New methods of telephone cord construction use a parallel conductor that eliminates the binder and filler threads of the older twisted cord method. A thinner, lighter, and easier to make cord is the result.

Jacketed Cords for Telephone Sets

Except in the very early days of telephony, almost all telephone sets have used cords of one type or another to connect the receiver or the handset to the rest of the set, and to connect the set either to a wall-mounted subset or to a connecting block. From the very beginning, every effort has been made to have these cords as light, flexible, and wear-resistant as possible. Although subjected to bending, twisting, kinking, rubbing, and pinching, in addition to pulling the conductors should not break, the insulation not fail, and the outer covering should not wear away.

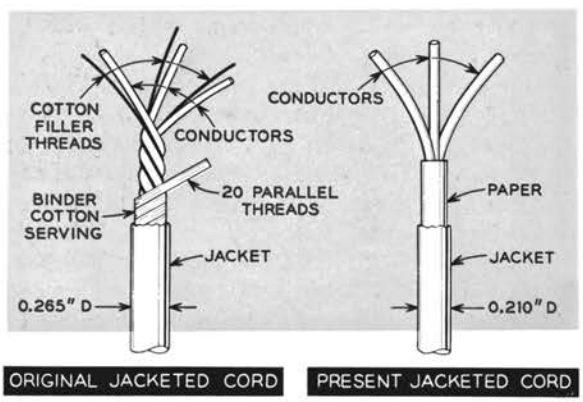
For many years telephone-set cords were covered with a brown cotton braid, and some of these are still in use. Earlier, the conductors themselves were also insulated with cotton braid. Telephone sets, however, are often located where the cords are subject to moisture. The cotton braid was therefore given a water repellent treatment; even so, moisture often caused leakage currents between the conductors and also accelerated corrosion of the conductors and rotting of the braid. Using rubber to insulate the conductors solved some of these problems, but before rubber-insulated cords could be made for general use, special rubber compounds had to be developed (RECORD, *August*, 1938).

Although insulating the conductors with rubber helped prevent many moisture troubles, the cotton outer braid was still subject to wear. In an effort to reduce troubles from worn-out cords, and to reduce the frequency with which the cords had to be replaced, the first rubber-jacketed cords for telephone sets were introduced for Bell System use in 1938. These cords were heavier and larger in diameter and — primarily because of the expensive finishing operations required — considerably more costly than the textile-covered cords. For these reasons, they were not considered desirable for general use but were restricted to sets that were subjected to unusually hard service or extreme moisture conditions.

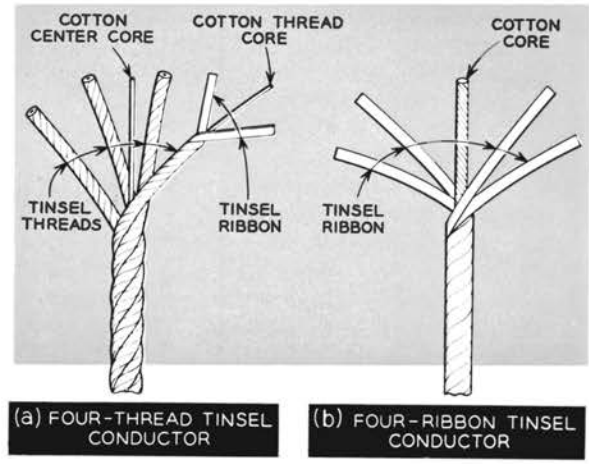
Because of the rubber shortage, rubber-jacketed cords were not produced for civilian use during World War II; after the war, a survey indicated that neoprene would be more suitable than rubber for this purpose. Neoprene resists deterioration by oil and is less susceptible than rubber to ozone cracking. It was used, therefore, as the covering material when the production of jacketed cords was resumed. Otherwise, the construction of these cords was unchanged from that of the pre-war versions.

It was recognized that cord maintenance would be materially reduced and customer satisfaction increased if jacketed cords suitable for general use were available. This meant that both the weight and the thickness of the cords must be reduced — without, however, reducing the ability of the conductors to withstand bending and twisting. Laboratories' engineers and Western Electric accordingly undertook the development of new methods of cord construction. They developed a parallel conductor construction that eliminated the binder and filler threads which were characteristic of the older twisted construction. Laboratory tests showed that this parallel construction withstood bending and twisting just as well as the twisted construction, and that a thin paper wrapping would serve the function of the binder threads. The change in construction resulted not only in a thinner, lighter cord, but in a cord that was easier to manufacture.

Cords made by the new method and jacketed with neoprene were standardized in 1949 and essentially replaced those covered with textile braid for black telephone sets. By early 1954, cords of similar design — but using polyvinyl chloride plastics for insulation and jacketing — were in production for color sets. Recently, improved polyvinyl chloride plastics have largely replaced neoprene, even for black set cords.



Old jacketed cord design (left) had conductor and filler threads twisted and covered with a cotton binder. New cord (right) conductors are parallel.



Old telephone conductor (a) with a twisted cord design, versus new conductor (b) of less diameter, greater flexibility and simpler construction.

In addition to design changes in the methods of cord construction, a new type of tinsel conductor was developed. Formerly, tinsel conductors consisted of several tinsel threads wrapped around a cotton yarn core. Each tinsel thread, in turn, was made by wrapping one or two tinsel ribbons around a cotton yarn core. The new tinsel conductor has four tinsel ribbons wrapped in an overlapping manner around a single — but larger and stronger — cotton core. Smaller in diameter than the former tinsel conductor, the new tinsel conductor withstands bending and twisting better and is much more flexible than the older conductor. This new conductor is now being used in all vinyl-jacketed cords and in some neoprene-jacketed versions. Present plans call for its use for all conductors of station cords as soon as manufacturing facilities are available.

Laboratory tests and field experience with the jacketed cords indicate a marked lengthening of service life — with consequent lower maintenance costs — over that of the textile-braid covered cords. The search for improvement continues, however, in this as in other phases of the telephone art. New materials and manufacturing methods will lead to smaller and smaller cords with greater and greater resistance to wear.

C. A. WEBBER
Outside Plant Development