HOW TO MAKE AN ELECTRIC SOLDERING IRON.

BY ARTHUR B. WEEKS.

A design for an electric soldering iron is given in the accompanying illustration. The drawing is made to scale and is suitable for a working drawing. The core, *C*, can be made of iron or copper. Cut a 7-16-inch standard thread on one end, leaving a shoulder so as to make a tight fit on washer, *A*. At the opposite end, the washer does not fit over the core, but a hole is drilled for a screw ¼-inch No. 20 round head, ⅝ inch long. The dark lines indicate the mica lining. After fitting the India mica on the core, put micanite rings over each end; these will assist in holding the mica in place. The best fit of mica can be made by using thin pieces and pasting them around until the desired thickness is attained. A suitable mica cement is commercially known as "Brown Dielac." The insulating washers at each end should be of the best micanite, commonly used for commutator segments, since it is free from mica cement and therefore very homogeneous.

The copper tip can be made from an ordinary soldering copper, cut off, drilled, and tapped. The outside shell can be made of steel tube with an end piece brazed on, and a tube, *D*, brazed thereto. Several holes should be drilled in this tube for free air circulation. Have an ordinary tool-handle of wood. The washer, *B*, serves also as a rest or guide for the outer shell, *E*. The only point at which the shell is secured in any way is at the copper end, where four or five small machine screws are used around its circumference.

Before putting on the shell, and after the copper is secured in place, all is in readiness for winding on the wire. This is the important part of the operation. German-silver wire has been used with more or less success, but it is rather short-lived. Krupp iron wire is extremely desirable, and answers the purpose well. The writer has tried several sizes of wire; for ordinary use No. 26 B. & S. will be found satisfactory. Put the copper in a lathe and pass one end of the bare wire through a mica-lined hole close to the core, as shown on lower side. Much depends on this insulation. Wind carefully, spacing the turns about the thickness of the wire, or a little more. When the first layer is wound, cover it over with mica, the same as was used on the core. Do not let the wire slacken at all. Wind the following layers in the same way, insulating carefully between each. If properly proportioned, there is space for four layers of wire. The copper should heat sufficiently to make solder flow well in about five minutes. Since the mica will not endure excessive heat for long, the wire must be well proportioned. This can easily be ascertained by trial. (When the tool is in use, favor it as much as possible by shutting off current.) When the fourth and last layer of wire is completed, bring the end out through a well-insulated hole at the top of washer, *B*; and where the winding is finished, pass a piece of bare wire over the last layer of mica, and twist it near the washer where the wire passes through, to keep the wire from slacking up. Tie again at center and at further end, to retain mica. Make connections for asbestos-wrapped wires in the handle as shown. Make a loop at each end, and pass a small stove bolt through them. Insulate the bolts with asbestos; allow a little slack in handle. Connect a lamp plug to the end of wires, *S*, allowing as much wire as desired. As constructed, there is no way to make the wires fast to binding posts; this has simplified the construction, and will be entirely satisfactory, provided the tool is not allowed to swing from the outside wire, *S*. To make this part still more complete, binding posts can be set in, however, in the outer end of the handle, and provided with suitable shell over them. Avoid using fluid flux too freely on the copper while at work, lest it find its way into the windings and cause a burn-out.

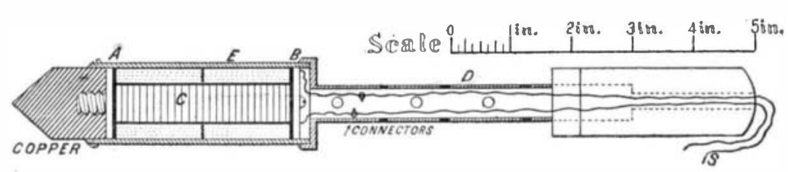
This soldering iron should take from one to two amperes on 110-volt circuit. It can be connected into any lamp socket and used with perfect safety in places where there is great fire risk. It is especially useful where torches and gasoline stoves and charcoal pots are prohibited. The copper tips are renewable. When the wire is rendered brittle from continued use and a break occurs, it is best to rewind rather than try to patch it up, since it would not last long, but would continue to open right along. The writer has used silicate of soda with considerable success for cementing the wires in place. This can be tried later; and where greater heat is required with special soldering devices, or where wire passing five to eight amperes is used and mica will not answer at all, some such medium must be used, unless the construction is such that porcelain can be utilized for insulation.

Where silicate of soda is used, the entire iron windings should be baked in an oven before applying current. The material will then be solid throughout.

There are few troubles incident to the use of an electric soldering iron. Usually if an iron fails to give out heat, it is due to an open circuit in the windings or at the connections or in the attachment plug. The attachment plug should be fused. See that it is always intact.

An open circuit may be due also to complete oxidation, as well as to fusing caused by a short circuit in the windings. Again, if the windings become grounded, that is, if they touch the shell in places that would short-circuit the coil, the fuse will blow until the fault is remedied. For this reason, the insulation must be careful and thorough throughout. Look well also to the insulation where the wires pass through the washer, and cover them thoroughly with asbestos from the point where they leave the washer, using the previously mentioned mica paste.

In damp places it is well to stand on a board while using the iron. In locations containing much iron construction, do not handle any part of such construction with one hand while using the iron with the other, as a ground on the system may occur, and should another take place on the opposite side while thus engaged, injury is liable to follow.



SECTION OF AN ELECTRIC SOLDERING IRON.

THE DOUBLE-DECK SUBWAY SYSTEM.

Broadway, with its enormous traffic, has been for many years a coveted route for underground railway builders. The physical obstacles which would be met with under the street surface are many. These obstacles, such as the cable road structure, the gas and water pipes, sewers and electric wire ducts, are so located that unless the tunnel is built at considerable depth they must necessarily be disturbed. During construction the street traffic must be maintained without serious interruption, as also must the use of the gas and water pipes, electric wires and sewers.

A somewhat intimate acquaintance with the above conditions under Broadway led Mr. J. W. Reno, of this city, to design a number of years ago a form of subway, and a method of construction, which would provide a complete four-track railroad with the greatest possible economy of space. This form of construction has become known as the Reno double-deck tunnel, which consists essentially of two side walls, a roof, and floor, divided vertically and horizontally by columns and girders into four compartments or trackways.

The routes which are now under consideration by the Rapid Transit Commission include Broadway and Lexington Avenue, the width of which between curb lines is approximately 40 feet. The fact that a tunnel with four tracks on a level requires a width of at least 53 feet makes it impossible to build such a structure without encroaching to a large extent upon the sidewalk vault property now in use by adjoining buildings. These sidewalk vaults are very valuable, and contain in many cases boilers, engines, and other conveniences which it is next to impossible to locate anywhere else. Experts have testified before the Rapid Transit Commission that it would cost the city $12,000,000 to condemn these vaults along Broadway for railroad purposes. It is obvious that the construction of the Reno plan would not necessitate the expenditure of any money for this purpose.

Another disadvantage in the construction of a wide tunnel is the fact that the operations of tunneling would be in close proximity to the foundations of the buildings, necessitating the shoring up and underpinning of many structures. This work alone has been estimated by engineering experts before the commission to amount to approximately $3,500,000 additional. In the Reno tunnel, which is clearly illustrated on the front page of this issue, the side walls are distant from the building line about 25 feet, combined with a new method of construction, makes it unnecessary to disturb foundations of any of the buildings, thus saving a very large sum on this head. The method of construction proposed is as follows:

A narrow trench would be constructed on one side of the street at a time, by driving down a special form of steel sheet piling, and excavating the ground between the sheeting. This trench would then be filled in with concrete, to form the side wall of the tunnel. The other wall of the tunnel would be constructed in a similar manner on the opposite side of the street, after which the steel beams, which form the roof of the tunnel, would be placed in a position under the cable road structure, the tunnel roof completed and the street surface restored. Simultaneous with the construction of the tunnel wall, the pipes, sewers and electric wire ducts would be surrounded by a permanent pipe gallery, so that there would never be any necessity in the future for tearing up the street surface in order to make alterations and repairs. It is well known that those doing business on Broadway are put to great loss, amounting to millions of dollars in the aggregate, on account of the almost endless disturbance of the street pavement necessitated by the present imperfect arrangement of the pipe and wire systems. In the plan here illustrated there would be ample space for commodious pipe galleries on either side of the tunnel structure.

For a considerable distance along the Broadway route the base of the double-deck tunnel would be below the water line, and the construction along this portion would be similar to that previously described, with this exception, that in order to preclude any possibility of the settlement or movement of the ground, it is proposed to freeze by well-known methods the wet sand under the line of the base of the tunnel, previous to its excavation. After the tunnel walls and invert are constructed, it will be perfectly safe to allow this frozen material to thaw, and return to its previous condition.

Some objection has been raised to the double-deck tunnel because of the possibility of noise and vibration from the trains on the upper tier of tracks; but in the opinion of the writer all vibration and noise will be done away with if the tracks are laid upon the ordinary stone ballast, and supported by sufficiently strong flooring, composed of steel and concrete construction. By reference to the engraving, it will be seen that the bases of the columns between the express tracks are inclosed by a concrete wall. The purpose of this is to distribute the pressure of the columns along the center line of the invert, and also to act as a safety device in case of the derailment of a train, to prevent its butting into a column and causing great damage to the structure. This wall is not made continuous, cross openings being thus left in order to permit of the ready passage of the workmen from one track to another. These openings also provide refuge places in which the workmen can stand out of the way of passing trains.

At the local stations in the double-deck subway, the pipe and wire ducts would be carried over and under the platforms, the waiting rooms being located under the cross streets similarly to the present subway. The express stations will be located at long intervals, and at such places as City Hall Park, Union Square, Madison Square, 42d Street, 72d Street, 96th Street, etc., where it would be perfectly practicable to spread the local tracks and bring the express tracks up a grade of 7½ feet, the local tracks being carried down a grade of 7½ feet to meet them. This construction would result, at the express stations, in placing all four tracks on a level, with island platforms between them, giving the same facilities for transfer of passengers from the local to the express trains as is now the case in the corresponding stations of the present subway.

Railroad engineers will appreciate the advantage of this arrangement, in that it will give to the long, heavy express trains an ascending grade as they approach the station, and a descending grade to assist in their acceleration as they leave the station.

In conclusion, from the foregoing it can be conservatively stated that this double-deck tunnel will have all the advantages in convenience and economy of operation possessed by the four-track level tunnel, while at the same time it will be free from the disadvantages of encroachment upon private property, interference with building foundations, and interruption of street traffic; and finally, because of the inherent economy of its method of construction, it will save millions of dollars to the taxpayers.

Meteorological Summary, New York, N. Y., March, 1905.

Atmospheric pressure: Highest, 30.61; lowest, 29.71; mean, 30.12. Temperature: Highest, 74; lowest, 14; mean, 40; normal, 38. Warmest mean, 48, 1903. Coldest mean, 29, 1872. Wind: Prevailing direction, northwest; maximum velocity, 47 miles. Precipitation, 3.65. Average, 4.05. Deficiency, 0.40. Greatest, 7.90, 1876; least, 1.19, 1885. Total snowfall, 3 inches. The maximum, 74, on the 29th, is the highest temperature for March recorded by the Weather Bureau since its establishment in 1871.

A petition in bankruptcy was filed recently in the courts at New York by Annie L. Costen, the daughter of the inventor of the Costen lights, which are used generally as signals on shipboard. The construction and composition of these lights is a secret closely guarded by the family. After the death of the father, the business was carried on by the widow, and upon the latter's demise the daughter succeeded to it, and conducted it in a cottage on Staten Island, where she also lived. The death of the father resulted from an accident while making the lights, and recently the daughter had a narrow escape from the same fate by a mishap which caused the partial destruction of the Staten Island cottage, and it was this incident which caused the woman's financial distress.