The Construction of a Multiple Tuner

Complete Working Drawings and Specifications for the Amateur

By C. L. Sears

MANY articles have been written on the Multiple Tuner but the writer has not seen any which gives details enabling the amateur to build his own set. They have described the working or manipulation of the set, but have not given the size or shape of the coils, or their winding dimensions and wire sizes. Here is a set which is somewhat modified and has not the complications of the commercial sets. These instructions were not taken from any professional source, but were evolved by the author after having obtained the wiring diagram.

First we shall figure on the case.

Well seasoned cherry, walnut or mahogany, ½ inch thick should be used. We shall need (see Fig. 1):

2 pieces ½ x 13 x 15 inches (A)
2 pieces ½ x 5 x 12 inches (B)
2 pieces ½ x 5 x 15 inches (C)

These dimensions allow for mitered corners, as shown at *A*. If square joints are to be used the pieces *B* can be made 1 inch shorter or ½ x 5 x 11 inches. The box should be glued and assembled with finishing nails about 1¼ or 1½ inches long. The bottom should be put on with a dozen 1 inch No. 10 wood screws, flat head iron, to allow for inspection of the interior. After the box is assembled the nail heads should be set below the surface with a nail set and the holes filled with bees-wax. The case should be well sandpapered and given four coats of varnish put on very thin, sandpapering lightly after each coat. The coats of varnish should be put on at least 24 hours apart and kept in a warm dry place while drying. The inside of the box also should be given one coat, although it need not be sandpapered as it is only used to improve the insulating properties of the wood.

For polishing the box about five cents worth of finely powdered pumice and the same amount of rotten stone will be needed, also a small block of wood about 3-inches square and 7/8 inch thick. The block should have four or five thicknesses of old muslin tacked on it. The tacks should not be placed on the face but on the edges.

Place some of the pumice on a piece of heavy paper and also have a shallow pan of water handy. Then dipping the block into the water and into the pumice go evenly over the entire surface of the box with a scouring motion in the same direction always. Rub the varnish down in this manner, keeping the block well moistened and dipping in the pumice as needed until the box is very smooth. It will take about an hour or so to do all the surfaces. Then clean off all the remaining pumice stone and water with a damp cloth and wipe dry. Now take the rotten stone and, using oil instead of water, proceed as before, until a finish similar to a piano finish is obtained. A finished box like this can be purchased for about three or four dollars, but more satisfaction is to be had if box and all are made from the rough materials.

In Figs. 2 and 3 are shown the forms of the primary, intermediate and secondary coils. These will require the use of a lathe. For Fig. 2 fiber tubing 4¾ inches in diameter and 1/8 inch thick is required. This can be made by glueing 1/32 inch fiber in four layers around a wooden form.

After the tubes have set hard they should be given a coat of glue and be wound with a single layer of No. 22 double cotton-covered copper wire 1¼ inches wide or 35 turns split ¼ inch apart at the center as shown in Fig. 2. Two binding posts made of 3/8 inch, 6-32 brass machine screws, with two small hex nuts on it, should be mounted about 3/16 inch from each side of the tube and the ends of the wire soldered to them. This completes the two primaries. One primary should have its winding covered with another piece of 1/32 inch fiber and a layer of No. 32 single silk-covered copper wire should be wound on it, split ¼ inch at the center also, and have a winding of 186 turns, 93 on each side of the center, with 6 taps taken off. The taps and the starting point or lead should be fastened to 7 binding posts on the edge, as in the primary coil. This completes the secondary. Then the wooden forms for the intermediate coils should be turned out; they should be made of ash. Four small quad-style binding posts should be mounted inside the forms, two on each coil. These coils have a semi-spherical form to allow for closer coupling between the circuits. When the forms are completed they should be given a light coat of glue and a single layer of No. 26 S.S.C. wound on each side of the center. Wind from edge inward 59 turns or a total of 118 turns on each coil. The two ends in the center should be soldered together and the outer ends each fastened to a binding post making a single split layer. The wire must all be wound in the same direction around the form. It is a good plan to varnish both the two primary tubes and the intermediate forms although no varnish should be put over the wire. The tubes and forms should then have a 3/16-inch or slightly larger hole drilled through them as shown in the illustrations Figs. 2 and 3.

Next we must consider a loading coil. This will require two flanged discs of ash turned to the dimensions given in Fig. 4. A cardboard tube this size can either be made by rolling a piece of cardboard around a wooden form or a very serviceable tube can be made from a paper carton or box. A small quad binding post should be mounted in one of the turned wooden ends and the other wooden end should be drilled as shown at *A* with 13 holes set in a curve as shown for the leads or taps to come through. Then the wooden end holding the binding post should be fastened in the tube and after the tube has had a light coat of glue over its entire surface, 14 holes should be punched in a spiral around the tube from within ½ inch of one end to within ½ inch of the other. The first six from the binding post end should be spaced about ¼ inch apart and the remainder about 9/16 inch apart. Then the wire, No. 22 D.C.C., should be put on, the end being soldered to the binding post. Instead of soldering pieces of wire on the coil to make taps when coming to a hole in the tube, simply loop the wire for about 15 inches, push it through the hole in the tube and draw it tight; this will save the soldering of 12 joints and will also make a neater appearance. When all the taps or leads have been put through the tube they should be run in proper order through the holes made in the wooden end and the end fastened to the tube. This completes our loading coil except for varnishing the two ends, not the wire.

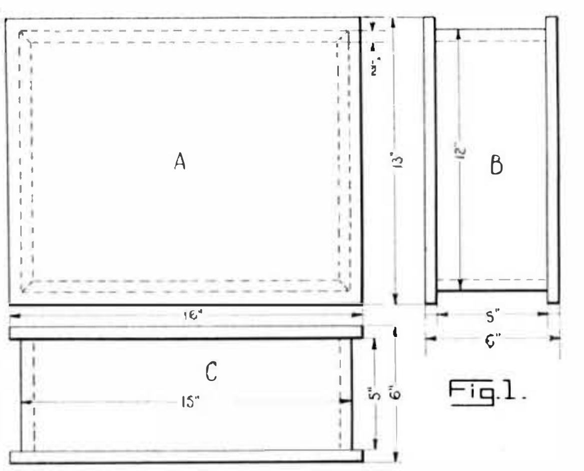


Fig. 1.

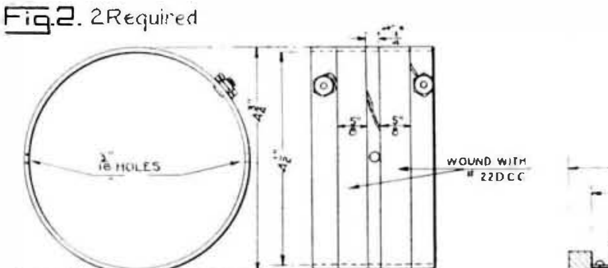


Fig. 2. 2 Required

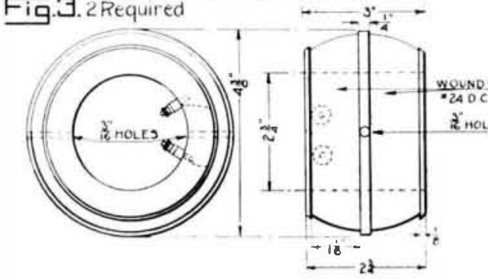


Fig. 3. 2 Required

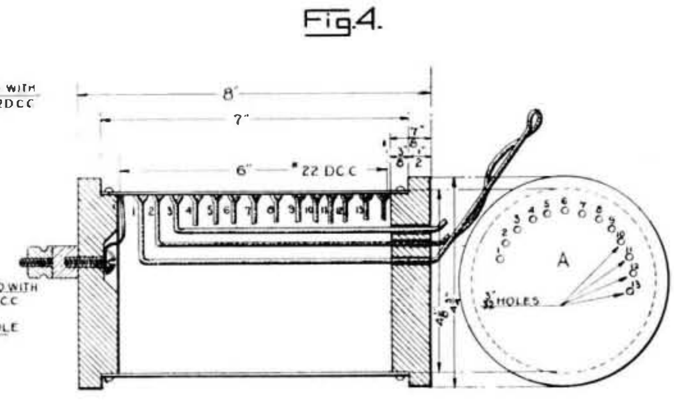


Fig. 4.

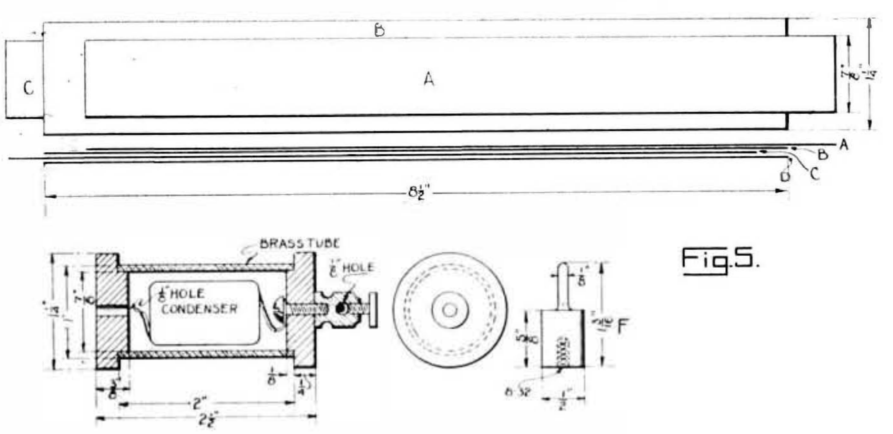


Fig. 5.

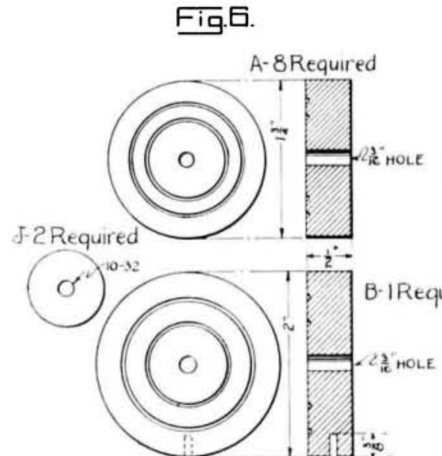


Fig. 6.

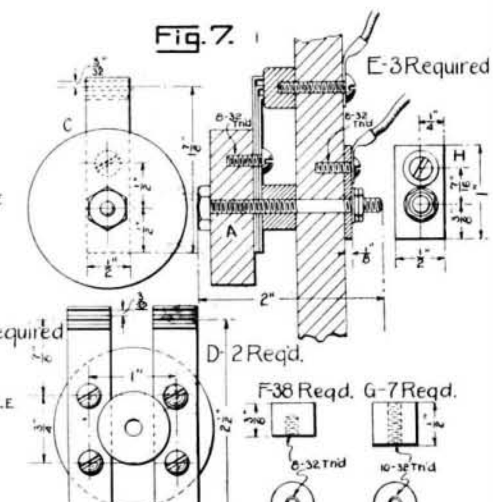


Fig. 7.

In Fig. 5 we have a sketch of the fixed condenser which has a capacity when rolled of about 0.002 microfarad. The greatest fault with most commercial fixed condensers is that their capacity is approximately 0.015 or 0.01 microfarad, which is about five times too large, giving a poor tone to the incoming signals. This condenser will require three pieces of good quality note paper 1¼ x 8½ inches, and two pieces of medium weight tinfoil or, better, copper foil, 7/8 x 8½ inches. This paper should have no holes, print or ink nor bits of foreign matter in it. Each piece of tinfoil should be placed on a piece of the paper while still hot, after paraffining all three sheets. Then after arranging the pieces of paper evenly and flat on top of each other, place the tinfoil end as shown, solder a short piece of drop-cord to each terminal, roll the whole thing around a small piece of wood about ½ inch in diameter, and tie firmly with a piece of light string. This will result in one connection being on the inside and the other on the outside. Then remove the piece of wood, roll the condenser in some paraffine and let it cool. Solder each small piece of wire to a ½ inch 8-32 brass machine screw.

To make the case for the condenser we shall need a 2 inch length of 1 inch brass tube having a 1/16 inch wall, two small binding posts like the one shown, and also two pieces of 3/8 inch black fiber 1¼ inch diameter with a 7/8 inch flange for the ends. In assembling the condenser care should be taken that the ends do not touch the inner wall of the tube. At *F*, Fig. 5, is shown a small holder turned from ½ inch round brass rod, with a tapped hole in the base.

Next we must consider our switches. We shall need 38 switch points as shown at *F* Fig. 7, tapped 8/32 to a depth of 5/16 inch, and 7 bearings for handles, as shown at *G*. The switch points and bearings are made from ½ inch round rod. The switch arms or levers are made from 1/32 by ½ inch brass tape or strips. It will require 49 inches, cut as follows:

3 pieces 2 3/32 inches, one end bent over 3/32 inch.
3 pieces 1 15/16 inches, one end bent over 1/16 inch.
3 pieces 1 25/32 inches, one end bent over 1/32 inch.
For three single arm switches.
4 pieces 2 3/8 inches, both ends bent over 1/32 inch.

(3/16 inch holes). The pieces shown by *C* are cut from 1/64 inch red sheet fiber. They are slightly greater than semicircles and should have a tin form made for them. The holes in the fiber are spaced exactly as in *B*, except that they are 9/16 inch holes instead of 3/16 inch. The six pieces (*F*) of black ¼ inch sheet fiber which are required for the tops and bottoms of the condenser also have 3/16 inch holes bored in them as in *B*. These pieces have a groove 1/8 inch deep and 3/64 inch wide cut in them on a diameter of 5 inches. The pieces shown at *E* are made of 1/32 inch brass, bent into a cylinder and riveted with small rivets. They form the sides of the three condenser cases.

The variable condensers 9 and 7 (Fig. 10) have 14 movable and 15 fixed plates. Condenser 11 has 6 movable and 7 fixed plates. In assembling the condenser a space of two washers (*G*) is used between each two plates, or six washers to separate the stationary plates and two to separate the movable or rotary plates, also pieces of fiber like *C* should be placed between each pair of fixed plates as insulation instead of air. A piece of ½ x 1/8 inch brass, such as used on the switch arm (see *H*, Fig. 7) should be used for each variable under the shaft for the rotary plates for connections for the handles and bearings (see *A*, Fig. 6 and *G*, Fig. 7). The assembling of

secondary variable (7 and 6 plates) shunted across the secondary coil; *8*, switch for throwing in either the tuning primary (*5* in Fig. 10) or the standby primary (*6*, Fig. 10); *9*, celluloid scale reading 0 to 90 degrees for pointer on coupling handle *12*; *10*, binding posts for phones; *11*, selective switch to use any one of three detectors or short circuit the phones when sending; *12*, coupling handle to rotate intermediate coils inside of primary and secondary tubes; *13*, switch to vary turns on the secondary; *14*, binding posts for extra detector, for testing, or for an audion detector; *15*, fixed condenser; and *16* and *17* are detectors.

In Fig. 9, *A*, is seen the interior arrangement of the box. The intermediate coils are placed inside the tubes, which should be set at right angles to each other, as shown, and mounted on a piece of 10/32 threaded brass rod, being clamped tightly by means of four 10/32 hexagonal nuts to each intermediate coil.

The tubes may be held in place by slotted pieces of wood, which should be set so that the coils can rotate through 90 degrees easily. The loading can be held in place by two No. 10 brass wood screws about 1 inch long.

All wiring should be done with drop cord The loading coil taps should all be carefully fastened to the switch contacts and firmly soldered.

Fig. 8.

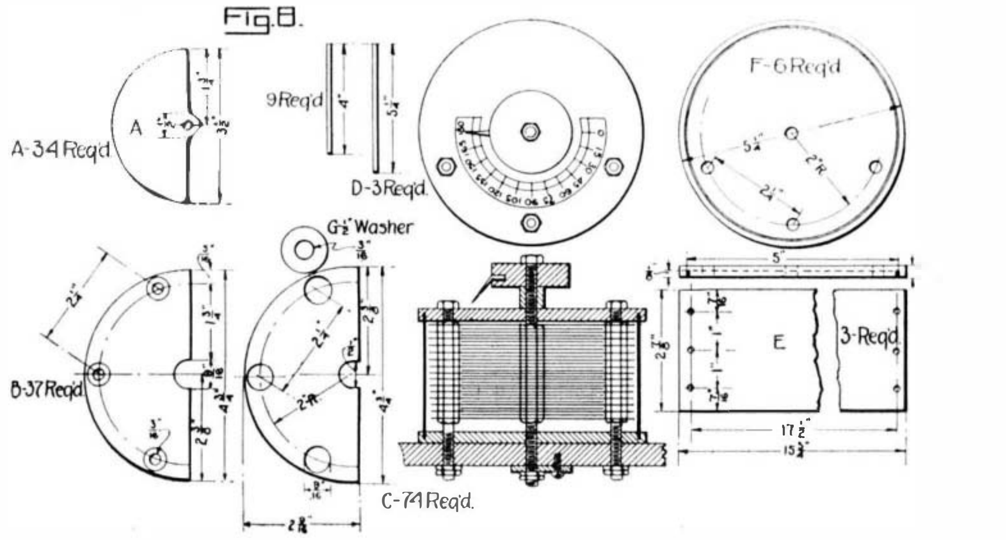
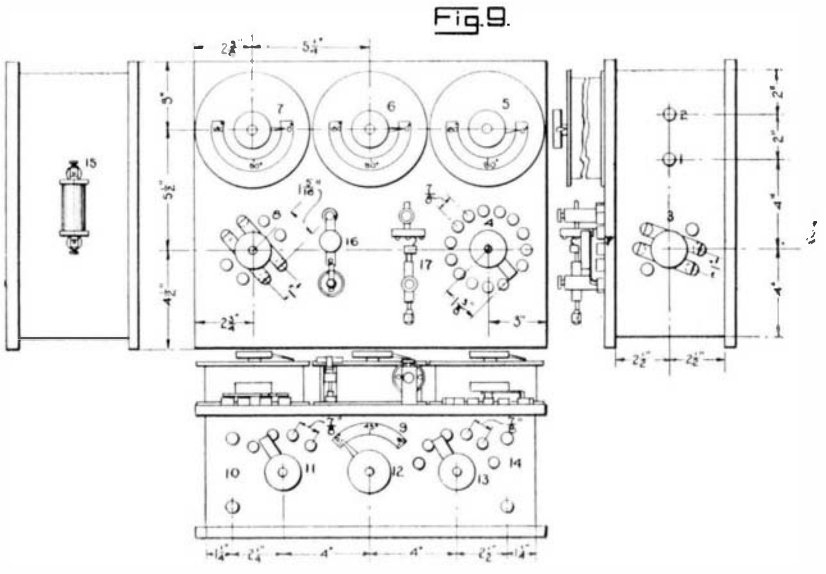


Fig. 9.



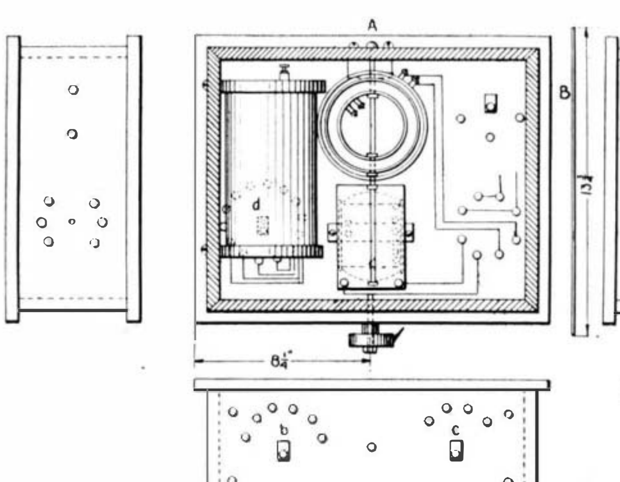
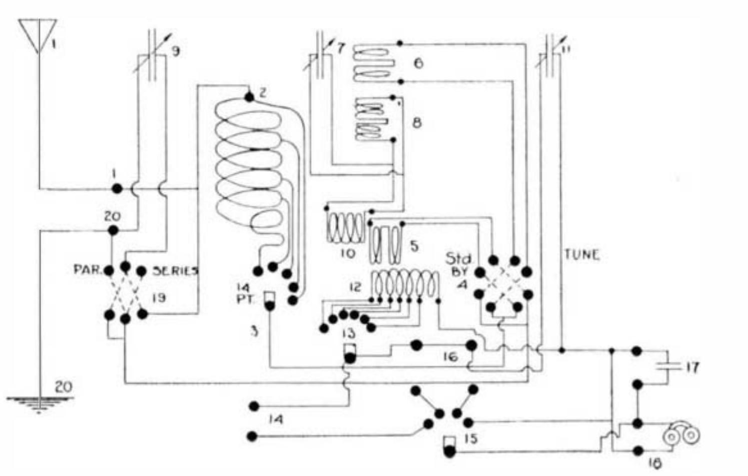


Fig. 9A.

Fig. 10.



4 pieces 2 9/16 inches, both ends bent over 1/16 inch.
4 pieces 3 1/8 inches, both ends bent over 3/32 inch.
For two double arms switches.

The pieces for the single arm switches should be drilled as shown in views *C* and *E*, Fig. 7; those for the double arm switches as in *D*. The switch handles are turned from ½ inch black sheet fiber as at *A* and *B*, in Fig. 6.

Bearings for double arm switches (see *J*, Fig. 6) are 7/8 inch in diameter, threaded through 10-32, and ½ inch thick. The handles may be knurled on the edges. Three of the 1¾ inch handles and the one 2 inch handle should have pointers set in them as shown in *B*, Fig. 6. Bore a hole about 3/8 inch deep into each handle, big enough to barely admit a piece of No. 12 aluminum wire, then flatten the tip of the wire and cut to a point. These handles will serve for the three variable condensers and the coupling handle for turning the intermediate coils. Three of the other 1¾ inch handles should be used in assembling the three single arm switches (shown in *E*, Fig. 7), and two should be used for the two double arm switches. The brass switch arms should be mounted on the bottom of the handles by means of 3/8 inch 8-32 brass screws (see sketches *D* and *E*, Fig. 7).

The variable condensers shown in Fig. 8 will require 37 pieces of 1/32 inch copper, 4¾ inches in diameter, for the electrodes. The best and the easiest way to do this is to cut out 37 circles 4¾ inches in diameter and then after making a form from a piece of tin each circle will make one fixed (*B*) and one movable (*A*) electrode. When cut out the electrodes should be drilled as shown

the three variables will not be explained; for the only differences between the kind given here and others, lies in the use of fiber insulators between the plates and the cases and this subject has been gone over a great deal heretofore. The plates are clamped top and bottom and held to the cases by 10/32 brass hexagonal nuts, although a better appearance would be had if small acorn nuts were used on top of the cases. The dials for the condensers are made from celluloid, the lines being scratched in, and black oil paint being rubbed in to make them show up.

Assuming that all our instruments are finished, the exposed brass work should be buffed. If the case is of walnut the brass work should be buffed and lacquered; if of cherry or mahogany the brass work should be nickel plated. After the brass work is completed the instruments should be assembled on the case (see Fig. 9). Single arm switches 4-11-14 have their contacts set in a circle around the center hole of 1 3/8 inch radius. Double arm (D.P.D.T.) switches 3 and 8 are mounted circles of 1 5/16 inch radius. For mounting the switches see sketches *E* and *D*, Fig. 7. The pieces marked *H* are used under the rotary members of the variables and the single arm switches, so that flexible wires need not be used.

In Fig. 9 *1* and *2* are aerial and ground posts; *3* is a switch for placing condenser (*5*) in series or parallel with the primary circuit; *4* is the switch for the loading coil (14 points); *5* is the ground condenser (15 and 14 plates); *6*, the variable (of 15 and 14 plates) connected across the leads of the intermediate coils which are in series; *7*,

In Fig. 10 the instruments in the wiring diagram are in their approximate places looking at the inside of the box with the front toward the observer. The parts are referred to by number as follows:

1, binding post for aerial connection; *2*, loading coil whose taps are connected to 13 points of the 14-point switch—the remaining point *3* shorts the loading coil; *3*, loading coil switch; *4*, rotary switch useing a D.P.D.L. switch to throw in either "tuning" primary or "standby" primary *6*; *7*, is the variable connected across the two leads, exactly in the center, which connects the intermediate coils *8* and *10* in series; *9*, is the variable used in the primary circuit; *11*, is the secondary variable connected across the secondary leads; *12*, is the secondary coil of No. 32 S.S.C. whose six taps are led to switch *13*; *14*, are the posts for the extra detector; *15*, is the selective switch for either short circuiting the phones, when sending, or selecting any of the three detectors at *16* or *14*; *17*, is the small fixed condenser connected across the phones; and *18*, posts for phones. If an audion is used instead of connecting the phones direct to the posts *18* they should be connected to the center posts of a small D.P.D.L. knife switch whose one side leads to posts *18*, and the other to the audion box phone posts.

The manipulation of these sets is familiar to many amateurs, but for the benefit of those who are not, a brief description will be given:

Connect up the ground and air either to an antenna switch or to the opposite sides of an anchor gap which is in series with an aerial oscillation transformer and ground connection. Instead of the anchor gap, which entails a loss in transmitting, a S.T.D.P. knife switch may be used, one side being used instead of an anchor gap and the other to control the primary current of the transformer. When the switch is up one can receive, but cannot send; when down the transmitter can be operated, as the receiving set is then short circuited.

When listening in the switch *8*, Fig. 9, should be set at standby position until a station is heard; then throw the switch to the tuning position and tune by adjusting the various condensers and secondary taps. The coupling of the intermediate circuit with the tuning primary and secondary circuits if loosened (by moving the pointer on scale of coupling handle between 0 degrees and 90 degrees) tends to lower the wave length of the circuit and it can be raised again by putting in more capacity by means of the intermediate variable condenser. The looser the coupling (the nearer to 90 degrees) the sharper the tuning. The switch *3*, Fig. 9, should normally be thrown so that the primary variable condenser is in series with the primary coils, except on very long wave lengths, when it should be thrown to the parallel connection position. A little practice will enable one quickly to set the capacities and coils in the correct relation to one another. If static is bad a high resistance coil of some sort wound on a porcelain or other non-metallic core to a resistance of about 10,000 ohms and connected directly across posts *1* and *2*, Fig. 9, will tend to destroy its effect when receiving. This set, for satisfactory long distance work, should be used with an aerial at least 30 feet above ground and 50 feet long, consisting of 4 wires, spaced 4 feet apart and connected in an inverted "L," so as to get as great a natural period or wave length as possible for an aerial of given size.

The telephones to be used with this set should preferably have a resistance of 3,000 to 3,200 ohms. If possible an audion should be used as it gives little or no trouble in comparison with crystal detectors, and is about three times as sensitive. A set like the one described will have a probable range on winter nights, especially, of about 1,800 to 2,000 miles with an aerial 50 feet high and 75 feet long.

The Medicine of the Old Testament—I*

Primitive Remedies, Practice and Superstitions of Acient Palestine

By Stuart B. Blakely, M.D.

In a study of the medicine of the Old Testament two points must be kept always clearly in mind: (1) It is a study of the non-medical literature of a primitive, nomad race. (2) References to disease and medical subjects are dark and incomplete. Careful study of the original Hebrew words themselves has been of little service. Most of the diseases described are either those of kings or personages of high estate or epidemics. If we realize that little is absolutely sure, that much must be inferred, and if we recognize the difficulties of the problems we shall not be led far astray in the medical survey of the Old Testament.

The scriptural references given in this article by no means exhaust the possibilities of the text.

The medicine of the ancient Hebrews was partly of Egyptian, partly of Assyrian and Babylonian origin with, in later times, a possible trace of Greek influence. The medicine of Egypt was famous in its time throughout the East. Cyrus and Darius both summoned physicians from that country. Many of the physicians at the courts of the kings of Israel were probably Egyptian. The learning and culture of Assyria and Babylonia reached flood mark. The ancient Hebrews acquired their medicine during the sojourn in Egypt, by intercourse with other nations, especially during the reign of Solomon, and during the captivities. But the Hebrews were never scientists. They had no scientific institutions. Their science and their medicine were borrowed and empirical. To their minds Jehovah was the highest authority in all things. Jehovah was the Supreme Healer. (Ex. 15, 26; Dt. 32, 39; Ps. 6, 2; 30, 2; 103, 3; Is. 30, 26.) Injury, disease and death were usually regarded as expressions of his wrath, as direct results of his omnipotent will. As a consequence of this belief we find little or nothing in the Old Testament concerning the cause, the course, or the curing of disease. Disease was often looked upon as a direct punishment for sin, a belief prevalent among primitive folk. Threats of disease for sin and disobedience and promises of protection against disease are very common. (Ex. 15, 26; Nu. 14, 12; Dt. 7, 15; 28, 59-62; 32, 39; II Sa. 24, 16; II K. 19, 35; II Ch. 21, 14; Job 2, 5–7; Is. 58, 8.)

Among most early peoples medicine has been at first the property of the priesthood alone. Among the Hebrews, however, the medical work of the priests seems to have been that of a sanitary police—observing, isolating, and disinfecting. Their duties seem to have been always distinct from those of the physicians. (Gn. 50, 2; Ex. 21, 19; II K. 8, 29; II Ch. 16, 12; Job 13, 4; Jer. 8, 22.) The physicians gathered and prepared their materia medica, prescribed for symptoms of disease and treated wounds. The word "physician" in Jer. 8, 22, is literally "a bandager." There are two references to definite consultations with physicians—Asa to be cured of the disease of his feet and Joram to be healed of his wounds. (II Ch. 16, 12; II K. 8 and 9.) The profession was not so highly nor so strictly specialized as among the Egyptians—*cf.* the corps of physicians in the service of Joseph. (Gn. 50, 2.) It was usually held in high esteem, but Asa was reproached because "in his disease he sought not to the Lord but to the physicians." The author of the apocryphal book of Ecclesiasticus is thought to have been a physician. The prophets Abijah, Elijah, Elisha and Isaiah, by virtue of what we call their miracles, may be classed among the healers of the Hebrews. Midwives followed their calling as they do to-day. (Ex. 1, 15-21.) Their duties were of the simplest. They received the baby, cut and tied the cord, washed the child, rubbed it with salt and wrapped it in swaddling clothes. (Ezk. 16, 4.) It has been suggested that the two mentioned by name in Ex. 1, 15, were the heads of corporations or societies of midwives. Such a thing as a hospital was unknown; the sick, except the lepers and probably the "unclean, were cared for in their homes. (Lv. 13, 46; Nu. 5, 2; II Ch. 26, 21.) The dead were burned, buried or placed in sepulchres. The Hebrews did not embalm. Their mind had no sympathy with the Egyptian idea that originated the custom. Jacob and Joseph were embalmed only to preserve their bodies until burial could take place. Among the Egyptians the art of embalming formed a special branch of medicine. The process varied not only according to the wealth and rank of the deceased, but also at different times in Egyptian history.

It might be interesting to glance briefly at the ancient Hebrews' ideas of anatomy. It is possible that dissection of the human body for scientific purposes had already been done at that early date, but in any knowledge thus obtained the Jewish slaves could have had no share. The Hebrews had no medical schools, no system of medical education. What little true anatomical knowledge they possessed of the internal organs was derived from injuries, war, and the slaughter of animals. All else was tradition or speculation. There are references to the heart, the liver, and the bile or gall, the diaphragm—"the caul above the liver" (Ex. 29, 13), the kidneys, the intestines and the internal fat, and the womb or matrix. The liver was evidently of value in divination. (Ezk. 21, 21.) Certain verses of Proverbs and Ecclesiastes have been cited as proof of Solomon's knowledge of anatomy and the healing art. Traces of a rude conception of embryology are found. (Job 10, 10; Ps. 139, 13–16; Eccl. 11, 5.) Blood to them was life, therefore sacred, and together with the internal fat must be returned to God before the flesh was eaten. (Gn. 9, 4; Lv. 7, 23–27; 17, 10–14; 19, 26; Dt. 12, 23.) They knew that dreams originated from inside the head. (Dan. 4, 5, 13; 7, 1.) The liver was the source of happiness; in several places in the Psalms it is called the "glory." (Ps. 16, 9; 30, 12; 57, 8; 108, 1.) The navel was the seat of health, the heart, the source of emotion and of mental and moral activity, the reins or kidneys the seat of desire and determination, the bowels the place of affection and sympathy. We still preserve many of these ideas as figures of speech, but the Hebrews believed them to be truths. The books of Job, Proverbs, and Ecclesiastes contain a curious store of medical lore.

Palestine was probably healthier than Egypt. In the latter country the valley of the Nile was flooded every year, creating conditions favorable for the development of disease. The plagues of the Egyptians were closely associated with the rising of the Nile and with other well-known climatic conditions of the country. Palestine, on the other hand, was isolated by land and sea. Communication with it was difficult. Disease was not apt to be carried to it. The land was dry and sanitation was good. There was no overcrowding and no poverty. Under the leadership of Moses, a priest from the temple of the Sun at Heliopolis, the Hebrews became the founders of public hygiene. In Leviticus and Deuteronomy are very definite rules and regulations regarding food, clean and unclean things, sexual hygiene, personal purifications, and contagious diseases. In Ex. 21, 22 and Lv. 24, are found traces of a medical jurisprudence.

We cannot enter into a discussion of the sanitary code of the Hebrews; neither will we describe practices that became religious rites, e. g. circumcision. We can only speak briefly of the drugs and methods used in treatment and call attention to some of the diseases and diseased conditions mentioned in the Old Testament text.

The ancient Hebrews had many medicines. (Jer. 46, 11.) We hear of no specifics. The following were some of their therapeutic agents: leaves of trees (Ezk. 47, 12), olive oil, balm of Gilead, a famous resinous application for pain and wounds, and a valuable article of commerce, fig plasters, oil and wine for wounds. The mandrake root was used for barrenness, following the old doctrine of signatures. (Gn. 30, 14–17.) The word translated "gourd" in the last chapter of Jonah is thought by some to mean the castor-oil plant. The personal and ceremonial use of ointments, perfumes, and incense was common, as among all Orientals. These were prepared by the apothecaries and confectioners. (Ex. 30, 25; 37, 29; Isa. 8, 13; II Ch. 16, 4; Neh. 3, 8; Eccl. 10, 1.) The ingredients were both domestic and imported, and their list is long. Among them were frankincense, myrrh, aloes, calamus, camphire or henna, cassia, cinnamon, galbanum, rue, spicery, saffron, storax and others. The following were more strictly medical in their use, as condiments or carminitives—cassia, cinnamon, coriander, cummin, salt, and probably also anise, mint and mustard. The prescription for the holy anointing oil is given in Ex., 30. Salt was used to harden the skin, niter and soap to cleanse it. (Jer. 2, 22.) The niter was natron, a mineral alkali; the soap was probably potassium carbonate mixed with oil. Elisha used salt to purify springs of water that were reputed to cause miscarriage and death. (II K. 2, 19-22.) Hyssop seems to have been a substance whose use approached that of an antiseptic. It was probably either the marjoram, or the caper plant. The Psalmist lauds its "purging" powers; it was sprinkled on the doorposts of the Israelites in Egypt and was employed to purify lepers and leprous houses. (Ps. 51, 7; Ex. 12, 22; Lv. 14, 4–7, 49–52.) Mankind still clings tenaciously to the belief that the smoke or vapor from burning incense or other odoriferous substances possess detergent properties. It is possible that Hazael practised hydrotherapy when he dipped a cloth in water and spread it on the face of Benhadad, King of Syria, though it sounds more like murder. (II K. 8, 15.) Mineral and oil baths were sometimes employed. The pool of Siloam possessed healing powers. (Neh. 3, 15; Is. 8, 6.) Hot springs—"mules" are mentioned in Gn. 36, 24. These were probably near the Dead Sea. The water of the Jordan contained sulphur, and was famous for its curative properties, *cf.*, Naaman's leprosy. The wearing of amulets, the use of charms and invocations and the laying on of hands in the presence of disease were common practices then as they are to-day. (II K. 5, 11.) The influence of the state of mind on sickness was clearly recognized—"a merry heart doeth good like a medicine." (Pr. 17, 22.) Some kind of arrow poison was possibly in use, most probably aconite. (Job 6, 4.) The water of gall, or the "water of the poisonous plant," may refer to the poppy. (Jer. 9, 15; 23, 15.) Food poisoning of vegetable origin—possibly colocynth or the bitter cucumber—is mentioned in II K. 4, 38–41, for which Elisah used meal as an antidote. Ptomain or meat poisoning was probably the plague that followed the eating of the quail. (Nu. 11, 31–33.) The Hebrews knew well the action of alcoholic drink. They made wine from honey, dates, grapes and other fruits, and it was sometimes spiced. Certain localities were famed for their product of the vine. The drunkard has been inimitably portrayed in Pr. 23.

As among the Egyptians many remedies were dietary. The ancient Hebrews had an ample and excellent variety of food: meat, fish, fowl, game, locusts, eggs, butter, milk, cheese, sour milk, meal of various grains, bread, beans, cucumbers, onions, garlic, lentils, herbs, manna, honey, fruits, melons, figs, raisins, grapes, nuts, olive oil, vinegar or sour wine, salt, and condiments. The ancient Hebrews probably had no sugar; honey, manna, and fruit juice decoctions were substitutes. The "sweet cane" of Is. 43, 24, and Jer. 6, 20, was probably the sweet flag or calamus. There is evidence of cannabalism taking place in Old Testament times under stress of circumstances. (Lv. 26, 29; Dt. 28, 53; Jer. 19, 9; Ezk. 5, 10.)

The surgical lore of the Old Testament is very scanty.

*Read before the Men's Forum of the First Congregational Church, at Binghamton, N. Y.