

A New Convertible Telephone.

ALTHOUGH standardisation is now universally recognised as a direct line to economy and is becoming an object of increasing importance in every branch of modern business, it has in many instances proved to be an ideal beyond immediate reach. In the provision of public telephone services efforts have been made from time to time with a view to adopting exclusively one or another of many systems of proved value, but progress has been so rapid that successive improvements and new developments have continued to present fresh aspects to an already difficult problem. The varied conditions under which telephones are required to operate, and the facilities demanded by different groups of subscribers have led also to the introduction of numerous combinations of switching and signalling arrangements designed to meet specific requirements. Even to-day, in spite of the progress made during recent years in the application of automatic switching equipment, manually-operated exchanges continue to be installed for public service in many parts of the world. From a practical point of view it may therefore be said that the universal adoption of one system is only a possibility of the distant future.

A certain measure of success has nevertheless been achieved in the unification of designs and types of apparatus peculiar to individual systems, but with the possible exception of protective devices and line materials there have been few standard items which could be adapted to the requirements of them all. The equipment, for instance, employed for a

manually-operated magneto system differs in almost every detail from that required for automatic C.B. working, and it would appear impossible to draw any comparison between individual components. If, however, the exchange be ignored and the subscribers' apparatus analysed, there is to be found a definite similarity between all telephones since a transmitter and receiver are essential in every case. In other words, the primary function is the same, the chief differences appearing in the methods of signalling and the source of current. Contrary to what would seem logical there is little evidence of the similarity having been given much consideration by the designer, and the importance which has been attached to the differences may be judged by the extent to which they have influenced construction. It would indeed be a difficult task to determine the number of types of telephones which have been produced and placed on the market. The effect of this diversity in design has been felt most acutely by Administrations who, in adopting a progressive policy and substituting new systems for old, have been faced with the problem of disposal of large quantities of recovered material, or alternatively the heavy expense of converting it where possible to operate under conditions very different from those it was originally designed to meet.

Delay in the production of an instrument which could easily be adapted to the requirements of almost every system of operation may be attributed also to the fact that the ideal had not been reached in any existing



Table type Convertible Telephone complete with cord and connection strip.

form of telephone, for it was generally acknowledged that considerable improvement in transmission efficiency would have to be the first step towards re-design of this important accessory. Later discoveries, however, removed all difficulties of this nature, and with the appearance of the **GEOPHONE** Handcombination Telephone it became obvious that a definite advance towards the desired end might be made immediately. Development work has now been followed by the introduction of the **GEOPHONE** Convertible Telephone which for the first time provides a modern means of standardisation of the major portion of the subscribers' apparatus throughout areas served by more than one system.

The advantages of the new instrument and the benefits to be obtained by its use will readily be appreciated on consideration of its principal features and the lines along which development proceeded. In the matter of construction the basic standard taken was the new handcombination telephone designed for automatic and manually-operated central

battery systems. The reason for this will be obvious, for while the convertible telephone was to be suitable for use on various systems, it had not to differ materially from the original. Standardisation was the object in view and the permissible modifications were therefore limited. After investigation it was a matter of great satisfaction to find that with one exception the whole of the essential components of the original instrument could be retained, and by providing an induction coil suitable for local battery operation the same telephone could be offered with various circuit arrangements for service on other than C.B. systems. The convertible telephone is therefore identical in appearance with the instrument previously described in this Journal and incorporates the same ringer, condenser, transmitter, receiver and Bakelite case and handcombination. Differences of a minor nature which have been introduced are confined to the terminal field in the base, the external connecting cord, and the terminal block, all of which have necessarily been enlarged to permit connection of hand generator, local battery, and earth leads when

required. The extended terminal field in the base also facilitates alteration of the internal circuit arrangements so that a minimum of labour and expense is involved in conversion of the instrument from one form to another. This feature is, in fact, one of the most valuable, for it also enables the manufacturer to produce and stock the complete telephone ready for insertion of the strap connections which constitutes the final operation before despatch from the factory.

In detailing the systems with which the convertible telephone may first be employed and the method of converting it ultimately into the standard instrument for automatic and manual C.B. working, it may be of interest at the same time to examine the actual circuit conditions. In the accompanying diagrams the wiring of the components is shown in schematic form for the purpose of easy reference, SH representing contacts operated by the switch hook.

Magneto Systems.

Under this heading may be included all methods of signalling and switching which require at the subscriber's premises the installation of both a hand generator and microphone battery. As already mentioned the convertible telephone is fitted with an induction coil for local battery use, and is complete with a five-conductor cord and enlarged terminal strip permitting simple connection of the usual two primary cells and the generator. The latter items constitute separate accessories, the generator being supplied in the standard form complete with case.

Probably the most well-known magneto system is that in which both calling and clearing signals are given by current from the

subscriber's generator which operates in the first place an indicator or relay bridged across the line through a break jack at the exchange, and on completion of the conversation, a similar device connected across the cord circuit. The necessary instrument connections are shown in Fig. 1 where the ringer is placed in series with the condenser and is disconnected from the line in the speaking condition. By introducing the condenser in this manner the same arrangement holds good for systems in which the clearing signal is not dependent on the operation of the generator, but is provided by the loop being broken on replacement of the handset. The action of the subscriber in restoring a normal line condition by replacing the receiver is also employed in other systems where a hand generator is used for calling, and where in some cases ringing current from the exchange is sent out over one line to earth. Suitable instrument circuits for the most familiar of these, giving loop clear and earth clear are shown in Figs. 2, 3 and 4. By simple cross-connecting in the terminal field the convertible telephone may be prepared at once for service in any of the forms indicated and is completed by the addition of the generator box and microphone battery.

C.B.S. Systems.

The three well-known central battery signalling systems employ instruments requiring a local microphone battery but no generator, both calling and clearing signals being dependent upon operation of the subscriber's hook switch. Although in each case the exchange is signalled on completion of the line loop when the receiver is removed, differences in the methods of ringing the subscriber and obtaining supervision do not permit the use of only one form of telephone.

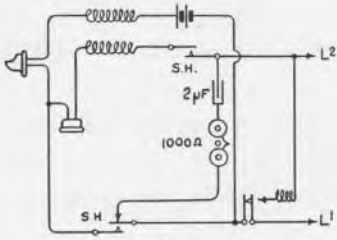


FIG. 1

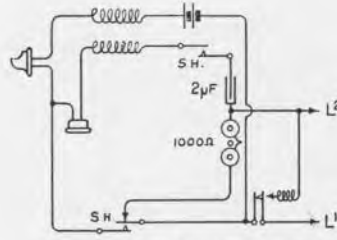


FIG. 2

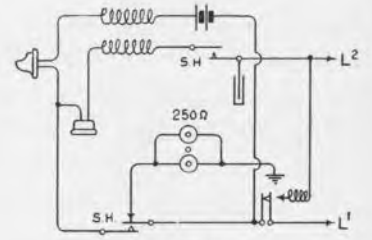


FIG. 3

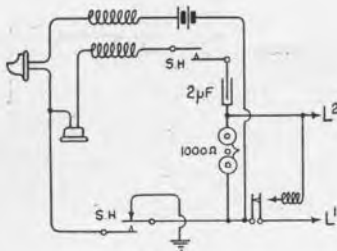


FIG. 4

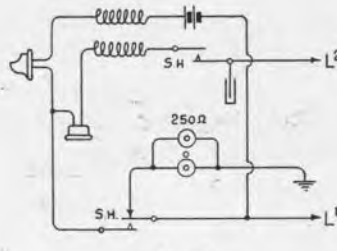


FIG. 5

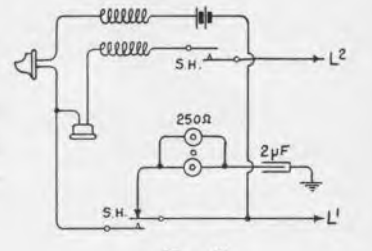


FIG. 6

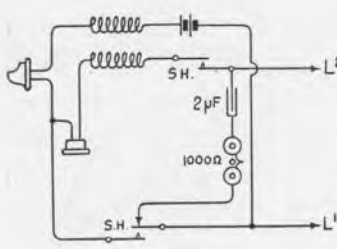


FIG. 7

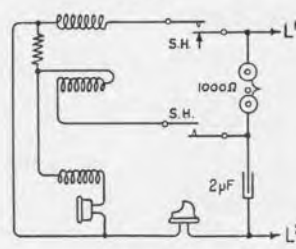


FIG. 8

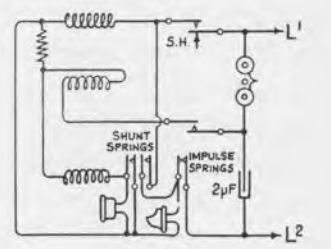


FIG. 9

Alternative instrument connections.

The first system (No. 1) requires connection of the ringer to earth as shown in Fig. 5, and when party line working is adopted, the addition of the condenser in series with the ringer (Fig. 6). In C.B.S. systems Nos. 2 and 3 the telephone circuit is simplified to some extent since an earth return for ringing or clearing is no longer required, and in the normal condition the ringer and condenser are placed in series across the line as shown in Fig. 7. Supervision is obtained by interruption of the line loop when the receiver is replaced after conversation.

Preparation of the convertible telephone for C.B.S. service is simple in the extreme

and involves only re-arrangement of the terminal connections, the provision of the microphone battery, and if necessary the connection of an earth lead.

Manual and Automatic C.B. Systems.

The simplicity of conversion for use on manually-operated and automatic C.B. systems cannot be emphasised too strongly, for it is this feature which is of the greatest practical value. If, for example, the telephone is serving as a magneto instrument and it is desired to modify it for use on an automatic C.B. system, the change is effected by the removal of the generator box and microphone

battery, replacement of the existing induction coil, and the addition of a dial which takes the place of the dummy normally fitted over the dial aperture. It will therefore be seen that the cost of alteration is limited to the purchase of a new induction coil and the necessary dial, while the only items thrown spare are the generator and battery. Conversion for manual C.B. service is even more simple since the dial is not required.

Where the telephone is first employed in C.B.S. form the same procedure applies, but in this case the battery is the only item recovered.

From Figs. 8 and 9 which show the circuits of the instrument after conversion for manual and automatic C.B. service respectively, it will be noted that the induction coil which replaces the L.B. type comprises four windings. While this might at first appear to complicate alteration, the work is actually so simple that it may readily be carried out on site by semi-skilled labour. Since the two coils are similar in general construction, and the internal wiring of the telephone is designed to satisfy every requirement, replacement involves nothing more than the transference of fixing screws from one coil to the other, and the connection of existing wires to their respective terminals. The short cord em-

ployed with the dial is terminated directly in the base.

The principal reasons why the **GEOPHONE** Convertible Telephone merits the serious consideration of every telephone engineer may be summarised as follows:—

- (1) It represents the latest practice in telephone design and is unsurpassed in efficiency
- (2) Conversion from one form to another for service in conjunction with different systems is simple and inexpensive.
- (3) It is rendered suitable for wall mounting by the addition of a standard bracket.
- (4) Where more than one system is in use it permits standardisation of subscribers' apparatus, and consequently reduces the variety of spare parts to be stocked.
- (5) When adopted for C.B.S. or magneto working it simplifies conversion in the event of a manual or automatic C.B. system being introduced.
- (6) It reduces the first cost since the manufacturer is enabled to concentrate on the production of one class of instrument instead of many.

