

to a temperature of from 120° to 130° C. As the substance is ordinarily softened by heat, it is necessary to take some means to prevent it from sticking to the mould. For the purpose soapstone will answer, and the mould, as well as the piece of caoutchouc, should be well brushed or dusted with this substance.

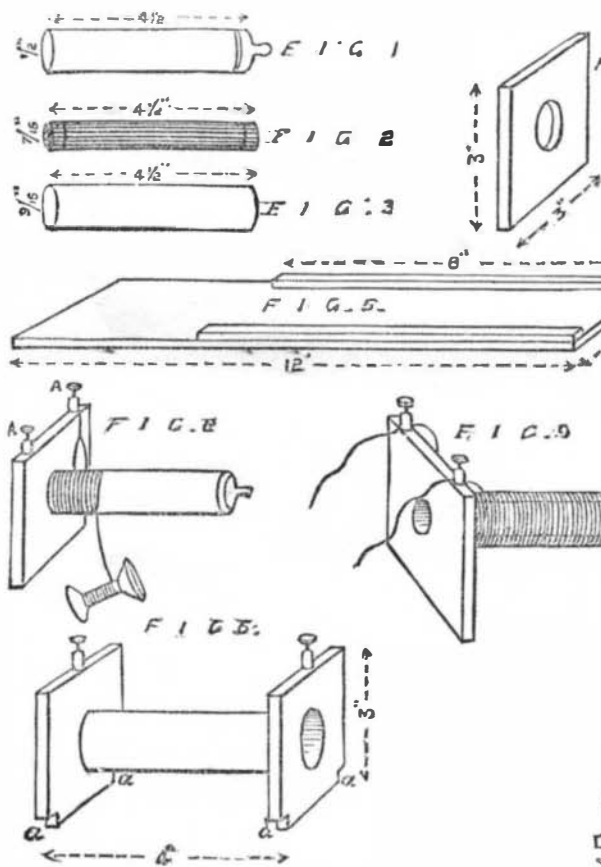
The duration of the heating varies with the thickness of the rubber sheet. As a general thing, from 20 to 30 minutes ought to be sufficient. It may be mentioned here that special apparatus has been constructed for pressing and vulcanizing. The proper vulcanization is of the greatest importance in determining the durability of the stamp.

All that remains to complete the stamps is the mounting of the rubber plate upon a suitable base or handle. This is best done either with zinc or with a solution of caoutchouc in benzine. The surface of the handle, as well as the backpart of the stamps, having been covered with such a solution and well pressed together, after drying the entire stamp will be ready for use.—*Amer. Lith. and Printer.*

## HOW TO MAKE A MEDICAL COIL WITH PRIMARY AND SECONDARY CIRCUITS AND REGULATORS TO BOTH.

By S. R. BOTTONE.

1. PROCURE a well seasoned board of walnut about 21½ in. in length, 3 in. wide, and ¾ in. thick. From this cut one length 12 in. long for the base board (Fig. 5) and three pieces 3 in. square (like Fig. 4) for the coil heads; when cut, a fillet 8 in. long must be nailed or screwed on the two sides of the base board (as shown in Fig. 5); these fillets should be ¼ in. square section. Corresponding square nicks must be cut of two of the square heads (as shown at *a, a, a, a*, Fig. 6). All the woodwork when thus squared and finished should be soaked for a quarter of an hour in melted paraffin wax, and then rubbed dry while still warm.



## HOW TO MAKE A MEDICAL ELECTRICAL COIL.

2. Procure a thin brass tube (known in the trade as "triblet tubing") about ½ in. diameter, 4½ in. long; turn up a short plug and button to fit one end of this tube and serve as a handle (see Fig. 1, *a*). This may be fastened to the tube by driving in three fine brass brads, and filing off the heads flush with the tube.

3. Now cut up about 100 lengths of straight iron wire (best soft annealed) No. 22 gauge, say, about 4½ in. in length; fill the brass tube with them as tight as you can fit them; cut them all to the same length (they must protrude a little beyond the tube). Now draw out about a couple of inches of the iron bundle and wrap it tightly round with twine, leaving about ½ in. free. Draw more out, and continue wrapping until you have wrapped to within ½ in. at each end of the bundle. Tie the string, and withdraw the bundle from the brass tube. Melt a little solder in a ladle, dip the ends of the iron bundle into soldering fluid (zinc dissolved in hydrochloric acid), and then at once into the melted solder. Allow the bundle to cool; file off the superfluous solder, so that the bundle will just enter freely into the tube. It should appear like Fig. 2 when the string has been removed.

4. The next operation is to make a good stout paper tube, also about 4½ in. in length, into which the brass tube (Fig. 1) can slide easily. To make this, put a few turns of soaped writing paper round the tube No. 1, then roll and glue seven turns of good stout brown paper, 4½ in. in length, round this writing paper, or else it will be difficult to draw out the tube. This paper tube (Fig. 3) must be allowed to dry thoroughly while still on the brass tube (Fig. 1). When quite dry, it must be slipped off, the writing paper lining drawn out, and then it must be soaked for a few minutes in melted paraffin wax.

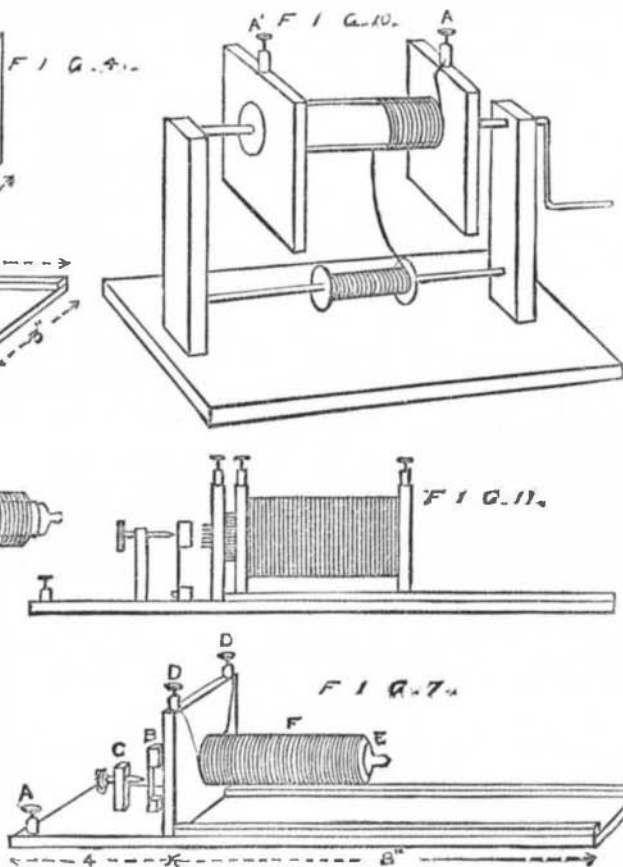
5. The iron bundle should also be allowed to stand in melted paraffin wax for some time, and then stood up to drain in a warm place. This will prevent rusting. When quite cold, all superfluous paraffin having been removed, a strip of brown paper, ½ in. wide, is rolled round one extremity of the iron bundle, until it is of such a diameter as to fit tightly into the paper tube, Fig. 3. This paper strip must be cut off at this point and glued tightly round the end of the iron bundle.

The brass tube (Fig. 1) is then slipped over the iron bundle until it just reaches the little paper collar just made. The brass tube and bundle together are pushed, button end first, into the paper tube, Fig. 3; and when the paper collar around the iron bundle is just about to enter the paper tube, it is to be well served with hot glue and forced into the tube. The whole must now be allowed to dry and set thoroughly.

6. Taking one of the 3 in. heads (the one which has not any nicks in the sides), we bore a central hole with a brace and center bit, just large enough for the paper tube (Fig. 3), with its iron core, to fit tightly (see Fig. 4). Putting a little thin good hot glue round the free extremity (the end opposite that at which the brass enters), we push it into the hole in the square head, until it projects about ¼ in. on the other side. This must be allowed to dry thoroughly before proceeding to the next operation.

7. We may now proceed to wind the primary coil. To this end, we take about ½ lb. of No. 24 silk-covered copper wire, and wind it round the tube, as shown at Fig. 8, from end to end, in continuous layers, taking care to put a sheet of paraffined paper between each layer, and also to baste each layer with melted paraffin wax before winding on another. About four layers will thus be got on, and an even number of layers must be aimed at, so as to get the two ends of the wire at the same extremity, so as to be able to fasten them under the binding screws, *A A* (Fig. 8). To effect this, before screwing down the said screws, the ends of the copper wire are stripped of their covering and wound once round the screw of the binder. Free ends of wire, at least 6 in. in length, must be left for attachments, etc. This is shown at Fig. 9.

8. This primary coil, with its iron core, sliding brass tube regulator, etc., may now be fastened to the base board by means of two screws from underneath, as shown at Fig. 7, at 4 in. from one end, and therefore 8 in. from the other. One of the free ends of the primary wire is brought to one of the binding screws, *A*,



while the other connects to the clapper, *B*. A short piece of wire connects the platinum screw pillar, *C*, to the other binding screw, which is not visible, as it is behind the platinum pillar. At this point it will be well to try the working of the primary coil. For this purpose, couple up the two binding screws on the base board with a good bichromate cell. Connect the two binding screws, *D D* (Fig. 7), with the two brass handles intended for use. Screw up the platinum screw, *C*, the clapper, *B*, begins to vibrate. Now hold the handles in your hand. As long as the brass tube, *E*, is entirely over the iron core, little or no sensation is perceptible. If an assistant pull out the tube, little by little, the current will be found to increase in strength until the regulator tube is quite out.

9. The secondary coil now demands our attention. A paper tube, precisely similar to Fig. 3, but of such a size as to slide easily over the primary coil, *E* (Fig. 7), is prepared, and paraffined. This must be cut exactly the length of the coil, *F*, leaving the knob, *E*, projecting. The two square pieces of board in which the nicks were cut (Fig. 6) must then have central holes cut in them to take this paper tube, and then glued, one at each end of the said tube, as shown at Fig. 6. Two small binding screws are then to be inserted in the center of the upper edge of each square. A bung is now placed in each end of the tube, and a ¼ in. iron rod pushed through both, to serve as an axle. This is then mounted on two standards, as shown at Fig. 10; and beginning by attaching one end of the uncovered wire to the binding screw, *A*, about ½ lb. No. 36 silk-covered copper wire is now carefully coiled on, being most diligent in avoiding kinks, breaks, or flaws of every description. Each layer must be paraffined and separated from its neighbor by paraffined paper. When the quantum of wire has been laid on, the finishing end is connected to the binding screw, *A'*, Fig. 10. The last coil should be covered with paraffined paper, and finally covered with a jacket of good silk velvet. The secondary coil is then complete, and may be slid in its place over the primary, coil (see Fig. 11). When it is quite over the primary, the secondary current will be at its strongest, if the metal tube regulator is drawn out; it will be weaker as the metal tube regulator is

more and more inserted; or may be even more delicately regulated by sliding the secondary coil itself more or less over the primary. The secondary coil, while the primary is being excited with a freshly made pint bichromate, will give a ½ in. spark when the regulator is out and the secondary coil right over the primary. This will pass easily through a dozen persons.—*Eng. Mechanic.*

[ELECTRICAL REVIEW.]

## BOURSEUL'S TELEPHONE OF 1854.

IN 1845, a wise and modest young man, reared in peaceful studies, became a soldier of the army of Africa; but being devoted to science, and gifted with one of those privileged intellects which permitted him to reach its highest regions, he did not despair. "I have no longer my professor," said he, "but I have yet my books; these shall be my friends, my guides, my consoling."

In 1849, at length, the young Charles Bourseul, son of an army officer, and himself a soldier in the 43d Line, gave his comrades of the garrison of Algiers a course of mathematics which attracted the attention and friendly interest of the Governor-General of Algiers. No one had recommended the simple soldier to the General, he had recommended himself; and the General, recognizing his merit, had generously held out a protecting and friendly hand. There is in that simple fact a touching eulogy of the soldier and the General.

To-day, freed from military service, Mr. Charles Bourseul dwells in Paris, and it is he who is the author of the curious article which you are about to read. We wish him all the success that he himself expects, and we shall be happy to see him attach his name to the marvelous discovery of the transmission of speech by electricity. Electricity has performed so many miracles, why not that (in despite of the Academy, where it is treated as a folly, or, when one wishes to be polite, as Utopian) which has not yet been attempted?—a view which is encouraging, it is necessary to avow, for the inventors, for those sublime initiators without whom the Academy would be but a collection of fossils. Let us say it once more, to sustain the ardor of genius in the search for the unknown: There is nothing to expect, unless an insolent sneer, from these votaries of science. Fulton and enough of others learned so to their cost, but if you speak to-day to an Academician of steam and the telegraph, he will tell you the thing was very simple, and that if the Academy had wished to take the trouble, the discovery would have been made very much sooner. Ah, well, most wise doctors, here is a problem. Read the note of Mr. Charles Bourseul:

"It is known that the principle on which telegraphy is founded is the following:

"An electric current, passing over a wire, comes to a piece of soft iron, which it converts into a magnet. Whenever the current is absent, the magnet has ceased to exist.

"That magnet, which takes the name of electromagnet, can, then, attract and set free, in turn, a movable plate, which, by its coming and going, produces the signals employed in telegraphy.

"Sometimes one uses that movement directly, and makes it produce points and dashes on a band, which is unrolled by a clock movement. The customary signals are then formed by combinations of these dashes and points. Such is American telegraphy, which bears the name of Morse, its inventor.

"One also converts that coming and going movement into a rotary movement. Thus are derived the dial-telegraph of the railroads and the state telegraph, which latter, by means of two wires and two needle indicators, reproduces all the signals of aerial telegraphy, as heretofore used.

"Let us imagine now, placed on a horizontal movable circle, the letters, figures, punctuation marks, etc. One can see that the principle explained will serve to enable him to choose at a distance such and such a character, to determine its movement, and, consequently, to print it on a page placed for the purpose. Such is the printing telegraph.

"A further step has been made. By means of the same principle, and by a mechanism sufficiently complex, we have attained a result which, at first glance, seems a prodigy. Writing itself is reproduced at a distance, and not only writing, but a stroke, a curve, in such manner that, being in Paris, you are able to design a profile by ordinary means, and the same profile is designed at the same time at Frankfurt.

"The efforts made in these directions have succeeded; the apparatus has figured in the London expositions. There is, however, something lacking to perfect the details.

"It will seem impossible to go further in the direction of the marvelous. Let us try, however, to take some further steps. I have asked myself, for example, if speech itself cannot be transmitted by electricity; in a word, if one can speak at Vienna and make himself heard at Paris.

"The thing is practicable; and this is how it can be done:

"Sounds, every one knows, are formed by vibrations, and carried to the ear by the same vibrations reproduced by the medium which intervenes.

"But the intensity of these vibrations diminishes very rapidly with distance, in such a way that there are, even to speaking trumpets, horns, and acoustic cornets, very narrow limits, which cannot be passed. I imagine that one is speaking near a movable plate, so flexible that it will not miss any of the vibrations produced by the voice; that this plate establishes or interrupts successively communication with an electric pile. You will be able to have at a distance another plate, which will make at the same time exactly the same vibrations.

"It is true that the intensity of the sounds will be variable at the point of departure where the plate vibrates from the voice, and constant at the point of arrival, where it vibrates from the electricity, but it is shown that it cannot alter the sound.

"It is evident, also, that the sounds will be reproduced at the same height of the gamut.

"The present state of acoustic science does not permit one to say, *a priori*, whether the articulate syllables of the human voice can be reproduced. The manner of producing these syllables has not been sufficiently studied. It has been remarked, it is true, that