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## Solderless Wrapped Connections

### Introduction

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In the telephone plant during the course of a single year, the operation of connecting a wire to a metal terminal is carried out approximately one billion times. Many of these connections are made in the factory. Others are made during the installation of equipment and a substantial number are made in the course of normal operation of the telephone plant. Successful functioning of the plant depends on trouble-free performance of each of these connections, most of which are now soldered in accordance with long-standing practice. Recently, a new technique for joining wires to terminals has been developed which will have important technical and economic advantages in the Bell System and which should have similar advantages in other fields.

The immediate need for a new connection arose with the development of the new wire spring general purpose relay.\* In this relay the terminals appear in the form of closely spaced wires and the standard methods of applying connections were not satisfactory. Since the production schedule for these new relays required something like fifty million connections a year on relay terminals alone, an intensive effort was made to devise a satisfactory method for wiring. The first result was the development of a tool which could wrap a few turns of wire around the terminals of the relay, and do this efficiently on the closely-

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\* Keller, A. C., A New General Purpose Relay for Telephone Switching Systems. Bell System Tech. J., **31**, pp. 1023-1067, Nov., 1952.

spaced wire terminals.<sup>†</sup> It was soon found that similar tools could be used to advantage on existing types of terminals, and the Western Electric Company is now making extensive use of wrapping tools. Connections made with these tools are being soldered after wrapping.

In the meantime, further development work indicated the possibility that by wrapping the wire under tension around a properly shaped terminal, the need for soldering might be eliminated. Major economies appeared possible if such a solderless wrapped connection were applied extensively in wiring communication equipment. In addition, there would be freedom from trouble due to solder splashes in equipment and there would be an appreciable reduction in the consumption of tin for use in solder.

Three papers in this issue of the JOURNAL describe the present status of the program undertaken to exploit these possibilities. The paper on design indicates that practical tools for making solderless wrapped connections can be designed, built and used; the paper on analysis describes the basis for belief that the method is fundamentally sound; and the paper on evaluation indicates that the resulting connections are satisfactory for use in the telephone plant.

Other types of tools capable of cutting, skinning and wrapping the wire in one operation are under development, and the problems presented in adapting the basic techniques to other conductors, such as aluminum wire and stranded copper wire are being studied. In fact, a whole new area of development effort has been opened up.

Thus the work reported in the following papers is of interest from two points of view. On the one hand it is a record of progress in the continual quest for less expensive and more reliable equipment. On the other hand, it is an example of the broad effects which are often the result of development aimed at a specific problem. The search for a solution to the problem of making connections to a new type terminal has led to a new approach to the whole problem of wire-terminal connections.

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<sup>†</sup> Miloche, H. A., Mechanically Wrapped Connectors. Bell Labs. Record, **29**, pp. 307-311, July, 1951.