SCIENTIFIC AMERICAN

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HOW TO MAKE A TELEPHONE CALL.

No telephone line is complete without a signal of some kind which will serve to attract the attention of a person in the vicinity of the instrument. A battery call answers very well for short distances, but for a distance of from one to twelve miles or more, the battery has been found impracticable and the magneto call is generally employed. This instrument not only serves a good purpose in connection with the telephone, but it answers very well indeed for general signaling purposes. It is always ready for action, and does not involve the care of a battery.

The line drawings presented herewith are one-half the actual size (linear measurement) of the instrument, and the perspective view is also one-half the actual size; the only dimension not obtainable from the drawings is the depth of the signal box, which is 3 inches. As all of the dimensions may be obtained from the engravings, it will be unnecessary to repeat them in the descriptive matter.

The pole pieces, A A′, between which the armature, B, revolves, are formed of soft gray cast iron, with ears, *a a*, at the top and the ears, *b*, at the bottom, separated by bars, C C′, of non-magnetic material, such as vulcanized fiber, hard rubber, or they may be made from hard wood, well varnished or saturated with paraffine to prevent them from shrinking or swelling. The pole pieces, A A′, are clamped to the bars, C C′, before they are bored out. They are bored out to loosely fit the armature, B′. The pole pieces are provided with flanges, *c*, which rest upon the bottom of the casing and are drilled to receive screws, *d*, by means of which the magnet is secured in place in the casing. In the pole pieces, A A′, above the ears, *b*, are drilled and tapped holes, *e*, for receiving the studs, *f*, by which the horseshoe magnets are secured to the pole pieces. The studs, *f*, are drilled for receiving keys, *g*, by which the magnets are clamped in place.

The compound magnet, D, is composed of three flat steel bars forming U-shaped magnets, *h*, *h′*, *h²*, with the space between the poles adapted to receive the pole pieces, A A′. The magnet, *h²*, fits over the adjoining edges of the magnets, *h h′*, and the three magnets are drilled to receive the studs, *f*, which extend through the magnets and into the pole pieces, the parts being clamped together by keys driven through the holes in the studs, as shown in the perspective view.

The armature, B, is the well known H type of Siemens, made of soft gray cast iron, the shaft, *i*, being cast integrally with the body of the armature. The part, *j*, which receives the wire is narrower and shorter than the polar extremities of the armature. The armature is turned so that its convex sides will revolve very near, but not in contact with the pole pieces. The shaft at the ends of the armature is turned, and to one end is fitted a sleeve, *k*, of insulating material (vulcanized fiber or hard rubber), on which is placed a brass ring, *l*. In the inner side of the metallic ring, *l*, is inserted a stud, *n*, to which is soldered one terminal of the armature coil, the other terminal of which is soldered to a screw, *n*, inserted in the shaft, *i*. The armature is wound in the same manner as an electro-magnet, the wire being carried around one arm of the armature until one-half of the wire is in place. It is then carried across the central portion of the armature and wound upon the other arm of the armature. The wire used is No. 34 silk-covered wire, there being about 1½ ounces of wire upon the armature, or enough to give it a resistance of 200 ohms.

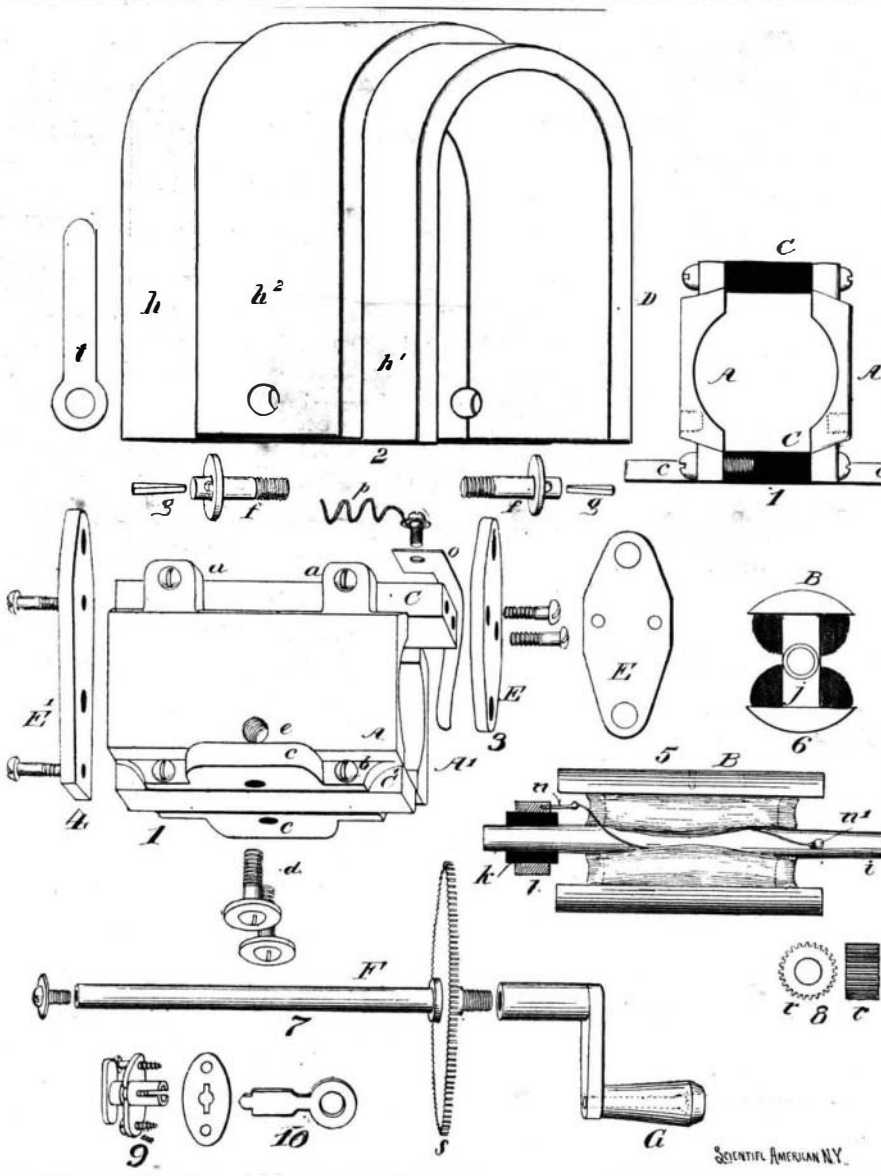
To the bar, C, is secured a brass plate, E, by means of screws which pass through the plate and into the bar. In the plate, E, opposite the center of the bore of the pole pieces, there is a bearing for one end of the shaft of the armature, and in the opposite or upper end of the brass plate, E, there is a bearing for the driving shaft, F. To the opposite end of the bar, C, and to the bar, C′, is secured a plate, E′, which is also provided with bearings for the armature shaft and for the driving shaft. To the bar, C, is secured a curved spring, *o*, which bears upon the insulated ring, *l*, and this spring is connected by a wire, *p*, with a binding post, *q*, at the top of the casing.

Upon the end of the armature shaft, *i*, outside the plate, E′, is placed a pinion, *r*, and upon the shaft, F, is placed a spur wheel, *s*, which engages the pinion, *r*. The shaft, F, is held in place in the machine by a screw inserted in the end of the shaft, and a washer held by the screw against the end of the shaft and bearing against the plate, E. The crank, C, by which the shaft, F, is turned, is screwed onto the end of the shaft through an aperture in the side of the casing. On the stud, *f*, projecting through the front of the magnet is placed a contact spring, *t*, which is clamped by the key which holds the magnet in place.

The mechanism thus described comprises the magneto generator which generates the alternating current required for operating the magneto bell. The machine is held in place in the casing by the screws, *d*, as already described, and the back of the casing is cut away to let the magnet, *h²*, into the back, thus economizing room. To the cover of the casing is attached the magneto bell, H, the magnet and armature of which are placed within the door, while the bells are placed on the outside of the door, the hammer extending through the door and between the bells.

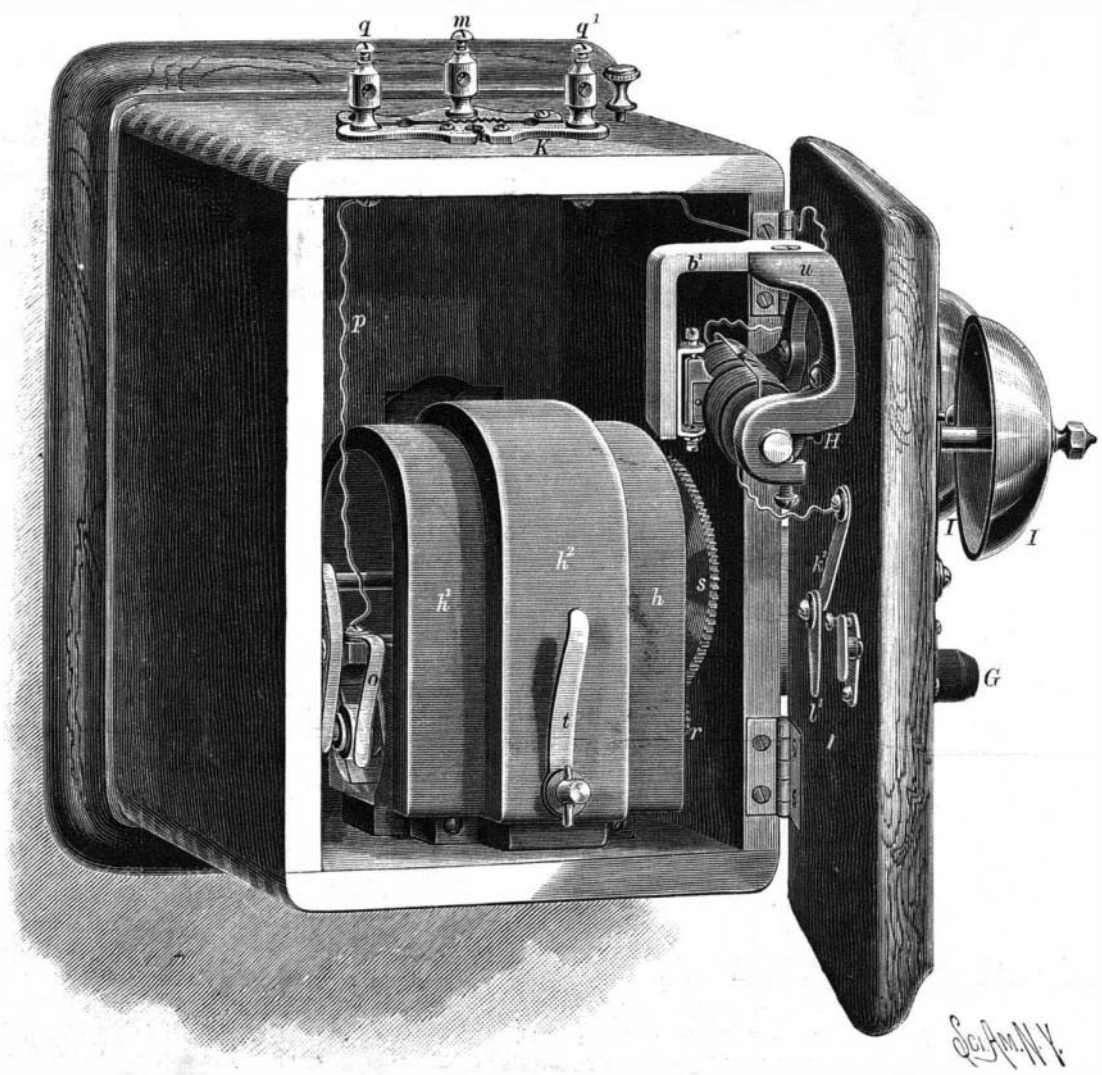
The body of the magneto call consists of a curved casting, *u*, which is secured to the inner face of the door and provided with loops, *v v′*, for receiving the soft iron pole pieces, *w w′*, of the bell magnet. These pole pieces are held in place in the loops *v v′* by screws passing through

(*Continued on page* 118.)



1. Pole pieces. 2. Field magnet. 3, 4. End plates. 5. Armature, side view. 6. Armature, end view. 7. Driving shaft. 8. Pinion. 9 and 10. Door lock and key.

DETAILS OF MAGNETO CALL—THE GENERATOR.



MAGNETO TELEPHONE CALL.

HOW TO MAKE A TELEPHONE CALL.

(*Continued from first page.*)

the side of the loop and bearing against the pole piece. The convex side of the casting, *u*, is provided with a rectangular notch, *a'*, for receiving the L-shaped permanent magnet, *b'*, which is held in its place by a screw passing through the magnet into the casting. To the L-shaped magnet, *b'*, is secured a plate, *c*, which is bent twice at right angles, and in the bent ends of which are inserted pivot screws supporting the armature, *d*, which extends downward between the adjacent ends of the pole pieces, *w w'*. The armature is covered by a strip, *e'*, of copper, and in the end of the armature is inserted a wire, *f*, carrying at its extremity a bell hammer, *g'*. To the outer surface of the door, and on opposite sides of the bell hammer, are supported two bells, I, by studs, *i'*, projecting from adjustable plates, *j'*, pivoted to the door at one end and provided with a curved slot at the opposite end for receiving a clamping screw, which passes through the slot and into the door. By means of this device the bells may be adjusted so that each will receive a stroke of the same power from the bell hammer, *g'*.

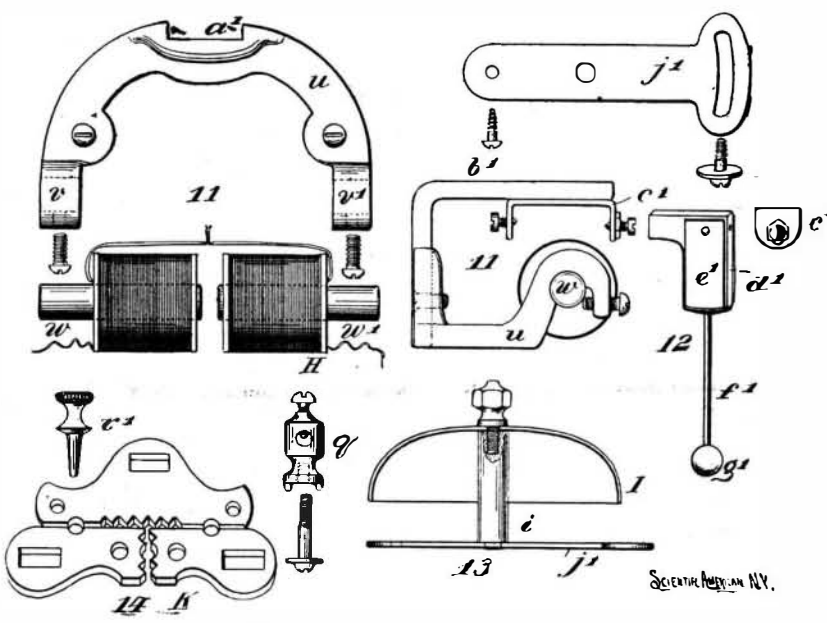
The spools on the pole pieces, *w w'*, contain about 1½ ounces of No. 34 silk-covered copper wire. They are wound in the same direction, and the inside ends are connected together. The outer end of one spool is connected with the upper hinge of the casing, which, in turn, is connected with the binding post, *q'*; the outer end of the remaining spool is connected with a strip, *k'*, of copper attached to the door and connected with a plate, *l'*, which comes into contact with the spring, *t*, when the door of the casing is closed.

On the top of the casing there is a plug switch, which also answers as a lightning arrester. The rear plate of the switch is provided with the binding post, *m*, which is connected with the ground. The binding posts, *q q'*, receive the ends of the line wire, the connections being made as shown in the article on the telephone in SCIENTIFIC AMERICAN, No. 5, current volume (February 3).

When the call is placed at the end of the line the call box is grounded by inserting the plug, *r*, between the rear or ground plate and the front plate that is not connected with a line wire. When it is desired to cut the call box out of the line, the plug is inserted in the circular space between the two front plates, the current passing from one end of the line through one of the binding posts and plate to the plug, the other plate and binding post to the other portion of the line. When the armature, B, is turned by revolving the crank, G, opposite ends are alternately presented to opposite poles, the consequence being that the rapid changes of magnetism in the armature induce alternate pulsations in the winding of the armature which operate the polarized bell of the instrument, also the polarized bell of the distant instrument, both being normally in the circuit.

While talking over the line it is important to cut out the magnet on account of its resistance, and while signaling over long distances the signals are more effective if the telephones are cut out of the line.

These machines can be purchased for $4, and we therefore doubt if it is profitable to undertake to make them; however, they may be made without fear of legal complications, as they are not patented.



11. Bell Magnet. 12. Armature. 13. Bell. 14. Lightning Arrester and Cut-out.

DETAILS OF MAGNETO CALL—THE BELL.

Experiments on Schnebelite.

Some very interesting experiments on the remarkable explosive "schnebelite" were recently made at Argenteuil, France. The brothers Schnebelin, one a priest and the other a lieutenant in the French artillery, are the inventors. The chief ingredient of schnebelite is potassium chlorate, the dangerous properties of which have been modified so that a powerful and safe explosive has been obtained. The new powder is made in three forms—for military rifles, for sporting guns, and for mining purposes. At the recent tests at Argenteuil the Abbe Schnebelin prepared his explosive in the presence of a number of spectators, and afterward ground the powder in a coffee mill and struck it with a hammer without exploding it. Heat ignites the powder only at 540° Fahrenheit. The explosive gives off little smoke, though it hardly compares with the so-called smokeless powders in this respect. The test in the quarries near Argenteuil showed that the explosive is especially good for blasting, as the impact of the drill will not set off an unexploded charge remaining in the drill hole.

A New Silkworm.

According to a report of the French consulate in Trieste, *Bombyx iasiocampa otus*. The moth is similar to that of the silkworm, but the cocoon is much larger, and the silk finer and snow white. The worm feeds on the leaves of the evergreen *Quercus ilex*. Experiments are being made with the intent of raising this newly discovered worm for commercial purposes.

Staining Leather.

This is essentially a process of painting of the leather by means of colored liquors which are brushed on by suitable brushes. The apparatus required for this purpose is quite different from that used in the dipping method. The principal feature is the tables. These are made with a perfectly flat and smooth top, and should be of some hard wood—beech, birch, or teak, or, better still, of wood covered over with a sheet of lead, which need not be very thick, but no wood containing tannin. The size of the tops should be proportioned to the size of the skins which are to be treated. Thus for kid and lamb skins, the size may be 4 feet by 3 feet, for sheep skins about 5 feet by 3½ feet, and for larger skins in proportion. Several different sized tables must be provided, suited to the variety of skins which are to be stained. It will conduce much to the convenience of the workmen if the tops are provided with a rim round their edge standing up from 1½ to 2 inches, having draining holes at two opposite corners, so that any surplus liquors may run into suitable receptacles placed underneath, or into the drains. The principal requirement in such tables is smoothness of the top. This should be absolutely free from any cracks or indentations which might catch and scratch or tear the skins while working.

On the right hand corner or edge of the table, a shelf may be fixed to hold the various vessels containing the dye liquors. These may take the form of earthenware mugs, and should not be too large, so that they may have to be frequently refilled from the main stock of dye liquor, a method which assists in getting uniform colors. Below this end of the table may be placed a tub of dye liquor, which may be large enough to contain enough for a day's supply. This may be heated by steam pipes if the use of hot liquors be necessary, and from it the smaller mugs are replenished. Into this tub may be run the surplus dye liquor from the table, so that there is not too much waste of material.

At a convenient place, handy to be reached by the worker, should be a water tap fitted with a flexible hose-pipe, so that with it the skin can be well rinsed after dyeing, if such a proceeding be necessary. If it is not convenient to fit up a water pipe, the dyer ought to have a tub of clean water beside him, and this tub should be used by him alone. It is not desirable that other dyers should have the use of it, as in this case there will be a risk of off shades being produced. Near by is a horse or rail, on which the skins, after being colored, are hung to drain before being taken to the drying room.

As to the brushes, several will be required. These should be made of soft fiber, about 6 by 2 or 2½ inches in size, and of as convenient form for handling as possible. Those made for brushing shoes or grates will be found serviceable as, being of fair size, a good extent of surface can be covered at one sweep of the brush, and this means greater evenness of color in the finished skin. The number of brushes which will be required will vary according to the character of the work, and no rule can be laid down here on this point. It is important, however, that a brush be kept for each particular mordant and dye, so that there is no risk run of getting new colors or liquors contaminated by the remains of old colors, or of mordants which may be left in old brushes. However well these may be washed, it is scarcely possible to remove every trace of old color or mordant from them, which, getting into a new liquor, might spoil it, and this is more likely to occur with light colored liquors than with dark ones. Skin coloring is a very delicate matter, especially with kid leathers.

The coal tar colors lend themselves admirably to this method of coloring leather and are mostly used for the purpose. For two reasons, the natural vegetable colors are rarely used. In the first place it is obvious that solubility in water is absolutely necessary, and the coal tar colors, with few exceptions, possess this property in a great degree, while the vegetable colors, as a rule, do not. The second reason is that the coal tar colors are self-colors, and do not require any mordant; and on the other hand the vegetable colors, with few exceptions, require a mordant to develop any color from them. The coal tar colors alone, therefore, will be treated of in these articles.

The basic colors, such as magenta, Bismarck brown, phosphine, etc., are those which give the best results with this method of working, and this is due to the fact that they have naturally a strong affinity for the fiber, so that no preparation of the leather is required. The acid colors also work well, but to obtain fast colors and the best effects they require the aid of a little acid as a kind of mordant. These colors are sold in the form of the alkali salts of sundry color acids, and as it is necessary that this color acid and the leather should enter into mutual combination, the color acid must be liberated from its combination with the alkali before it will form the new compound with the leather. This is effected by the addition of a stronger acid—sulphuric, acetic, etc.—to the dye liquor, or the leather may be prepared by treatment with a little acid liquor. Weak solutions of the dyestuffs should be used, say 1 to 1½ ounces to a gallon of water, and if this does not give a deep enough color, it is better to go over the skins several times than to aim at getting the full depth of shade at one operation.

The method of working is comparatively simple. The skins are laid on the table, and by means of the brushes the dye solution is brushed over the surface. The sweep of the brush may be made either in straight lines or in circles, which is, perhaps, the best way, the main idea being to cover as much surface as possible in one sweep, as thereby more even results are obtained. Too much color should not be taken by the brush at one time, only just enough to saturate the bristles. Speed of brushing is a very important element in obtaining even shades; when the work is done slowly there is time for one part to get dry before another is touched, and this is avoided by taking quick sweeps with the brush. When one coating has been given, the skin is hung over the horse to dry, and another is treated. When the whole batch of skins are done, the first is then examined to see if the right depth of color has been obtained, in which case it is transferred to the drying room to become thoroughly dry. If another brushing is necessary, this is repeated as before, until the correct depth of color has been reached, before the skin is sent to the drying room.

In the event of using azo and acid colors, which, as noted above, require some acid, this may be added to the dye bath, or the leather may have previously received a brushing with a little weak acid liquor, or again, after the color has been brushed over a brushing of acid liquor may be given. Probably the best method of working is a combination of these plans; the leather is brushed over with a solution of 1 pound of sulphuric or 3 pounds of acetic acid in 10 gallons of water, then with the dyestuff solution, then with the acid again, these operations being repeated until the proper depth of color has been obtained. These acid and azo colors will stain the leather without the aid of an acid, but the latter has a very material influence on the brightness of the shade or tint.

It may be mentioned that machines have been devised to stain the leather, and so do away with brushing. One such apparatus consists essentially of a table of a circular form made with a rim; on this the skin is stretched.

From a horizontal arm, placed a short distance above the table—made of tubing in which are a series of holes—dye liquor is poured on to the skin while the latter is made to revolve along with the table. The surplus liquor runs off through holes in the edge of the table, and can be used over and over again.—*Dyer and Calico Printer.*

Gunpowder and Explosives.

The London *Daily Telegraph* thinks that the days of gunpowder as a charge for naval guns are numbered, as some experiments just concluded at the government proof-butts, Woolwich, appear to prove a decided superiority for cordite. A 6-inch quick-firing gun was loaded with 29 pounds 12 ounces of the ordinary black gunpowder, and yielded a velocity of 1,890 feet per second, with a pressure strain on the gun of 15 tons per square inch. The same gun was charged with 14 pounds 3 ounces of cordite, and gave a velocity of 2,274 feet per second and a pressure of 15·2 tons. More important still, after 250 rounds had been fired, there were no signs of erosion.