuit on metallic loop 3 Protectors 'H' fitted to protect coils from lightning In the absence of a Superimposed circuit at this point the two protectors on terminals 5 6 & 7 would be replaced by a single protector joined between terminals 5 & 6



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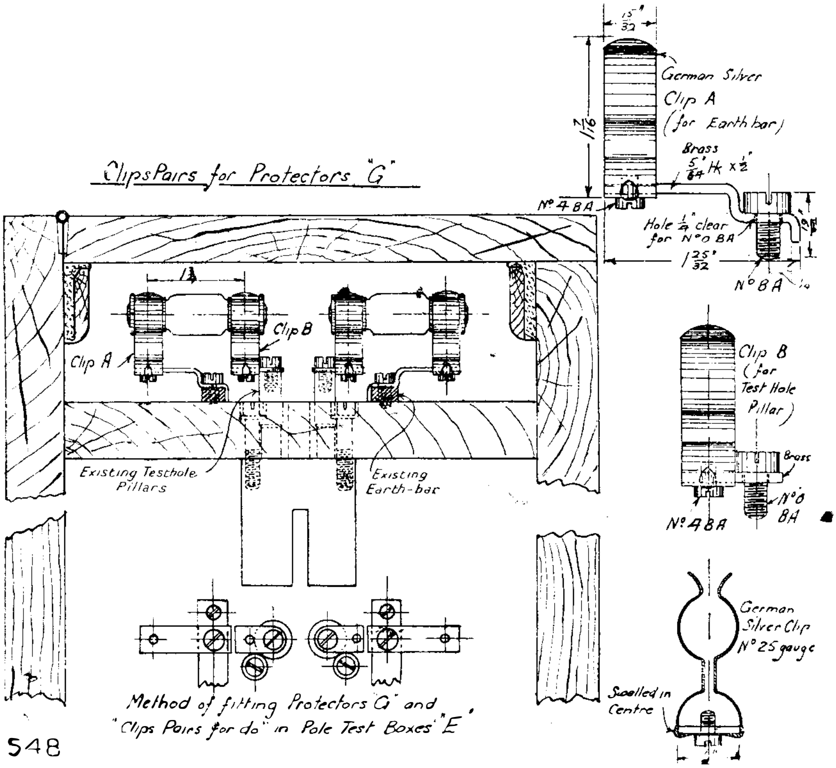
Intermediate station on superimposed telegraph circuit served from intermediate point on divided loop 4 Protectors 'H' fitted The same arrangement would hold good for two independent superimposed circuits connected respectively to the up and down sides of the loop

to render the transformer still more efficient it has recently been decided to make provision for fitting them with lightning protectors.

In the latest design of instrument the terminals are mounted on the top of the transformer on an ebonite slab $\frac{3}{8}$ in. thick, and to facilitate the fitting of the protectors the position of the terminals has been rearranged as shown in 1.

In view of the fact that these transformers are used largely in damp situations it was necessary to provide for a type of protector not susceptible to loss of insulation in the presence of moisture, and as the result of a series of tests it was decided to adopt the vacuum protector shown in **2** as being the most suitable for the purpose. By comparison it has been shown to be more sensitive than either the old " vacuum protector " used by the Post Office, the circular carbon protector " C," or the small rectangular type " D." The new pro-



7.—METHOD OF FITTING PROTECTORS.

tector consists of a vacuum tube containing two serrated carbon electrodes with spark-gap, and will be known as protector " G."

These protectors have been provided with special extension clips to permit their ready connection direct to the transformer terminals. This combination of protectors G and extension clips will be known as protector " H." The clips consist of stamped copper strips, and they are securely soldered to the ends of the protector as shown in **3**.

The encased transformer now being introduced will fit in the later form of small pole test-boxes known as " F," but cannot be accommodated in the older pattern, which was originally designed for a small plug switch; it will therefore be necessary in some cases to change the test-box.

It will prevent risk of breakage if the protectors are fitted to the transformer after the latter has been placed in position in the test-box.

4, 5, and 6 show diagrammatically the measure of protection afforded in a few typical cases by means of protectors "H" fitted to seven-terminal transformers.

It is also intended that this new type of vacuum protector shall supersede the carbon plate protector with a mica separator now fitted in the pole test-boxes "E" in positions where satisfactory insulation is difficult to maintain. "Clips pairs for protectors G" shown in 7 enable the change to be made with a minimum amount of disturbance to the existing fittings in these boxes. 7 also shows the method of fitting protectors G and "clips pairs for protectors G" in pole test-boxes E.

CABLE FAULTS AND THEIR REMOVAL: AN EXPERIMENT.

THESE are days of pressure, and there are few engineers who are not more or less affected by the bustle and rush of modern methods. Yet it is certain that much time and energy are wasted because it is found impracticable to pause and consider what are the best means of dealing with emergency works. These often present very complex problems, for the solution of which more time for reflection and review is required than the Post Office engineer is able to bestow. For example, when a cable breakdown occurs owing to saturation with water, should the cable be dried out by heat and air, or should the damaged section be renewed?

Most engineers have had experience of paper cables damaged by water, and, perhaps, after the application of the desiccator for a time, the cable was sufficiently restored to carry the working circuits, but its insulation resistance was never so high after, as it was previous to, the breakdown. In such circumstances the first and only consideration is, "get the circuits through." There is neither time nor opportunity for careful investigation, consequently phenomena frequently pass unobserved, and therefore unexplained. There is, however, a reason for the low insulation resistance, and because of its importance in the future good working of the cable it is worthy of careful inquiry. Hence, with a view towards the solution of this problem, the result of a recent experiment is submitted for consideration.

A gallon of water from the Regent's Canal was placed in an ordinary galvanised iron pail with a short length of 14/10 paper core cable, the lead sheathing of which was slightly damaged, so that water could find its way into the core. The wires were bared and bunched at one end and connected to the positive pole of a dry-cell battery of about 24 volts, while the lead sheathing was attached to the negative plate.

This arrangement was continued for twelve hours, but the cable was immersed for thirty hours. On the removal of the cable from the water the lead sheathing was stripped, when it was observed that the water had travelled only a few inches along the paper on either side of the opening in the sheath.

The insulating paper was badly stained with a dark greenish substance which proved to be copper. This discoloration was quite noticeable and easily detected by the naked eye. After the cable had been thoroughly dried by the application of heat, tests were made for the presence of copper in the insulating paper. It was found that even on a small piece of the outside wrapping an appreciable amount of copper was present. There were also traces of lead, but it is thought that the presence of lead was due to mechanical contact.

At first sight the factors of the experiment, viz. saturation in more or less dirty water for thirty hours with a current from a battery of about 24 volts applied for twelve hours, may seem too severe. It may be well, therefore, to remember the following points met with in actual practice :

(1) The damaged cable might consist of 1200 wires, any number of which may be earthing in consequence of the wet section, and many of its wires may be connected at an exchange to an earthed battery of 24 or higher voltage.

(2) The water from the canal in question more nearly resembles water after passing through the average city soil than water from any other source.

(3) Twelve hours is not too long to allow for the thorough restoration of a wet cable.

With these factors in view it is not unreasonable to suppose that electrolysis to a considerable extent would take place. The difficulty, however, is to decide without delay on the course to be adopted in effecting repairs. That is to say, should the cable be replaced or should it be dried out. Of course each case of damage must be considered on its merits ; but still a rule for general guidance might be suggested as follows :

Immediately the underground chamber has been cleared of water remove a section of the lead sheathing about the vicinity of the fracture, and closely examine the paper wrappings for a dark greenish deposit, which indicates the presence of copper. Should such be present, even to a traceable degree, the damaged section must be cut out without hesitation, otherwise the subsequent insulation resistance of the cable will never be satisfactory. Further, all the elements for short circuits will be present. Hence it is evident that the opportunity of preventing even one short-circuit, to say nothing of the fact that the cable will be restored to its original condition, will more than repay the additional cost, if any, in making good the damage.

Should a long length of main cable of loose construction be saturated with water no time should be lost in diverting the working circuits to another cable, after which the damaged cable should be examined and a decision arrived at as to the best course to be adopted in the circumstances.

Since preparing the foregoing notes an interesting case of the condition of a main cable which had been damaged by water came under the writer's notice. A few years ago water got into a cable at a joint in one of the City of London manholes, and the cable was dried out by heat and air and the working circuits handed over apparently duly restored. A few weeks ago it was found necessary to bring into use several of the spare wires in the cable when it was found that six pairs were short-circuited. After making Bridge tests it was decided to remove a certain lead sleeve, which happened to be the sleeve which was put on over the damaged section. The insulating paper of practically every wire was distinctly tarnished by copper while several of the outside pairs were quite useless. Needless to say the joint was re-made and the faults disappeared.

R. J. L.

NOTES AND COMMENTS.

Anglo-Belgian Telegraph Commission, 1911.

This Commission was appointed to consider what improvements should be made in the utilisation of the existing submarine cables between the two countries.

The Commission met during the second week in November, and consisted of the following delegates:

M. Dussart, Ingénieur Principal; M. Piérart, Inspecteur; M. Bocquet, Ingénieur; Mr. A. J. Stubbs, Assistant Engineer-in-Chief; Mr. F. P. Didden, Assistant Controller, C.T.O.; Mr. A. C. Booth, Staff Engineer.

There are four separate submarine cables between the two countries, as shown in the following table:

Cable.	Type.	Length.	Date.
Dumpton Gap–Middlekerke; also known as Ramsgate–Ostende	6-wire telegraph	58·5 knots	1853
St. Margaret's Bay–La Panne I; also known as Dover–La Panne I	4-wire telegraph	47·8 ,,	1866
St. Margaret's Bay–La Panne II; also known as Dover–La Panne II	4-wire telephone	47·2 ,,	1902
St. Margaret's Bay–La Panne III; also known as Dover–La Panne III	4-wire telephone loaded	48 ,,	1911

All telegraph circuits are worked by the Hughes type-printing telegraph apparatus either on the simplex or duplex method as required by the necessity of the traffic. As the cables are comparatively short there are no repeaters in the circuits to the Belgian towns, but at Brussels repeaters are used on the circuits which are extended into Germany, and at London on the Antwerp circuit, which is extended to Liverpool.

The telegraph circuits are used as shown in the following table:

Conductor.	Communication between	Apparatus.
Ostende cable:—		
1	London–Cologne	Hughes simplex.
2	,, Antwerp	,, duplex.
3	,, Ghent	,, simplex.
4	,, Brussels	,, ,,
5	,, Dusseldorf	,, duplex.
6	,, Frankfurt	,, simplex.
La Panne I:—		
1	Liverpool–Antwerp	,, ,,
2	London–Brussels	,, duplex.
3	,, Antwerp	,, ,,
4	,, ,, (Anglo Co.)	,, simplex.
La Panne II:—		
2s (superposed on a telephone loop)	London-Cologne	,, ,,

From the above it will be seen that there is a total of eleven circuits giving fifteen channels of communication. In the busy hours of the day the accommodation is barely sufficient to carry the traffic as expeditiously as is necessary, and should any of the lines become interrupted or either cable be broken the service suffers considerably.

The Commission has recommended the use of the Baudot system as being the one most suitable for providing the desired improvement, and at the same time retaining the advantage of directly printed telegrams in Roman type.

It is anticipated that Baudot quadruple duplex will be possible, but as triple duplex (six channels per circuit) will give a sufficient increase in the number of available channels for immediate requirements, it has been suggested that such an installation should be provided for trial on the London–Antwerp service.

This practical test on this fairly difficult circuit, comprising a length of submarine cable, subject to inductive interference from the other circuits through the same cable, and connected to aërial lines at each end, which are subject to variations in insulation, etc., will prove a useful experience. It will also to some extent provide an answer to the question whether it is advisable to utilise the duplex balance on the Baudot system generally, or to use it as a simplex system only. In the latter case much greater accuracy in adjustments is necessary owing to the fact that the segments are about half the length on a simplex set as compared with a duplex set giving the same number of channels.

This practical test should be of great interest to the several continental administrations now making considerable use of the Baudot system, as it will indicate which is the easier to maintain:

(*a*) Accurate adjustments to small segments; or—

(*b*) A duplex balance to segments twice as long.

On underground lines where the electrical conditions are stable, the duplex balance has already justified its use on a quadruple set giving eight channels carrying from 400 to 600 messages per hour.

THE "AUTOMATIC" SITUATION.

Quite a considerable amount of interest has been aroused by the announcement that the Post Office has decided to instal automatic switching equipment at some of its new or reconstructed telephone exchanges. The daily press, ever on the look-out for interesting copy, has not despised the subject, and through its means even the man in the street has received an impression that something new in the telephonic development of this country may be looked for very soon. Telephone engineers know very well that this something is not really new at all. The automatic method is as old as the common battery manual system, but, as it represents a much more radical departure from previous practice, the troubles and sorrows of its youth have been correspondingly multiplied and protracted. Only within the past few years have telephone men generally awakened to the fact that the automatic exchange has arrived, that it will work, that the public like it and will work it, and that under proper conditions it will give more economical and better service than the manual system upon which most of us had previously been inclined to pin our faith. The British Post Office is no pioneer in this matter. With characteristic caution it enters the field at a comparatively late stage, when it is able to reap the advantage of the experience gained by more adventurous administrations in America, Germany, Austria, Holland, Sweden, and elsewhere. So far only three small orders have been placed by the Post Office, and these cover installations of, roughly, 500 lines each—at Epsom, Caterham, and the G.P.O. buildings in London. Plans for larger installations, up to 10,000 lines, are under consideration.

At Epsom the Strowger system with its well known finger-dial calling device is being installed. The apparatus has been delivered and its erection only awaits the completion of the switch-room. Caterham will have the Lorimer system, which employs telephones fitted with levers which enable a subscriber to set up the digits of the number required and check its correctness before he sends in the call. The relative merits of the finger-dial switch and of the setting levers as a calling device have never been authoritatively determined, and these two installations will help the Post Office to come to a conclusion on this point. Most automatic systems can be worked with either arrangement, but from the subscribers' standpoint the matter is one of some importance. The preference of engineers is naturally for the dial switch, which is much the simpler of the two devices and cheaper both to supply and to maintain.

The Lorimer is a power-driven system and includes a series of geared shafts and clutches, maintained in continuous rotation by a motor, and furnishing the necessary motion to the switching apparatus when required. The function of the relays and magnets associated with the selecting switches is thus one of control only.

The Strowger apparatus, on the other hand, is normally at rest, and all the motions of its switches are directly produced by the signalling and selecting impulses acting upon the electro-magnets of the switches. The determination of the relative merits of these two principles is still a matter in which the opinions of advocates of automatic systems are divided. It is interesting to note that among other leading systems now in the field, that of the Western Electric Co. includes a motor drive and a system of continuously rotating power shafts, while those of the American Automatic Co., the Kellogg Co., the North Electric Co. (Clement Auto-manual) and Messrs. Siemens and Halske (slightly modified Strowger) utilise direct electro-magnetic signalling impulses. Most of our readers will have noticed with interest the recent formation of an English company (the Automatic Telephone Manufacturing Co., Ltd.), which has acquired the extensive telephone works of the British Insulated & Helsby Cables, Ltd., at Liverpool, primarily with a view to the manufacture of automatic exchange equipment. The Western Electric Co. and Messrs. Siemens Bros. are also preparing for the manufacture of automatic plant in their London telephone works, and other large English firms of telephone suppliers are taking steps in the same direction. There thus seems to be every probability that it will be possible for the Post Office to maintain, in connection with automatic installations, the principle of competitive supply which is so dear to the hearts of Government Departments.

The automatic system still has its opponents, and among these one frequently finds a tendency to invoke the high authority of the engineers of the American Telephone and Telegraph Co. in support of the manual system against the automatic. This is both unfair and misleading. It is true that the American Telephone and Telegraph Co. has not at the present time any automatic or semi-automatic system in actual operation at a *public* exchange. The immense telephone interests which this company governs and the delicate conditions of its organisation introduce a host of considerations, from which the Post Office is free, and which make even the first step in the introduction of automatic switching a momentous one, which can only be taken after the very fullest deliberation and private experimental investigation. The company has, however, been so favourably impressed with the possibilities of automatic switching apparatus that it has spent a very large sum of money in experimenting with and developing a system of semi-automatic exchange working. Such a system requires the installation of apparatus identical in form and function with that of a full automatic system. The amount of automatic switching apparatus necessary at a semi-automatic exchange is, in fact, greater than at an exchange on the full automatic principle, since the counterpart of the subscribers' calling devices has also to be provided at the former.

The Chief Engineer of the American Telephone and Telegraph Company has publicly stated that he expects the introduction of the semi-automatic system to provide more efficient and more economical service that is given by the company's existing manual system.

For good or for evil, then we fear our engineers must face another long period of strenuous effort to master new problems and to adapt themselves to new conditions.

As regards lay-out of plant the automatic system is much less flexible than the manual, and the realisation of its best results depends more vitally upon the accuracy of the original installation plan. Guess and trial will not do. Surveys and traffic studies must be as full and complete as foresight can make them before the construction work involved in serving an area is begun. Junction problems and the costs of alternative methods of "satellite" exchange service can only be settled by looking far ahead. With the automatic system all parts of the area are to a great extent interdependent, and the area must be considered as a whole. Departures from the original plan cannot be introduced with the same facility and absence of waste as with the manual system.

The training of an adequate staff of exchange attendants is a subject of the greatest importance, and indeed one may safely say that it is here that the greatest difficulties of all are to be anticipated. The possibility of strikes and other labour troubles must be faced. Even at Chicago, the headquarters of the Strowger system, we hear that the new automatic installations are passing, or have passed through troubled waters from the labour standpoint.

One is confident that the staff of the Engineering Department will respond manfully to the extra calls which the introduction of the automatic system will make upon their time and their energy. The formulation of instructions and the dissemination of information on the subject will necessarily involve much careful and laborious work on the part of the Headquarters staff. In this work the POST OFFICE ELECTRICAL ENGINEERS' JOURNAL will endeavour to bear its part, and in our next issue we hope to present our readers with an article on the subject by an officer who is closely associated with the Post Office installations now in progress.

The 'Post Office Circular' of December 12th contained the following announcement:

ENGINEERING DEPARTMENT.

The Postmaster-General has pleasure in announcing that the Lords Commissioners of the Treasury have sanctioned a revision of the Engineering Department of the Post Office.

The future classification and rates of pay will be as follows:

Superintending Engineers and Staff Engineers.
£520—£20—£700.
London Allowance, £50.

Assistant Superintending Engineers and Assistant Staff Engineers.
£420—£20—£500.
London Allowance, £40.

Executive Engineers.
£315—£15—£405.
London Allowance, £30.

Assistant Engineers.
£105—£15—£300.
London Allowance, £20.

Chief Inspectors.
£150—£10—£200.
London Allowance, £20.

Senior Inspectors.
London 57s.—2s.—65s.
Provinces 52s.—2s.—60s.

Inspectors.
London 30s.—1/6—55s.
Provinces 30s.—1/6—48s.

Skilled Workmen, Class I (Established).
London 39s.—1/6—47s.
Provinces 37s.—1/6—45s.

Skilled Workmen, Class II (Established).
London 26s.—1/6—38s.
Provinces 24s.—1/6—36s.

Skilled Workmen (Unestablished).
London $6\frac{1}{4}$d. to $7\frac{3}{4}$d. per hour.
Provinces 5d. to 7d. per hour.

Unskilled Labourers (Unestablished).
London $6\frac{1}{4}$d. to 7d. per hour.
Provinces 5d. to 6d. per hour.

Boys and Youths.
London $2\frac{1}{2}$d. to $4\frac{1}{4}$d. per hour.
Provinces 2d. to $3\frac{3}{4}$d. per hour.

The present distinction between the Maintenance and Construction Staff will no longer obtain; and the whole of the adult force below the rank of Inspector will be divided into skilled and unskilled classes.

Fifty per cent. of the skilled workmen will be established; and these will be divided into two classes, whose rates of pay will be those shown above. The whole of the established linemen and mechanics will fall into the two classes of established skilled workmen; and the application of the above-mentioned percentage will result in the creation of about 1100 new established posts, to be filled from the unestablished maintenance and construction ranks.

None of the new engineering classes will be entitled to stripes; but a right to continue to receive stripes will be admitted in the case of all individuals who have rendered any stripe-bearing service in the Post Office.

Service on the new class of Unskilled Labourer will not be taken into account for pension purposes, except in the case of persons who have rendered service in the old class of Labourer (Skilled and Unskilled), and who have therefore had reasonable ground for expecting that the whole of their adult unestablished service would be included for pension purposes when followed without break by established service.

The assignment of the existing staff to the various classes will be notified to the individuals concerned as soon as possible. The whole of the officers borne on one class will not necessarily find themselves upon one class after the revision.

In some minor respects, the conditions of service on the new classes will differ from those hitherto obtaining; and certain changes will also be made in the conditions governing recruitment and promotions. These changes will be announced as soon as possible.

In applying the new scale to the old classes of Assistant Superintending Engineers, Second Class Staff Engineers, and First Class Engineers, the immediate benefit to any individual officer to whom the new scale is granted will be limited to an increment not more than twice as large as the normal increment on the old scale.

The Revision.

The last general revision of the Engineering Department took place on August 17th, 1903. There is a tradition that a revision should be made every five years, but it does not seem to be in accord with facts, for it is on record that previous revisions took place on July 20th, 1897, August 7th, 1891, April 1st, 1889, and April 1st, 1881. It will be seen that the intervals beginning from '81 were eight years, two years, six years, and six years, and that the present revision has the doubtful honour of breaking the record for length of interval by four months. We are not taking into account a rearrangement of Engineers' salaries in November, 1904. It is not known how long the actual preparation of the revision has occupied, but apparently it has been spread over the last three or four years. For many months the revision, under its more familiar title of "the scheme," has been the main topic of conversation between engineer officers, and the near approach of the transfer of the National Co.'s staff has not tended to decrease the interest and anxiety with which its issue was looked forward to.

As we go to press shortly after the announcement has been made, sufficient time has not elapsed to allow of a safe judgment being formed as to the effect of the changes.

We may, however, trust ourselves to comment on two points:

Some officers who have received intimations that their present appointments are redundant, and that they will be held against positions on the Inspectors' classes, have concluded that they are now outside a door closed to further advancement. We do not know if their impression is right or wrong; but we hope that it is wrong, and that a way will be kept open for every man who acquires proper qualifications to make his way onward and upward. We are firm believers in the "marshal's baton" theory, and every student of human nature knows that men will work better and more happily when buoyed up by the possibility—no matter how slender—of ultimate advancement, than they will when they know that an arbitrary limit has been put to their progression. It is to be hoped that the announcement promised in the penultimate paragraph of the revision to the effect that "certain changes will also be made in the conditions governing recruitment and promotions" will allay anxiety on this head.

Much speculation is being indulged in as to the meaning of the last paragraph, the limitation laid down as to immediate benefit to officers *to whom the new scale is granted* having in some cases the effect of deferring the enjoyment of the scale to a dim and distant future. Probably, however, inquiries which are being made will elicit enlightenment on this matter.

THE TRANSFER.

At midnight on December 31st, 1911, the thirty-one years' license of the National Telephone Company will run to its close, and a great and financially successful business organisation with its plant worth some number of millions sterling which we do not even dare to hint at and its 18,000 employees will pass into the ownership of the State.

Writing in mid-December and before the issue of the classification lists which our new colleagues may be excused for awaiting with great eagerness, we shall confine our remarks to the transfer as it effects our JOURNAL.

Although the Staff of the Engineer-in-Chief will be suddenly inflated by a very large number of officers, we do not anticipate any immediate increase in our circulation, because we already include among our subscribers a large number of the Company's Staff. We do, however, anticipate, and hope for, and will welcome, an immediate increase in the number of our contributors. The Board of Editors of the JOURNAL offers a hearty welcome to those who are now joining the staff of Post Office Engineers, and expresses the hope that the new life will not be less happy and prosperous than the old.

LOCAL CENTRE NOTES.

METROPOLITAN CENTRE.

PRESIDENT'S INAUGURAL ADDRESS DELIVERED AT THE OPENING OF THE SESSION, OCTOBER 16TH, 1911, BY MAJOR W. A. J. O'MEARA.

GENTLEMEN,—I do not desire to-night to disappoint you by claiming your attention to a lengthy address. You will have read—possibly with some satisfaction—that my remarks are to be brief. Personally, I think that there is much to be said on both sides in favour of a short address on this particular occasion. At the outset, I should like to say that the Metropolitan Centre is to be congratulated on the fact that the average attendance at the local meetings is well maintained. Moreover, the fact that we have such a full programme for the Session which opens to-night happily encourages the belief that the interest in the work of this Institution is by no means on the wane, and that we can still expect to reap many advantages from the readiness of our colleagues to place their experiences before us. Further, looming ahead is the transfer of the National Telephone Company business to Post Office control, and this fact suggests the possibility of a substantial increase in the membership of this Institution, probably before the end of the present session. While referring to this matter, I feel that I would like to extend on behalf of the Institution a very cordial welcome to those members of the engineering division of the Company's staff who desire to join the Institution in due course. It goes without saying that a no less cordial reception will be accorded to any offers which may be made by members of the transferred staff to read papers before the Institution.

As you know, considerable attention has been devoted recently by influential bodies and by the press and public generally to the matter of the education or training of engineers as well as to the subject of the value of degrees. The first-named subject is one which is very familiar to members of this Institution—having been dealt with specially on one or two occasions—and I have no doubt that most, if not all, of you have read with great interest that portion of the address delivered some weeks ago by Sir William Ramsay before the British Association which relates to this subject.

Possibly you may remember Sir William's apt remark: "In England we have made technical education a local, not an imperial question. Instead of half a dozen first-rate institutions of university rank, we have a hundred . . . and the training given is not that for captains of industry, but for workmen and foremen."

That the fallacious idea prevails, sad to say far too widely in this country, that the functions of an engineer correspond to those of a foreman, is, I think, beyond doubt, and it is in the interests of, and it should be the aim of, engineers to remove this wrong and sometimes mischievous impression. There are, it is true, "quack" engineers in this world, as there are "quack" doctors, but with this distinction: that while the medical profession has secured legal protection against "quackery," such protection has not, unfortunately, been secured by the engineering profession. I believe that a great amount of injury has been done, and is still being done, by "quack" engineers, and I consider that some system of registration should obtain, and that before a young man is admitted to practice as an engineer, he should be required to submit some suitable proof of his qualifications for the profession. This raises the question of the value to be placed upon the possession of scientific degrees. Those who have followed the discussion which took place at the Institution of Civil Engineers during the past summer on the important question of the training and education of engineers will not have failed to have discovered that there was a marked division of opinion on the subject of the value of degrees. Naturally, one has been anxious to discover the reason for this difference. It seems to me that what the commercial world is looking for is something in the nature of a hall-mark indicating the quality of the probable practical efficiency of the embryo engineers. The employer really desires that the student turned out from our educational establishments shall bear some mark which will not only indicate the amount of his theoretical and practical knowledge, but also his real power to apply this knowledge to the work which the young engineer may be called upon to undertake rather than a degree indicating examination room performances. The requirements for the degrees conferred under the present system are largely based on considerations more limited than those in the contemplation of the manufacturer or other employer, and it is not surprising, therefore, that so much disappointment is felt in commercial circles with the degrees which are being so liberally bestowed, and which, necessarily, are almost wholly granted in respect of academic attainments of a certain order. I recognise that the situation is a very difficult and far-reaching one. It may be that too many young men entering the engineering profession commence to specialise too early in life, to the neglect of their general education. Further, it may be that the fascination of science and the details of the application of its principles to particular engineering problems tend to absorb completely the attention of the majority of the students, to the exclusion of matters a knowledge of which is essential if the engineer is to be something more than a mere tool to do the bidding of those not having the same intimate knowledge of his craft. The solution of the difficulty can be effected if, for the present requirements for a degree, there can be substituted some means for marking down a man's qualifications in such a way as to include not only his theoretical knowledge, but also his ability to apply it readily and effectively in a mundane organisation, in which it must be recognised that human beings, and not the materials used, constitute the factor of prime importance. In condemning the system under which degrees are granted, it is necessary to guard against the danger of a wholesale condemnation not only of the system itself but also of all those on whom these degrees are conferred. Until the present system is modified, it seems to me that the degree must be accepted as an indication mainly of certain scholastic attainments, and that the employer must himself be content to undertake the task of assessing the value of the personal and practical qualities of each aspirant engineer. It is little wonder that such great interest has been aroused recently in the matter of the training and recruiting of engineers. The reason is not far to seek. Everyone who has any knowledge of the practical side of engineering fully recognises that owing to the advances which have been made in recent times and to the large sums of money involved in engineering schemes, it is more and more necessary that the proper class of young men should be drawn into the profession. I am persuaded no surer way to do this exists than that of properly appreciating the status and the value of the work of engineers. Sir James Inglis doubtless had this matter in mind when, some three years ago, in his Presidential Address before the Institution of Civil Engineers, he pointed out how important it was that the engineering work in Government Departments should be entrusted only to highly trained engineers. In view of Sir James's personal experiences not only as an engineer but as an administrator, his opinion in this connection is very valuable, and it is hoped that at no distant date his views on this subject will be very widely shared by all those in the highest authority.

In closing, I would remark that if a full recognition of the status of engineers is to be secured, not only must each individual engineer display adequate professional and general knowledge, but the whole body of engineers must also actively co-operate to obtain the creation of a governing body to effect an efficient control over their profession, and thus to protect adequately their own interests and those of the public generally.

The Committee have arranged for a most interesting and instructive series of papers to be read at the general meetings of the Centre during the winter session. This anticipation has been borne out by the successful meetings held on October 16th and November 13th.

On the first-named occasion the President delivered an inaugural address, a report of which appears above, and afterwards read a paper entitled "The Various Systems of Multiple Telegraphy," which had been prepared by special invitation for the International Congress held at Turin.

The subsequent discussion was opened by Mr. Moir, and was continued by Messrs. Stubbs, Slingo, J. E. Taylor, Pollock, Elliott, and Lack. The President replied.

Upon the motion of Mr. J. M. G. Trezise, who had occupied the Chair during the reading of the paper by the President, a hearty vote of thanks was tendered Major O'Meara.

At the meeting of November 13th Mr. W. S. Mountain read his paper on "Departmental Contracts."

The object of the paper was to explain the policy of the Department with regard to works given out to contract, and to explain the clauses of the agreement which the successful tenderer has to enter into with the Postmaster-General when given a contract by the Department. Mr. Mountain illustrated his remarks by quoting cases in which difficulties had arisen under the various clauses. The discussion, which was of a most interesting character, was opened by Mr. Noble, and was continued by Messrs. Gunton, Warren, Turner, Cornish, Myles Hook, Hines, and Bartholomew.

Mr. Mountain replied to the various points raised, and was accorded a hearty vote of thanks.

On November 2nd 60 members of the Centre paid a visit to the Royal Small Arms Factory at Enfield Lock.

They met with a very cordial reception from the officials, and under the guidance of the officers who had been deputed by the Superintendent to take charge of the party, spent a most interesting afternoon in inspecting the various processes by which small arms are made for the Army. The visitors were much struck by the effective yet simple methods by which the respective operations were carried out.

The Committee have made arrangements for visits to the National Physical Laboratory and the Associated Portland Cement Works respectively.

The visit to the Laboratory will, at the request of the Director, take place after Christmas, and the date of this visit, and also that to the Cement Works, which will also take place in the new year, will be announced in due course.

EASTERN CENTRE.

The Opening Meeting of the Session 1911–12, which was rendered notable by the attendance of the members of the Council of the Institution, was held at Cambridge on the afternoon of Tuesday, September 12th, 1911.

The Chairman, Mr. J. F. Lamb, in his opening remarks welcomed the Council to the meeting, and explained that Mr. A. W. Martin, who had promised to speak on the subject of "Costs Involved in Telephone Transmission," was unable to be present owing to official business, but that Mr. E. H. Shaughnessy had, at short notice, kindly consented to fill the breach.

Mr. Shaughnessy then delivered a very interesting lecture on "The New Scheme of Primary Centres for Telephoning the Kingdom," giving particulars of the special study which had been undertaken at Headquarters with the object of framing a scheme which should provide for the rapid development of the Trunk Telephone Service that might be expected in the near future. The proposals had in view the possibility of economically bringing within the limits of commercial efficiency conversation between any one subscriber and any other subscriber in the United Kingdom. It was shown that by using heavy-gauge conductors for main circuits between the selected primary centres corresponding reductions in the gauges of the wires between primary and zone centres and zone centres and trunk centres, etc., could in some cases be effected.

A very full discussion followed. This was opened by Mr. H. R. Kempe, and taken part in by Messrs. F. S. Parkinson, A. Evans, W. H. Calveley, J. F. Lamb, A. R. Nichols, T. Cobbe, H. G. Tissington, P. Dunsheath, and W. Slingo.

Mr. Kempe was of opinion that there was a possibility that the proposals might be considerably modified by the introduction of loading coils on open lines. Experiments were about to be made of loading two wires between London and Leeds. Mr. Kempe also gave the meeting some very valuable information with respect to the new loaded telephone cables leading to France and to Belgium.

Mr. Slingo, who said the Council were delighted to meet the members of the Local Centre, stated that the question of the best means of telephoning the country was one which had been exercising the minds of engineers for a long time. The opening of exchanges with limited service always led to trouble. It ought to be possible to join subscribers through without terminal losses. He expressed the opinion, which was much welcomed, that the insertion of testing points on telephone trunk lines should not be too liberal, and such maintenance of the lines as would prevent the occurrence of faults should be the aim of the engineer.

On the afternoon of Tuesday, November 7th, 1911, Mr. W. S. Mountain, of the Engineer-in-Chief's office, visited Cambridge and read his paper on "P. O. Engineering Department Contracts." The various clauses contained in the contract forms were examined, particular reference being made to Form E.-in-C. 137. Mr. Mountain's remarks on the main reasons why certain engineering work is done by contract were of special interest to those present.

The discussion was opened by Mr. W. Scarr and taken part in by Messrs. J. J. Dwyer, A. H. Dell, T. Cobbe, E. H. Shaughnessy, W. H. Calveley, and A. Gwilliam, and was valuable as indicating the various points of view from which the subject is treated mainly by the outside engineer and the inside accountant. It is thought that a good mutual understanding of the difficulties on both sides resulted and much profit will accrue from the meeting.

NORTH-EAST CENTRE.

The session opened on October 26th, 1911, when a most interesting paper entitled "Recent Developments in Telegraphy" was contributed by Mr. T. E. Herbert. The subject-matter was mainly concerned with the various systems of type-printing telegraphs now in use, and during the progress of the meeting a number of photographs of various types of apparatus were handed round for the information of those present.

At the close of the meeting Mr. Sinnott expressed the regret he felt at leaving the district, and, in referring to the transfer of the Sheffield and Bradford Sections to other districts, wished the members concerned the best of luck under the new conditions.

Mr. Longden, in a few well-chosen words, voiced the good wishes of the staff who remain attached to the North-East District for the future of those gentlemen about to be transferred.

On November 20th Mr. E. H. Farrand read an instructive and practical paper on " Mileage Records."

Mr. T. B. Johnson, the Acting Superintending Engineer, in his opening remarks, said it gave him great pleasure as a Yorkshireman to again take up duty in the county of broad acres, and he hoped he might spend many years amongst us.

In the course of his remarks Mr. Farrand showed how the mileage records of his Section had been placed on a more satisfactory basis by the introduction of specially designed card-indexes.

The animated discussion which followed went to show that the lecturer had selected a subject having a very real bearing on the work and interests of the members.

On behalf of the members Mr. Johnson bade farewell to Mr. F. Reid, who was under instructions to leave for Headquarters the following day.

On October 26th a smoking concert was held at the Hotel de Ville. Mr. J. Sinnott presided over a good company, and an excellent programme of recitals and musical items, arranged by Mr. H. N. Bard, was presented, to the enjoyment of all present.

During the interval the Chairman took the opportunity of wishing the staff good-bye ere his return to London to take up duty in the Engineer-in-Chief's office. He also referred to the pending transfer of the Bradford and Sheffield Sections to the North-Western and Midland Districts respectively, and wished all concerned every success under the new conditions. Messrs. Longden, Pickering, and Farrand, on behalf of the District Staff, also supported the expressions of goodwill made from the chair, and Mr. T. E. Herbert (Sheffield) and Mr. W. J. Finlayson (Bradford) responded.

NORTH-WESTERN CENTRE.

The first meeting of the 1911–12 session was held on October 2nd, when the Chairman of the Centre delivered his Inaugural Address. There was a good attendance of members, and the address covered a wide field and proved full of interest. A vote of thanks to Mr. Groves was passed unanimously.

On November 6th a meeting of the members of the North-Western District and new South Lancashire District was held to hear Mr. R. Nimmo deliver his paper on the "Manchester Fire Alarm System." The paper was illustrated by means of numerous slides, and the system was described in detail. A good discussion followed, and the meeting closed with a vote of thanks to the lecturer.

SOUTH WALES CENTRE.

Mr. W. S. Mountain occupied the attention of a meeting of the South Wales Centre of the Institution held at Cardiff on October 10th with his paper on "Departmental Contracts." The subject is, at this juncture, specially appropriate to the South Wales District, as a main underground route is planned, to extend from Berkeley Heath, on the east, to Worcester, on the north, and Haverfordwest, on the west. The Berkeley–Worcester section has been completed, but the West Wales route has only recently been commenced, and consequently many members who anticipate a further acquaintance with the underground contractor at an early date listened on this account with additional interest to the reading of the paper.

Mr. A. W. Sirett, who carried out the Berkeley–Gloucester–Worcester Section of the route mentioned above, made special reference to his experiences on this work in a paper on "Main Underground Work," which he read before the succeeding meeting held on November 14th.

Both of these papers proved very interesting, more members than usual participating in the discussions. Guided by Mr. Mountain's "hints" and Mr. Sirett's "experiences" the extension of the main underground westwards should have no terrors for the engineering officers who will in due course have to undertake the work.

'Wireless Telegraphy,' by Erskine Murray.—A new edition of this work has been added to the South Wales Reference Library.

SCOTLAND EAST CENTRE.

The 1911–12 Session was opened on October 25th, when Mr. Mountain, of the Headquarters Staff, read a most instructive paper on "Departmental Contracts" before a large attendance of members.

Mr. Machugh, Superintending Engineer, presided.

Mr. Mountain dealt with his subject in a very able manner and covered all the main difficulties met with in specifications and conditions of contracts.

On conclusion of the reading an interesting discussion followed and Mr. Mountain was thereafter accorded a very hearty vote of thanks.

On November 29th Mr. G. C. Jefferyes read a very interesting paper on "Block Signalling" before a good attendance of members. The lecturer dealt with the subject under the following headings:

(1) The early methods of controlling railway traffic; the time-interval system; passing places; defects of system.

(2) Introduction of electric block; the staff and ticket system.

(3) The electric tablet and staff systems; methods of controlling traffic with these.

(4) Webb and Thompson's block apparatus; mechanical and electrical details and their inter-relation.

(5) Blocks for double-line working; classification and general principles of design; early forms; single-needle instruments used as block apparatus.

(6) Instruments worked (*a*) by permanent currents; (*b*) by transitory currents; Preece's apparatus.

(7) Detailed description of Preece's single wire block; electrical action: method of working.

(8) The telephone as an adjunct to the block; joint use of line-wires for block and telephone connections.

On conclusion of the lecture Mr. Jefferyes was, on the motion of Mr. Machugh, who presided, heartily thanked for his excellent paper.

The lecture was illustrated by fourteen lantern-slides, shown by Mr. Tyson.

On the afternoon of Wednesday, December 20th, 1911, Mr. Gill will read a paper on "Records," and in the evening of that day a whist drive and dance will take place in the Carlton Hotel, Edinburgh.

SCOTLAND WEST CENTRE.

The first meeting of the Branch was held at the Technical College, George Street, on October 26th, Mr. Stewart, our Chairman, presiding over a good attendance.

The Chairman, referring to the great superiority of the room in which the meeting was held to the linemen's room used for previous meetings, proposed a hearty vote of thanks to the Governors of the College for the privilege they had afforded, and this was carried with acclamation. Mr. Mountain then read his paper on "Departmental Contracts," and the Chairman, Mr. Angwin, and Mr. Fossett took part in the discussion.

The second meeting of the session was held at the Technical College on Monday, November 20th, when a paper by Mr. A. S. Angwin on "Exchange Transfers" was read, enjoyed, and discussed.

On Friday, December 15th, our Annual Dinner is to be held at the Arcade Café. A good gathering is anticipated, and visitors are expected from the Scotland East District and from the National Telephone Company.

PROGRAMMES OF CENTRE MEETINGS.

SESSION 1911-12.

METROPOLITAN CENTRE.

1911.

October 16th.—Opening address followed by "The Various Systems of Multiple Telegraphy." The President.

November 13th.—"Departmental Contracts." W. S. Mountain.

December 11th.—"Distribution by means of Parallel Cables." E. A. Pink.

1912.

January 8th.—"Precautions against Fire." A. J. Stubbs.

February 12th.—"Economics of Telephone Transmission." A. W. Martin.

February 26th.—"Machine Switching in Telephony." B. O. Anson.

March 11th.—"Telegraph History." H. R. Kempe.

April 22nd.—Annual General Meeting.

The meetings are held in the Lecture Hall of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C., at 6 p.m.

Proposed Visits to Works will be announced from time to time.

EASTERN CENTRE.

1911.

September 12th.—"New Scheme of Primary Centres for Telephoning the Kingdom." E. H. Shaughnessy.

November 7th.—"Departmental Contracts." W. S. Mountain.

1912.

January 9th.—"Staying a Telegraph Line." T. Cobbe.

February 6th.—"Faults." W. Scarr.

March 5th.—"The re-modelling of a Main Telegraph Line." H. A. McInnes.

April 2nd.—(Subject to be announced later.) F. W. Cheshire.

NORTH-MIDLAND CENTRE.

1911.

October 11th.—"Departmental Contracts." W. S. Mountain.

† "Wayleaves." J. E. Devey.

† "Wireless Telegraphy" (with experiments). H. M. Campbell.

† "The Slide Rule." N. F. Cave-Brown-Cave.

† Date not yet fixed.

NORTHERN CENTRE.

1911.

October 24th.—"Departmental Contracts." W. S. Mountain.

November 21st.—"Lifts and New Heating Plant at Newcastle H.P.O." H. R. J. Dunthorne.

December 19th.—"New Electric-Pneumatic Plant at Newcastle H.P.O." H. R. J. Dunthorne.

1912.

January 23rd.—Visit to Armstrong College, Newcastle.

NORTH-EASTERN CENTRE.

1911.

October 26th.—"Recent Developments in Telegraphy." T. E. Herbert.

November 27th.—"Mileage Records." E. H. Farrand.

† "Departmental Contracts." W. S. Mountain.

NORTH-WESTERN CENTRE.

1911.

October 2nd.—Inaugural Address. J. W. Groves.

November 6th.—"Manchester F.A. System." R. Nimmo.

December 4th.—"Departmental Contracts." W. S. Mountain.

1912.

January 8th.—"Telephone Transmission." W. Moon.

February 5th.—"Unit Costs" (Discussion).

March 4th.—"London County Council F.A. System." A. W. Field.

IRELAND CENTRE.

† "Departmental Contracts." W. S. Mountain.

NORTH WALES CENTRE.

1911.

October 23rd.—"Lineman's Duty Charts." R. G. Masaroon.

October 23rd.—Visit to Railway Signal Works, Fazakerley.

December 5th.—"Engineering Departmental Contracts." W. S. Mountain.

1912.

January 9th.—"Some Telephone Cord Circuits." T. Plummer.

February 5th.—"Wheatstone Working in Canada." J. Lockhart.

March 5th.—"Steel." B. J. Stevenson.

April 3rd.—(Subject to be announced later.) Annual Dinner.

Visits to Works will be announced later.

SOUTH WALES CENTRE.

1911.

October 10th.—"Departmental Contracts." W. S. Mountain.

November 14th.—"Main Underground Work," with special reference to the Berkeley Heath, Gloucester and Worcester Main Underground. A. W. Sirett.

December 12th.—"Wayleaves." E. D. Careless.

1912.

January 9th.—"Maintenance and Faults." J. Martin.

February 13th.—"Office Organisation and Equipment." P. E. Milford.

March 12th.—"Wireless Telegraphy," with special reference to P.O. Station, Fishguard. W. Pennington.

† Date not yet fixed.

SOUTH-WESTERN CENTRE.

1911.

October 12th.—Visit to Bristol Corporation Docks and Canadian Liner "Monmouth."

October 24th.—"Stores Distribution and Accounting." A. J. Ross.

November 12th.—"Departmental Contracts." W. S. Mountain.

November 28th.—"Theory of C.B. Telegraphs." R. Bradfield.

December 12th.—"Notes on Building Construction." G. W. Bannister.

1912.

February 12th.—"Re-modelling of the Irish Main Line, Rickmansworth to Broadway." H. A. McInnes.

March 12th.—"Bournemouth C.B. Exchange. Transfer from N.T. Co.'s Magneto Exchange." A. E. Chapman.

SCOTLAND (EAST) CENTRE.

1911.

October 25th.—Departmental Contracts." W. S. Mountain.

November 22nd.—"Block Signalling." G. C. Jeffreys.

December 20th.—(Subject to be announced later.)

1912.

January 24th.—"General Submarine Work." F. H. Machugh.

February 21st.—"General Submarine Work," continued. C. Crompton.

March 21st.—(Subject to be announced later.) J. McIntyre.

SCOTLAND (WEST) CENTRE.

1911.

October 26th.—Opening Address. D. Stewart.

October 26th.—"Departmental Contracts." W. S. Mountain.

November 27th.—"Exchange Transfers." A. S. Angwin, B.Sc.

December 18th.—"Some Notes on Estimating Work." T. Hetherington.

1912.

January 22nd.—"C.B. Installations." J. Richardson.

February 26th.—"Some Notes on Building Construction." W. Holmes.

March 25th.—(Subject to be announced later.)

ENGINEERING DEPARTMENT CHESS CLUB.

THE Chess Club opened its seventh season very successfully at "Ye Mecca," Cheapside, on October 3rd. The Championship and Handicap Tournaments are now in full swing, and much enthusiasm is being shown amongst the members. The membership has risen to over sixty, and weekly attendances are being very well maintained.

The League match with the Stores Department has been won, but a friendly match with the London, County, and Westminster Bank, and a League match with the London County Council have been lost. The match with the Paymaster-General's Office was also lost on adjudication.

 CORRESPONDENCE

CORRESPONDENCE.

To the Editors of THE POST OFFICE ELECTRICAL ENGINEERS' JOURNAL.

INTERNATIONAL CONFERENCE OF TELEGRAPH AND TELEPHONE TRAFFIC ENGINEERS.

SIR,—The inauguration of International conferences and the congregating of specialists of different nationalities for the purpose of exchanging experiences, opinions and suggestions on matters of interest common to all has met with such support and encouragement from administrations concerned directly and indirectly that one may, perhaps, be excused if in searching for the most practicable solution of other problems, equally important, though in a different sphere, one suggests a conference not yet established.

It cannot be gainsaid that telegraph and telephone traffic officers, though I am inclined to place them under a more appropriate category, viz. engineers, have problems to solve unique in their peculiarity. I append a few.

(1) Distribution of traffic—inland and foreign.

(2) The effect of the telephones on telegraph traffic, and the potentialities of closer relationship of the two means of communication.

(3) Delivery of telegrams by telephone and the consequent reduction of boy labour.

(4) Automatic, semi-automatic and manual systems of telephony from commercial points of view.

(5) The calculation and provision of (*a*) equipment, including trunk and junction facilities, and (*b*) staff.

(6) Systems of operating, and operators' loads.

(7) Press and other exceptional rates.

(8) Registration of telephone calls and fees.

These subjects alone—and there are others no less important—afford sufficient material to compile a programme for International consideration and discussion, and the country which has the courage to take the initiative and convene a conference of telegraph and telephone traffic engineers will receive unquestionably no less hearty support than that accorded other institutions, and if but a few of the problems referred to above are solved the utility and efficiency of the dual service will be enhanced.

I am, Sir,
Yours faithfully,
GEO. W. J. PRAAT.

London Telephone Service,
October 28th, 1911.

To the Editors of THE POST OFFICE ELECTRICAL ENGINEERS' JOURNAL.

ENAMELLED COPPER WIRE.

DEAR SIR,—With reference to Mr. Smith's interesting paper appearing in this month's issue, can he please say if any alteration takes place in the gauge and resistance of the finer-sized wires passing through this process?

The wire is of course first drawn to standard gauge and resistance by manufacturers, and supplied bare for enamelling. This necessitates its being subjected to a certain strain when passing through the enamelling process and twice heated to a temperature of 600° F. Can Mr. Smith please say if any lengths have been specially tested to ascertain if any alteration takes place between commencement and final process of re-winding for sale?

INTERESTED.

To the Editors of THE POST OFFICE ELECTRICAL ENGINEERS' JOURNAL.

DEAR SIR,—In reply to "Interested," standard sizes of bare wire are supplied by manufacturers. During the enamelling process the wire is not subjected to sufficient strain to affect its gauge. The resistance of a wire varies inversely as the square of its diameter; consequently, if the wire were stretched, an appreciable increase in the resistance would result.

Numerous conductivity tests show that there is no alteration in the resistance of the wire, even in the smallest gauges, after it has passed through the process.

Yours faithfully,

W. B. SMITH.

ELECTRICAL ENGINEERS AND THE PUBLIC.

WE reproduce hereunder some notable paragraphs from the Presidential address (American Institute of Electrical Engineers) of Dr. Dugald C. Jackson. Our readers are, we think, aware that the services of this able American engineer have been retained by the Department in connection with the valuation of the National Telephone Company's plant.

Dr. Jackson said:

Members of the American Institute of Electrical Engineers are pleased to refer to electrical engineering as a profession, and to the Institute itself as a professional society. When this occurs as a thoughtless repetition of fine sounding words it has little meaning, since mere repetition of an alleged truth does not make it a real truth, and it can be established as a real truth only by tracing it to some adequate foundation. But when those statements arise from a ripe understanding that the word "profession" means more than a mere organised vocation for earning one's bread, it has a high and commendable meaning. The word "profession" "implies professed attainments in special knowledge, as distinguished from mere skill; a practical dealing with affairs, as distinguished from mere study or investigation; and an application of such knowledge to uses for others, as a vocation, as distinguished from its pursuit for one's own purposes." This sets the professional man in a position which demands from him an attitude of service and of leadership. He must have a masterly knowledge, in addition to skill in a vocation. He must deal practically in the affairs or needs of men. His duties must be performed with a touch of disinterested spirit in addition to the vocational spirit of earning his livelihood. Such men have a duty to the public; and in the performance of that duty, they must exert their influence on that thought and practice of the day which affects the welfare and progress of the nation. We as electrical engineers cannot escape that duty in case we wish to maintain the professional character of our occupation.

. . . .

It may be retorted that the tenets which I am advocating will lead engineers out of a professional spirit and into "commercialism." It is worth while to pause here to reflect on that point. The word "commercialism" strictly means the characteristics of business or commercial life, but custom has made it applicable to any undue predominance of commercial ideas in a nation or community, and it has thereby come to infer a willingness to establish the strife for money in a position of precedence over reason and righteousness.

It has been alleged that learning loses of its dignity by becoming fashionable. It has also been alleged that learning loses of its dignity by becoming useful. Of the latter, at least, experience has proved the contrary—happily for engineers who are proud of their profession, for engineering is necessarily an embodiment of the useful application of knowledge and learning. Engineering, relating, as it does, to the application of the powers of nature to useful purposes, must necessarily bring its followers into intimate contact with commercial affairs in an age when, as in ours, the industries dominate commerce, and the abatement of war has reduced the importance of military engineering. The tenets which I advocate do not tend to entangle the engineers in the depths of "commercialism" with which they may come in contact; but, on the contrary, those tenets propose that engineers should safeguard and nourish their professional spirit by assuming a part in public affairs in a spirit of disinterest, for the purpose of guiding the useful applications of natural forces to the greatest practicable service to society. A true engineer is a devoted follower after truth. He differs diametrically from the devotees of pure "commercialism," who are strictly opportunists. He also differs from pure idealists, who are often notable for refusing to accept any advance unless it wholly meets their personal ideals. The spirit of the engineer rejoices in obtaining any move toward the truth, but is always seeking farther advance. This characteristic spirit has been manifested in men of great achievement in many walks of life. It is a part of the life of such men as Martin Luther, Gladstone and Lincoln.

. . . .

I have observed in Macaulay's writings a paragraph which is graphic in illustration of our present situation. "Everywhere," he says, "there is a class of men who cling with fondness to whatever is ancient, and who, even when convinced by overpowering reasons that innovation would be beneficial, consent to it with many misgivings and forebodings. We find also everywhere another class of men, sanguine in hope, bold in speculation, always pressing forward, quick to discern the imperfections of whatever exists, disposed to think lightly of the risks and inconveniences which attend improvements, and disposed to give every change credit for being an improvement. In the sentiments of both classes there is something to approve. But of both, the best specimens will be found not far from the common frontier. The extreme section of one class consists of bigoted dotards; the extreme section of the other class consists of shallow and reckless empirics."

The public, misled or annoyed by the reluctance of some honest but overcautious managements to make frank public statements of financial results and present convincing statistics of operation, enraged by the acts of a few adventurers who from time to time have secured a speculative hold in the public service field, and enticed by the arguments of individuals with ulterior motives, are likely to follow the radical leadership of demagogues or of honest but false empirics. This is a danger which seriously exists in states where no public supervision of the service companies is provided, and also in a lesser degree in states where such supervision has been established. The danger must be rolled back by the exertions of fair-minded and right-thinking men. A serious menace to the welfare of the nation would be caused if unfair dealing toward the public service companies were established as a policy. A scrupulously frank and honest dealing with the public by the companies should be insisted on, but the public must be taught the importance of dealing on its part with an equally scrupulous fairness and a well-balanced generosity. It is here that I say lies a duty of electrical engineers to the public. It is to give of their time and brain to convincingly establish the facts (the *facts*, I repeat) which the public do not understand in regard to the business of the public service companies, to indicate the means for rightly treating these new influences which we and our fellow engineers have been creating by our works, and to aid in establishing measures which will favour and sustain mutual confidence and fair dealing between them and the public. This is an obscure and difficult problem on account of its touching the edge of men's ambitions and men's passions, and it seems at times to possess the opacity and insolubility of a millstone; but looking persistently and with care into what appears to be a millstone not infrequently proves it to be composed of reasonably transparent material. The members of our Institute should take somewhat to themselves as professional men this obscure and difficult problem, and aid in its solution as a matter of their duty to the public.

IN INDIA.

Mr. A. E. McCloskey, expert in telegraph, telephone, and railway signalling systems, who comes from the Engineering Department of the British Post Office, and has been on loan to the Bombay, Baroda, and Central India Railway during the past eighteen months, has now handed in his report on the re-organisation of the Company's Telegraphs. It is understood that he has been successful in obtaining for the Company several concessions from the Government.—*Indian Engineering.*

THE MARCONIGRAPH.

THE November issue of the 'Maconigraph' contains some interesting articles showing the characteristic enterprise of Marconi's Wireless Telegraph Co., Ltd., in different parts of the world. The decision of the Russian Government some time back not to enter into contracts with firms other than those established in the country led to a decline in the business done by the Company with the Russian Goverment. A company was then formed, and to this fell a considerable portion of the contracts placed by the Russian Government. The Marconi Company have now secured the controlling interest in this company and their fine works, and the arrangement will enable the Marconi Company to take advantage of the very big business both present and future of the Russian Government, besides eliminating much of the competition which it would have to encounter otherwise.

The trials and tribulations of an engineer who went out to Siam to make trials with portable wireless apparatus is one more of the many interesting articles which will be found in the 'Marconigraph.'

The unsuccessful attempt of Mr. Wellman to cross the Atlantic in an airship is still fresh in the memory of our readers. Another attempt is to be made to accomplish the feat with the airship "Akron." According to the 'Marconigraph' the new airship will be 258 ft. long; it will contain 400,000 cubic feet of hydrogen, and will have a lifting capacity of 13 tons. The engine will be able to develop 317 horse-power, and the vessel will carry a 3-kilowatt Marconi wireless set of special construction. Mr. Jack Irwin, the wireless operator who accompanied the Wellman airship and who will be on the "Akron," contributes to the 'Marconigraph' some of his experiences, and demonstrates the important part played by wireless in the rescue of the daring aviators aboard the ill-fated Wellman airship.

LIBRARY NOTES.

THE following books have been added to the Institution Library, and are available for the use of members:

No.
191. 'Vector Analysis.' J. G. Coffin.
192. 'Propagation of Electric Currents.' J. E. Fleming.
193. 'Problems in Electricity.' R. Weber.
194. 'Structural Engineering.' J. Husband and W. Harby.
195. 'First Principles of Railway Signalling.' C. B. Byles.

New Editions.

677. 'Building Construction.' Mitchell.
23. 'Wireless Telegraphy.' J. E. Murray.
17. 'Electric Wave Telegraphy and Telephony.' J. Fleming.
751. 'Journal of the Manchester Municipal School of Technology,' vols. iii and iv.

NEW BOOKS.

'Dynamo and Motor Attendants and their Machines,' by F. Broadbent, M.I.E.E. (S. Rentell & Co., Ltd., 36, Maiden Lane, W.C. Price 1*s.* 6*d.*)

'The Telegraphists Guide,' by J. Bell and S. Wilson. (S. Rentell & Co., Ltd., 36, Maiden Lane, W.C. Price 2*s.* net.)

Another edition—the seventh—of this guide has just appeared, and we are pleased to note its continuous improvement. Its authors are apparently determined to leave nothing undone which will assist in bringing it to the front as a text-book for telegraph students.

New matter has been added on accumulators, concentrator switches, relays, duplex and quadruplex working, submarine cable working and the megger.

The student, even if well stocked with other text-books, would be wise to possess a copy of the Guide.

NEW LISTS.

Messrs. Wm. Geipel & Co. have issued a leaflet describing their time switches.

The "Arbiter" type is arranged for switching "on" by hand and for switching "off" automatically. It is particularly suited for use where the restricted hour system is adopted.

The "Opus" type is arranged to switch "on" as well as "off" automatically, and is suited for such purposes as the lighting of streets and large buildings, sign lighting, stair and corridor lighting. It can be arranged for various functions.

These switches have had a thorough trial during the last two years, and amongst others the Manchester Corporation have quite a number in use, and notwithstanding protection and keen competition on the part of local firms, Messrs. Geipel have secured a contract for sixty-eight Geipel steam traps for the New Copenhagen Hospital.

The India Rubber and Gutta Percha and Telegraph Works Co., Ltd., Silvertown, E., have issued a new list, No. 40A, of their twin cables, flexible conductors and cords.

RETIREMENT OF MR. W. BROWN.

THE approaching close of the present year will constitute the end of another critical phase of the Post Office history of the telephone, and provide the final stepping-stone to absolute State domination of the telephone service in this country.

Several important features in that history have already been relegated to the past, and should it ever be the desire or duty of an industrial historian to record the various successes and failures of the earlier periods, it would be difficult to accurately delineate progress without a recognition of the influence of Mr. W. Brown, who

 RETIREMENT

has recently, after an exceptionally long career, retired from the Post Office service. His connection with the technical side has been so intimate that it is scarcely practicable to refer to any stage of Post Office development without associating his ability and work in a very direct and definite form.

As a pre-transfer servant of the United Kingdom Telegraph Company, he passed with the telegraphs to the control of the Postmaster-General, and was for many years the immediate subordinate

WILLIAM BROWN.

colleague of Mr. M. Cooper, whose lamented demise, at a comparatively early age, left Mr. Brown to assume the responsibility of the engineering branch of telephone work under Sir John Gavey. This advancement occurred at a time when telephone matters were rapidly becoming an important factor in electrical communication. Trunk line working was then of a very limited character, and international telephones were non-existent. In connection with the latter, Mr. Brown took a prominent part in the establishment of a telephone service with Paris, and after the completion of this—at that time a colossal and distinctly novel work—he was closely identified with the inauguration and construction of the backbone Post Office trunk system throughout Great Britain.

The introduction of large gauge copper wire and a number of telephone circuits on one route gave rise to one of many technical problems which fell to his duty to solve. This was rapidly followed by the inherent difficulties in speaking over multiple cables, and another set of adverse electrical phenomena had to be eliminated.

A climax, however, arrived with the acquisition of the trunk lines of the National Telephone Company in 1896, and Mr. Brown's energies and resources were taxed to the uttermost. It may safely be recorded that since then there has not been the slightest cessation of the continual demands upon his wide experience, capabilities, and persevering disposition.

This phase was rapidly succeeded by an equally exacting step arising out of the decision that the Post Office should seriously enter into competition with the National Telephone Company as far as regards local service. In accordance with the new policy thus initiated, it became necessary to establish a number of local exchanges of unusual magnitude in several London areas.

The central battery system, which had only recently matured as far as regards its application in this country, became the special charge of Mr. Brown. He has since occupied the onerous position of having to pursue in a very vigorous manner the inception and establishment of numerous important telephone schemes with all the accompanying ramifications entailed by modern requirements.

Although all this is now past, it was within the period of his service that unique difficulties arose in reference to the future carrying on of the whole of the telephone service by the State, and he has emerged from a very harassing period during which heavy demands were showered upon him.

It is, however, a misfortune that he is unable to take part in the culmination of his earlier labours, and although the monument is not completed, it must be a source of great satisfaction to him that the plinth and foundation have been to a large extent moulded by his hands.

The accomplishment of such laborious duties under extremely exacting conditions could not have been secured without the possession of some of those excellent characteristics which have made Mr. Brown an important unit in the telephone world. His work has been of that thorough description which is lasting, and when that is said nothing need be added.

It is not a matter of surprise or regret that after a strenuous life of many years, nature steps in and determines the limit of human energy. When it does no servant of the nation can lay down his pen with the knowledge of having successfully fulfilled his duty better than Mr. Brown.

F. T.

It is very good of the Board of Editors to give me an opportunity to add a note to the foregoing "Appreciation," but I fear that anything I can write must be in the nature of bathos when following Mr. Tandy's balanced and enthusiastic article. It is, however, an honour to be permitted to do honour to my old friend, so well known among old-stagers by Mr. Cooper's favourite title of "William Brown of Newcastle"! His strenuous labours and indomitable perseverance earned and well merited the steady promotion that came to him—labours persisted in often under grave disability in respect of health. To have been closely associated with the long list of important works to which Mr. Tandy refers marks a man of ability, and one's recognition and admiration are increased when one realises that the position was won by sheer merit, with no adventitious aid of either "influence" or "luck." Now, we very heartily wish him good luck and long life.

A. J. S.

STAFF CHANGES.

POST OFFICE ENGINEERING DEPARTMENT.

PROMOTIONS.

Office.	Name.	Appointment.	Previous Service.
Eng'g. Dept.	Alexander, R.	Engr., 1st Class	S.C.&T. Edin., '85; Jr. Clk., Eng'g. Dept., '98; Engr., 2nd Cl., '03.
"	Shaw, J. H.	"	S.C.&T. Belfast, '92; Jr. Clk., Eng'g. Dept., '98; Sub-Engr., '99; Engr., 2nd Cl., '03.
"	Baxter, J.	"	S.C.&T. B'ham, '87; Jr. Clk., Eng'g. Dept., '98; Engr., 2nd Cl., '03.
"	Hart, W. L.	Clk., 1st Cl.	S.C.&T. Cambridge, '95; Jr. Clk., Eng'g. Dept., '98; Clk., 2nd Cl., '04.
"	Storey, S.	Clk., 2nd Class	S.C.&T. Dublin, '89; Jr. Clk., Eng'g. Dept., '99.
"	Hardcastle, J. R.	"	S.C.&T. Leeds, '91; Jr. Clk., Eng'g. Dept., '98.

STAFF CHANGES.

RETIREMENTS.

Office.	Name.	Appointment.	Previous Service.
Eng'g. Dept.	Murray, W. F.	Staff Engr., 2nd Cl.	Tel., '70; Relay Clk., '89; 2nd Cl. Engr., '94; 1st Cl., '00.
,,	McNab, R.	First Eng., "Monarch"	Ch. Engr., Unest'd., '83.
,,	Pollock, W.	Clk., 2nd Cl.	S.C.&T. Belfast, '82; Jr. Clk., Eng'g. Dept., '85.

TRANSFERS.

Name.	Former.		Present.		Date from which to take effect.
	Rank.	District.	Rank.	District.	
Kennedy, D. H.	Staff Engr., 2nd Cl.	E. in C.O.	Asst. Sup'g. Engr.	Met. C.	15 : 11 : 11
Batchelor, W. M.	Ditto	,,	Ditto	N.	23 : 11 : 11
Reid, F.	—	N.E.	Asst. Engr.	E. in C.O.	21 : 11 : 11
Hines, J. G.	—	Test Branch	,,	Met. C.	1 : 12 : 11
Hines, J. G.	—	,,	,,	Testing B'ch.	1 : 10 : 11
Buchanan, J.	—	Sc.E.	,,	N.W.	18 : 12 : 11
Osborn, W. M.	—	E. in C.O.	Second Class Engr.	Testing B'ch.	1 : 10 : 11
Tabor, H. J. H.	—	,,	Ditto	,,	1 : 10 : 11
Lawson, R.	—	,,	Probationary Sub-Engr.	Met. C.	19 : 10 : 11
Gleed, S. W.	—	,,	Ditto	,,	19 : 10 : 11
Jones, L. J.	—	,,	,,	,,	19 : 10 : 11
Jacquest, A. H.	—	,,	,,	Met. S.	19 : 10 : 11
McKickan, J. J.	—	,,	,,	,,	19 : 10 : 11
Banks, A. E.	—	,,	,,	,,	19 : 10 : 11
Macrae, D. L.	—	Met. C.	3rd Class Clk.	,,	31 : 5 : 11
Keane, M. J.	—	N. Wa.	,,	Ire.	3 : 4 : 11
Eginton, A. F.	—	E.L.	,,	Met. S.	16 : 10 : 11
Owen, W. G.	—	Met. S.	,,	E.L.	16 : 10 : 11
Gamgee, A.	—	Met. C.	,,	Met. S.	1 : 11 : 11
Delaney, W. J.	—	Met. S.	,,	Met. C.	1 : 11 : 11

COMMUNICATIONS.

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