HARPER'S ELECTRICITY BOOK FOR BOYS

WRITTEN AND ILLUSTRATED BY

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"HARPER'S OUTDOOR BOOK FOR BOYS"

WITH AN EXPLANATION OF ELECTRIC LIGHT, HEAT, POWER, AND TRACTION BY JOSEPH B. BAKER, TECHNICAL EDITOR U. S. GEOLOGICAL SURVEY

AND

A DICTIONARY OF ELECTRICAL TERMS

Extract from Chapter IX: "Line ... Telegraphy"

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Chapter IX

LINE AND WIRELESS TELEGRAPHS

A Ground Telegraph

NEARLY every boy is interested in telegraphy, and it is a fascinating field for study and experimental work, to say nothing of the amusement to be gotten out of it. The instruments are not difficult to make, and two boys can easily have a line between their houses.

The key is a modified form of the push-button, and is simply a contact maker and breaker for opening and closing an electrical circuit. A practical telegraph-key is shown in Fig. 1, and in Fig. 2 is given the side elevation.

The base-board is four inches wide, six inches long, and half an inch in thickness. At the front end a small metal connector-plate is screwed fast, and through a hole in the middle of it a brass-headed upholsterer's tack is driven for the underside of the key to strike against. Two L pieces of metal are bent and attached to the middle of the board to support the key-bar, and at the rear of the board another upholsterer's tack is driven in the wood for the end of the bar to strike on and make a click. The bar is of brass or iron, measuring three-eighths by half an inch, and is provided with a hole bored at an equal distance from each

end for a small bolt to pass through, in order to pivot it between the L plates. A hole made at the forward end will admit a brass screw that in turn will hold a spool-end

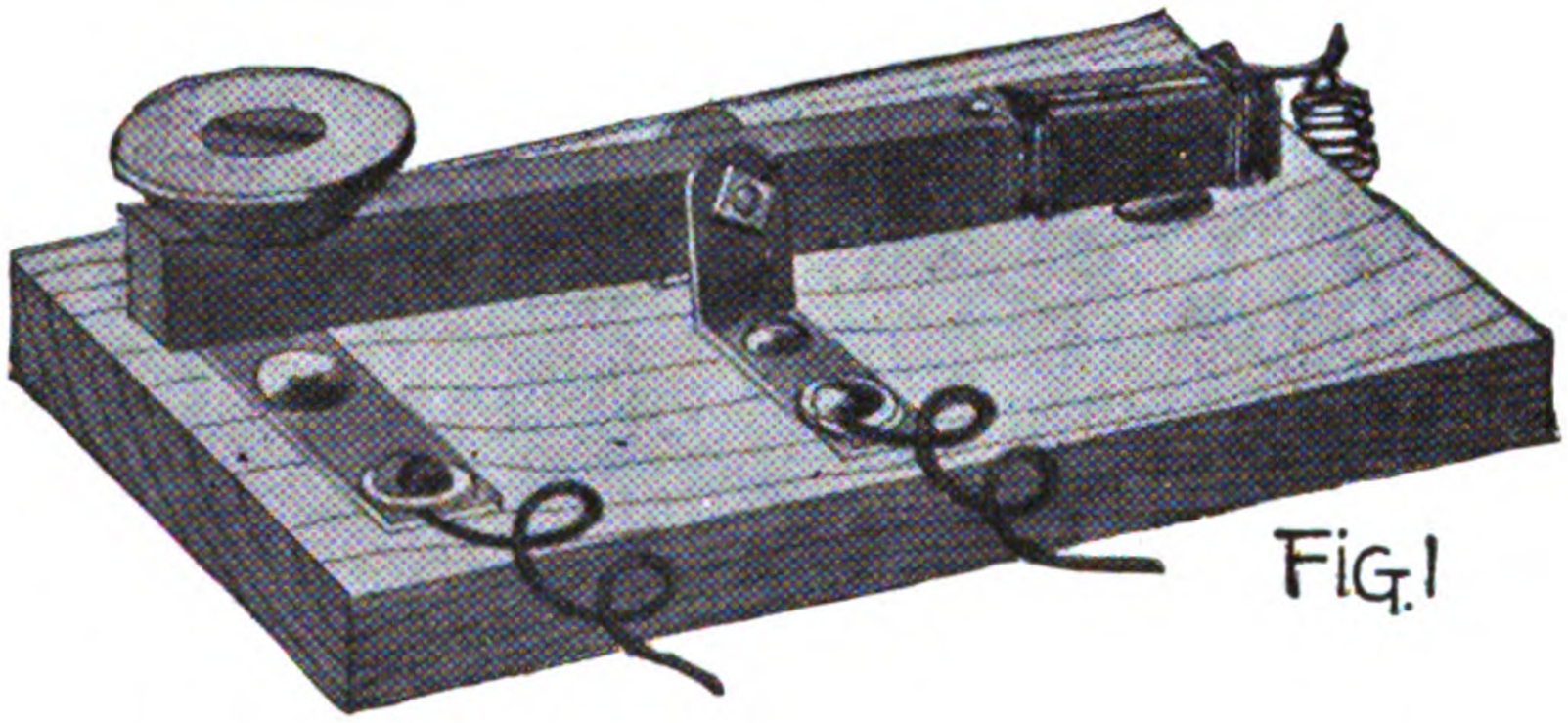


FIG. 1

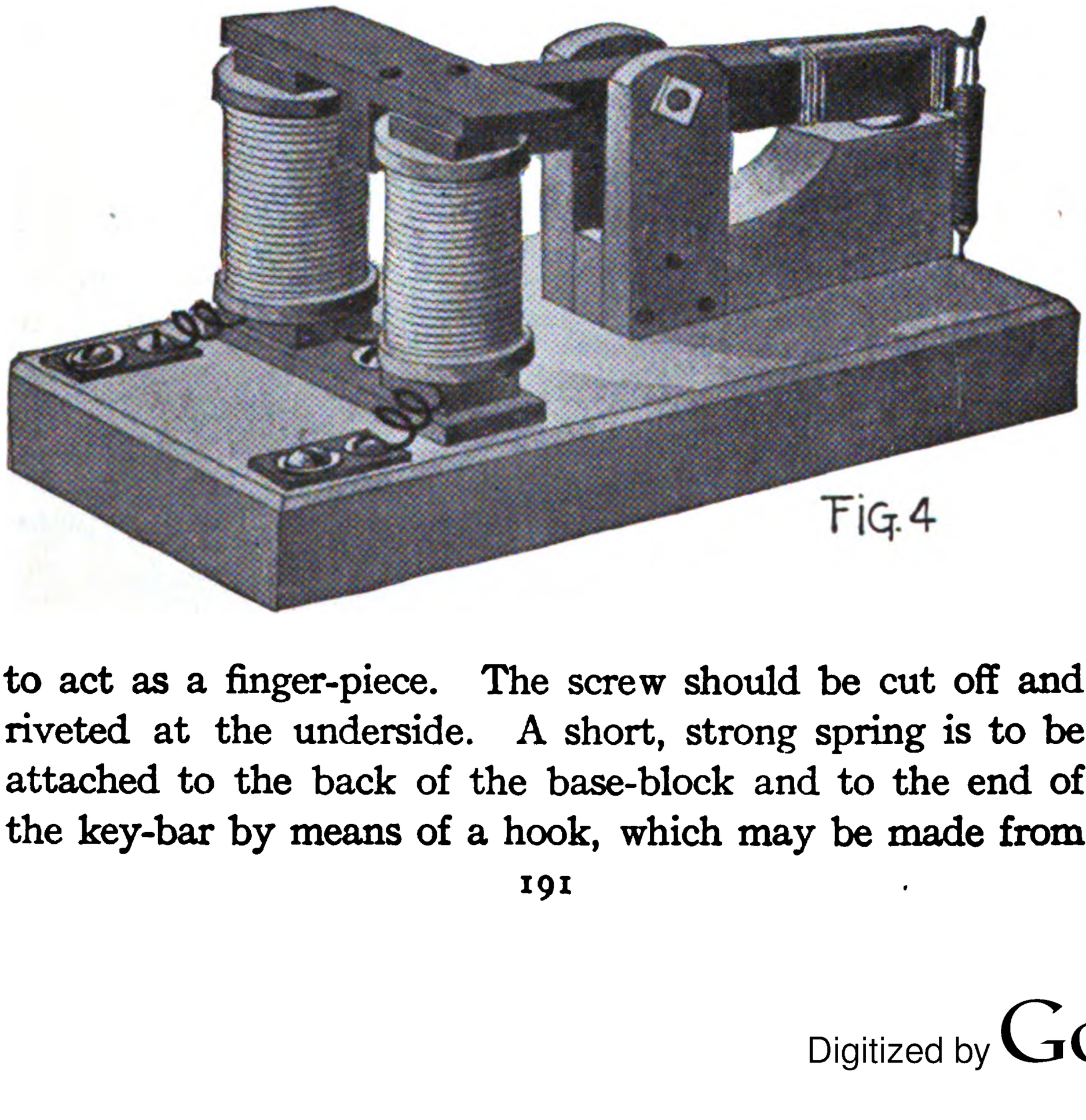


FIG. 4

to act as a finger-piece. The screw should be cut off and riveted at the underside. A short, strong spring is to be attached to the back of the base-block and to the end of the key-bar by means of a hook, which may be made from

a steel-wire nail flattened. It is bound to the top of the bar with wire, as shown in Figs. 2 and 3.

The incoming and outgoing wires are made fast to one end of the connector-plate and to one of the L pieces that support the key. When the key is at rest the circuit is open, but when pressed down against the brass tack it is closed, and whether pressed down or released it clicks at both movements. A simple switch may be connected with the L-plate and the connection-post at the opposite side of the key-base, so that, if necessary, the circuit may be closed. Or an arm may be caught under the screw at the L-plate, and brought forward so that it can be thrown in against a screw-head on the connector-plate, as shown in Fig. 3. The screw-head may be flattened with a file, and the underside of the switch bevelled at the edges, so that it will mount easily on the screw.

In Fig. 4 (page 191) a simple telegraph-sounder is shown. A base-board, four inches wide, six inches long, and seven-eighths of an inch in thickness, is made of hard-wood, and two holes are bored, with the centres two inches from one end, so that the lower nuts of the horseshoe magnet will fit in them, as shown in Fig. 5. This allows the yoke to rest flat on the top of the base, and with a stout screw passed down through a hole in the middle of the yoke and into the wood the magnets are held in an upright position.

From the base-block to the top of the bolt the magnets are two inches and a quarter high. The bar of brass or iron to which the armature (A in Fig. 5) is attached is four inches and a half in length and three-eighths by half an inch thick. At the middle of the bar and through the

side a hole is bored, through which a small bolt may be passed to hold it between the upright blocks of wood. At the front end two small holes are to be bored, so that its armature may be riveted to it with brass escutcheon-pins or slim round-headed screws. The heads are at the top and the riveting is underneath. A small block of wood is cut, as shown in Fig. 6, against which the two upright pieces of wood are made fast. This block is two inches and a half long, one inch and a quarter high, and seven-eighths of an inch wide. The laps cut from each side are an inch wide and a quarter of an inch deep, to receive the uprights of the same dimensions.

At the top of this block a brass-headed nail is driven for the underside of the bar to strike on. A hook and spring are to be attached to the rear of the sounder-bar, as described for the key, and at the front of the base two binding-posts are arranged, to which the loose ends of the coil-wires are attached.

Just behind the yoke, and directly under the armature-bar, a long screw is driven into the base-block, as shown at B in Fig. 5. It must not touch the yoke, and the head should be less than one-eighth of an inch below the bar when at rest. On this the armature-bar strikes and clicks when drawn to the magnets. The armature must not touch the magnets; otherwise the residual magnetism would hold it down. The screw must be nicely adjusted, so that a loud, clear click will result.

When the sounder is at rest the rear end lies on the brass tack in the block, and the armature is about a quarter of an inch above the top of the magnets. The armature is of

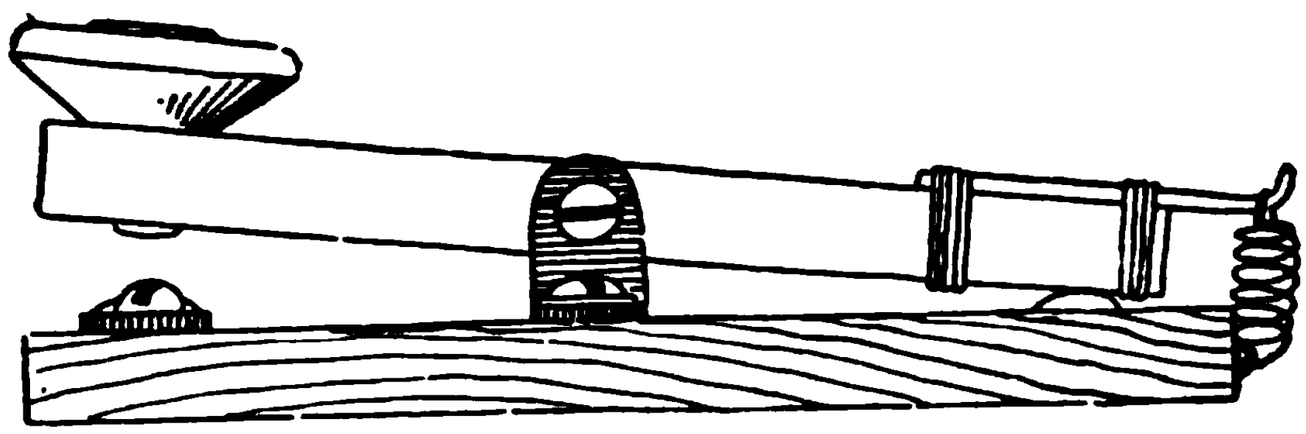


FIG.2

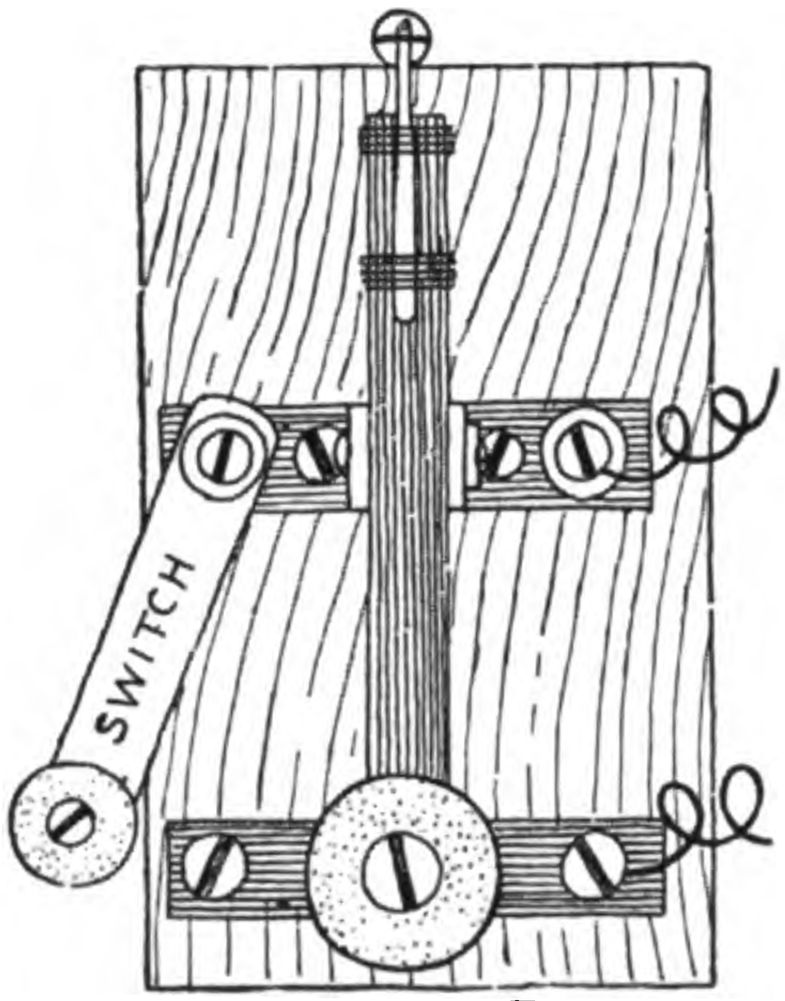


FIG.3

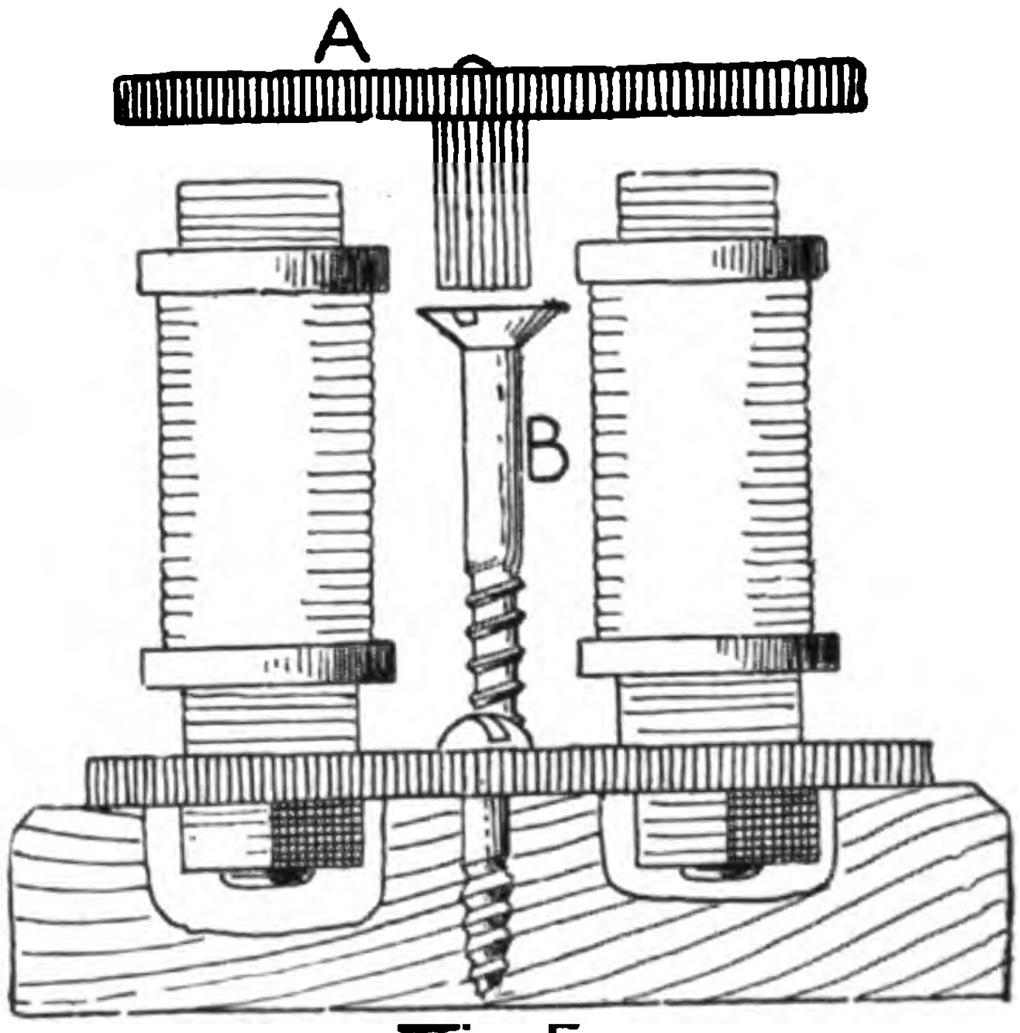


FIG.5

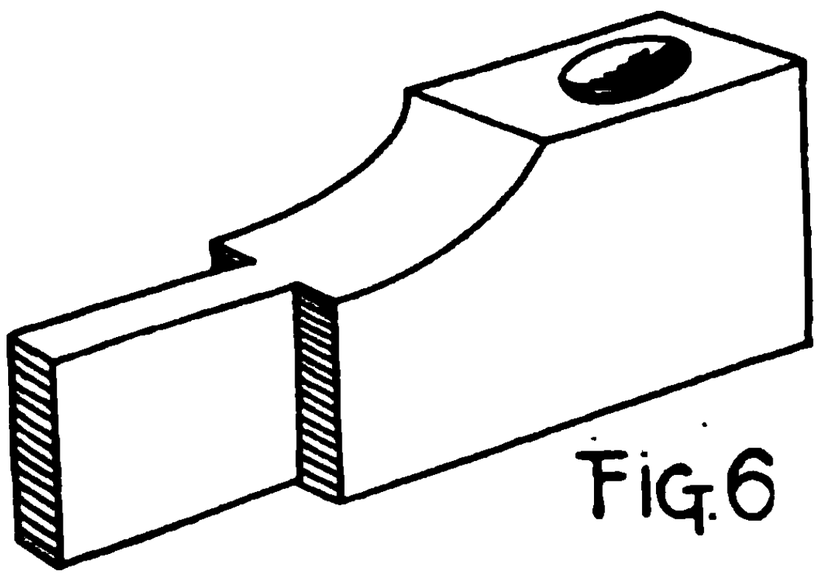


FIG.6

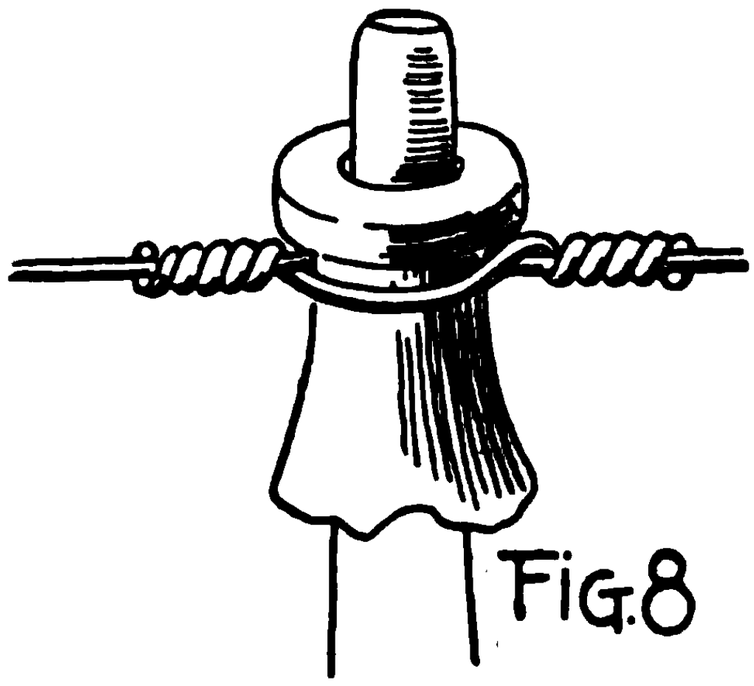


FIG.8

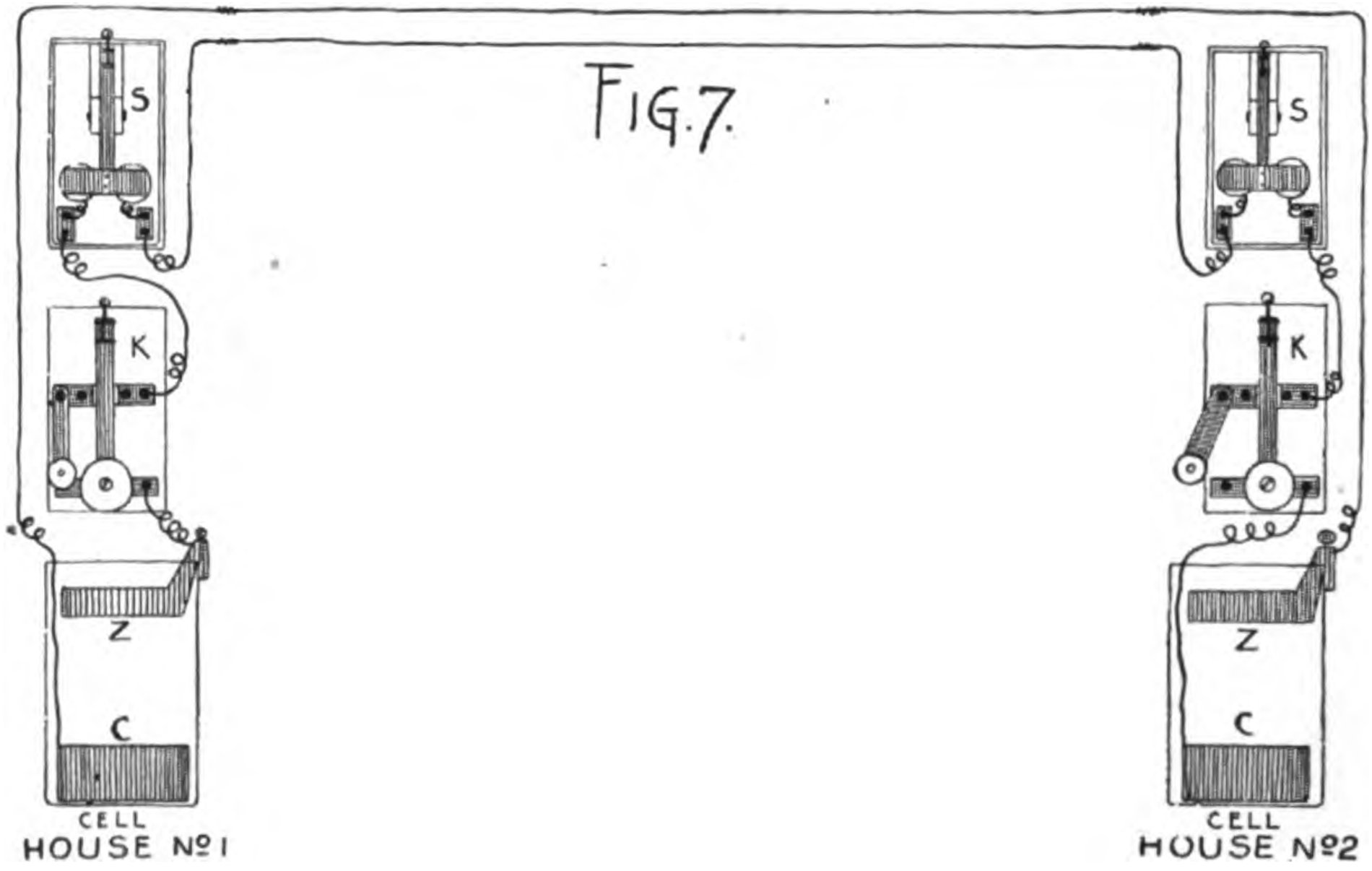
soft iron, two inches and a half long, seven-eighths of an inch wide, and an eighth of an inch thick. These small scraps of metal may be procured at a blacksmith's shop, and, for a few cents, he will bore the holes in the required places; or if you have a breast or hand drill the metal may be held in a vise and properly perforated.

By connecting one wire from the key directly with one of the binding-posts of the sounder, and the other with the poles of a battery, and so on to the sounder, the apparatus is ready for use. By pressing on the key the circuit is closed, and the magnetism of the sounder-cores draws the armature down with a click. On releasing the key the bar flies back to rest, having been pulled down by the spring, and it clicks on the brass tack-head. These two instruments may be placed any distance apart, miles if necessary, so long as sufficient current is employed to work the sounder. Two sets of instruments must be made if boys in separate houses are to have a line. Each one must have a key, sounder, and cell, or several cells connected in series to form a battery, according to the current required.

In the plan of the telegraph-line connections (Fig. 7, page, 196) a clear idea is given for the wiring; and if the line and return wires are to be very long, it would be best to have them of No. 14 galvanized telegraph-wire, copper being too expensive, although much better. These wires must not touch each other, and when attached to a house, barn, or trees, porcelain or glass insulators should be used. If nothing better can be had, the necks of some stout glass bottles may be held with wooden pins or large nails, and the wire twisted to them, as shown in Fig. 8. When the line is not in use

the switches on both keys should be closed; otherwise it would be impossible for the boy having the closed switch to call up the boy with the open one. Take great care in wiring your apparatus to study the plan, for a misconnected wire will throw the whole system out of order.

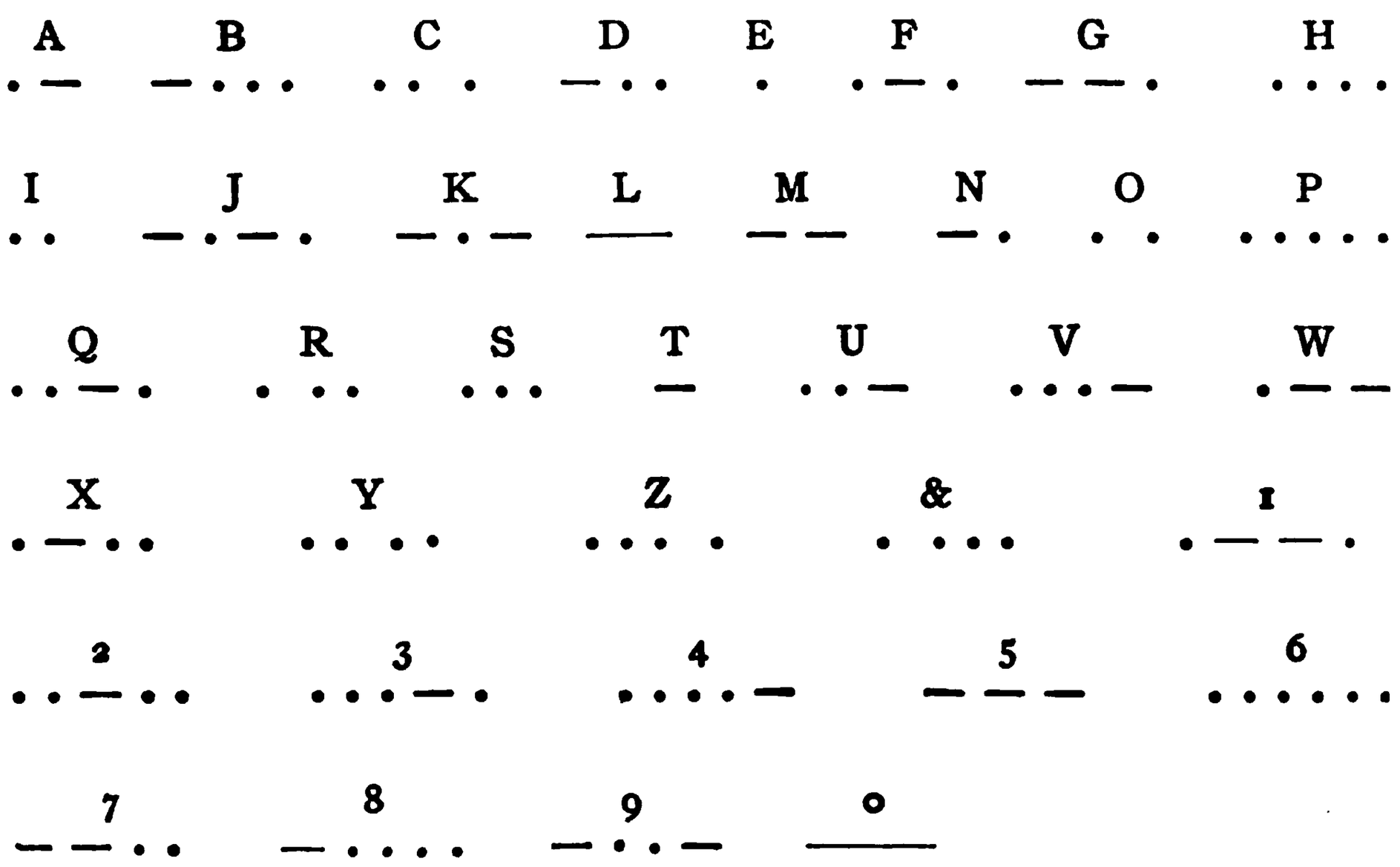
FIG. 7.



To operate the line see that all switches are closed and that the connections are in good condition. When the boy in house No. 2 wants to call up his friend in house No. 1 he throws open the switchon key, as shown in the plan, and by pressing down on the finger-key his sounder and that in house No. 1 click simultaneously. As soon as he raises or releases the key the armatures rise, making the up-click. If he presses his key and releases it quickly the two clicks on the sounder in house No. 1 are close together; this makes what is called a dot. If the key is held down

longer it makes a long time between clicks, and this is called a dash. The dot and dash are the two elements of the telegraphic code. You will understand that the boy in house No. 2 hears just what the one in No. 1 is hearing, since the electric current passing through both coils causes the magnets to act in unison. So soon as the operator in house No. 2 has finished he closes his switch, and the other in house No. 1 opens his switch on the key and begins his reply. This is the simple principle of the telegraph, and all the improved apparatus is based on it, no matter how complicated. The complete Morse alphabet is appended:

The Morse Telegraph Code



Any persevering boy can soon learn the dot-and-dash letters of the Morse code, and very quickly become a fairly

good operator. Telegraphic messages are sent and received in this way, and are read by the sound of the clicks. Various kinds of recording instruments are also employed, so that when an operator is away from his table the automatic recorder takes down the message on a paper tape. In the stock-ticker, employed in brokerage offices, the recording is done by letters and numerals, and the paper tape drops into a basket beside the machine, so that any one picking up the strip of paper can see the quotations from the opening of business up to the time of reading them. These quotations are sent out directly from the floor of the exchanges, and by the action of one man's hand thousands of machines are set in operation all over the city.

Perhaps the most unique and wonderful telegraphic signal-apparatus is that located on the floor of the New York Produce Exchange and the Chicago Exchange. The dials, side by side, are operated by direct wire from Chicago. When the New York operator flashes a quotation it appears simultaneously on the New York dial and simultaneously on the Chicago dial, and vice versa.

Electrical instruments are not the only means by which the Morse alphabet may be transmitted, for in some instances instruments would be in the way, while in others the wires might be down and communication cut off.

This is interestingly illustrated by an event in Thomas A. Edison's life. When he was a boy and an apprentice telegraph operator on the Grand Trunk Line, an ice-jam had broken the cable between Port Huron, in Michigan, and Sarnia, in Canada, so that communication by electricity was cut off. The river at that point is a mile and