Lesson 6

Wire Splicing and Soldering

It looks easy to splice electric wires and it is easy after you know how, but just because it looks so easy, there are too many electricians who do it in a careless and haphazard way. A poor joint causes heating and may cause enough resistance to make electrical devices operate poorly, even though it doesn't open the circuit altogether. In this, as in every other part of your work, I want you to learn to do it right.

To make a splice that will conform to the requirements of the National Electric Code, it must be mechanically and electrically secure without solder and then must be soldered to prevent corrosion or rust. After the joint is soldered, you must cover it with insulation that will be equal to the original insulation you removed to make the splice.

MAKING SPLICES.

I want you to make all the splices described in this lesson with the exception of the telephone cable splice. Do not be satisfied with making one of each, but continue practicing until you can make them neatly and rapidly. I sent a number of pieces of wire in your binder, so you can practice making the splices. If possible, you should get some old #14 and some stranded wire and make a lot of these splices. Be sure to carefully note the figures and follow them closely when practicing the splices.

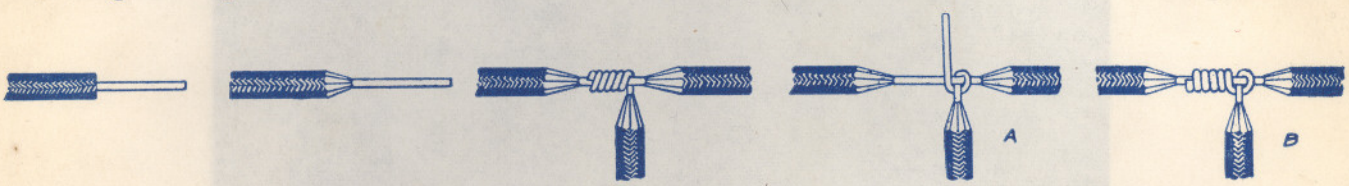

Fig. 1 Fig. 2 Fig. 3 Fig. 4

STRIPPING THE INSULATION.

The first thing to do is to learn how to cut the insulation off the wire. This is called stripping the wire. There are several devices manufactured for stripping wire, but nothing is much better than an ordinary pocket knife. Use the sharp edge of the knife for cutting away the insulation and the back of the blade for scraping the wire, so your knife will not dull so quickly.

Never cut the insulation away as shown in Fig. 1, as you are liable to nick the wire. The wire can be easily broken if it is nicked. Also, the diameter is reduced at the nicked point and the resistance of the wire is increased. Always cut the insulation the way I have shown you in Fig. 2. Whittle the insulation off the wire just like you would sharpen a lead pencil, until all the rubber and braid have been removed. Then take the back of the blade and scrape off all the rubber, until the metal shines. After the wire has been stripped and scraped, it is then ready to splice.

TAP SPLICE.

The splice shown in Fig. 3 is an ordinary tap which is used when connecting the end of a branch wire to a line wire. Strip about 4" of insulation off the end of the wire you are to connect and strip about 1-1/4" of insulation off the line wire. Hold the wires firmly with one hand, having them crossed at right angles. Be sure you do not let them slip or turn and then wrap the wire you are attaching, around the running wire, being careful that the turns are tight and close together. Put about 5 or 6 turns in this splice.

KNOTTED TAP.

You can see the knotted tap in Fig. 4. It is better than the ordinary tap splice I have just described, because it cannot untwist from the main wire. The only difference between the two splices is the knot where the two wires come together. Strip the branch wire and the running wire the same as in the regular tap splice. Hold the wires firmly as before and make one turn backward on the main wire. Then bring the end of the connecting wire back of where it started as in Fig. 4A, then twist onto the running wire about 5 turns, finishing the splice as in B.

FIXTURE SPLICE.

The fixture splice shown in Fig. 5 is the one you will use a great deal in wiring and connecting fixtures, or in other places where you have to connect wires of different sizes.

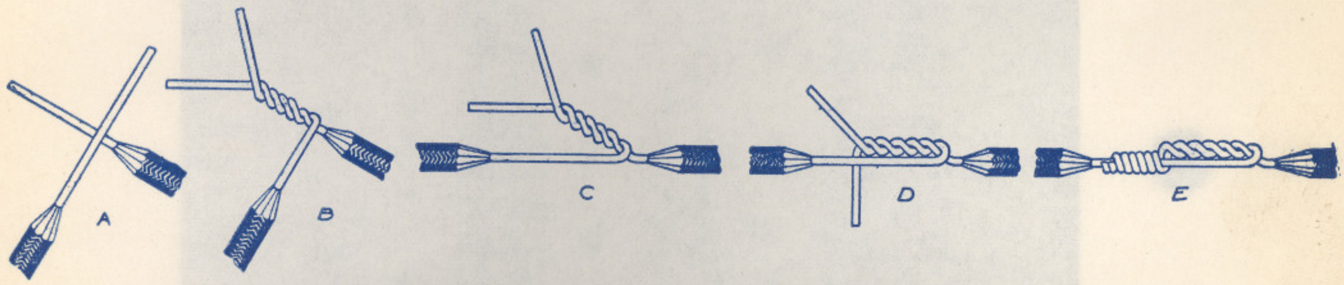

Fig. 5

First strip the insulation off the wires for a distance of about 4" or 5" and then scrape the wire. Hold the wires together firmly as shown in Fig. 5A, now twist the wires together with your pliers, making 3 complete turns as shown in B. Be sure that both wires twist. If only one wire twists and the other remains free, the joint will not hold. Straighten out the end as in C and then bend the twisted portion close to the long wire as in D. Now, wrap the two ends in the same direction around the long wire and the splice is complete as shown in E.

WESTERN UNION SPLICE.

The Western Union splice you see in Fig. 6 is the most common one used in connecting large or small wires together.

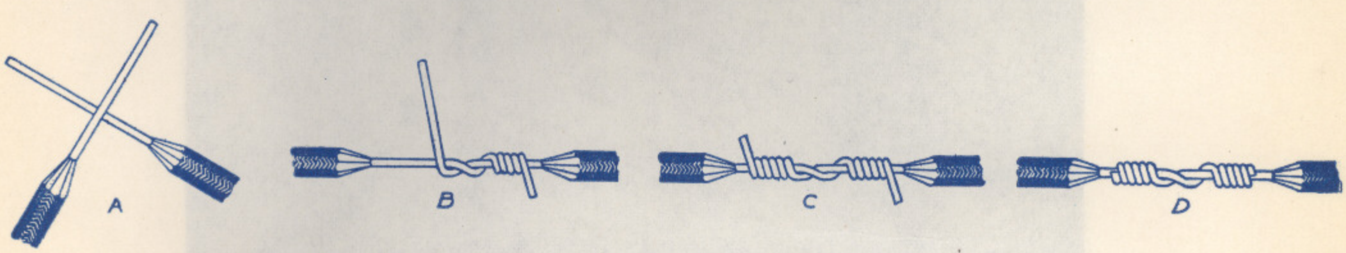

Fig. 6

Strip off about 4" or 5" of the insulation and scrape the two wires. Hold them firmly in position as in Fig. 6A. Make 5 turns with one wire as in B, then make 5 turns in the other direction with the other wire as in C. Cut the ends of the wire off short and be sure that the ends which remain do not stick out, as the sharp points will cut through the insulating tape you will place on the joint. Pinch the end down with pliers. Have the turns tight and close together. There should be no movement between the turns of wire or the wires themselves when you finish the splice.

DUPLEX WIRE SPLICE.

In Fig. 7 I show you two Western Union splices as they are used in a duplex conductor. The thing to note here is that you place the splices so they cannot touch each other. The splice is made just the same as you would for a single wire, but you should be very careful to see that you do not cut away any of the insulation so there is any chance of the two wires coming together. In taping this joint, you place rubber tape around each splice, then cover the entire joint with friction tape.

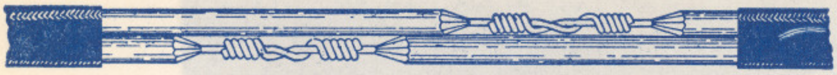

Fig. 7

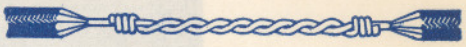

Fig. 8

SPLICING OUTSIDE LINES.

In Fig. 8 I show you a Western Union line splice. The neck is made much longer to give strength to the joint and the few end turns prevent untwisting. I advise you to use this splice on all outside wires, both bare and insulated, as it will stand more strain than the other style of splice used on interior wiring.

SLEEVE JOINT.

The "McIntire Sleeve" shown in Fig. 9, is mostly used in making line splices on outside wires but is sometimes used on inside work also. This sleeve is pressed from copper sheets into the form of a double tube. The 2 wire ends are cleaned and placed into the tubes at opposite ends. Two pair of linemen's "connectors", (See Fig. 10), are used to make this splice. Each pair of connectors is clamped to the sleeve at the ends and the sleeve is twisted about 3-1/2 turns. Fig. 11 shows the completed splice. No solder is used on the sleeve splice.

Fig. 9

Fig. 10

Fig. 11

PIG-TAIL JOINT.

Sometimes the pig-tail joint shown in Fig. 12 is used in making the connections between fixture wires and between the wires in conduit and other boxes, where the connections are made between different circuits, or circuits and fixtures. It is a simple and easy joint to make because the wires, after being stripped, are laid side by side and the ends twisted around each other. This kind of a joint does not have a great amount of strength to resist pulling strain. Where there is no strain, or very little space to work in, you can use this joint and get satisfactory results. You can use this kind of a joint to connect 2 or more wires together.

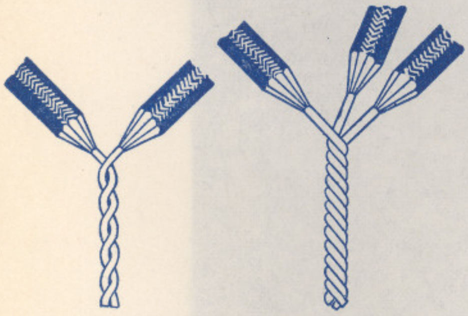

Fig. 12

Fig. 13

Fig. 14

ANOTHER FIXTURE SPLICE.

In Fig. 13 I have shown you a joint that you can use between a main conductor wire and the smaller wire in a fixture. This joint is easy to make and makes a good secure job. You start by wrapping the bared end of the small fixture wire around the larger conductor, leaving about 3/4" of the large wire unwound. Then bend the end of the large main conductor back over the wrapped part of the joint and squeeze it with a pair of pliers. This prevents the small wire from unwrapping and makes a good solid joint, especially after it is soldered.

BRITANNIA JOINT.

For joining solid wires, #8 and larger, in interior work, you will often use the Britannia joint that I have shown you in Fig. 14. You first strip the insulation from the wires for about 5" and bend the tip end over slightly. You will need a piece of #18 bare wire about 2 or 3 feet long to wrap the joint.

The two large wires are placed together, the binding wire is placed parallel with the large wires with the center of it even with the center of the joint. Then hold the three wires together with your pliers while you twist the binding wire on the right side of the center. After that end is complete, remove the pliers and twist the left side, making a complete joint as shown. You should pull the binding wire as tight as possible when making up this joint. The joint is only strong when soldered and should only be used where there is no strain on the wires.

DOUBLE TAPS.

When it is necessary to tap two branch wires to a main wire at one place, make a cross joint as in Fig. 15. "A" shows you how the two branch wires are wound around the main wire in opposite directions, starting from the center of the joint and running one branch wire away from the center one way and the other one in the opposite direction. You can also make this cross joint by wrapping the two branch wires in the same direction while keeping them side by side as at "B". Which style of joint you use will depend upon which is the most convenient in the location you find the wires in.

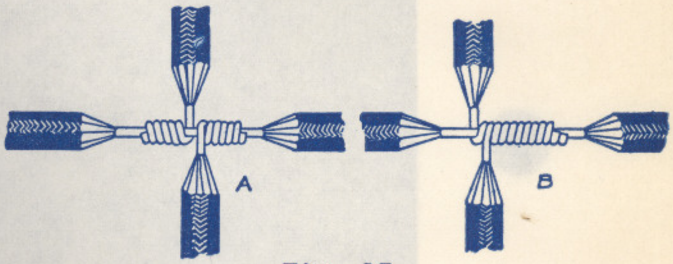

Fig. 15

REMOVING RUBBER INSULATION FROM HEAVY STRANDED WIRES.

I will now show how you can easily remove the insulation from stranded rubber covered wires so they will be clean without digging the rubber out of the strands.

Make a cut into the insulation at each end of the space from which you are removing the insulation, by going around the wire with a knife, as in Fig. 16A. The knife should touch the wire all the way around. Do not place too much pressure on the knife, as it may cut the strands. After this cut is completed, make another cut into the insulation parallel to the wire for the full length of the space. I show you this operation in B. You can then peel the insulation from the wire with a pair of pliers as shown in C.

The knife used in this operation can be the regular electrician's type, of average size, or a large knife made from a file for the larger sizes of wire. One edge of the file can be ground sharp for about 6 inches ,and some tape wound on the other end to form a handle.

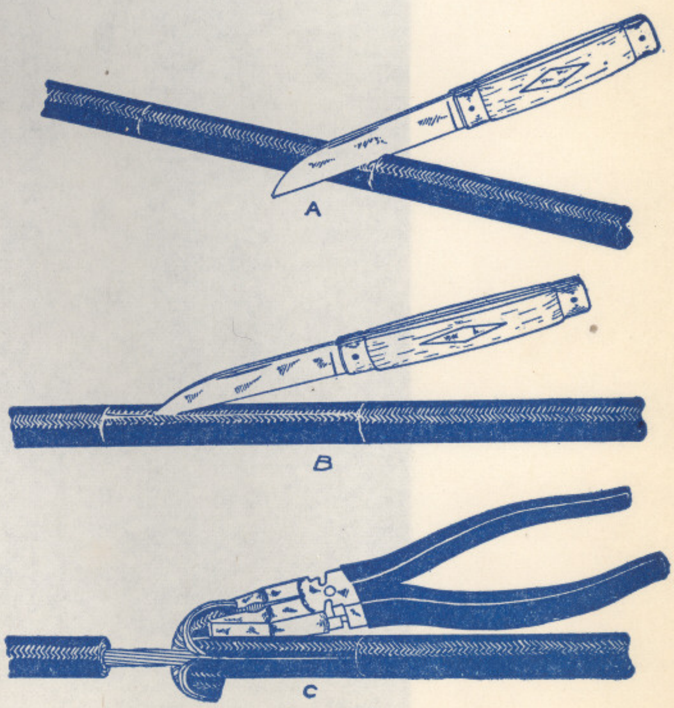

Fig. 16

REMOVING WEATHERPROOF INSULATION.

The best way to remove weatherproof insulation is to pound it with a hammer, with the wire placed on a solid object. The insulation is hard and will break when pounded. Be careful not to flatten or nick the wire. When the wires are suspended in the air, such as on poles, you will need to use a knife to remove it. Weatherproof insulation is very tough, and you will often find it very difficult to remove.