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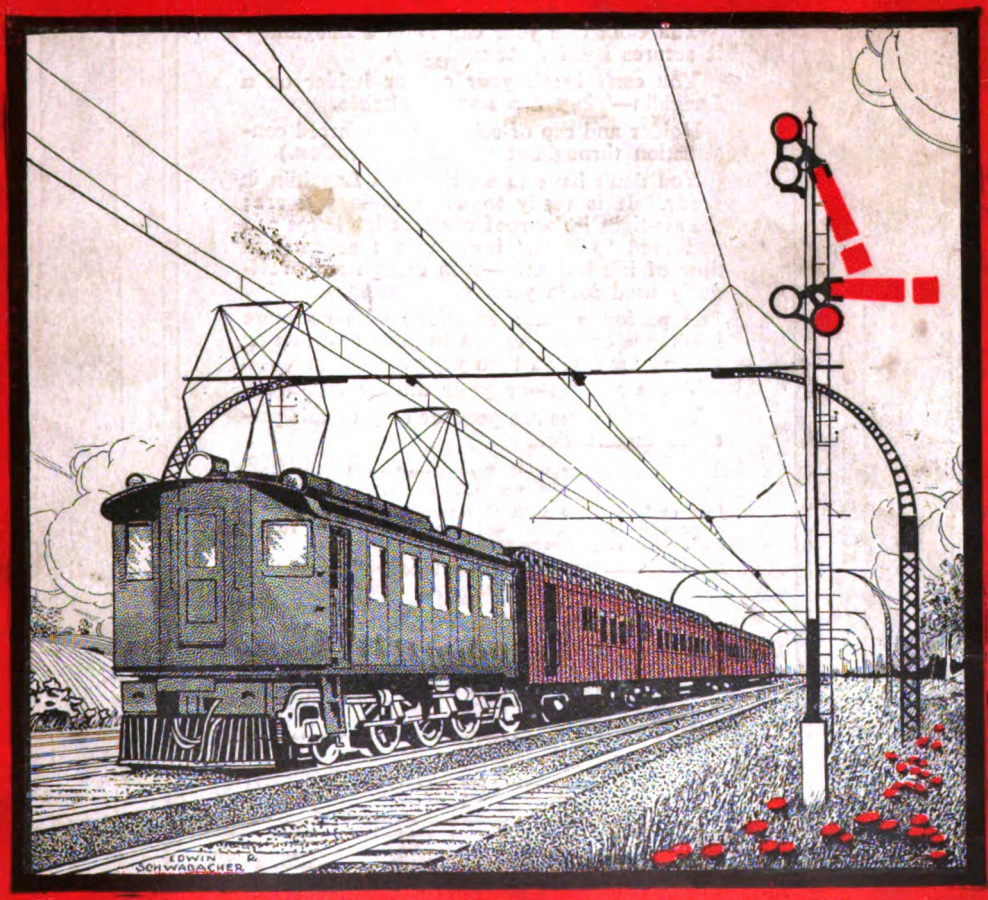

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MODERN ELECTRICS AND MECHANICS

ORLAND J. RIDENOUR, President. W. G. RIDENOUR, Secretary. AUSTIN C. LESCARBOURA, Editor.

Volume 28. **May, 1914** **No. 5**

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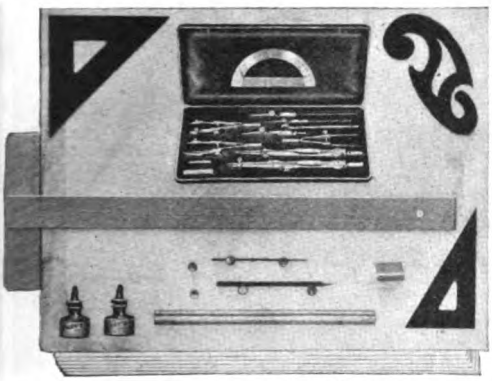

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Modern Electrics and Mechanics

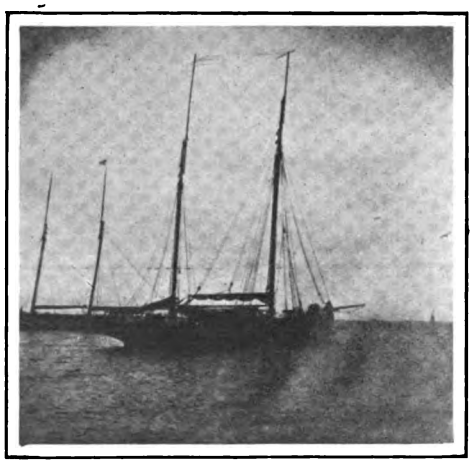
VOL. XXVIII. May, 1914 No. 5

WIRELESS AND THE FISHERMEN

Many are the Advantages Derived from the Recent Installation of Radio Apparatus on Deep Sea Fishing Boats

By Dr. Alfred Gradenwitz

ENDEAVORS have been made for some years to apply wireless telegraphy to the needs of deep sea fishing. When in December, 1909, nine fishing cutters with a crew of 27 had been destroyed by a storm in the North Sea, the German Emperor ordered an investigation to be made into the case, as a result of which the use of wireless telegraphy for the transmitting of storm warnings to fishers on the sea was advised. Steps were just being taken to carry out the measures suggested by the Commission, when in November, 1911, five German herring boats with 70 fishers were lost during a storm in the North Sea. As there is a periodical recurrence of such accidents in all fishing countries, it will be readily understood how much human life and property could be saved by timely wireless storm signals to the fishermen.



THE HERRING BOAT "DROSSEL" EQUIPPED WITH WIRELESS APPARATUS

The application of wireless telegraphy to deep sea fishing, however, is bound at the same time to prove of the greatest economical importance in view of the usefulness of the regular information service thus afforded. This is best shown by the example of Norway, where an official intelligence service on the conditions of prices and catches along the entire coast of the country has long resulted in considerable surplus gains from the fishing industry. From every small fishing village and, of course, from all the larger places, daily telegrams are sent out, dealing with the catches and other matters, which are brought by posters to the notice of the public. This information can also be obtained privately by an inexpensive subscription. Every fisher is able to learn

from these telegrams where it would be most profitable to turn in order to obtain an output as satisfactory as possible, and every trader is in a position to make his arrangements in accordance with the general conditions of fishing. Since the market is thus kept permanently informed on the condition and chances of fishing, there is a far greater stability of the trade than in other countries.

In Germany, as in most other countries, an information service of this kind could only be kept up by the aid of wireless telegraphy, in opposition to Norway, where fishing is carried on along the coast with the mainland as basis, so that wires readily transmit any information.

In 1908 two Cuxhaven fishing steamers, thanks to a government subsidy, were equipped with wireless telegraph apparatus, though wireless sets were likewise provided for some other steamers of the Cuxhaven fishing fleet, the innovation was not adopted as readily as had been hoped. The general reluctance of fishers and difficulties in training the men are obstacles not yet entirely overcome.

THE ONE-HALF KW. STATION ON BOARD THE "DROSSEL," SHOWING THE SEPARATE RECEIVING AND SENDING OUTFITS

A decisive step was taken in 1912, when the German Society for Deep Sea Fishing entrusted Dr. Erich F. Huth, of Berlin, with the installation of a .5 kw. station on the herring boat "Drossel." A similar station to that on board the "Drossel" was erected on the grounds of the Society at Vegesack, near Bremen; government subsidies being granted for both these stations. The experimental service of the land station was confined to communication with the Elsfleth Navigation School and with Dr. Huth's Experimental Station at Berlin.

The wireless station on board the "Drossel," apart from the source of power, was installed in a wardrobe in the captain's cabin and comprises two parts separated by a partition, the upper part being the sender and the lower the receiver. In one of the illustrations may be seen the sender, to the left in the upper part of the figure the spark-gap, in the centre the antenna ammeter, and to the right a regulator for adjusting the coupling. Underneath there are the antenna switch for changing over from sending to receiving, and the Morse key. The sender employs a musical quenched spark-gap, and its main wavelength is usually 600 metres, although a wave of 300 metres can be emitted as well. Both the sending and receiving antenna switches —both mounted on their respective sets—are connected by a small belt.

The receiving set consists of a special switch and plugs by means of which, in conjunction with the rotary condenser placed underneath, the receiver can be tuned continually to the waves intermediary between 200 and 3,000 metres. Different detectors can be plugged into the circuit, as well as one or two telephone receivers.

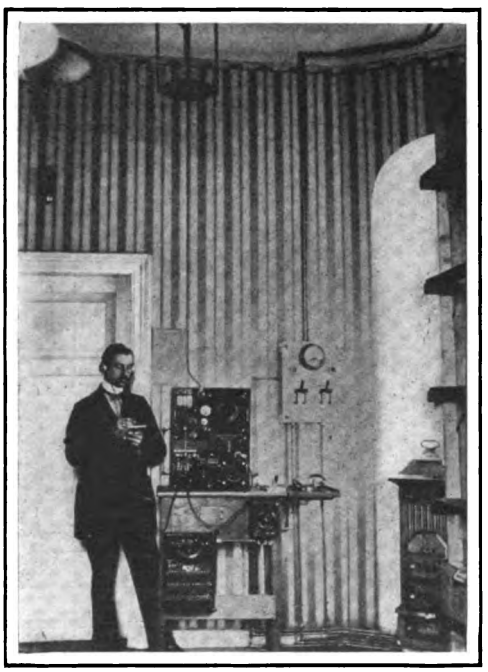
Above the receiving apparatus there is a small switchboard carrying an ammeter, as well as the switches and fuses required for the current supply. The rheostat regulator, visible below the apparatus, serves to control the alternating current. The isolated arrangement of the sender and receiver,

respectively, affords the advantages of making both sets self-contained and allowing, for instance, the sender to be removed for supervision without interfering with the working of the receiver. The general switchboard arrangement of the station, moreover, entails a saving in space, ease of mounting and ready access to all vital parts.

There being no source of electrical energy on board the "Drossel," as found on electrically-lighted fishing steamers and herring boats, the supply of alternating current of 500 cycles is secured from a dynamo coupled to a steam turbine, both of which are installed in the engine room.

The iron mizzen mast — also serving as engine funnel—and the great mast of the boat were used as antenna carriers, the great mast being extended 3 metres and the funnel 6 metres by means of wooden bars. A four-wire antenna about 20 metres long is stretched out on spreaders between the great and mizzen masts. The bars, constituting the extension of the masts, are readily removed and the antenna and leads can be hauled in at a moment's notice. The antenna leads up to a certain height were placed in a protective box, preventing any mechanical injury by the sails. All other conductors are held by porcelain insulators. The entire station as well as the aerial can be easily and cheaply installed. The arrangement of the antenna, in spite of its simplicity, has given excellent results in stormy weather.

The .5 kw. land station installed in the management buildings of the Fishing Society is of the same type as the station on board the "Drossel." Since a continuous current supply was available, the 500-cycle alternating current is furnished by a motor and alternator installed in the cellar of the building. The whole station was accommodated on a small table in one of the offices. The rheostat regulator and starter for the alternating current generator are fixed in the front part of the table, while the requisite switches, fuses and the ammeter of the exciter circuit are placed on the small switchboard to the right of the station. A single bronze wire about 100 metres in length serves as antenna and is stretched out freely between a stack about 30 metres high, and the building. The range of the station by day is about 150 kilometres over land.



RECEIVING AND SENDING APPARATUS IN THE OFFICES OF THE FISHING COMPANY AT VEGESACK

Systematic tests were made with these stations in the autumn of 1912 during two fishing campaigns in the vicinity of the Dogger Bank in the North Sea and close to the South Eastern coast of England, respectively, a permanent communication between the land and with passing ships being maintained in both cases.

These experiments again show one of the main advantages of wireless telegraphy to lie in the possibility of individual fishing boats communicating to one another information on their daily catches. As soon as a vessel has found a satisfactory catching place, it is able immediately to call in other vessels of the same company, or its friends among the fishers. Catches thus would become more productive and trips could be abridged and made more profitable, quite apart from the benefit derived from the storm signals.

Minnesota has a forested area of 28 million acres, the largest of any state east of the Rocky Mountains.

CURING HUMAN ILLS BY MAGNETIC WAVES

Describing a New Type of Magnetic Wave Apparatus that is Proving Highly Satisfactory

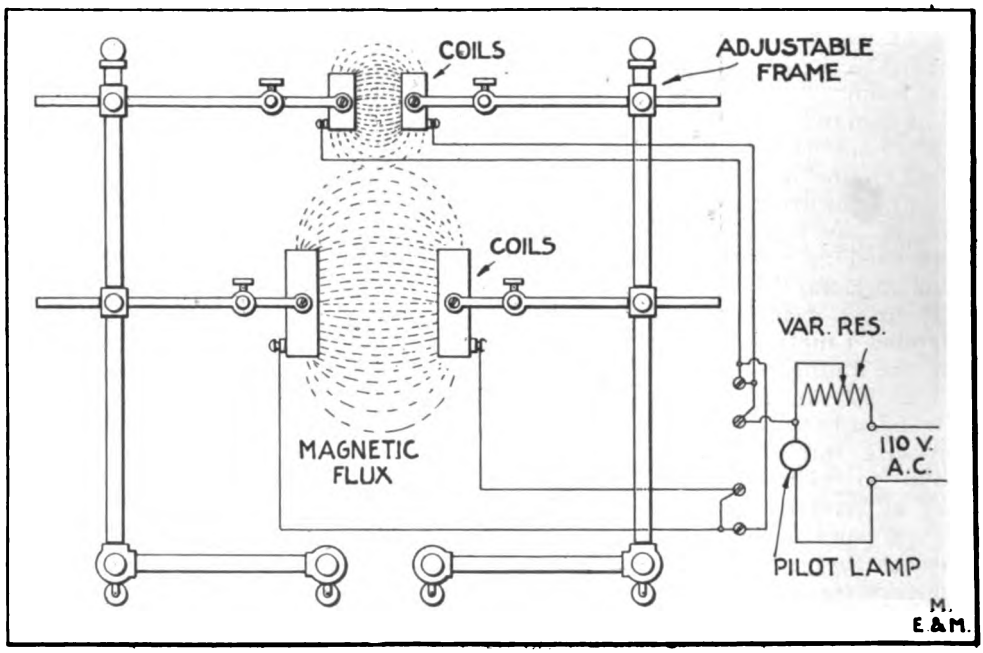
By Henry Townsend, Jr.

ELECTRICITY as an aid to the physician in curing human ailments is not new and there are numerous medical practitioners in every city to-day who make use of its wonderful properties in some form or other. The electric current as employed heretofore has invariably been one of relatively "high voltage" and "low amperage," taking the human body as a condenser.

A newly devised magnetic wave apparatus, developed by Bachelet, is entirely different in its arrangement and electrotherapeutical effect. This apparatus does not employ any high voltage or dangerous electric currents at all, but quite on the contrary, the current utilized is the same as the ordinary house lighting current and therefore harmless. To render it more so, there is no direct application of the electric current to the patient, but magnetic waves of sinusoidal form are passed through the body under treatment. In other words, the magnetic waves set up or produced with the Bachelet device, generate by electromagnetic induction a powerful current of "low voltage" and "high amperage," employing the human organism as an accumulator.

A view of the magnetic wave generator as supplied for physician's requirements is depicted here. In instances where the ordinary alternating current supply at 110 or 220 volts is available, the magnet coils, which produce the magnetic wave field, are readily connected directly to it. For direct current installations, a dynamotor or motor-generator set is required to furnish the necessary alternating current for exciting the magnetic windings of the apparatus. A suitable controlling rheostat, together with the necessary current gauges, etc., is included with the outfit. Any physician can learn to operate and apply the mag-

(*Continued on page 632*)



THE BACHELET APPARATUS FOR GENERATING MAGNETIC WAVES

THE "IRON HORSE" YEARS AGO AND TODAY

By L. J. Lesh

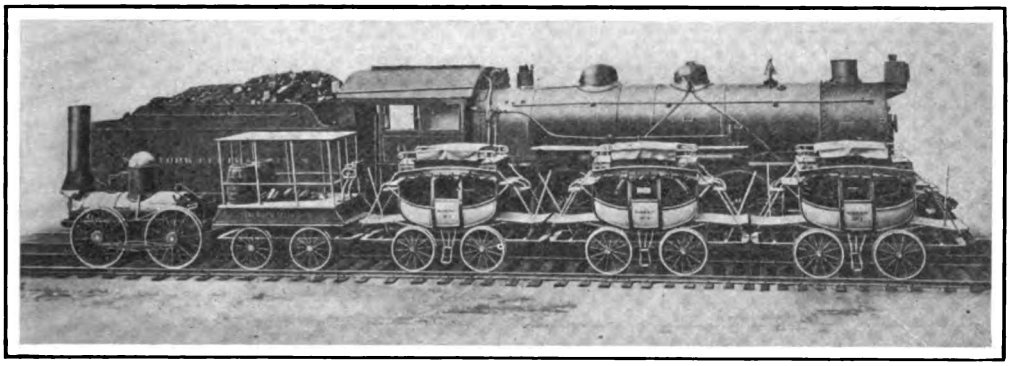
THE accompanying photograph shows in an interesting way the development of the locomotive in America. Here is the little "De Witt Clinton," the marvel of its time, and the gigantic Pacific type locomotive of the present day.

On the 9th of August, 1831, the first railroad locomotive in New York State pulled its train of diminutive stage-coach cars out of Albany and headed for Schenectady. The engineer mounted a small seat, attached to the rear of the tender, and gave the signal for starting by blowing a tin horn. The fuel used on this trip was dry pitch pine; coal having been previously tried with unsatisfactory results.

As there was no spark arrester on the stack, the smoke and sparks poured back on the passengers in such volume that they raised their umbrellas as shields. The covers were soon burned off these and each man whipped his neighbor's clothes to put out the fire started by the hot cinders.

When a stop was made at the water station the train hands tried to remedy the disagreeable jerks, resulting from the slack between the coaches, by wedging a rail from a neighboring fence between each car and tying it fast by packing yarn. This plan succeeded and the train arrived at Schenectady without accident. After the party had partaken of refreshments, they returned to Albany, thus completing the first regular trip of a steam locomotive and train in New York State.

What a contrast this little outfit presents to the big locomotive behind it! The modern engine is longer than the whole De Witt Clinton train and in comparison to the latter's speed of fifteen miles per hour, the Pacific type will pull a train at 100 miles an hour without exerting itself. The historic engine tipped the scales at a modest six tons, while the big unit with which it is compared weighs 422,000 pounds. It is hard to realize that such a few years have elapsed since the total railroad mileage in New York State was 17 miles as compared with 9,000 miles to-day, and when the only railroad train in service was made of stage coaches converted for use on rails in contrast to the luxuries of such trains as The 20th Century Limited.



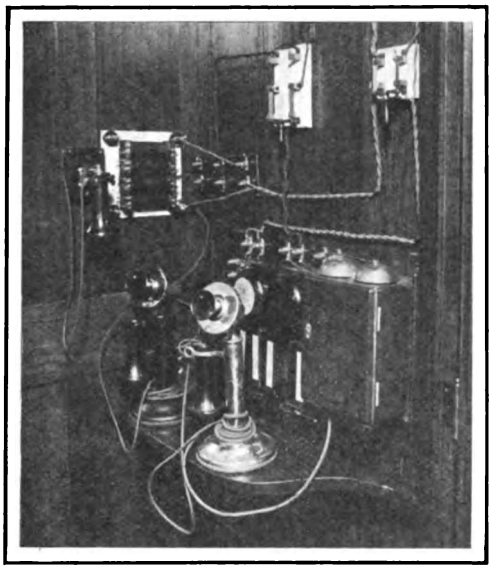
EIGHTY YEARS OF LOCOMOTIVE DEVELOPMENT—THE DE WITT CLINTON AND ITS TRAIN OF COACHES ALONGSIDE A MODERN PACIFIC TYPE LOCOMOTIVE

The Department of Commerce, Radio Service, has suspended for a period of thirty days the license of a radio operator who had indulged in unnecessary and unauthorized radio conversation and used profane and obscene language by radio. This is the second case where an operator's license has been suspended by the Department because of not complying with the requirements of the law.

IMPROVING UNDERGROUND CABLES

WHAT is claimed to be the means of eliminating the inductive and condenser effects of underground cables for telegraphy and telephony has recently been demonstrated by a New York engineer, Guiseppe Musso.

Mr. Musso has invented a form of



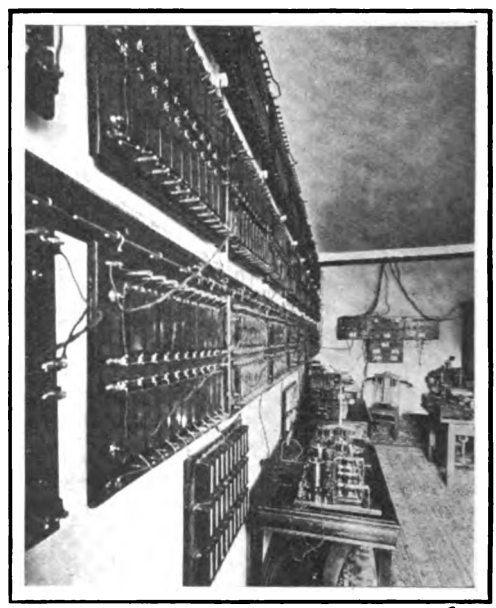
LONG DISTANCE TELEPHONE APPARATUS

Showing the Conventional Desk Telephone as well as the Additional Equipment Required.

circuit that treats telegraph and telephone currents in such a manner, before they are sent over an underground cable, that they are given a characteristic exactly opposite to that impressed by the induction and capacity of the cable. The result is that as the currents are being sent over the cable, they gradually become normal again due to the counter effects of the two aforesaid factors. The system is extremely simple and consists merely of a special form of circuit. The conventional telephone or telegraph apparatus is used with this system.

In order to demonstrate the merits of his system Mr. Musso has erected on the wall of his laboratory a large number of condensers and resistance coils that are said to represent the same capacity and inductance as an underground cable 5,000 miles long, or an aerial conductor 22,000 miles long. Telephone conversation over this artificial cable can be carried on with ease and no distortion of the sound is noticeable, although, of course, the sound is considerably weakened by the great resistance of the conductor.

Mr. Musso believes that the most important application of his system will be for the Atlantic cables, to enable telephonic communication between Europe and America. Not only can this be accomplished, but he also states that the speed at which cable messages are sent could be considerably augmented because of the elimination of any retardation effects such as are now limiting the number of words that can be sent per minute. It is proposed to bridge the telephone system across two cables, both of which would still be used independently for regular telegraph traffic, as at the present time. Thus, the telephone system would not interfere in any way with cable traffic and would not necessitate great expense to inaugurate and operate.



AN ARTIFICIAL CABLE FOR TESTING

This Combination of Condensers and Resistances is said to Equal a Cable 5000 Miles Long.

THE MYSTERIES OF LIGHTNING

Numerous and Puzzling are the Unaccountable Freaks of this Least Understood of Nature's Phenomena

By Moore Stuart

IN a general way we understand the theory of thunderstorms. As a matter of fact, there is no phenomenon of nature, not excepting even earthquakes, of which we know so little.

Man-made lightning—meaning by this electricity of the highest potential which we can artificially produce—will act according to certain known laws. It will, for instance, travel along a metal conductor. But a flash of lightning will frequently leap from a well defined metal path and launch itself through the air or to some adjacent object which is an infinitely poorer conductor of electricity.

This may be due to the almost inconceivable force of a flash of electricity or lightning. It is estimated that a flash a mile long represents a pressure of discharge equal to 3,000,000,000 volts. As such a flash lasts but a thousandth part of a minute, the entire energy dissipated by the discharge is equal to about 300,000 horsepower. Put into other words, if we could find some means of saving and using lightning, we would be richer by a good round sum for every flash.

Lightning, as we know it, is usually accompanied by a clap of thunder which is louder the nearer the hearer is to the point of discharge, although this is not an invariable rule. There are cases on record of most destructive lightning flashes that were unaccompanied by a sound.

Such a phenomenon occurred in Bradford, England, a few years ago. What are described as silent thunderbolts fell in a graveyard, destroying one monument and smashing to atoms nearly seventy glass cases containing wreaths and flowers.

In the same summer, Swanscombe in Kent, was terrified by a freak of lightning. All of a sudden "a great mass of blue fire" swept along the street and the next moment it was seen that the fine old parish church, built nearly 700 years before, was struck. The building with all its fine old carved oak was soon a roaring furnace. Only a part of the chancel was saved.

Scientists are still hopelessly at sea as to the cause of that peculiar occurrence known as globe lightning. At Coventry some years ago, during a violent thunderstorm, it passed along the street like a soap bubble built of blue fire, and drifted into a shed where it exploded, blowing off the roof of the house. At Rheims in France, a similar fire ball came into a cobbler's shop through the open window. The solitary occupant of the place sat perfectly still—paralized with terror—while the fearful visitant hovered for an instant overhead. Then it moved towards the fireplace and presently passed up the chimney. Next there was an explosion like a bursting shell and the upper part of the chimney came crashing down.

Not long ago, Count Hamilton made a record of a similar freak of electricity. He was sitting at dinner at a house on Lake Wener in Sweden, when just after a vivid flash of lightning, a brilliant white ball appeared over the table, and after hanging poised there for some seconds went off with a loud bang. Fortunately it did not harm anyone, although it was quite close to several people. Those who saw it stated that it was like a ball of "cold lightning."

In 1892, Sydney, Australia, was visited by a terrific dust storm, in the midst of which a perfect hail of fire balls began. These set fire to a number of houses and a most appalling panic set in. A cry was raised that the end of the world had come and people rushed out of their houses in terror, into the inky darkness of the dust-swept streets.

The most amazing and terrifying display of the power of lightning is seen on mountains. In 1905 a party was on top of a mountain in the Caucasus when a huge violet ball surrounded by vivid rays struck a rock nearby and exploded like a bomb, bursting into atoms. One of the party was severely hurt.

About the time Franklin was making his kite experiments in this country, Professor Richman, of St. Petersburg, was working along the same lines. He had erected on his house an iron rod to collect electricity from the clouds during a thunderstorm. In August, 1753, during a terrific electrical storm, he was observing along with Sokolow, the indications on an electrometer when a tremendous thunder clap burst over the neighborhood. Richman bent over his instruments and while in this position, his head being a foot from the lightning rod, Sokolow saw a globe of bluish fire, about the size of the fist, shoot from the iron rod to the professor's head with a report like that of a pistol. The shock was fatal. Richman fell back and instantly expired. Sokolow was stupified and benumbed, the red hot fragments of the rod striking and burning his clothes.

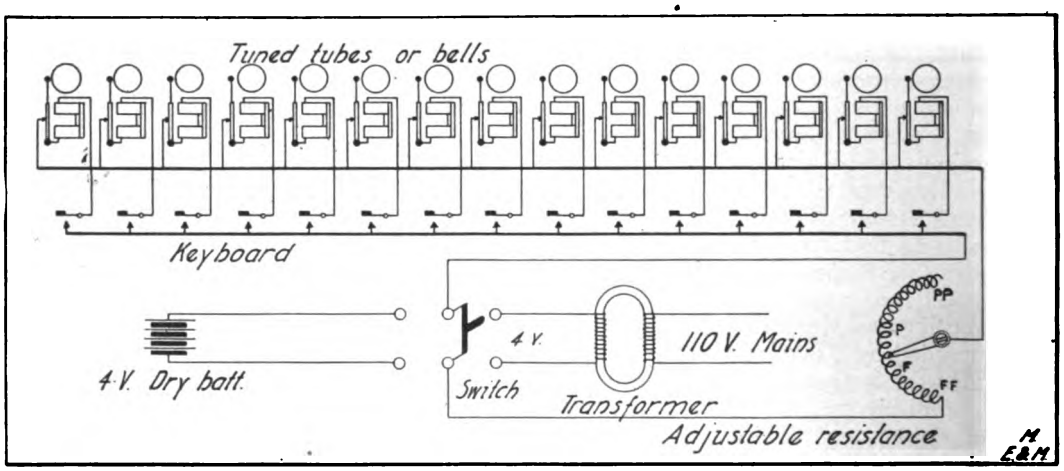
THE ELECTRIC TUBAPHONE

By W. A. Talmage

THE writer having purchased a Turkish tubaphone for amusement purposes, found that he was not clever enough to manipulate the beaters rapidly and for that reason conceived the following simple and effective electrical idea.

Having constructed a suitable box in the shape of a miniature grand piano—the legs are omitted in the illustrations—the author purchased fifteen electric door bells and fifteen spring parts of door bell pushbuttons, as well as some German silver wire, a double throw double pole knife switch, three dry cells and a toy transformer.

The pushbutton springs were arranged beneath the keys, making the under contact of each a common or strapped wire leading to the center post of the double throw switch. The upper contact springs were wired in cable fashion to the electric bells, which were mounted on a flat board of hard wood and arranged so that the hammers would strike the center of the tubes. The gongs had been removed from the bells and the tubes were laying flat in the bottom or floor of the case, as in the illustrations.



WIRING DIAGRAM FOR THE ELECTRIC TUBAPHONE, SHOWING HOW IT MAY BE OPERATED BY EITHER DRY CELLS OR A STEP-DOWN TRANSFORMER

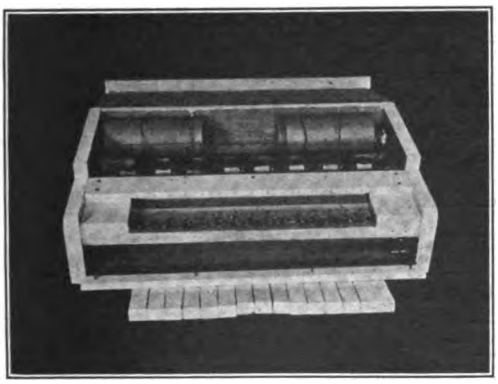
The double pole switch was mounted in the rear of the case with binding posts for the transformer connections, and the batteries were placed in the interior of the case as shown.

The adjustable resistance was made from the German silver wire and its switch was placed under the right hand end of the keyboard. The resistance switch had four contacts, namely, ff, f,

p and pp, these terms meaning "Extra Loud," "Loud," "Soft" and "Extra Soft"; the resistance governing the current flowing to the ringers and hence the degree of loudness.

The transformer was found to be the best for operating the electric ringers, although satisfactory results could also be obtained with the battery. Owing to the rapid decrease in the flow of current from the dry cells when two or more keys were depressed, the cells soon died down and were only kept for emergency purposes. However, good music was obtained from dry cells when operating only one key at a time. The placing of the switch as well as the using of two sources of current is optional with the constructor.

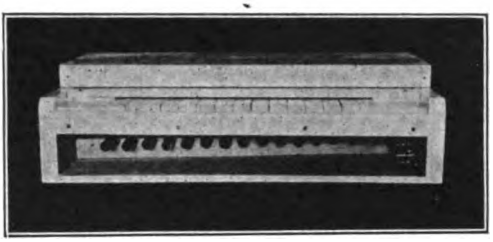
The writer later made a flexible cable of twenty wires; fifteen of which were connected to the ringers, two to each of the straps or common wires previously described, and the remaining wire for a spare, should any of the others become defective. The object of using two wires to each of the straps was to lower the resistance for the flow of current when two or more keys were depressed. The other end of the cable was connected to springs placed under the keys of a piano, and when this was played, the combination of sounds was delightful. Fortunately, the tubes were in tune with the piano itself.



TOP VIEW OF THE ELECTRIC TUBAPHONE

Another combination may be secured by purchasing tuned bells from any musical instrument dealer and adjusting these to operate as described above. In this instance the ordinary door bell vibrators may be mounted on a single board or placed in any part of the room; no box or case being necessary if connections are made to piano keys.

The illustrations and drawing speak for themselves, and any person with fair mechanical and electrical talent can easily construct one of these electrical instruments. The dimensions are not given since they will widely vary in different cases, depending primarily on the sizes of the tubes, spring contacts and vibrators used.



ANOTHER VIEW SHOWING THE SOUND TUBES

The effect of several bells ringing at a time is far superior to the playing of the tubes separately by an expert musician, and with a little practice, the use of the controlling device and the operation of the keys are easily mastered.

CANADIAN WIRELESS LAWS

Although the subject of the Canadian wireless laws has been discussed in these columns before, it is again forcibly brought to our attention by one of our readers who has been struggling to secure a satisfactory sending range with a wave-length of not over 50 metres. It must be said that the limitation of 50 metres for the sending outfits of amateurs makes it almost impossible to secure satisfactory results. In comparison, the American amateurs are indeed fortunate since the wireless laws of the United States allow them any wave-length not exceeding 200 metres.

Mr. Marquis V. Bryant, 6 South Highland avenue, Nyack, N. Y., is desirous of communicating with persons within a distance of 40 miles from Nyack, with the object in view of establishing regular radio communication. His set is highly efficient and in excellent working order. He is "listening in" practically every night. His call is 2AF.

ELECTROLYTIC PREVENTION OF BOILER CORROSION

By Harry N. Holmes
Professor of Chemistry, Earlham College.

BOILER pitting with waters containing chlorides, magnesium chloride in particular, is an important engineering problem. Hot water reacts with the chloride of magnesium to form magnesium hydroxide and hydrochloric acid which readily attack the boiler metal—all the faster because of the high temperature.

One of the recent methods of preventing this effect is the use of a counter electric current opposing the solvent attack. Careful tests in a considerable number of boilers in Australia have shown that this method is very effective. A bar of wrought iron is suspended in the boiler to act as anode and the metal of the boiler is made the cathode. A current of electricity of from 1 to 2 amperes and 4 to 8 volts is passed between these poles. Zinc or aluminum could be used instead of the iron anode, but with no better results. In fact, with excess current some metal from the anode passes into solution and deposits on the boiler. Naturally, this should be iron, although that is a side issue.

It is best to use a current slightly in excess of the amount calculated, but a large excess merely dissolves a considerable amount of the anode bar and increases the formation of boiler scale. Careful experimenting shows that the proper current can be calculated from a knowledge of the solvent effect of the boiler water on the iron. To quote one experiment, since the electro-chemical equivalent of iron is .00029 gram per second per ampere, in other words, 1.044 grams of iron is carried by a current of one ampere per hour, it was only necessary to measure the loss in a given time to know how much current would prevent this loss. A cylinder of iron was immersed in water (same as that used in the boiler), for 72 hours and a loss in weight of .3 gram noted.

Dividing this .3 grams by 1.044 gives .288 amperes required to deposit or prevent the solution of .3 grams in one hour (depending on the direction of the current), and this is equivalent to .004 amperes for 72 hours. Such calculations were made for many installations and the results were confirmed by actual work later. In each case a slightly larger current was used and corrosion was always greatly lessened. In making such calculations a piece of metal of nearly the same sort as the boiler should be used and the same water taken. Objection has been made to this method to the effect that since electrolytic action is set up between one portion of an iron tube in a state of strain and another portion not strained, the strained portion dissolving, it would seem that local action would continue in any event. However, results show that these local actions are inhibited by a sufficient external current.

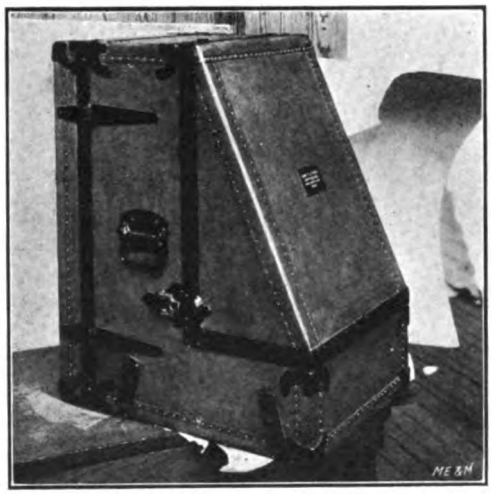
UNITED STATES ARMY CAMP SWITCH BOARDS

By Walter C. Freeman

TELEPHONY is gradually superseding the telegraph wherever conditions permit in the handling of a modern army. As in commercial practice, many decided improvements have been made by the engineers of the United States Signal Corps, both in methods and equipment. One of the most interesting refinements in apparatus which have been recently made is the development of the camp switchboard.

The camp switchboard, as the name implies, is designed for use at the larger camps of a semi-permanent nature to afford a means of communication between the quarters of the various officers

and also with commercial systems when available. This type of portable switchboard packs complete, as shown, in a strong trunk weighing about two hundred pounds, which can be handled in the same manner as ordinary luggage. To insure against possible injury from rough handling all of the apparatus is assembled and supported upon a structural iron framework which nests closely within the trunk. The trunk proper is constructed from heavy waterproof fibre board and is provided with a removable front cover and hinged back. A number of small compartments are arranged inside of the cover to accommodate auxiliary parts and repair apparatus, such as drop coils, extra fuses, etc. A complete set of tools necessary to make any adjustments while in the field is also contained in this space. The legs of the switchboard are designed much the same as the familiar camera tripod, and are arranged to knock down and pack in the hinged back.

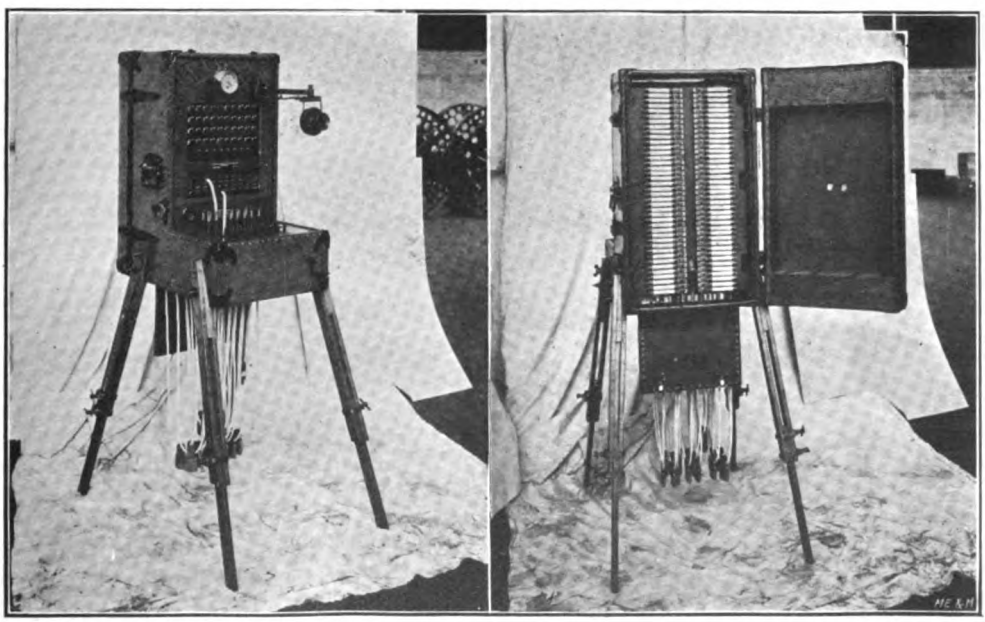


AN ARMY CAMP SWITCHBOARD COMPLETELY CLOSED, READY FOR TRANSPORTATION

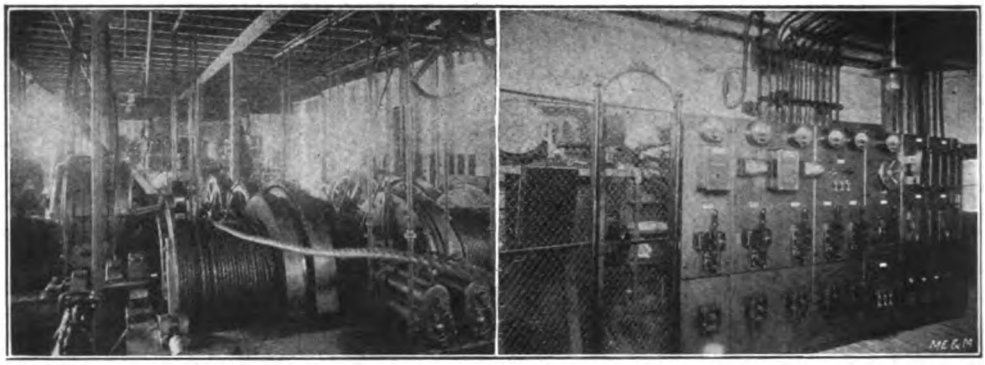
The switchboard is wired and equipped complete with forty magneto line equipments of the manually restoring drop type. These line equipments are terminated in the rear of the board on a hinged arrester plate. The protection includes tubular porcelain fuses and carbon block arresters. Line wire connections are made upon Fahnestock binding posts to facilitate rapid setting up. Both the line and supervisory signals are provided with night alarm contacts and wiring with controlling key and night alarm bell.

Eight pairs of connecting cords are installed, each being equipped with the usual complement of cords, plugs, cord

(*Continued on page 636*)



FRONT AND REAR VIEWS OF AN ARMY CAMP SWITCHBOARD, ILLUSTRATING THE COMPACTNESS OF THIS EQUIPMENT

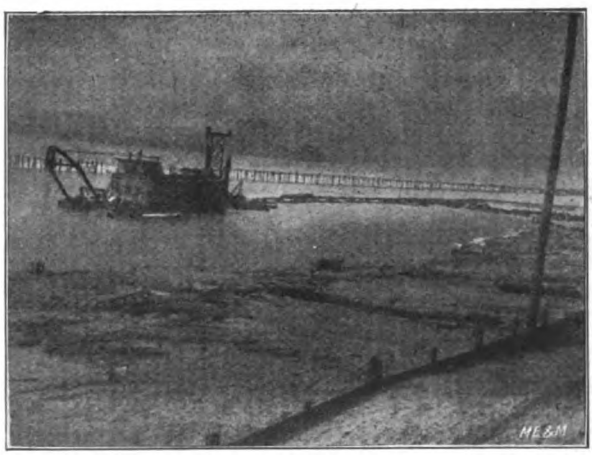


One of the Electrically-Driven Cable Drums. Switchboard and Controlling Devices.
VIEWS ON BOARD THE ELECTRIC HYDRAULIC DREDGE

THE ELECTRIC HYDRAULIC DREDGE

An Interesting Application of Electricity in Connection with Flood Protection and Drainage Work

IN connection with the flood protection and drainage work of the East Side Levee and Sanitary District of Illinois, the engineers are filling a part of the Mississippi River bed, elevating 150 acres 25 feet. A new shore line is being established a considerable distance from the old harbor line. In order to accomplish this fill, two rows of piling were driven into the river bed, at the new shore line. The piles nearest to the shore were driven first, after which a heavy mattress weighed with stones was laid on the river bed, attached to the piling. The second or outer row of piling was driven through the mattress. The piling serves as a backbone for a rock dyke, which is being built, and back of which the river bed is being filled. The mattress on the river bed being flexible will quickly adjust itself to any depression which may occur, and sinking down under the weight of the rocks, will act as a filler. The river will not get a chance to work its way under the toe of the levee.



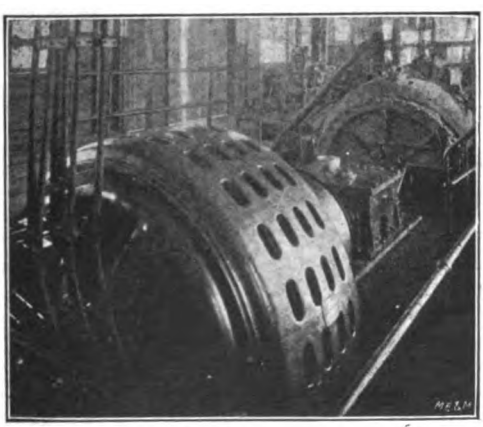
THE ELECTRIC HYDRAULIC DREDGE AT WORK ON THE MISSISSIPPI RIVER

This fill is being accomplished by means of an electrically operated hydraulic dredge, equipped with a 20-foot centrifugal pump, driven by a 1,000-h.p. motor. The machinery equipment consists of a 20-inch manganese-steel pump, with interchangeable runners of 54, 58 and 60-inch diameter, direct-connected to the motor. The motor is a 2,200-volt, 25-cycle, 356-r. p. m. type, capable of operating continuously at 25 per cent. overload. It is of the slip-ring type with drum controller and external starting resistance. In addition to this, the motor is furnished with external rotor resistors and suitable switches, so that 15 per cent. continuous speed reduction may be obtained if desired.

A steel ladder at the bow of the dredge

supports the suction-pipe, cutter-head, driving shaft and gearing. The ladder is 80 feet long, and is pivoted on two hollow pivots. Through the one on the right passes the suction-pipe, and through the one on the opposite side the cutter-shaft is driven by a countershaft geared to a 75-h.p. slip-ring induction motor.

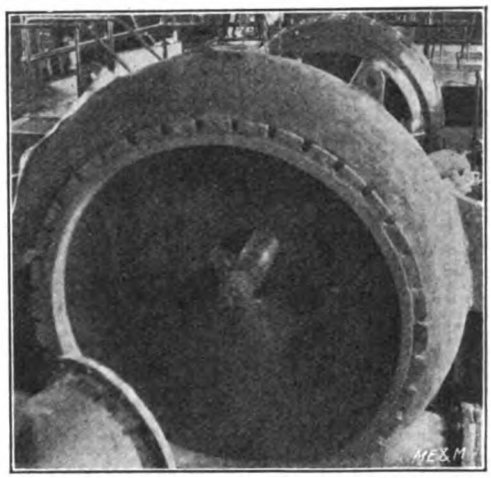
The pump is located at the center of the hull transversely to its length. The discharge pipe passes back on the left side of the stern, connecting with the pipe line. The pipe line is supported on steel pontoons. The pipe line is composed of 20-inch pipe, in 50-foot lengths on the pontoons and 16-foot lengths on the shore. Connections between the pontoon pipe sections are made by means of heavy rubber sleeves fitting over the ends of the pipe. This form of connection was made necessary by the movement of the water. The shore lengths are adjusted by simply telescoping, no sleeve being required. The pump sucks water containing about 25 per cent. solids, from the river bed, and discharges the mixture through the pipe to various points inland. The water finds its way back to the river through a flume, and the solid matter remains. When the fill is completed the gravel, dirt and sand released from the river would fill 171,-



VIEW OF THE MOTOR-DRIVEN PUMP

000 railroad cars, making a train about 1,300 miles long. The water which will have passed through the discharge pipe conducting the solid matter would equal about 12¼ billion gallons, or a volume equal to the Mississippi River at flood stage for three miles or at low stage for 17 miles.

The electrical energy used in this work is purchased from the East St. Louis and Suburban Railway. The service is measured at the power house, the construction company bearing the loss of transmission line and transformers. The



A CLOSER VIEW OF THE DREDGING PUMP

power supplied by the East St. Louis and Suburban Railway is obtained from the Keokuk Dam Power Plant. The Mississippi River, we may say, by its own energy is replacing the land which it washed away in years past, is protecting the territory which it has so often devastated, and is making its own channel more suitable for navigation.

In a housed barge which is moored to the shore are three enormous electric transformers. The electrical energy used on the dredge is transmitted to it from the barge through a steel-armored submarine cable 600 feet long. On the deck of the barge is a 10-foot cable reel. The end of the cable is taken into the transformer house on the barge through the hollow axle of the reel and is connected to a 13,200-volt automatic oil switch.

This switch is mounted on a single panel switchboard which carries an ammeter and a voltmeter. The line end of the cable terminates in a weatherproof pot-head which is clamped to a transmission line pole. Between this and the line are three choke coils which, together with the lightning arrester, constitute an effective protection against lightning.

The attachment of the cable and choke coils to the transmission line is arranged with clamps, so that they may be quickly and easily removed from the line when it is desired to change the location of the dredge and pontoon line. From the low-tension side of the transformers the current is led through three 2,200-volt disconnecting switches, at the lower end of which is connected a 2,200-volt, three-conductor sub-marine cable similar to the 13,200-volt cable. This cable is in one 1,200-length and is laid along the discharge pipe on the pontoon line. The excess cable is carried on a reel of 10-foot diameter, mounted on the stern of the dredge. The cable terminates in three copper rings built inside the deckhouse of the dredge, on the end of the hollow axle through which the cable leads.

Three brushes take the current from

THE LAND END OF THE TRANSMISSION LINE, SHOWING THE TRANSFORMERS

the rings, thus allowing the cable to be shortened or lengthened at will without interfering with the operation of the dredge. A five-panel switchboard is built near the back end of the deckhouse and controls all the energy used on the dredge. All motors are equipped with time-limit or instantaneous-overload protective devices, and in addition to this the main motor is equipped with a low-voltage release. An air-storage tank is installed of such capacity that in case the electrical energy should suddenly fail for any cause, there would be sufficient air to allow the setting of brakes and dogs on the swinging and hoisting equipment in order to secure all lines.

The dredge has been in operation twenty-four hours a day and seven days a week since August 10, 1912, it not being necessary to shut down during the winter owing to the extremely mild weather in the Mississippi Valley. At the end of March, 1913, after having pumped over a million yards of material, it was decided to discontinue the use of a cutter and try a straight-suction device, as the material pumped was fairly clean sand which runs freely. The cutter, cutter-shaft, and cutter-head bearing were removed from the ladder, and a 45 degree elbow and suction pipe were substituted. This enabled the dredge to dig to a considerably greater depth than was possible when equipped with the cutter. The lower end of the suction pipe was belled out and bars were placed across the opening to prevent large pieces of wood or stone from entering. With the new device the cost of maintenance has been reduced considerably, the hours of running time have been increased, and the yardage per hour has been increased.

Compared with steam dredging, the electrically operated dredge is said to have the advantages of lower first cost, requiring less space and consequently a smaller dredge. With the turbid water of the Mississippi River, steam dredges must shut down at least once a week to clean boilers. Troubles of transferring coal to the dredge due to low water or ice conditions are eliminated by using electricity for power.

EDGEWOOD HIGH SCHOOL WIRELESS CLUB

The Edgewood High School Wireless Club, of Edgewood Park, Pa., has been organized, with headquarters at the school. The purpose of the club is the advancement of wireless telegraphy among the amateurs of that district and the increasing of the number of enthusiasts.

The officers of the club at present are as follows Charles Milligan, president; Harold Knapp, secretary, and Herman Swoboda, treasurer.

The club call is EHS and the members will be pleased to hear from other stations in that district.

THE NEW CABLE TELEGRAPHY

An Account of What is Being Done by Cable Experts in an Effort to Keep Pace with Wireless Engineers

By Donald McNicol.

Illustrations from drawings made by the author.

NOT long since a noted scientist, who is thoroughly informed in regard to the development and the present state of the various existing methods of telegraphy, stated that had the Morse telegraph and submarine telegraphy been invented subsequent to the discovery of wireless telegraphy, the former would have been hailed as a tremendous advance in the art of electric communication.

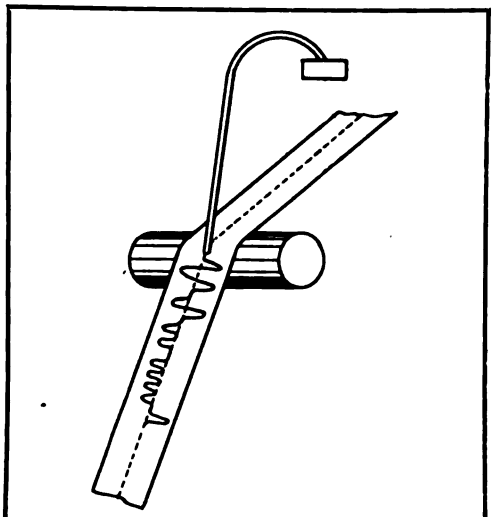


FIG. I.—PRINCIPLE OF THE SYPHON RECORDER

In the popular mind the reverse is considered to be the true situation; and, so far as the statement quoted is concerned, it depends largely upon the point of view as to which invention is regarded as of the greater utility.

Those who have extensive knowledge of traffic conditions generally concede that Hertz wave signaling arrived none too soon to take care of a class of telegraph traffic and of service that could not possibly have been handled by means of conducting wires. And, all are agreed that the development of wireless signaling was the result of a genius unsurpassed in the annals of electrical achievement.

Millions of dollars have been invested in submarine cables and it is natural to suppose that the spur of self-preservation has stirred the professionally energetic cable expert to renewed activity in devising ways and means of improving cable telegraphy, to the end that should "wireless" ultimately supplant the continuous conductor, the surrender will be made only after the latter method of signaling has been developed to its highest state of perfection.

The purpose of this article is to call attention to improvements along certain lines that have been made within recent years in submarine telegraphy.

When Cyrus W. Field was in the midst of the technical difficulties which developed when plans for laying the first Atlantic cable were being made, he appealed to the great physicist, Michael Faraday, to undertake the task of determining, by laboratory means, the feasibility of operating the long cable at speeds sufficiently rapid to be commercial.

Faraday's report was to the effect that he did not think the cable as proposed would carry the unit impulse across the ocean fast enough. Mr. Field then asked him how fast it would carry the signal. Faraday replied that it would take about one second to get the signal through the entire length of the cable. With a feeling of great

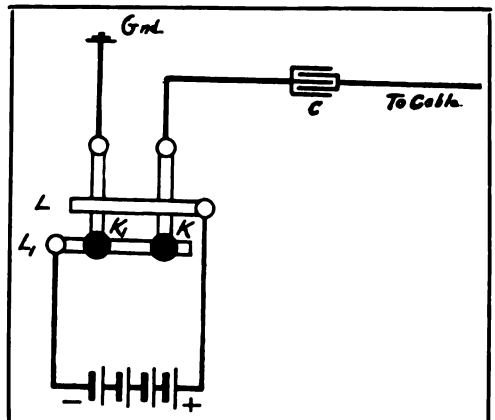


FIG. 2.—THE DOUBLE KEY ARRANGEMENT FOR TRANSMITTING

relief Mr. Field proceeded with his great undertaking, stating, "that's fast enough for me."

Now let us see what this signaling speed meant in words per minute. Assuming that it was understood that a new impulse could be started on its way each second; then, knowing that the average letter (Continental Morse code) contains 3.15 elements, and the average English word (five letters) 15.76 elements, by means of simple multiplication we learn that the first Atlantic cable was laid with the understanding that the speed of transmission would be a little less than four words per minute.

It was quite well known, even at that early date (1857) that the characteristic of "capacity" of the cable was the

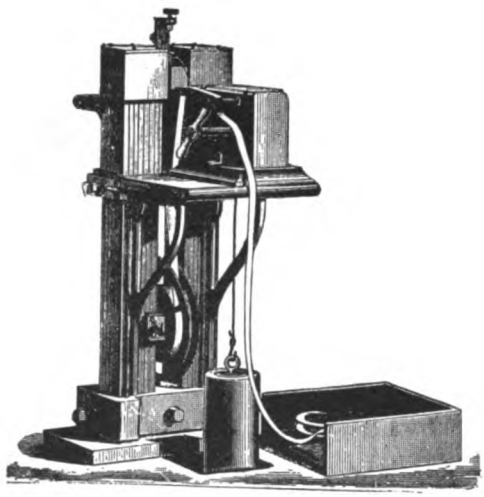


FIG. 3.—A FORM OF SYPHON RECORDER EXTENSIVELY EMPLOYED

factor that limited the speed at which individual impulses could be transmitted through the comparatively long submarine conductor.

There are at present sixteen cables in operation between America and Europe, of which twelve terminate in Great Britain. Of the latter, four belong to the Anglo-American Telegraph Company, one to the Direct United States Cable Company, two to the Western Union Telegraph Company, and five to the Commercial Cable Company. All of these cables are worked duplex, by means of which system one transmission in each direction may be made simultaneously.

The energy employed to operate a cable does not exceed a two-hundredth part of a horsepower. Thirty to 60 volts pressure at each end is sufficient to maintain the required current strength.

As pointed out above, the effect of capacity is to curtail the number of impulses that may be transmitted through the cable in a given time. This limitation of speed, however, applies only where the current strength in the conductor is required to vary from maximum to zero between successive impulses. It is obvious that inasmuch as it requires a definite period of time to charge a particular cable to maximum, a period practically of the same duration is required to discharge the cable to zero potential.

Fortunately, within a short time after the early cables were laid, a system of operation was invented which made it possible to operate a line by means of very slight variations of current volume.

A cable extending between Canso, Nova Scotia and Waterville, Ireland, has a length of 2,346 knots, a resistance of approximately 7,000 ohms, and a total capacity of 875 microfarads. The Direct United States cable between Ballinskelligs Bay, Ireland, and Torbay, Nova Scotia, has a length of 2,420 knots, a resistance of 7,300 ohms, a capacity of 991 microfarads, and an insulation resistance of 8,470 megohms per knot—a total insulation resistance of 3½ megohms. Ordinarily, cables worked duplex have their artificial lines adjusted only twice each year—in the spring and fall—in order to compensate for temperature changes.

An early formula for determining the speed of a given cable, that is, the time required for a signal to become recognizable through the entire line is:

With Morse apparatus: $t = \frac{414}{109} KR$ seconds,

With mirror galvanometer: $t = \frac{47}{109} KR$ seconds,

where K represents the capacity of the cable in microfarads, and R the resistance in ohms.

The formulae mean that the speed

depends upon the inertia of the receiving instrument employed and upon the retardation of the cable—in any given case the mirror galvanometer is practically nine times as rapid as Morse apparatus.

The obvious objections to the use of the mirror galvanometer were overcome by the invention in the year 1867 of the "siphon recorder" by William Thompson (later, Lord Kelvin) of Glasgow University.

The siphon recorder is an instrument which, when connected into the cable circuit, makes an ink record of the received impulses on a moving band of paper. The siphon consists of a glass tube almost as fine as a human hair and bent into the shape of a siphon. It is suspended by means of a fine bronze strand; one end of the tube dipping into a small receptacle containing a pure aniline ink, while the low end of the tube moves to and fro across the width of the moving tape, in response to the movements of the receiver magnet coil to which the siphon is attached. Due to capillary attraction of the liquid, the ink flows through the siphon, marking the tape as indicated in Fig. 1.

In the Thompson siphon recorder and in the later receiving instrument, the Cuttriss recorder, the siphon does not actually touch the paper tape, as such contact would cause friction which would seriously interfere with free movement of the siphon. In the case of each instrument an electrical method is employed to cause the ink to "spurt" out of the end of the siphon, resulting in the deposit of a series of dots on the tape, resembling closely a continuous line.

As indicated in Fig. 1, the movements of the siphon to the left represent dots, while the movements to the right represent dashes. The signals comprising the word "think" appearing on the specimen tape, are, for the purpose of clearness, shown more even and regular than they would appear on the recorder tape at the end of a long cable.

In cable operation, while the alphabet is in reality composed of dots and dashes (Continental Morse code), the marks transmitted representing dots and dashes are of the same length.

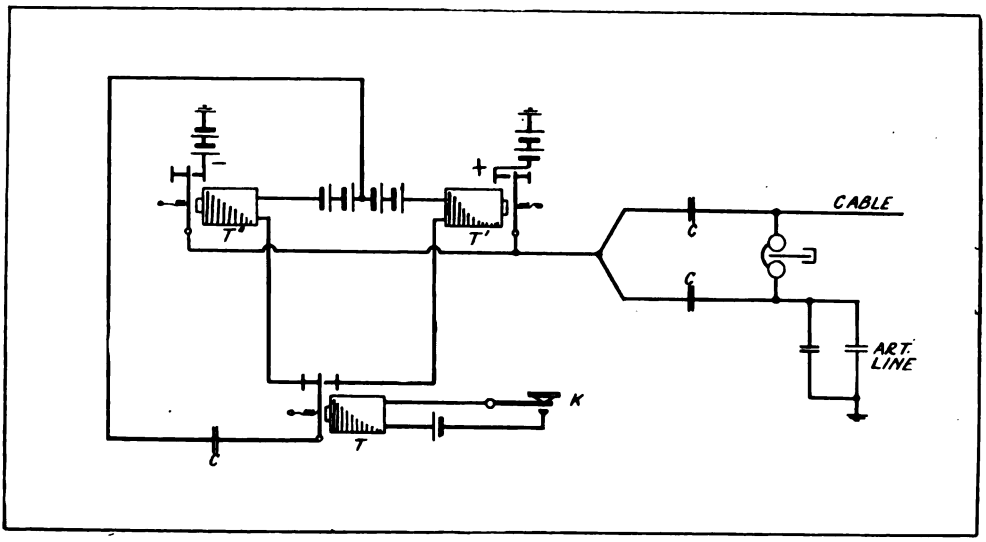


FIG. 4.—THEORETICAL WIRING DIAGRAM OF A PICARD TRANSMITTER CIRCUIT

Fig. 2, in simple lines, shows the double-key transmitting arrangement employed. When key K is depressed it makes contact with lever L, thereby "grounding" the negative terminal of the main battery, and as the key K remains in contact with lever L, a positive current is sent to line. When, on the other hand, key K is depressed while key K_1 remains in contact with lever L, a negative impulse is sent to line, and the positive terminal of the battery is grounded. In other words, depressing the right hand key, when

used to transmit "dashes" results in the inking siphon at the distant end of the cable marking the moving tape on one side of the center line, while depressing the left hand key results in the marks representing "dots" appearing on the opposite side of the center line of the tape.

Fig. 3 shows a view of the actual appearance of one type of siphon recorder.

Before undertaking to describe the new cable transmitter and receiver circuit arrangements, it may be well to explain briefly what is meant by the statement "the marks transmitted, representing dashes and dots are of the same length."

By referring to Fig. 2, it may be observed that a condenser C is inserted in series with the line. The presence of this condenser in the cable circuit provides that when the key K only is depressed the condenser is charged negatively — the condenser immediately charging the cable conductor. On the other hand, when the key K_1 only is depressed the condenser is charged positively, immediately reversing the charge in the cable.

It is evident that the conditions of current in the cable conductor are different from those which would obtain in the circuit were the condenser not so inserted. In the latter case, holding down the key K would result in a uniform current strength being maintained in the circuit as long as the key remained down. Depressing the other key would result in a uniform current of the opposite sign being maintained in the circuit as long as that key remained closed. The presence of the condenser, therefore, permits a current of but short duration to flow, regardless of the length of time the key is held closed.

In cable signaling, then, the key is held closed the same length of time in making a dash as in making a dot. At the receiving end these momentary impulses of either polarity result, simply, in kicking the siphon to the right or the left of the neutral line of the paper tape, and the recorder signals appear thereon as indicated in Fig. 1.

During the past forty years many attempts have been made to utilize the siphon recorder as a relay for the purpose of operating locally a reading sounder and to repeat signals automatically into other cable circuits, or into land lines.

Owing to the extreme feebleness of the received currents and to their lack of positive definition, it has been found impracticable to use the recorder to attain these highly desirable ends.

Within the past few years several developments have taken place which have made it possible to operate submarine cables in a manner quite similar to land line Morse operation. Various inventions, which, collectively, have brought about this improvement, are: The Brown drum cable relay, the Huertley and the Orling cable relays, and the Picard and the Gott transmission systems.

Fig. 4 illustrates theoretically the Picard transmitter circuits. Owing to the presence of the condenser C, when the transmitting key K is depressed, the armature lever of transmitter T is "kicked" to the left, momentarily making connection with its closed contact, resulting in a plus impulse being sent into the cable. When key k is released, or opened (and herein lies the chief merit of the arrangement) the armature lever of transmitter T"—due to the reversal of charge in condenser C—is "kicked" into momentary contact with its front stop to which the minus pole of the main line battery is connected. This, it will be observed, sends to line a negative impulse.

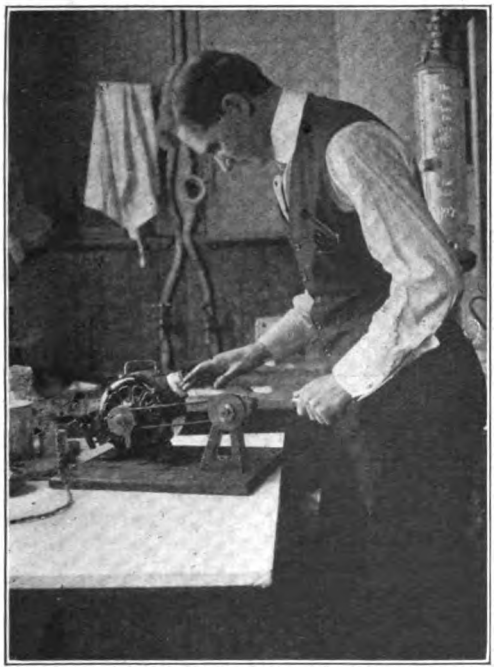
It is evident that as the transmitting key remains depressed, the cable will possess a charge of definite sign for a considerable length of time, due to the fact that the sending end of the cable is insulated from the earth and from battery during the interval between the depression of key K and its release. When the key is raised after the transmission of, say, a "dash," the consequent movement of transmitter tongue T" injects a negative impulse into the cable, thereby "canceling out" the previous charge. Each signaling impulse, therefore, finds the cable conductor in a symmetrically neutral condition electrically; a condition conducing materially to the formation of clearly defined characters at the distant end of the line.

(To be continued in June issue)

HOUSEHOLD MOTOR OF MANY DUTIES

One of the most useful as well as most interesting devices a person can have in a home is a small electric motor operated by current supplied from the electric light circuit. If the man of the house is handy with tools, he can, with but little trouble, rig up many ways in which a small motor can be put to actual work.

The illustration shows a one-tenth horsepower motor running a home-made grinding and polishing lathe with which the owner is grinding a knife. The motor is held to the wooden base of the lathe by cleats which are easily released. The lathe is connected up by means of a piece of sewing machine belting. The lathe support, or upright, is a piece of scrap brass which has been drilled and filed for use. The cost of the lathe was



SHARPENING CUTLERY AND POLISHING METALWARE ARE TWO OF THE TASKS EFFICIENTLY PERFORMED BY A SMALL MOTOR

$1.20; over half of that sum being expended for the grinding and polishing wheels.

Besides this, the motor has several other duties. It is light and easily handled, and can be changed as needed from one device to another, viz., vacuum cleaner, sewing machine, washing machine, ventilating fan, and mangle. The cost of the motor was less than $15. The owner has obtained from it many times that value in actual work performed. The cost for current is but two cents an hour.—*J. C. Munn.*

HOW TO USE AN ELECTRIC FLAT-IRON AS A TOASTER STOVE

The illustration shows how easy it is to utilize an electric iron as a toaster stove and have it operate in a perfectly

MANY TASTY THINGS—IN FACT A WHOLE MEAL—CAN BE PREPARED ON AN ELECTRIC FLAT-IRON AS SHOWN IN THE ILLUSTRATION

satisfactory manner. The only requirement is a small metal stand to hold the iron in an inverted position, that is, with the ironing surface up.

On this iron many dainty things can be prepared to eat. By the use of toothpicks, marshmallows can be deliciously toasted without burning or having them drop off, which often happens when they are held to an open fire.

An appetizing lunch for one or two can be prepared in this way. Make first some tea or cocoa; then, while this is cooling, warm some soup and toast a few slices of bread, and finally fry or scramble an egg or two, and the lunch is ready. If desired a few slices of bacon can be fried.

The stand can be easily made from metal strips with rivets to hold them.—*J. C. Munn.*

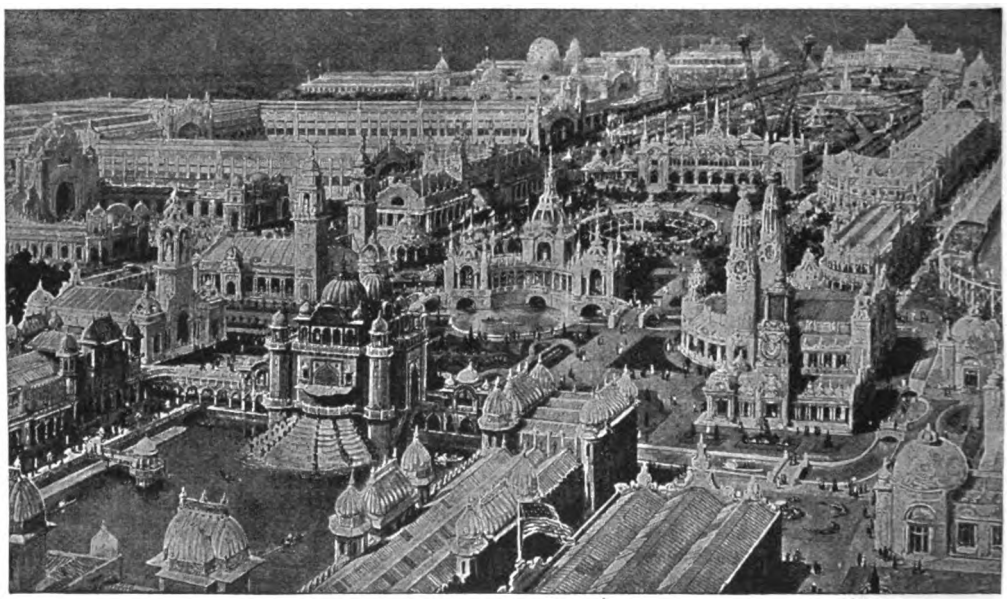
The June issue will be the best yet. Watch for it!

ANGLO-AMERICAN EXPOSITION

Held at London, to Celebrate One Hundred Years of Peace Between England and the United States

By Ellsworth Haskins

THE object of the Anglo-American Exposition, that will be held at Shepherd's Bush, London, from May to October, 1914, is to celebrate in a most fitting manner the one hundred years of peace, progress and prosperity between English-speaking peoples.



AVIATOR'S VIEW OF EXPOSITION GROUNDS

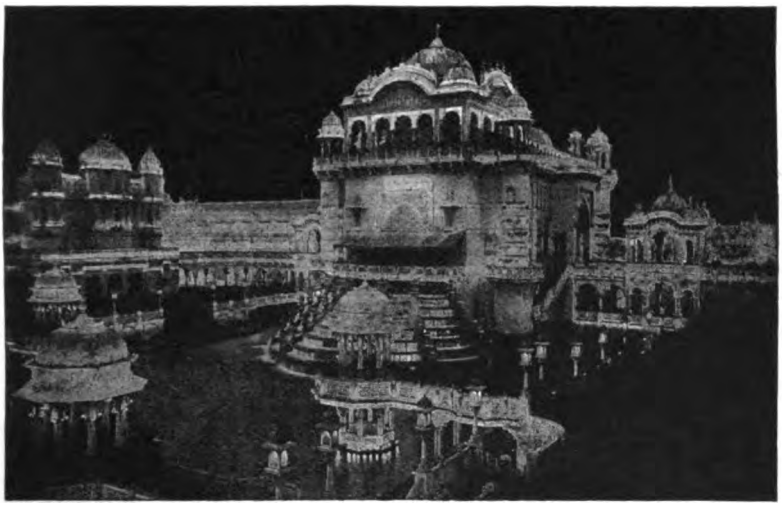
One of the purposes of this exposition will be to demonstrate in a practical manner the progress which has been made by the British and American peoples in every branch of civilization during these one hundred years. The progress of various industries will be shown in chronological order—from inception to perfection—not only demonstrating how each nation has worked on its own inventions, but also where both have worked hand in hand to perfect the creation of the other.

A most interesting feature of the exposition will be the displaying of such objects of historical interest as are associated with famous statesmen, authors, artists, inventors, philanthropists, financiers, merchants, manufacturers and others, of the one hundred years of peace. This past century of progress in education, science, literature, inventions, improvements in social life and betterment of the conditions of working men and women, will be celebrated by appropriate exhibits.

The imposing exposition palaces are of the highest possible decorative design and will contain one million square feet of floor space. They are entirely fireproof; being constructed of steel and concrete throughout. The grounds will be beautifully laid out with artistic gardens, lakes, and lagoons. These buildings at the present time are already sufficiently finished for the reception and installation of American and British exhibits.

The Fine Art Palace, which has been pronounced the largest and best equipped building of its kind in Europe, contains

thirty galleries for paintings in addition to the superb central Sculpture Hall covering 30,000 square feet, that will be devoted to a collection of American and British exhibits.



COURT OF HONOR BY NIGHT

The Congress Hall, situated in the centre of the Exposition Grounds, will be devoted to Congresses and Conferences on subjects of interest to America and the British Empire.

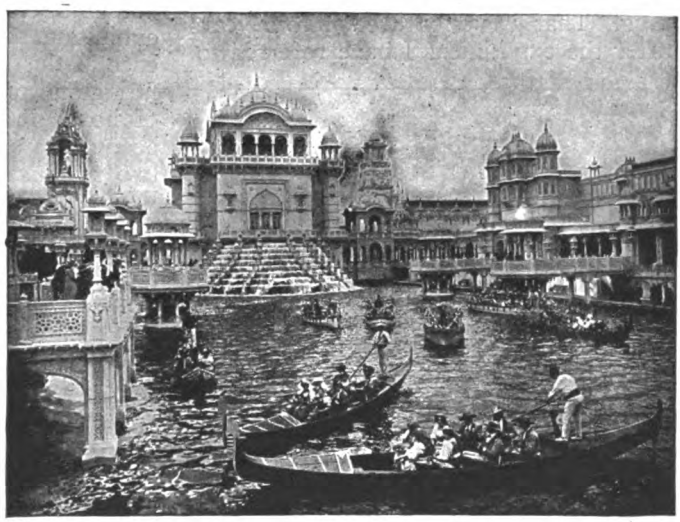
The Exposition Grounds at Shepherd's Bush, are within 15 minutes of the centre of London's main thoroughfare. They are readily reached by several railroads which are capable of conveying to the spot over 80,000 persons per hour, or nearly a million visitors a day.

The Great Stadium—the largest in the world—having a seating capacity for 100,000 people, will form a part of the exposition. It will possess a running and cycle track, as well as a splendid swimming tank of over 100 metres in length. It is intended to organize international sports, historical pageants, spectacular productions and fireworks, that may be viewed by the vast audience.

Amusements of the most varied nature will be provided. The dignity of the exposition will be maintained by keeping the amusements in a separate part of the grounds. The many amusement devices will represent the latest of their kind.

In regard to the electrical features of the Anglo-American Exposition, it is interesting to note the speech of Mr. W. M. Mordey, M. I. C. E., on the subject of arranging for the British electrical exhibits:

"It is a very fitting thing, I think, that the electrical engineers of America and this country should join together in showing one another, and in showing the world, what they have been doing in developing the branch of engineering which has not only progressed but has had its whole birth and life within the one hundred years, the century which this exhibition is intended to cover.



CONGRESS HALL

"We owe much to America. We have

to go back further than one hundred years to find when our debt began. It began in connection with roast turkey, and I am sure you will agree it is appropriate I should mention that fact in this historic building, for it was in 1748 that that marvelous man Benjamin Franklin actually killed a turkey by an

HALL OF SPORTS AND PHYSICAL CULTURE

electric spark, roasted it by an electric jack over a fire that was lighted by an electric spark. That was the first contribution of American electrical science to the industry that was to become so great.

"You will remember that Franklin's next contribution was to prove the identity of the electric spark and of lightning. That was only three or four years after the experiment I have referred to.

FOOD STUFFS BUILDING

"Then there was a long pause, and we come to one hundred years ago exactly. It was in 1813 that Davy—we then began to make our contributions—it was in 1813 that Davy erected on Burlington House the first arc lamp. Then there was another gap, and another man came forward, and it is a rather curious and very significant thing that the two great early contributors to this science and industry of ours, that one was a printer's apprentice, Benjamin Franklin, and the other a bookbinder's apprentice, Michael Faraday. It was in 1831 that Faraday practically laid the foundation of the whole of the modern science of electrical engineering, and you may see in the Royal Institution to-day the little disc of copper that he rotated on a magnet and obtained a current from. Then America and Germany helped, and I am of opinion that England and America did more than their share, perhaps, in developing the science of electrical engineering; and I may mention one other fact to show what the growth has been. It was, I think, in 1858 that Holmes lighted the South Foreland lighthouse by electricity. Faraday said, when he saw that little five or ten horsepower machine, 'It was my baby, but you have made a man of it.' I wonder what Faraday would say now to the latest British machine of 40,000 to 50,000 horsepower in one city of America to-day filling one small part of the demand for the city of Chicago—the direct work of Faraday, helped on and made possible by the work of another great Englishman, Charles Parsons.

"That brings us to the subject that we are going to try to show in this joint exhibition of electrical industry and science at the White City next year. It is fitting and proper, I think, that the place of honor in the exhibition should have been given to electrical engineering. The two sections—the British and American Electrical Engineering Sections—will join, they will meet in the great Central Hall and be separated only by the pavilion where we British engineers will hope we will have the pleasure of meeting many of our comrades from the other side."

Railroads caused nearly half the forest fires in Colorado and Wyoming last year, and almost one-sixth were set by lightning. In California lightning started more than half, with railroads a comparatively insignificant cause.

There are approximately four million acres of timber land in New Hampshire of which about half is in farmers' woodlots.

NOVEL ANTENNAE FOR RADIO RECEPTION

Numerous are the Substitutes that May be Employed for Receiving Wireless Messages.

IN the Jahrbuch der Drahtlosen Telegraphie, Vol. 7, p. 75, there appears an exceedingly interesting article by E. Leimer upon some experiments which he performed with various devices used as receiving antennae for radio-telegraphic waves. Such devices as he mentions, and gives quantitative results for, may often be of considerable value in emergency cases. Some of his experiments gave the following results:

(1) In the immediate vicinity of a very powerful station, for example in Paris, one need only stretch out horizontally the connecting cords of a 2,000 or 4,00 ohm pair of receivers and stand thus near an open window or upon a balcony, to hear the signals of the Eiffel tower.

This arrangement is certainly the height of simplicity, and naturally the signals heard by its means are very weak, but it is mentioned on account of its remarkableness. To insure a better reception one can use a small antenna consisting of one or more wires bent into a square with sides measuring 1½ feet, which is set into the frame of an open window; or else form a somewhat larger square and stretch it out within the room.

(2) For a range of about 50 miles a metal rod of any kind (such as a leader pipe or a fire escape ladder) may, in dry weather, be successfully used. Again, the use of a gas pipe as antenna and water pipe as ground, both in the interior of the house, may serve the purpose; it seems, to the author, to make little difference if these pipes later touch each other, as, for example, in the cellar.

(3) For a range of about 150 miles, and perhaps further, it is quite unnecessary to run antenna wires outside the house. The author states that he has secured perfect reception with two wires 60 feet long stretched out beneath the roof* of a house; these wires being, furthermore, about 4 inches from the roof shingles. He noticed, also, that reception of signals during a rainstorm became at first much better and then, as the roof grew thoroughly wet, somewhat weak—although at all times were signals intelligible. It is not necessary that the roof be a very high one; the roof of a shed 20 feet in height, surrounded on all sides by three story houses, was used, and did not give very much poorer results. The same holds for an antenna of two wires 60 to 90 feet long stretched out only 3 feet over the surface of the ground, even in a back yard. The squares of metallic wires used as clothes driers on the roofs of houses also gave a weak reception of signals.

A lightning rod secured to a 60 foot chimney was tried after being separated from its ground connection. When smoke was issuing from the chimney, the signals became perceptibly stronger—the smoke evidently acting as a prolongation of the lightning rod antenna.

(4) For a safe range of 650 miles, and, with proper atmospheric conditions, of 1,000 miles, a specially built antenna is necessary. But for the reception of a powerful station at a distance of 650 miles one can dispense with this, by the use of some of the following:

If one runs a 300 foot wire at a distance of about 3 feet from a free-lying system of power wires and parallel to it, then the former will act as an antenna; the signals being considerably strengthened by waves received on the power wires and re-radiated to the antenna. This strengthening is indisputable, since, if the antenna is removed to a distance of 30 feet from the power system, a perceptible weakening of signals is noted. If the power wires are charged, especially with an alternating current, then the induction effects of the latter become very disagreeable in

* The author refers to a wooden, shingle roof. Very poor results are obtained with indoor antennae under grounded metallic roofs.

the radio receiver. The roaring sound produced by this induction may be considerably reduced if a variable condenser is connected between the antenna wire and receiving set, and is then varied until a minimum roaring noise is obtained. It is always practicable to use a free-lying bell or telephone system of wires as an antenna. In order not to disturb the regular use of the lines, and also to aid in the reception of wireless signals, one or two variable condensers of small capacity are placed in series with the receiving set and the line. It is quite easy to obtain settings on these which will ensure a minimum of exterior noises and at the same time a maximum of intensity in the received signals.

If the length of the (double) line is over 600 feet, the author finds that it makes no difference whether it is longer, or is laid as a sub-surface cable from thence on, or is connected at one or both ends to telephones, or is grounded, or runs over the city roofs, or in open country—always provided that it is connected to the receiving set through a variable inductance so that it may be tuned—it acts equally well. With a 750 foot line one can hear, in any kind of weather, without difficulty, all stations working at a wave length of at least 2,000 meters, up to a range of 600 miles; and this may be stretched at night to a range of 1,000 miles.

It would appear that some of these devices may prove of distinct value under certain circumstances. The telephone line could even be used as a radiating antenna, by the substitution of a sending for a receiving set. *J. W.*

WIRELESS AND THE BLIZZARD

Perhaps no greater opportunity could have been afforded for wireless telegraphy to prove its worth than the recent blizzards that played havoc with the telegraph lines in the States of Pennsylvania, New Jersey and New York.

During the heighth of one of the blizzards, the Lackawanna Railroad was able to secure accurate information as to the position of various stalled trains as well as issue train orders by means of wireless stations. Emergency radio stations were immediately installed between Hoboken and Buffalo and placed in service to accommodate traffic. With practically all the telegraph and telephone wires down, the wireless stations offered the only means of communication between various points. Numerous messages were sent back and forth with the result that telegraph traffic was not so seriously affected in consequence. Not only did the Lackawanna Railroad benefit by the wireless stations, but the Erie and Central Railroad of New Jersey were also able to secure information from the isolated sections of their systems, through the courtesy of the Lackawanna Railroad.

GEORGE WESTINGHOUSE

With the death of George Westinghouse, the electrical and mechanical industries have lost perhaps the best known and most successful inventor and manufacturer of modern times. In fact, the name of Westinghouse is known by practically everyone—man, woman and child.

George Westinghouse died on March 12th, in New York City. He was 68 years of age and at the time of his death was either President or Director in 22 corporations affiliated with the great business he founded.

This genius was born at Central Bridge, N. Y., October 6th, 1846. He spent most of his boyhood days around a workshop when out of school. His greatest invention in after life was that of the compressed air brake now universally used on the railways of the entire world. Aside from this, Westinghouse has almost innumerable mechanical as well as electrical inventions to his credit. There are said to be between 35 and 40 Westinghouse companies in both Europe and America at the present time, employing about 50,000 persons and involving a total capital of $200,000,000.

During the recent cold weather in New York City in the latter part of February, the electric light signs in the theatre district were considerably dimmed every night. Upon closer investigation it was found that hundreds of birds sought shelter and warmth from the excessive cold by gathering around the electric light bulbs on the signs. It is said that sparrows and pigeons constituted the larger number of these birds.

SMALL ALTERNATING CURRENT MOTORS

Complete Working Instructions for the Building of Small Alternating Current Motors in Several Sizes*

By A. E. Watson, E. E.

Illustrations from drawings made by the author.

Of prime importance in the mechanical construction is the quality and fit of the bearings. Especially must certain precautions be taken with those of the self-oiling or oil-ring type such as is almost universal with electrical machinery. Aside from the stipulation of proper metal for the bearing linings, these latter must not be either too loose or too tight on the shaft. The small clearance between stator and rotor demands a fairly snug fit, while the principle of effective oiling requires that the shaft be smaller than the hole in the lining, since otherwise there will be no room for the layer or film of oil. In the case of a machine of this size these two factors can be fairly well balanced against each other if there is a difference not exceeding 1/200 inch in the diameters. A second condition is that the lubricating oil should be of the thin "mineral" sort, not lard oil, and that there should be proper channeling in the bearing linings to permit a considerable and reliable flow. The loose ring that hangs upon the shaft and dips into the oil in the reservoir slowly revolves, and laden with oil, delivers it to the shaft; it then flows lengthwise the shaft to the collecting grooves in the housings and finds its way by the obliquely drilled holes back to the reservoir. If the shoulders on the shaft have been properly shaped, there will be no throwing of oil into the room, and the only cause for loss of oil will be the capillary attraction that will gradually spread the lubricant over the outer surfaces of the machine in the familiar manner. This can be regularly removed by wiping with a cloth or waste.

Fig. 17 shows the details of the bearings and allied parts. It is assumed that the holes in the cast bronze linings have been bored and reamed, and used for sizing the shaft. A true arbor, or piece of stock specially turned for the purpose, should be used when turning off the outside of the castings, as required to fit the 7/8 inch reamed holes in the end shields. Internal corners of the linings should be rounded with a hand tool, so as to permit no binding on the shaft when pressed against the shoulders. When perfectly made these linings will be exchangeable for each other, and also end for end. The eccentric slot in

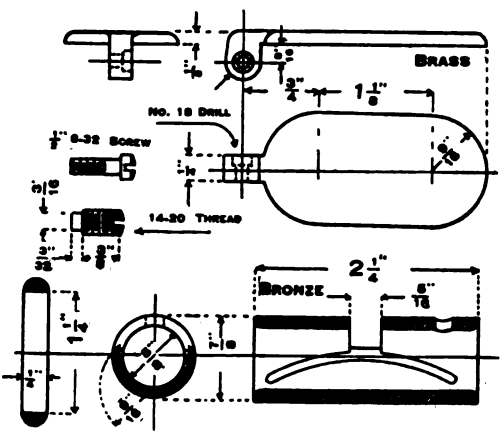


FIG 17.—DETAILS OF THE MOTOR BEARINGS

which the oil ring hangs can be cut by holding the lining offset from the center in an independent jawed chuck, or better, on an eccentric arbor and between lathe centers. A cutting-off tool can be used, but as this is rather apt to catch in the metal, the latter method is safer, for even if the tool does catch, the lining is then not likely to be injured. After removal from the arbor the sharp edge of this eccentric cut is to be removed to the extent of providing a small pocket on each side, and from the pockets the oil grooves start. These latter are not particularly easy to cut, but their importance is not to be minimized. The end

* This series began in the February issue. It is necessary to refer to the February, March and April issues for complete working details and drawings.—The Editor.

of a small round file can be ground to serve as a sort of "graver," and readily permit grooves at least 1/32 inch deep to be cut. Remove all sharp internal protruding edges; it being a good plan to force the arbor to its original position, thereby ensuring the full intended diameter.

The oiling rings can be made from brass tubing, but the requirement that they be exactly round rules out many such pieces of pipe as are found in a shop. If used, it should be bored out on the inside as well as turned on the outside. A casting is to be preferred. In use the rings are so flooded with oil as to make the driving force very small, and any inequalities in the contour of the circle will be apt to allow them to remain in some fixed position, and thereby defeat the whole scheme of the lubrication.

To determine the location of the set-screw holes in the linings, the machine is assembled so that the sheet iron of the two parts properly match, then an endwise movement of the shaft of 1/32 inch each way from this central position is allowed. A total endwise freedom of 1/16 inch will therefore result.

When this stage has been reached, the builder will feel that he has the end in sight. Certainly this should be the most interesting portion of the entire work.

Of first importance is the insulation of the winding from the iron, but with the slots well filed out and the sharp edges of the outer sheets covered with the fiber flanges, there is no reason for insufficiency in the remaining preparations. The "slot" insulation must be thin, moisture-proof, flexible, of high dielectric strength, and uninjured by moderate degrees of heat. Of course no one material possesses all these qualities in the desired degree, but the insulation most commonly used is cotton cloth treated with various oils or varnishes, and sold as "varnished cambric," or under such a trade name as "Empire Cloth." One thickness of such material will frequently withstand over 7,000 volts before being punctured. After some years of exposure to the air the cloth deteriorates and easily tears or pulverizes, but with this once in place on the motor, the builder need fear as little from breakdown as with any other insulation that can be mentioned.

Two layers of the varnished cambric should be used in the slots, and the pieces should not be much less in size than 3½" square. At first the builder may well cut enough for only two slots, —that is, for one coil,—then he will determine for himself just what dimensions will prove most acceptable. For preventing the edges from interfering with the placing of the wires he may prefer a rather long piece, but still 3½" wide, and temporarily fasten its ends in the slots adjoining those in which he is winding. At the corners of the slots the cloth may be nicked so as to permit it to lay onto the fiber without crimping.

For the 100 to 110 volt winding there should be about 38 wires per slot, but a few wires more or less will not noticeably affect the running of the motor. If the dimensions of the air gap are as described, and the service is at 110 volts, the builder can aim to get in 40 wires, but for the lower voltage, 36 will suffice. For other voltages the number of wires will be in direct proportion. To make sure the desired number of wires can be gotten into the insulated slot a test can be made by filling a slot with bits of the wire. A piece seven or eight feet long can be taken, given a coat of shellac, and when dry cut into 2" lengths. While the final winding is to be covered with shellac or other moisture-repelling varnish on the outside layers only, this present treatment is merely to keep the cotton covering from ravelling. No. 14 double cotton-covered magnet wire, should prove the right size for the Form 1 shape of slots. If a smaller size is used, the voltage will not be affected, but merely the ampere capacity, and the motor will have a correspondingly lower rating. Form 2 and Form 3 slots are evidently smaller, and No. 15 and No. 16 wire, respectively, will probably be required. About 9½ lbs. of the No. 14, 8½ lbs. of No. 15, or 7½ lbs. of No. 16 will be the required quantities to provide.

In preparation for the winding, convenience and accuracy will be gained by numbering the slots, or imagining

them to be numbered, in agreement with Figs. 18, 19, and 20. The starting coils are first to be put in place, and their appearance when completely wound, but not taped, is shown in Fig. 18. From the last wound coil, however, the metal retaining form has not been removed. To wind some one of these coils, say that to fill slots 1 and 6, the stator is turned nearly upon its

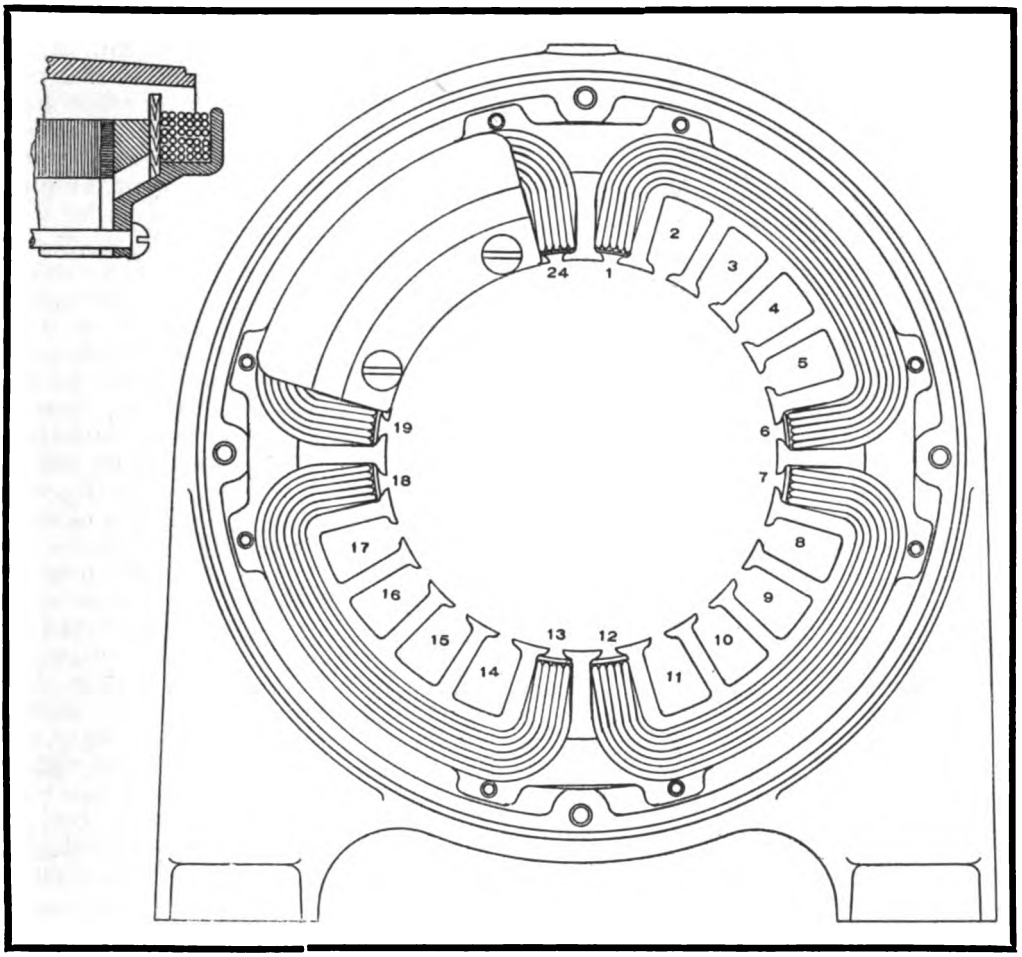


FIG. 18.—STATOR WINDING FOR SINGLE-PHASE MOTOR, SHOWING STARTING COILS IN POSITION, BUT NOT TAPED

back, with the sector-shaped blocks held by stove-bolts extending through slots 2 and 5. As a substitute for such blocks, or forms, straight sticks of wood may be used which quite fit the four slots intervening between 1 and 6. They can well be about 6" long, and protrude equally at both ends. Over these protruding ends place curved strips of sheet brass, lead, or even pasteboard, until the radius is increased by about one-eighth of an inch. This is merely to give clearance from the other coils to be wound later. Also, strips of thin wood should be laid upon the clamping ring and the fixed flange, so as to provide clearance from the iron work.

Leaving an end protruding five or six inches from slot 6, wind it and slot 1 full of wire, the appearance at each end of the machine being quite the same. Whether wound with clockwise or counter-clockwise direction of turns is immaterial. Leave out a similar length in slot 1, and to prevent the unwinding of the insulation, at once shellac it. All the sticks and spacings can now be removed, and the coil tightly bound together with cotton, not rubber, tape, the passing of the tape in

behind the coil for the overlapping turns being accomplished with the aid of a wire hook. The conductors are to be prevented from coming out of the slots by forcing in a narrow strip of fiber or wood.

To wind the second starting coil, occupying slots 7 and 12, the stator may be set on its feet and the coil wound exactly like the first, the beginning being left protruding from slot 12 and the end from slot 7. The beginning of the third coil is left extending out from slot 18 and its end from slot 13, while the fourth coil starts in slot 24 and ends in slot 19. After taping the four coils they may be given several coats of shellac, this serving both to keep the insulation clean and from absorbing moisture. The experienced winder will, however, take the precaution to ensure that the wire is dry before the shellac or other waterproof covering is applied, by "baking" the machine. In lieu of more convenient methods, this drying may be accomplished by leaving the motor in the kitchen oven over night when the fire is very low. The oven door should be left partly open. Since the alcohol in which the shellac is dissolved contains at least 5 per cent. of water, the act of applying shellac partly undoes this drying. For this reason other sorts of varnishes are usually preferred. Still, on a motor for so ordinary a voltage, the builder need not fear disaster from this convenient form of waterproofing.

If desired, these four starting coils can now be connected in the final manner, but the builder may as well wait until the other coils are placed, and then attend to this detail all at once.

The running coils are of the "concentric" type, that is, one is outside the other, giving the magnetic effect of two coils per pole per phase. In Fig. 19 an inner coil is shown as occupying slots 23 and 2, with the adjoining slots 22 and 3 ready for receiving the outer coil. The other three sets of coils are shown as completed but not taped. Outside the belt occupied by these running coils can be seen the contour of the starting coils with cross lines indicating the edges of the taping.

To compel the wires to follow the curved path and not infringe upon the clearance for the rotor, some sort of forms or guides will be required, and suggestions are given in the figure. A piece of 1/16" thick sheet brass about 1¼" square is to be bent to the curvature of the rotor space, and cut with a slot about ⅝" x 3/16", into which fits a narrow hooked casting, and the other end of this latter is held by a screw fitting into one of the regular bolt holes. The start can be made in slot 2 and the end in slot 23, the winding being somewhat at random, but as far as possible the wires should be placed orderly, else the desired number cannot be gotten into the slots; compactness is also desirable to prevent chafing and wearing of the insulation. It is to prevent this latter action that the taping is employed on the portions of the coils outside the slots. When slots 2 and 23 have been filled the wire is not to be cut, but new retaining forms provided, and the winding continued in the same direction until slots 3 and 22 are filled, the end being from 22. Before starting this outer portion, however, the coil just wound should be taped. Effective forms are shown in the sectional view and with the group of coils on the right hand side of Fig. 19. A longer piece of curved sheet iron or brass is to be held up against the portion already wound, and supported on a bent piece of metal that is held by the same screw as the inner form, but blocked off from the frame as shown. Strips of wood should be laid upon the inner coil to give at least one-eighth of an inch of space between the two portions. After these separators are removed space will be provided for threading in the tape and for permanently assisting the ventilation.

The three other pairs of coils are to be wound in the same manner. No. 2 will begin in slot 8 and temporarily terminate in slot 5, but as soon as the tape is applied and the forms adjusted, continued into slots 9 and 4, the end being in 4. No. 3 coil starts in slot 14 and terminates in slot 10, No. 4 in slots 20 and 16, respectively.

If the numbering has appeared illogical, the builder may revise it to accord with his own views, also to fit his own convenience of clockwise or counter-clockwise movement in plac-

ing the turns. The appearance depends upon whether the point of view be from outside the frame, from one end or the other of the machine or from the very center. The scheme is clearly shown in the diagrams, and with the principle readily appreciated, the builder will be likely to regard any actual numbering as superfluous.

With the coils wound, taped and varnished, sixteen ends will be left protruding which are to be connected in two circuits in a particular manner. The order of each circuit follows, however, the same rule as any multipolar direct current dynamo, so that if direct current is sent through it, magnetism of alternately north and south polarity will be produced. Indeed, one reliable test of correct connections can be made in this manner. As an aid in securing this result and for convenience in winding, it has been directed that all the coils be wound in a similar manner. Considering now the starting-coil circuit, the inside end of the first coil is to be connected to the inside end of the second coil; that is, the wire protruding from slot 24 is to be connected to the wire from slot 6. Next, the outside ends of second and third coils are to be joined; this will be done by joining the wires from slots 1 and 7. Then the inside ends of third and fourth coils are to be joined; namely by joining the wires from slots 12 and 18. Two outside ends will therefore be left,—one from slot 13 and one from slot 19; these are to be led to the connection board.

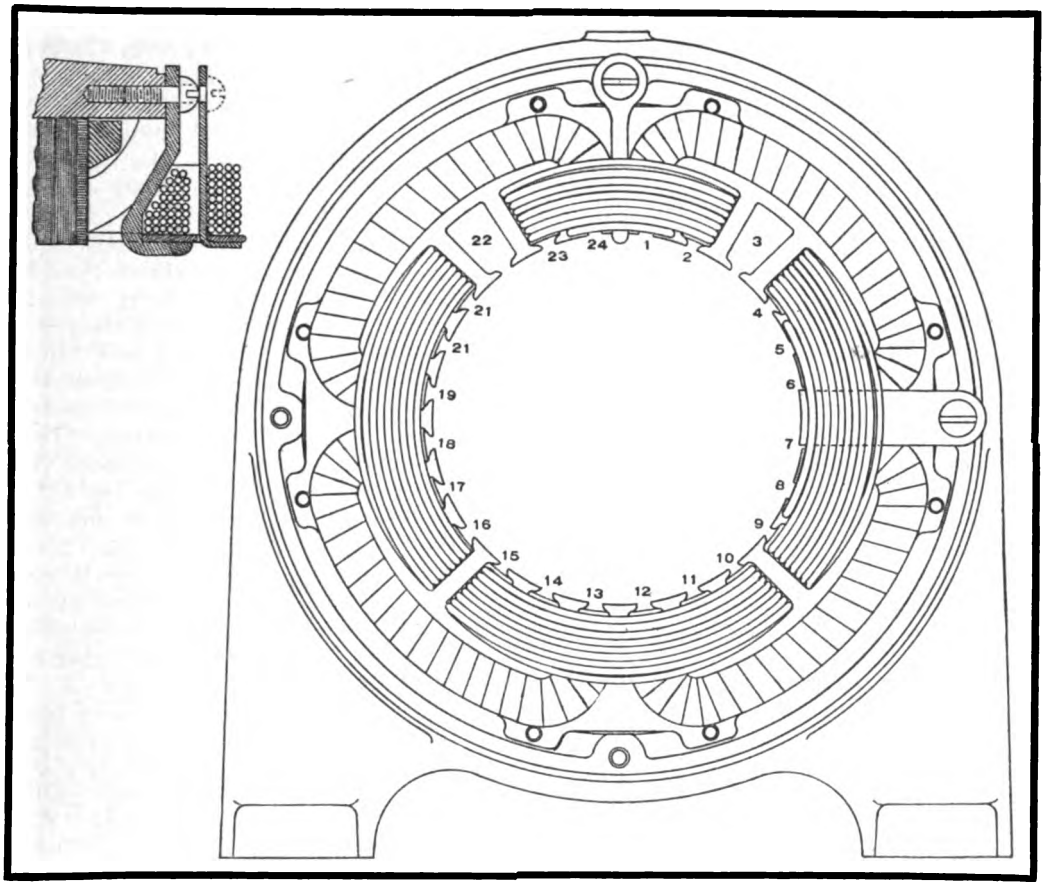


FIG. 19.—STATOR WINDING FOR SINGLE-PHASE MOTOR. STARTING COILS COMPLETED AND TAPED; RUNNING COILS NEARLY FINISHED

In similar manner the four double coils are to be joined in a circuit that is formed by joining first two inside ends of adjacent coils, then outside ends of the second and third; next, inside ends of third and fourth; finally

outside ends from first and fourth coils will be left free for leading to the connection board.

Before making these final connections, make sure that the polarity test proves the right order, and also that no connection exists between winding and frame or between the two sets of windings. When proved to be correct, the joints can be soldered, and if "flux" is used it must be neutralized with alcohol. Tape should then be applied, and the wires pressed back out of the way. The four ends must be specially insulated with rubber tape or pieces of small rubber tube and passed through the crevasse between the clamping ring and the frame out through one of the oblong holes in the outside of the frame. If the crevasse proves too narrow, four grooves may be filed in the edge of the interfering frame. The cautious builder will have examined this feature before winding, and if more space is required will have filed it when better access was provided than now.

The connection board is detailed in Fig. 7, and if not already made, is next in order. A piece of hard wood will answer, but if fiber or slate is at hand it is much to be preferred. Four ordinary binding posts are to be held by screws from the back, the four wires brought through additional holes beside the posts, wrapped around the grooved shanks and soldered. Not only does this procedure give simplicity and convenience, but also immunity from the nuisance of looseness. The two upper posts can well be assigned to the main, or running coils, but whatever the arrangement, the two circuits should be clearly marked.

Of course, the builder will be anxious to try the motor, and this he can do without waiting for the completion of the special starting devices that remain yet to be provided. To be on the safe side, some sort of a resistance for limiting the current should be included in the circuit. A motor-starting rheostat, an arc lamp resistance or choke-coil, an electric flatiron, toaster, stereopticon resistance, etc., are appropriate, but the builder can readily make up something for himself. A glass or wooden dish filled with water and containing two sheet iron plates for terminals suggests itself as about the quickest and most rugged arrangement; salt or carbonate of soda may be required to make the water sufficiently conducting.

A direct current test brings out a surprising result. With only a few batteries, of course, no external resistance will be required, but if the supply is taken from a direct current lighting circuit, it will be imperative, for while the main winding is supposed to be able to withstand the regular 110-volt alternating current, the impedance for direct currents is very small. Indeed, the ohmic resistance of this circuit will be only about 1.2 ohms, and No. 14 wire is good for about 7 or 8 amperes, but 110 direct volts would drive upwards of 90 amperes through it. If now the direct current be limited to a suitable amount, and an attempt is made to turn the rotor even slowly, no small effort will be required. The reason will be found in the great retarding currents generated in the short-circuited rods. Unless this effect is realized, the builder may conclude that the winding is defective. Yet with alternating currents this same rotor, so obstinate against movement with direct current excitation, must be willing and even anxious to rotate.

Now, with alternating current supply substituted, get the rotor turning as fast as can be by hand, then close the switch. If everything is right, the rotor will accelerate until nearly 1,800 revolutions per minute are reached. During this acceleration period the current will be abnormal, though limited by the rheostat, but when approaching the final speed, the current will be greatly reduced. Perhaps at first too much resistance will have been included to permit the expected start. but at each successive trial portions of the resistance may be removed, and finally altogether cut out. The precaution should be used always to give the rotor a start by hand before closing the switch.

After proving that the running coils operate in the desired manner, the starting coils should similarly be test-

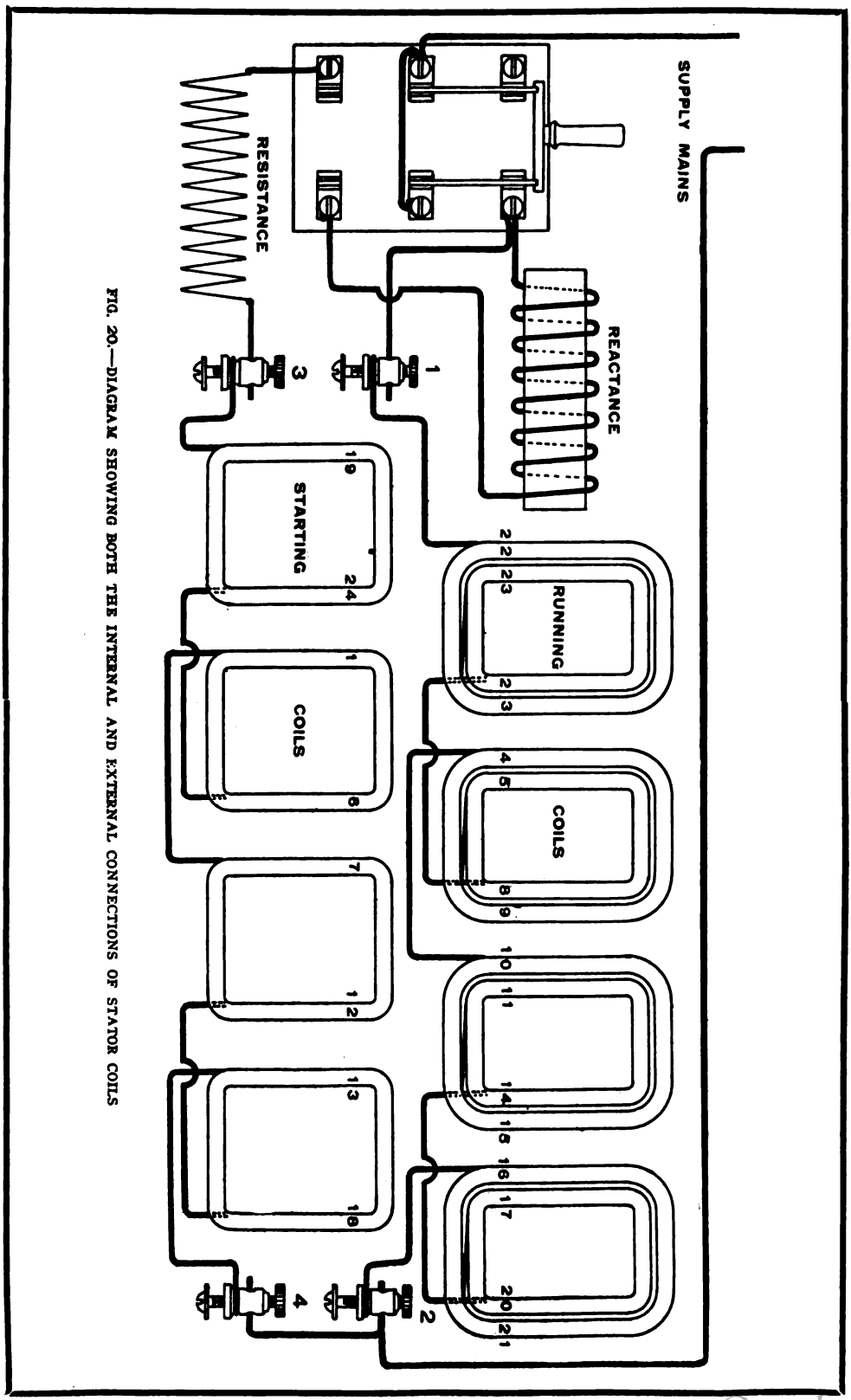


FIG. 20.—DIAGRAM SHOWING BOTH THE INTERNAL AND EXTERNAL CONNECTIONS OF STATOR COILS

ed, but in consequence of the fewer number of turns comprising this circuit, the external resistance should not entirely be cut out. Give the rotor a lively start by hand, in either direction, then close the switch. If the winding is correct, the rotor will accelerate in speed and reach about the same maximum as before, but in consequence of the lesser number of turns, the current required will be about twice as much as in the other case. These tests are merely to demonstrate whether each winding in itself is correct, and to suggest that when brought into the proper relations with the accessory apparatus will enable the motor to be self-starting. As stated in the first article, the machine is really a two-phase affair, adapted for a voltage in one phase twice as great as that in the other.

While the detailed explanation of the construction of starting resistance and reactance is reserved for the next article, the diagram given in Fig. 20 has been made complete, to show the relation of the internal windings to the external supply. It may be that the builder has on hand available devices without making the special ones to be described. These he can try, and perhaps permanently adopt. Taken in connection with Fig. 1 in the first article, the entire scheme of wiring will be fully comprehended.

IN RE. THE U. S. PATENT OFFICE

By George William Miatt

WHAT would you think of a guardian of a large and otherwise dependent family who half starved and hampered the only member thereof who not only supported himself, but also contributed largely to the maintenance of the other members of the family, and was also an important factor in the line of general stability, progression, and prosperity? As an economic proposition this would seem absurd, if not criminal. Yet this is a fair analogy of the way Uncle Sam is treating his Patent Department—the surplus to the credit of which approximates ten million dollars at the present time if we are to add to its $7,298,052 actual net cash surplus in the U. S. Treasury on January 1st, 1914, value of 50,000,000 copies of patents the printing of which was paid for out of the receipts of the Office, which is now selling them at the rate of about eight thousand per day at the price of five cents each.

A liberal provision by Congress to meet the ever-growing necessities of the Patent Office would not only be an equitable innovation, but would vastly increase the nation's income therefrom in a direct financial sense; while increase of facilities, by expediting and encouraging protection of inventions by Letters Patent, would add still more mightily to the wealth and prosperity of these United States.

Last year the total receipts of the Patent Office were $2,084,417.79 as against $1,947,383.28 disbursements, a net gain for the U. S. Treasury of $137,034.51. Nevertheless in certain divisions the work of the office is months behind on account of lack of facilities, human, humane, corporeal, incorporeal and otherwise; and unfortunately, though obviously, the classes in which there is the greatest activity in invention are those in which there is the greatest delay, and hence the greatest hardship to all concerned. Nearly thirty thousand applications for patents are awaiting official action at the present time.

Last year 70,367 applications for patents, including designs, were filed, of which number 35,788 eventuated into Letters Patent; 5,065 Trade-Marks were registered out of 7,369 applied for; and 21,867 patents expired by time limitation, the inventions involved becoming public property.

Of the 35,000 odd patents issued last year as above stated, 31,000 were to citizens of the United States—New York State leading with 5,312, or one

(*Continued on page 650*)

Experimental Department

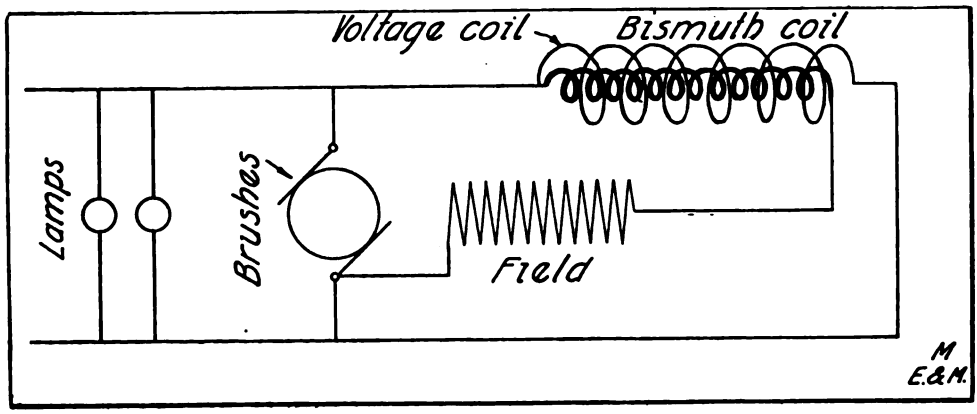
This department is maintained for the purpose of encouraging the experimenter to develop new ideas. Every reader is welcome to contribute to this department. Contributions should be written on one side of the paper only, using as many sheets as are necessary. Typewritten contributions employing double spacing are preferable. Good sketches are not necessary, as our art department can work up rough sketches that are clear enough to illustrate the idea. Sketches must be made on separate sheets from those containing the description. Return postage must be enclosed if return of unused manuscript is desired.

Three prizes of Five, Two and One-Half Dollars and One Dollar are awarded for the three best ideas published each month. Other contributions are paid for at space rates.

FIRST PRIZE

AN AUTOMATIC CURRENT REGULATOR FOR MOTOR CARS

I had a very simple though efficient type of shunt wound dynamo which I wished to install on my car to supply current for lighting purposes. The installation of the machine itself was a comparatively simple matter, for the drive was taken directly off the cooling fan pulley. I foresaw trouble, however, in the regulation of the output at varying speeds, but solved the problem of maintaining the output constant in the following manner:



The resistance of bismuth increases when it is placed in a magnetic field and the amount of increase varies directly as the strength of the field within certain limits. Equipped with this knowledge, I designed the regulator shown in the accompanying sketch. A coil of bismuth wire was placed in series with the field of the dynamo, this coil being also made the core of a voltage coil which was connected across the lamp circuit. Under these conditions the bismuth coil was subjected to the variations of voltage as indicated by changes in the field strength of the voltage coil, and its resistance fluctuated accordingly. When the voltage rose due to increased speed, the field strength increased and the resistance of the bismuth increased in proportion cutting down the strength of the field circuit and tending to keep the voltage normal. As a regulator, this arrangement worked to perfection.

The principal trouble encountered was the formation of the bismuth coil, since that metal is too brittle to be drawn into a filament. It was solved by embedding a long, loosely-coiled, steel spring, previously oiled, in plaster of Paris and, after the material had set, unscrewing the spring from the plaster. The bismuth, melted of course, was forced into this mold with the aid of a dentist's vacuum casting machine. When the plaster was carefully broken away, a perfect coil of the desired metal was left.

Contributed by

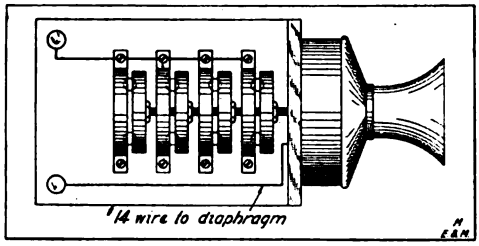
J. Naveman.

Electro magnets are being installed by treasure hunting ships for the recovery of submerged hulls.

SECOND PRIZE

HIGH AMPERAGE WIRELESS TELEPHONE TRANSMITTER

The accompanying drawings show an arrangement for building a wireless telephone transmitter capable of withstanding high amperage without heating.



No dimensions are given for the reason that transmitters differ in size. First secure a wooden base of suitable size. Then take a standard telephone transmitter and remove the back shell, carbon grains and carbon back. After this has been accomplished, mount the telephone on a wooden upright as indicated in the drawings. Next, fasten to the diaphragm a brass threaded rod upon which have been mounted four carbon backs measuring 1⅜ inches in diameter. These carbon backs may be purchased at most any electrical supply house or manufacturer of carbon materials. Arrange the carbon backs supporters, which are made of heavy brass or copper bent around some round shaped object of about the same size as the carbon backs, on a wooden base as shown. Battery bolts and nuts may be used for clamping the brass or copper rings around the carbon backs. Three of the carbon backs have large holes through their centers in order to accommodate the threaded brass rod which passes through them. Twenty-four ¼-inch carbon balls are placed between the carbon discs and backs.

Inasmuch as the drawings are practically self-explanatory, the minor constructional details are left to the builder.

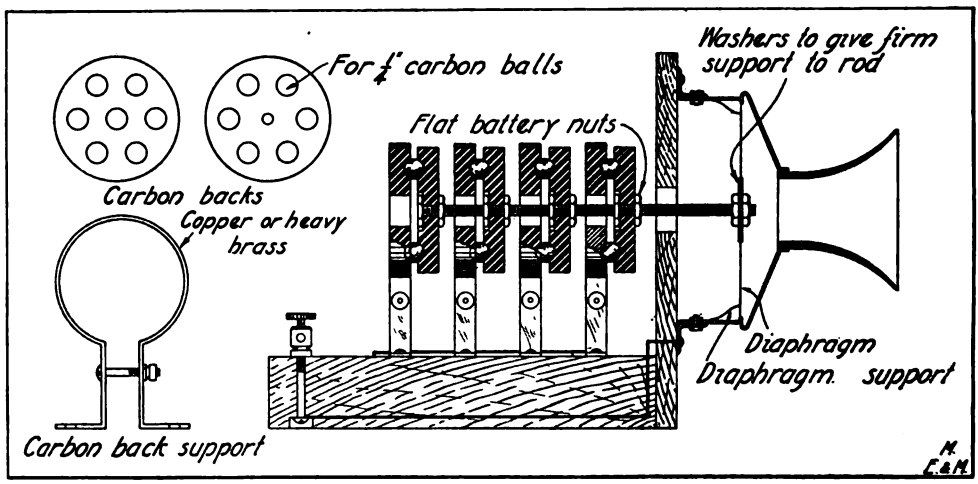
Contributed by

S. G. Ryder.

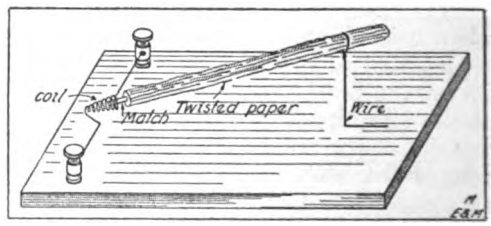
THIRD PRIZE

A HEATER OR STOVE LIGHTER

The accompanying diagram and description explain the making of a handy device to start a fire in a heater or kitchen stove from one's bed.



First, procure a board for the base measuring 4 by 6½ by ¾ inches. At about one inch from the end of this board place two binding posts about 1 inch apart. Next, take a piece of about



No. 28 or 30 iron or German silver wire and coil it into a cone shape so that a match head can stand in it. Fasten the ends of this coil to the two binding

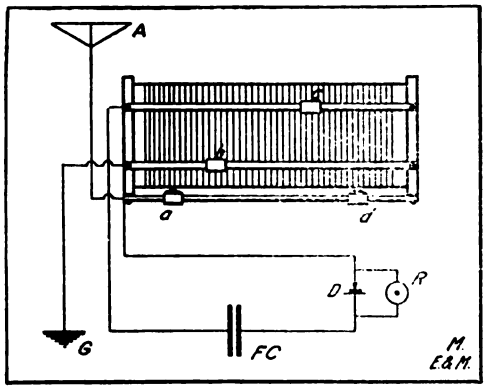
posts with the coil between the posts. At 1 inch from the other end of the board fasten one end of a piece of No. 14 wire about 7 inches long, so that it will stand upright. The other end of this wire should be made into a ring shape to hold the twisted paper. Three or four dry cells are connected to the binding posts in circuit with a push button over the bed. The current causes the wire to become red hot, which ignites the match head and the flame goes up the twisted paper through the draft hole and into the stove, thus igniting the kindling wood which must be prepared the night before. This device can be easily disconnected and moved out of the way during the day.

Contributed by

Hubert Ivey.

A NOVEL HOOK-UP

In the accompanying illustration is shown a novel hook-up for use with a three-slide tuner on which an additional slider has been placed, fixed condenser, crystal detector and receiver. The wiring diagram is self-explanatory. The rough tuning is done with the three sliders lettered A, B and C, after which



close tuning is effected by means of slider D.

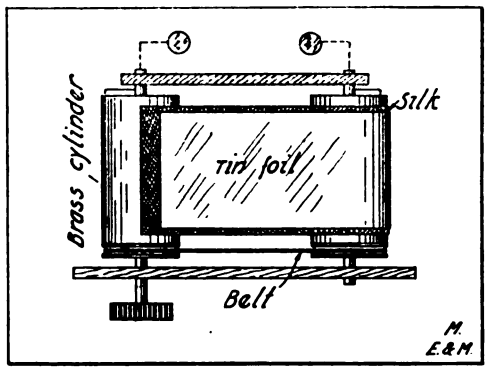
Contributed by

J. Hooton.

A ROTARY VARIABLE CONDENSER

The condenser shown in the accompanying illustration is much easier to construct than the intersecting plate type, although it likewise possesses the rotary action that is so much desired.

First procure a piece of curtain pole about an inch and a half in diameter. The kind referred to consists of a wooden cylinder covered with a thin sheet of brass. If this cannot be obtained, a piece of wood covered with tinfoil will answer nicely. This should be about seven inches long, although the dimensions may be changed to suit the requirements of the builder. Remove the brass on one end for about ½ inch and cut a shallow groove around the wood.



Now make a wooden cylinder the same size as the brass-covered one and cut a similar groove on one end. Drive a small rod in the ends of the rollers and mount them as in the drawing. Place a cord belt around the grooved ends so that when one is turned the other will also rotate.

Next, get a piece of light silk measuring six inches wide and about ten inches long. On this piece, paste a strip of tinfoil 5½ inches wide and long enough to reach once around the brass covered cylinder. Glue the ends of the silk to the cylinder in such a manner that when the knob is turned it will be rolled off one and wound on the other. Connect the brass cylinder to the rod on which it turns and the tinfoil to the other rod. Connections can be made to binding posts by means of brushes rubbing against the rods. The condenser may be enclosed in an attractively finished box and will present a very neat appearance. If the belt is covered with powdered resin no trouble will be experienced from slippage.

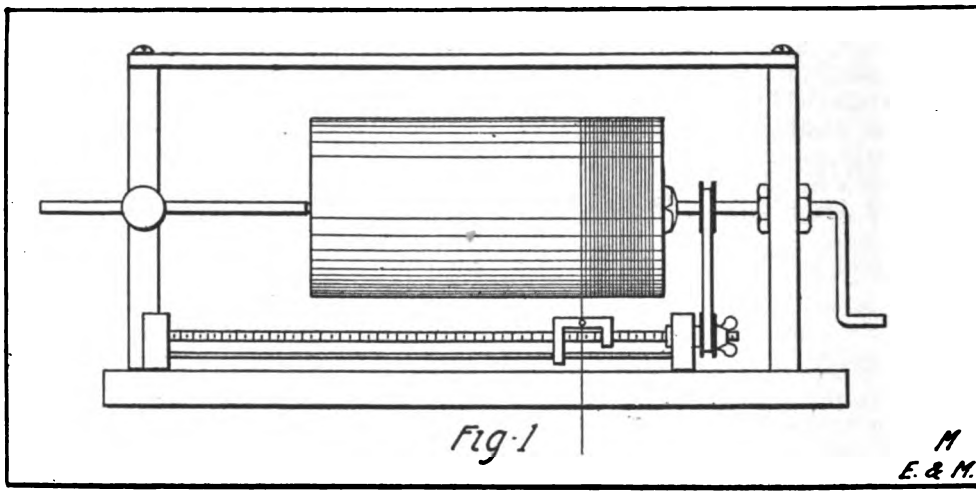
Contributed by

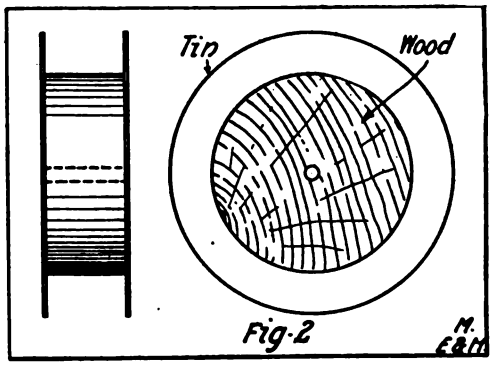
Lawrence Pentland.

Contributions to this department will receive prompt attention.

A USEFUL WINDING MACHINE

The winder illustrated herewith will accomplish the average winding that an amateur has to do. The principal part of the machine is the traveling wire guide. At the ends of the base there are two bearings through which passes a threaded rod. Directly under this another rod is placed to steady the wire guide. On each side of one of the bearings a nut and lock nut should be placed on the threaded rod to keep it from moving back and forth. At the same end a pulley, fig. 2, is held on the rod by a wing nut. The wire guide, an L-shaped piece of metal, travels on the threaded rod. There are four holes in the guide, one for the steadying rod, two threaded over for the driving rod and one for the wire to pass through. The handle, fig. 1, has a pulley and chuck attached. The chuck is simply a triangular piece of metal with bent corners that are sharpened so as to hold the drum head. By whittling the wooden wheel, fig. 2, the correct ratio may be obtained between the drum and the guide to suit different sized wires. The rest of the winder is simple enough to need no explanation. A heavy rubber band should be used as a belt. I have wound several loose-couplers and a tesla coil on my machine. I find that with a little experimenting I can wind the wire close or space it.





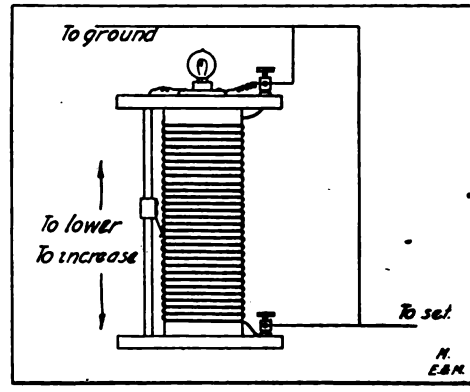
Contributed by

J. B. Worth.

A RADIATION INDICATOR

An efficient indicator for the radiation of a transmitter may be made as shown in the illustration from the following materials:

One fibre tube, 2 by 10 inches; 12 feet of No. 8 copper wire; 11 inches of ¼ by ¼ inch brass rod; a suitable slider, and a miniature lamp and socket.



Wind the wire upon the tube spacing the turns about ⅜ inch apart. Support the tube in a suitable frame and mount

the slider rod and lamp socket as shown in the illustration.

To tune a transmitting set, place the slider at the bottom of the coil and adjust the helix until the lamp glows. Raise the slider one turn at a time and adjust the helix again. Continue this procedure until the lamp glows with the least number of turns in the circuit.

Contributed by

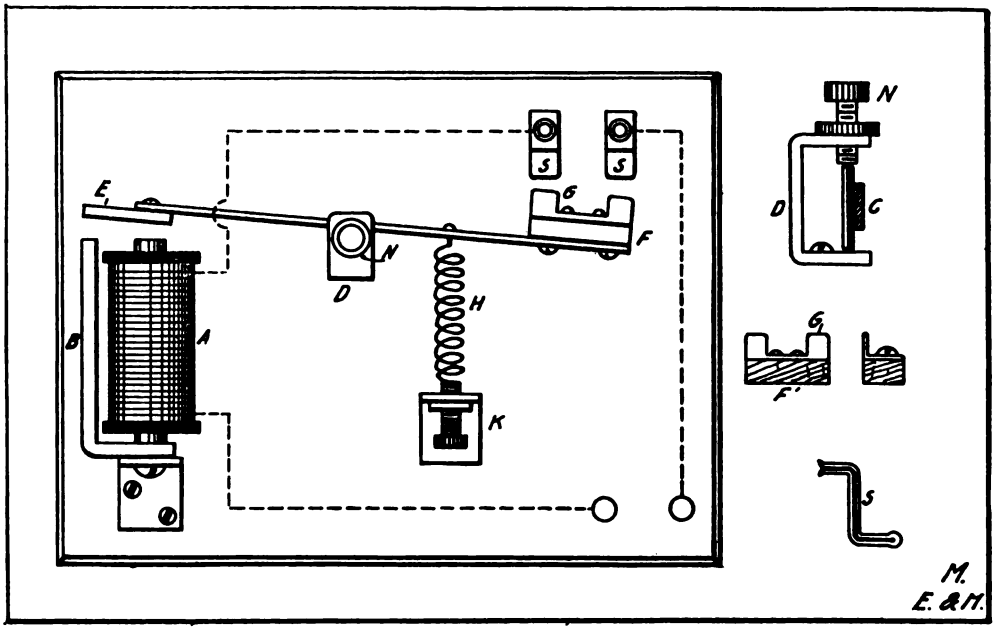
A. J. Macer.

AN AUTOMATIC CUT-OUT

When storage batteries are charged, some form of cut-out is necessary in the circuit to prevent the batteries from reversing and discharging back into the circuit or line, should the charging current be interrupted or fall below a given value. Especially is this true when batteries are charged from a generator driven by a gasoline engine, as in the case of a home lighting plant.

I have used a cut-out of the type shown in the accompanying drawing for about two years, and it has never failed or given any trouble. At times it has been used on currents as high as 90 volts and 3 amperes

On a fibre or porcelain base a coil A is mounted in the usual manner. To increase the strength by using both poles of the coil, a piece of soft iron B is bent and placed as shown; the short arm being clamped against the back pole of the coil. If desired, a pair of magnets may be used in place of the single coil. C is a bar of brass about ⅛ x ⅜ inch, which is pivoted at its center by means of a small nail sharpened smoothly to a point at each end and soldered perpendicularly to the length of the brass bar. It has bearings in two dents made in a U-shaped piece of brass D. It is better if the upper hole is omitted and a cone-shaped hole in the end of an adjusting screw, N, substituted. Bar C carries on one end a soft iron armature E and on the other end, fixed by screws, is a small piece of hard fibre F. Screwed to this is the contact blade G, cut and bent as shown from 0/32 inch copper. The ends of the contact blade should be sharpened and rounded off, so as to readily enter the clips S S. These clips are made of two strips of thin copper bent to a Z shape as shown. The blade should slide easily in and out of these clips without too much friction, and with no tendency to stick. Under normal conditions the contacts are free from the clips because of the pull exerted by the spiral spring H. Screw K furnishes a means of adjusting the tension of the spring so that the break will come when desired. The winding on the coil A is of enameled magnet wire, large enough to carry the full charging current because it is placed in



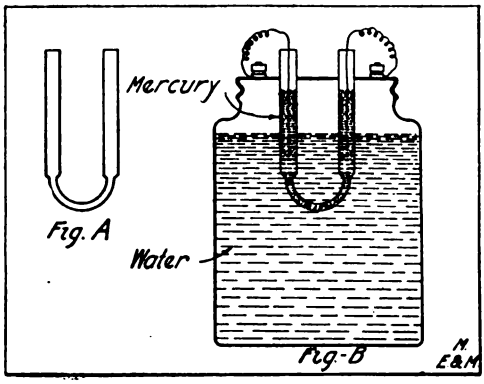
series with same. The connections are shown by the dotted lines. While placing this cut-out in series makes it necessary to reset it by hand, I consider it better in most cases than the parallel connection, as it gives a much quicker break and consequently there is not so much tendency to arc at the contacts. However, if it is desired to have the cut-out close itself when the current resumes its normal value, the coil should be wound with fine wire, of a size and length to keep the current down to about ⅛ to ¼ ampere, or 5 to 10 watts.

Contributed by

James P. Lewis.

A NOVEL INTERRUPTER FOR SPARK COILS

The following is a simple form of interrupter that will be found entirely satisfactory when used with a spark coil.



Procure a glass tube about 20 cm. in length and 4 to 6 mm. in internal diameter. Heat it in a flame until soft, and then draw out and bend as in fig. A.

One may experience some trouble in drawing the middle part of the tube sufficiently fine, for here the hole must be almost as small as that in a thermometer tube.

Next, procure a glass jar—a one-pint fruit jar will answer—and fit into the top a wooden or hard rubber cover. Bore two holes in the cover to pass through the ends of the glass tube and also mount two binding posts on top.

Cement the tube to the cover as in fig. B, and run wires from binding posts to the ends of tube.

To operate, fill the tube with mercury and the glass jar with water. Connect the interrupter in series with a key, 4 to 8 volt battery, and the primary of the spark coil.

The interruptions secured by means of this device are steady and of a high frequency.

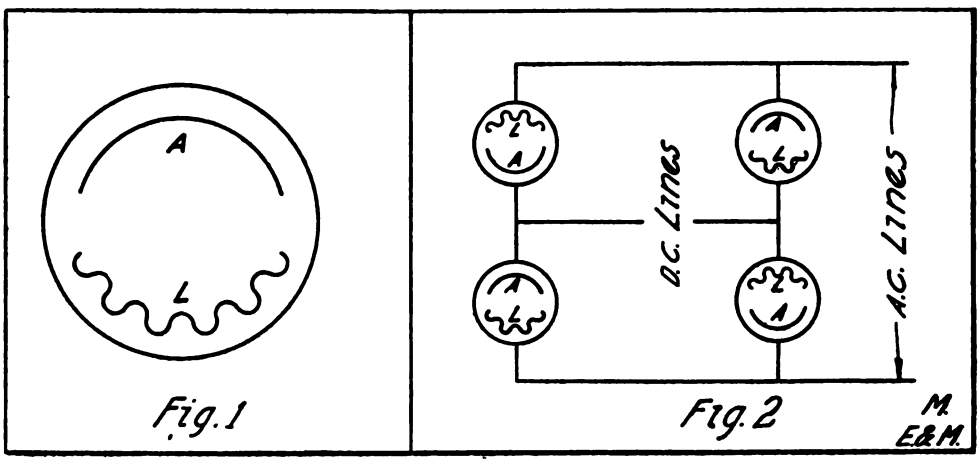
Contributed by

James L. Green.

A SIMPLE CURRENT RECTIFIER

A rectifier for changing alternating current into direct current may be readily made from the description that follows:

Procure four pieces of lead, each having about 24 square inches of surface, four pieces of aluminum, each having about 15 square inches of surface and four two-quart fruit jars. The lead plates, having more surface than the aluminum ones, should be corrugated as shown in Fig. 1, in which A represents the aluminum plate and L the lead plate. The rectifier cells should be connected



as shown in Fig. 2. Each jar is filled with a solution comprising:

Water ..... 2 quarts
Alum ..... 3 tablespoonfuls
Sodium Carbonate... 2 tablespoonfuls

Such a rectifier as is described above will furnish 4 to 5 amperes of direct current which is sufficient to charge storage batteries or to operate small motors.

Contributed by

Warren Clark.

A SIMPLE POLARITY INDICATOR

One of the simplest detectors for electrical polarity is blueprint paper. A white spot appears around the negative pole when the moistened paper is in contact with the wire, while the positive wire has no effect on it at all.

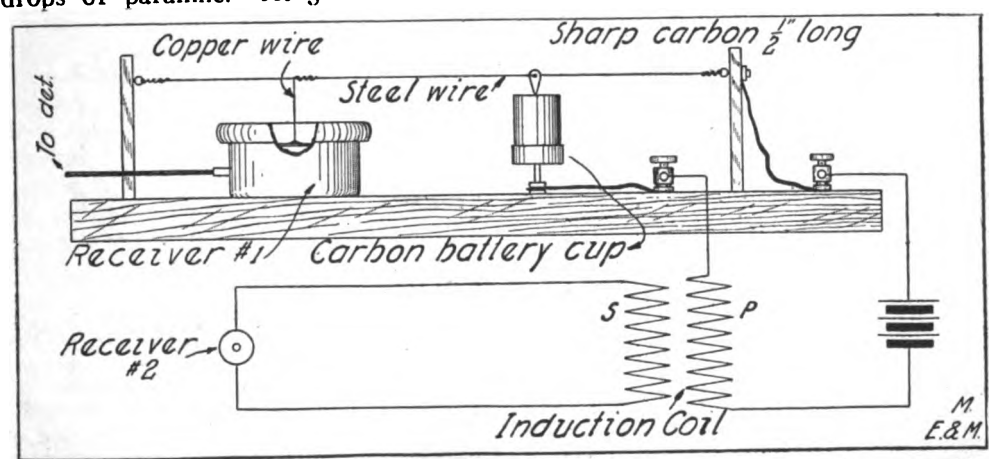
Contributed by

John Schmekeis.

HOW TO STRENGTHEN WEAK RADIO SIGNALS

This suggestion will undoubtedly prove of much interest and value to the somewhat handicapped wireless experimenter who has but two 75-ohm receivers with which to receive messages.

Procure one foot of No. 36 steel wire and stretch it between two uprights as shown in the accompanying illustration. At about 3 inches from one end of this wire attach a 3-inch piece of No. 14 copper wire which is fastened at its lower extremity to the diaphragm of one of the 75-ohm receivers by means of a few drops of paraffine. At 3 inches from the opposite end of the steel wire, fasten a sharpened carbon rod about ½ inch long, which is held to the wire by some suitable means. A battery carbon cup is set under the sharpened carbon rod.



The wiring can be readily followed from the drawing. The signals will be considerably augmented in volume and 75-ohm receivers used in this manner can be made to favorably compare with those of higher resistance.

Contributed by

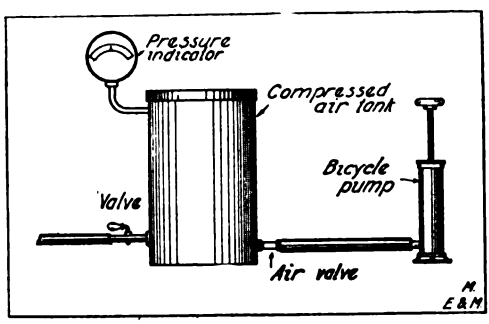
Creah Williams.

A COMPRESSED AIR TANK

An efficient and easily made compressed air tank can be constructed from the following materials:

First procure an old boiler such as is used for heating purposes and patch up the holes and solder all leaks carefully. If nothing better can be had, a good sized garbage can may be used by soldering the covering on so as to make it airtight.

Bore a hole in one side and solder on a valve that can be obtained from an old bicycle tire. Another valve, such as is used in a miniature steam engine, is also soldered in another hole. A rubber hose is firmly fastened to the steam valve. If it can be procured, a steam



gauge should also be soldered to another hole in the tank. The air is compressed by means of a bicycle pump attached to the tire valve.

This compressed air tank can be used with the blow torch described in MODERN ELECTRICS AND MECHANICS, with a wood burning outfit, or, if the tank is large enough, it can be used to inflate bicycle tires.

Contributed by

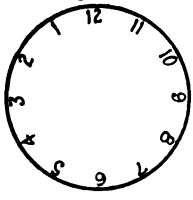
Ralph A. Hiteshew.

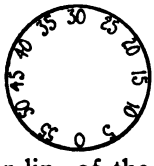
A NOVEL WATCH

A very novel and convenient watch may be made by removing the hands of an inexpensive watch and replacing them with two aluminum discs which are marked with the hours and minutes as shown in one of the accompanying drawings.

When the discs are placed on the hour and minute hand pinions, they should be so turned that some even hour on the large disc will come directly in line with the center line of the stem, and a line should be scratched on the crystal which corresponds to the center line of the stem.

To tell the time, read off the hour on the large disc which is nearest to the center line of the stem and the corresponding minutes from the small disc when the minutes are less than 30. When the minutes are greater than 30, read the hour to the right of the line scratched on the crystal.





If the crystal is painted black on the under side and a rectangle of the paint ¼ inch by ½ inch is scratched off, having for its center the line scratched on the crystal, and if the two discs are coated with luminous paint, the time can be seen on the darkest night.

One of the illustrations gives an idea how the watch will look when assembled. The time shown is 10.45.

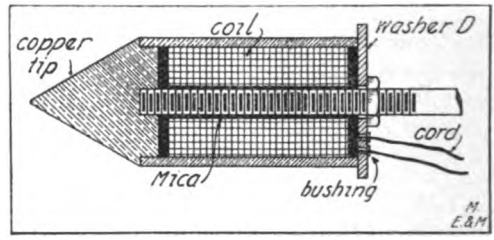
Contributed by

Davis H. Tuck.

AN ELECTRIC SOLDERING IRON

Anyone having electric light current can easily make this efficient soldering iron with few tools and at a small cost.

Chuck the copper tip of a soldering iron in a lathe and turn it down to a diameter which will tightly fit a brass tube for about ⅜". Take a 5/16 iron rod and thread it for about 4". Drill a



hole in the soldering iron tip, and tap it to fit the rod as shown in sketch.

The rod is then thoroughly covered with mica. Mica washers are placed on both ends of the heating coil. On this section of the rod which is covered with mica, the heating element is wound. It is composed of about 32 feet of No. 28 18% German silver wire when the iron is intended for use on 110-volt circuits. The wire is wound carefully around the tube and each layer is insulated with mica or paper asbestos until the coil contains all the wire. Then slip over the brass tube which fits the copper tip. Mica insulating bushings are fastened in the larger metal washer, *D*, and a nut fitted on the threaded bar holds the parts of the soldering iron together. Good insulation is necessary. The flexible connecting cord from the heating coil should have fireproof or asbestos insulation. An ordinary plug can be fastened to the connecting cord which should be about 5 or 6 feet in length.

Contributed by *Ralph Hiteshew.*

Tree planting on national forests has to be confined to comparatively short intervals in spring and fall. In spring it starts when the snow melts and stops with the drying out of the ground; in the fall it comes between the fall rains and first snowfall.

Practical Hints

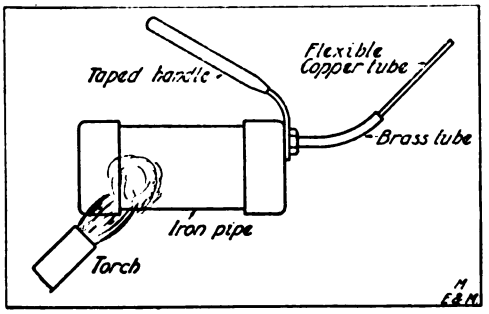
This department is devoted to contributions that deal with new tools, machinery, methods of simplifying different tasks and other similar subjects of interest to the electrician and mechanic in particular, and everyone in general. Contributions to this department should not exceed 200 words. A rough sketch is desirous in instances where the idea will be rendered more comprehensible by its use. All contributions will be paid for at regular space rates on publication.

HOME MADE OXYGEN CARBON REMOVER

It is my painful task, from time to time as occasion demands it, to remove the accumulation of carbon from the combustion chamber and piston of the stationary engine which I use for power purposes. Formerly the work was accomplished by removing the cylinder head, enabling ready access to the covered surfaces. But after having witnessed the ease with which an automobile repairman cleansed the six cylinders of a car motor by the oxygen process, I went back to the shop and constructed the piece of apparatus shown in the accompanying illustration and which has proved quite effective.

It comprises nothing more complicated than a short length of wrought iron pipe 1¼ inches in diameter, threaded and capped at either end. Through one cap a hole was drilled and tapped, and a similarly threaded length of brass tubing was screwed into the hole. A suitable length of annealed copper tubing was soldered in the end of the brass pipe. A handle was provided by fitting a piece of quarter-inch strap iron, drilled for the passage of the brass tubing, in place with a nut as shown by the sketch. The handle was taped.

To use the device, a small quantity of chlorate of potash, to which has been added a teaspoonful of manganese dioxide—the two being thoroughly incorporated—is introduced into the chamber formed by the pipe; the rear cap being removed for that purpose. After the cap has been tightly screwed in place again, the chamber is heated with a blow torch and the end of the flexible copper tubing is introduced into the combustion chamber of the motor. As soon as the ingredients are heated sufficiently, oxygen is given off and the heat should be kept constant to ensure a steady flow. In the presence of the oxygen, the caked carbon can be easily ignited and will burn from the surfaces in a minimum of time. Care should be taken not to apply too much heat. For cleaning multiple cylinder motors, the quantities of chemicals can be increased. Since the manganese dioxide



acts merely to stimulate the decomposition of the potassium salt, it is evident that the proportions are not all important. Both chemicals can be obtained at any chemists in small quantities and at low cost; care should be taken with the potassium chlorate not to leave it in contact with any foreign substance.

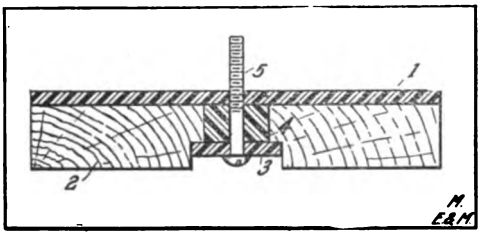
Contributed by

J. Naveman.

EFFICIENT DETECTOR BASES

By the following method good bases for detectors can be made at a small fraction of the cost of solid hard rubber ones. The drawing explains itself: 1 is a piece

of hard rubber sheeting; 2 is the wooden base; 3 a hard rubber washer; 4 a piece of hard rubber tubing, and 5 a machine screw on which the detector is mounted. Similar holes must be made for the binding posts and at all other places where insulation is required. The wooden part, 2, may be stained black.



I have a detector, like the one described on page 1066 of the January, 1913, issue MODERN ELECTRICS, mounted on a base like the one above mentioned and I am sure it would compare favorably with any other detector.

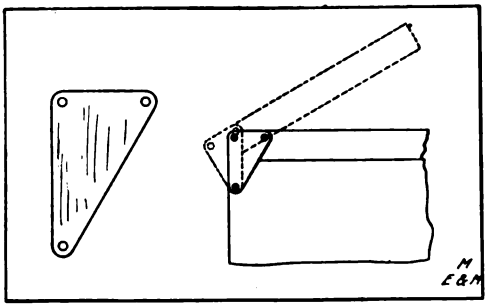
Contributed by

Leslie Jones.

SIMPLE HOME-MADE HINGES

A very good and simple hinge for boxes may be made by following the instructions given below.

The sketch is self-explanatory. The hinge should be cut from some sheet metal; brass being very suitable for this purpose. Tin may be used for lighter work. Three holes should be drilled—



one in each of the corners.

Contributed by

M. E. Robertson.

A SIMPLE METHOD TO CUT GLASS

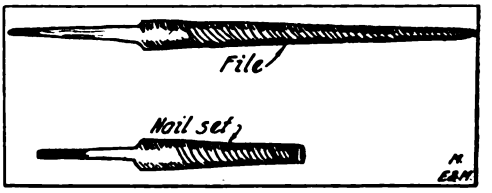
A very good Leyden jar can be made from any ordinary fruit jar. A piece of strong string is tied very tightly around the neck of the jar and it is immerged in boiling water. After it has been thoroughly heated it is taken out and immediately plunged into cold water. Remove the string and a slight crack will be seen in place of the string. Slightly tap the top of the jar and it will fall off. Another way in which to perform this operation is to first soak the string in kerosene or gasoline. The string is then ignited and allowed to burn all the way around. The jar is then plunged into cold water as before and it will again be found that the top may easily be removed by slightly tapping it.

Contributed by

F. C. Justice.

HOME-MADE NAIL SET

A good, durable, non-slip finger grip nail set can be easily and quickly made at the shop or home from an ordinary round file.



The illustration plainly shows how same is made.

Contributed by

B. W. Verne.

A FLUX FOR CLEANING THE SOLDERING IRON

In order to accomplish successful soldering, the iron or copper, as it is called, must be perfectly clean and tinned. When a tinned iron is put back in the flame to be further heated, an oxide forms on the iron. To remove this oxide quickly a form of flux is necessary in order to continue the soldering.

Procure a block of hard wood 2½" by 4" by ¾" thick and place on the top of it a clean, stiff piece of tin. The tin may be fastened to the block by countersunk brass screws, one being placed on each corner. Sprinkle over the tin some powdered ammonium chloride, commercially known as salammoniac. Place a few small pieces of half and half solder over the salammoniac. Heat the iron and rub

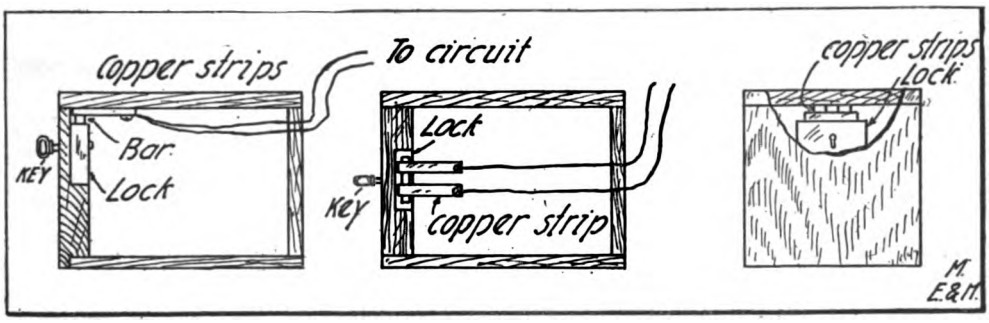
it over the surface of the tin. The sal-ammoniac removes all traces of oxide from the iron and causes the solder to adhere. It is a very good plan to rub the iron with an old rag before transferring it to the tin-covered block.

Contributed by

Earl E. Taylor.

ELECTRIC SWITCH LOCK

The accompanying illustrations show a simple electric switch lock which may readily be made from a drawer lock. The lock is enclosed in a nicely polished box so as to add to the appearance of the switch. The lock is so constructed that when the key is turned, the bar presses again two spring copper strips, thus closing a circuit. These copper strips are placed on the underside of the box cover, while the lock is held on the inside of the front of the box. The copper strips are placed close together so as to leave a slit of about 1/32 of an inch.



The author has used a lock constructed according to these directions to protect a circuit against tampering by unauthorized persons. It was used in connection with a small motor. The lock is connected in the circuit in the same manner as any single-pole switch.

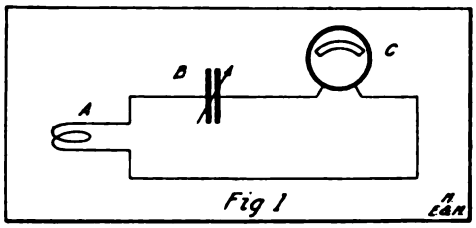
Contributed by

Walter Nehring.

DETERMINING THE LOGARITHMIC DECREMENT OF A STATION

To find the decrement of a wireless set it is necessary to have a decremeter, which, though rather hard to make, will prove very useful.

A decremeter consists of a milli-ammeter, variable condenser, and an inductance. The inductance can be made by winding about 15 turns of stranded wire on a hoop about 6 inches in diameter, or better still, by winding this hoop with stranded wire consisting of forty No. 40 enameled wires, and also connecting the instruments with this kind of wire.



The connection of the decremeter is shown in Figure 1.

We will now have to find the decrement of the decremeter (which will vary in the different instruments) by solving the following equation:

$$\delta = \frac{R}{2NL}$$

In which:

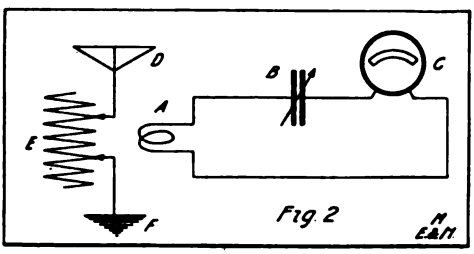
δ = Decrement of the decremeter.

R = High frequency resistance without the variable condenser.

N = Frequency.

L = Inductance in Henrys.

To find the high frequency resistance



for R it will be necessary to substitute a Wheatstone bridge in place of the variable condenser B. Figure 1.

The high frequency resistance of No. 40 wire is the same as the low frequency resistance.

N for the above equation is found by the following equation:

$$N = \frac{1}{2\pi\sqrt{LC}}$$

N = Frequency.
L = Inductance.
C = Capacity.
π = 3.1416.

After solving one and possibly both of the above equations you will have the decrement of your decremeter.

To find the decrement of both circuits, a b c and d e f (Fig. 2), solve the following equation:

$$\delta_1 + \delta_2 = \pi \frac{B_m - B}{B_m}$$

In which:
δ_1 = Decrement of your decremeter.
δ_2 = Decrement of the unknown circuit d e f (Fig. 2.)
π = 3.1416.
B_m = Degrees on the variable condenser scale when circuits a b c and d e f are at resonance.
B = Degrees on the variable condenser scale when the milli-ammeter reads 7/10 of resonance.

To find 7/10 of resonance, turn the variable condenser back till the milli-ammeter reads 7/10 of what it did when the two circuits were at resonance. After this equation is solved, subtract the decrement of the decremeter from the decrement thus found and the remaining will be the decrement of the unknown circuit d e f.

Contributed by
A Radio Experimenter.

A better method of finding the decrement of the decremeter would be to set it vibrating by means of some form of shock excitation (e.g., using a highly damped buzzer circuit as an exciter) and applying the "detuning" method mentioned above. The decremeter circuit would then vibrate in its own period and damping, and its decrement could be obtained by means of the third equation, δ_2 being considered as zero. That is,

$$\delta_1 = \pi \frac{B_m - B}{B_m}$$

This procedure should be applied at a number of wave lengths and a curve drawn showing the decrement of the decremeter at various wave lengths.

Still another method would be to use an arc as an exciter, the decrement of the arc circuit being considered as zero.

Readers interested in this subject should not fail to read the article describing the papers read before the recent meeting of the Institute of Radio Engineers, appearing in this issue, which deals with a similar subject.—THE EDITOR.

TOOL HOLDER ON OVERALLS

Electricians and various other mechanics who find it necessary to carry a screwdriver or similar shaped tool about, will find that a very serviceable holder can be

made from an ordinary wire crown bottle cap remover. This can be secured with thread on overalls. The tools are placed in as shown.

Contributed by *Bert W. Verne.*

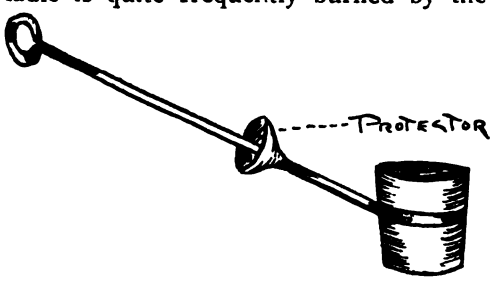
TO REMOVE STOPPERS

Heat the neck of the bottle by pouring hot water around it, or by turning it over quickly in a flame. This expands the neck and allows the stopper to be withdrawn. Still another method is to gently tap the stopper with some wooden object until it is loosened. Stoppers may often be removed by soaking in hot water or by placing a little oil around them, which gradually sinks in and loosens them.

Contributed by
Chas. A. Watcher, Jr.

HAND PROTECTOR ON LADLES

In foundries and shops where hand ladles are used for pouring metal, the hand supporting the weight near the ladle is quite frequently burned by the



great heat, as well as by splashes of the hot metal.

By placing on the light sheet iron protector, as shown, the hand is well protected.

Contributed by
B. W. Verne.

PATTERN MAKING

Describing the Interesting and Profitable Trade of Pattern Making and the Means of Learning It

By G. H. Willard

EDITOR'S NOTE: This is the first installment of a series on Pattern Making that will be published from time to time. The object of this series is to instruct readers of MODERN ELECTRICS AND MECHANICS in the trade of pattern making. Mr. G. H. Willard, the author of the series, has had wide experience in this field and is indeed well qualified for the work he has undertaken.

WHAT is pattern making? That is a question that has been asked a great many times by people that have no knowledge of mechanical trades. There are several different kinds of pattern making. The boot and shoe industry has a pattern maker. The different pieces of leather in the boot or shoe are cut to a certain shape and size; to cut these and have a great quantity of each shape and size, a pattern is made first and they are all cut like it. The person making this first sample or pattern is called a pattern maker. The hat industry also has a pattern maker. The pattern in this line is the block that the hat is made on. A new style or shape of hat has to have a block made first, which is made of plaster Paris and is cut and shaped with a knife and other tools used for this work to the desired shape and size. The maker of this block is called a pattern maker. The garment makers have a pattern maker, his duties being to make shapes of the different pieces of cloth for the new styles of dresses or wearing apparel. Any new design of any new thing of which there are several wanted, is first made into a pattern and the others are made from the pattern. The class of pattern maker I will try to illustrate and describe is the wood pattern maker, who comes under the mechanical lines. Any new design of machinery or anything cast in metals employs this class of mechanic so that the desired casting can be obtained. The duty of the wood pattern maker is to make something out of wood so that a casting of similar shape can be made in what is called a foundry.

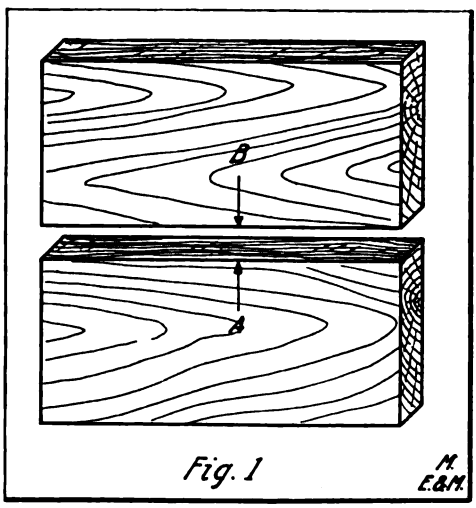


Fig. 1

Until the seventeenth century little was known of this class of pattern making as a trade. Today, it is one of the foremost trades in the mechanical lines. Why it is considered one of the foremost trades is because there are other trades that must be also mastered by the pattern maker. One of the other trades is drawing, which is highly essential be-

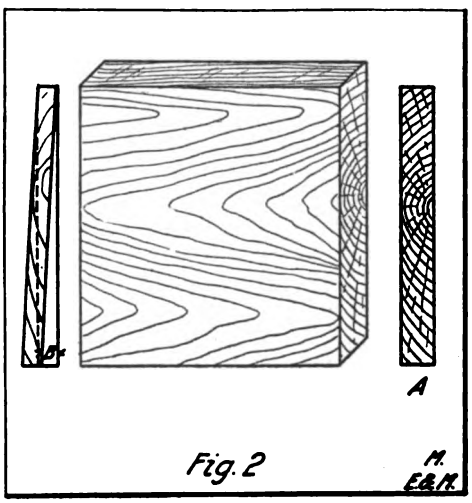


Fig. 2

cause when the pattern maker has a new pattern to make he receives a drawing showing the shape and sizes by figures of the casting wanted. He must picture in his mind the shape and size the casting will be when taken out of the sand. The drawing is the only thing the pattern

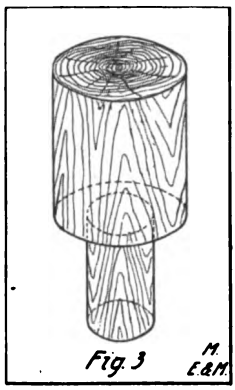


Fig. 3 M. E&M

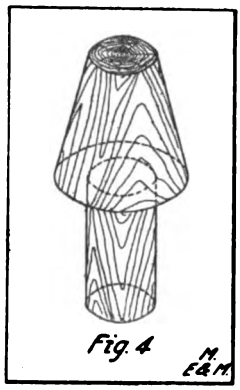


Fig. 4 M. E&M

maker has to work from. Another trade is the metal foundry. A good knowledge of this should be acquired so that the pattern maker will know the best way to make the pattern for the foundryman's convenience. A great many times there is more than one way to make a pattern and a good knowledge of the foundry enables him to know the best way to make it. Another trade that should be known is that of the machinist. The drawings do not show how work is going to be held in the lathe or planer for the machinist to work. A knowledge of this trade helps the pattern maker because he will know where and what shape to make lugs on the pattern so it can be held in machines. The drawings generally show what parts are to be machined and the pattern maker has to allow whatever finish he thinks necessary on these parts. Mathematics is another very important factor, as there are often angles, degrees and several dimensions to be figured; also problems of different kinds arise that a knowledge of mathematics helps to solve. A knowledge of how to use wood-working tools as well as both hand and machine tools, is a very important requisite. Years ago, very little was known about machine tools. Today a pattern shop without machine tools is not considered up-to-date. Imagine yourself sawing a log into boards by hand. A pit is dug in the ground and the log laid across it, one man working down in the pit and the other on top, drawing a large saw up and down. Picture any one planing a board by hand from one inch to one-quarter inch thick. Say the board is twelve feet long and twelve inches wide. This is what was done years ago. Take a look in a wood-working shop to-day and see how this same work is done. A large log to-day is sawed into boards all at once by what are called gang saws, some machines for this work being made with several large circular saws all on one arbor, while other machines are made with several band saws so arranged that boards are cut to any thickness desired. The boards are rough and show the saw marks. To make them smooth and parallel they are fed into what is called a cylinder planer. By this machine they can be planed to any desired size and will all be the same thickness and have parallel sides. Some shops are well equipped with machine tools, while others are very poorly supplied. There are several different kinds of hand tools used which will be described later. Wood patterns are made so that different metals can be cast from them. The pattern maker must know—when he starts on the pattern—what metal is wanted, as different metals have a different so-called "shrink." The drawing generally states the metal desired. Supposing a pattern were made for cast iron first, then the draughtsman changed his mind and

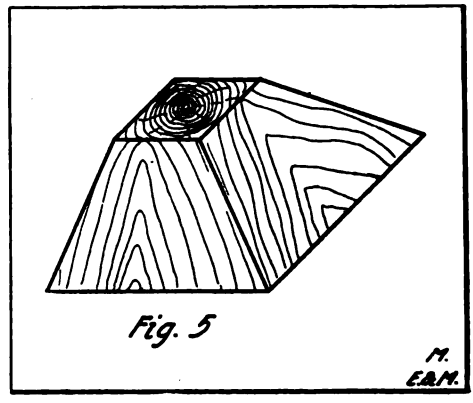


Fig. 5 M. E&M.

wanted it made of brass. This would necessitate another new pattern, because the shrink on brass is different than that of iron. Then again, he may change his mind and want it made of steel. This would require another new pattern as the shrink of steel is still different, so

(*Continued on page 625*)

HIGH FREQUENCY CURRENT APPARATUS

A Series of Articles Covering the Theory, Making and Operation of High Frequency, X-Ray and Ozone Apparatus*

By Frank Brewster

CHAPTER IV—HOW TO BUILD AN UNIPULSATOR

A unipulsator set, similar to that described in the first part of the last chapter, is easily built and is far cheaper than if purchased from manufacturers.

A special high tension step-up transformer suitable for the purpose can be made by anyone possessing ordinary mechanical skill, the only monetary expense being that for the necessary material which should not exceed one hundred dollars, including rectifier valve and choke coil.

The design for the transformer described hereafter is special, and has not been copied from that of some manufacturer, although the same results can be obtained with it as with those on the market.

Its rating is 5 kilowatts, actual secondary output, the primary input being slightly greater to compensate for the small loss in the transformation of the current. The electrical efficiency is about 96 per cent., or in other words, 96 per cent. of the energy put into the primary reappears in the form of stepped-up secondary current, suitable for X-ray purposes. This is quite a contrast to the operating efficiency of induction coils, which never reach a higher efficiency than 60 to 70 per cent.—and seldom that high.

The design here described in detail, is for a 110-volt, 60-cycle A. C. circuit, the current consumed by the primary winding at full load registering 45.5 amperes. The secondary output is 120,000 volts normally, and .0416 amperes or 41.6 milliamperes; a milliampere being 1-1000 of an ampere. The potential of the secondary current is susceptible of variation and can be increased considerably by cutting out some of the primary turns, and decrease in voltage is accomplished by the insertion of inductance in the primary circuit. The potential of 120,000 volts is all that is required for exciting the largest X-ray tubes ordinarily, except when working through high vacuums.

The first part of the transformer to be considered will be the laminated sheet-iron core, the sheets having a thickness of 1-32-inch or a little less, and are thoroughly annealed. Regular transformer core-iron or steel is procurable from electrical supply houses, cut to the desired size in many cases; otherwise, it

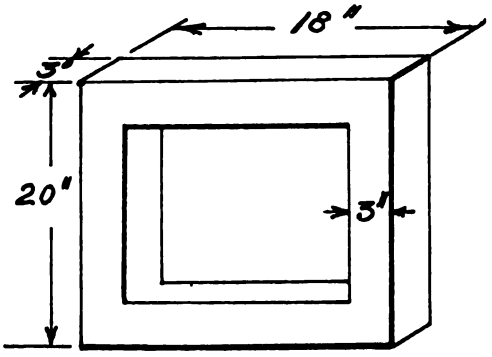


FIG. 18.—OVERALL DIMENSIONS FOR THE CORE OF 5 KW. TRANSFORMER

can be cut to size with a pair of tinner's snips.

The overall core dimensions are given in fig. 18. The amount of iron required is approximately 154 pounds; no allowance for waste in cutting being included. The iron should be cut up into strips of two sizes, viz., 17 inches by 3 inches and 15 inches by 3 inches, as seen in fig. 19 at E and F, where the system of building up the core is also made plain.

After all the iron strips have been cut and flattened, half the number of pieces like E, and the other half like F, are generally assembled as at G and H, fig. 19, where G is the first layer, and H the sec-

* This series began in the February, 1914, issue. It is necessary to refer to previous instalments for a better understanding of the present description. Back numbers may be had at 15 cents each.—THE EDITOR.

ond, etc., alternating the layers so that the joints at the corners will overlap each other and make a solid core of good magnetic permeability. As this type of apparatus does not have to be so perfectly built as commercial lighting transformers, the manner of building up the core indicated at I and J is practiced by a large manufacturer. There is very little loss experienced by utilizing this method of core assembly, and it is much easier to follow than the interleaved style, the iron strips in this case being cut 18 inches by 3 inches and 20 inches by 3 inches, respectively. In either case, the corners of the core; holes being bored down through the iron to accommodate the bolts. To offset this method, which is not the best anyway, the scheme depicted in fig. 19, at O and P, can be applied, and is just as easy as the former one, if not more so.

When the core sections have been prepared as described above, they are ready to receive their windings, but they must first be well insulated. To do this, the two longer legs, which are to contain the primary and secondary coils, should be covered with 12 layers and 30 layers of oiled linen or empire cloth, respectively,

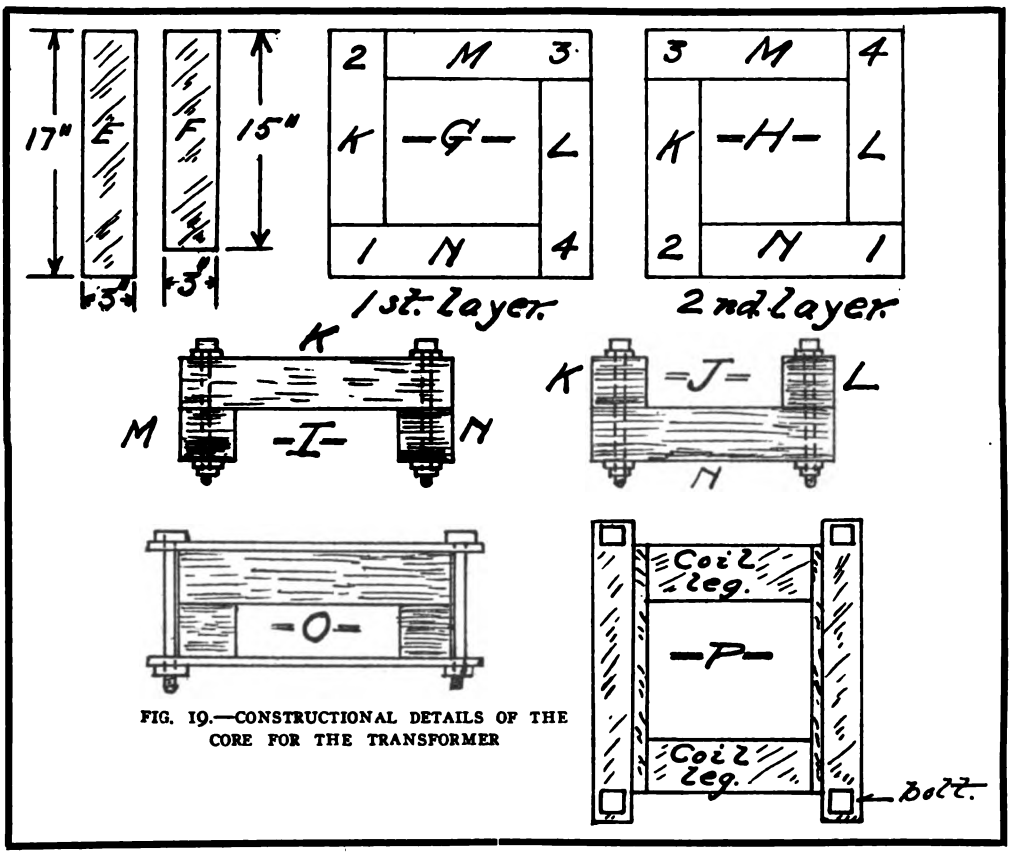


FIG. 19.—CONSTRUCTIONAL DETAILS OF THE CORE FOR THE TRANSFORMER

the legs of the core to contain the primary and secondary windings, i. e. legs K and L, must be assembled separately from the yokes M and N, to facilitate the placing of the windings on them. In the first method of assembling the core, the end or yoke strips M and N are staggered in between the projecting alternate strips K and L, after winding.

The complete core is held together by four iron bolts about ¾-inch in diameter, and some large iron washers, placed at the one covered with 30 layers to be the secondary leg. The insulating cloth must be 14 inches wide and of continuous width, not pieced, although the length may be composed of several pieces. It is to be wrapped on as tight as possible, the finished thickness not exceeding ¼-inch on the primary and ⅝-inch on the secondary core.

To wind the primary coil, a lathe or winding machine is a handy adjunct, as the wire to be used is quite heavy and

awkward to manage. The primary winding consists of 139 turns of No. 4 B. & S. gauge double cotton-covered magnet wire, or two No. 7 wires, wound on together to give the same area of copper. The layers are to be 13 inches long and 2½ in number. Connecting leads or taps, for varying the secondary potential, should be brought out from the 80th, 125th, and 139th turn, as well as the starting lead, making four leads in all. They may be left about 12 inches long and covered with rubber tubing. Each layer of the primary coil, as wound, should be given a good coat of orange shellac, mixed with alcohol or regular insulating paint. The disposition of the four leads will be taken up later.

The secondary coil now demands attention and is quite similar in construction to that of the induction coil treated in a previous chapter; the form winder there described and the method of impregnating the wire can be used to advantage here. The winding machine is preferably equipped with a counting device or cyclometer and trip finger on the main shaft which serves to count the number of turns put on the pies; it being very tedious to count them otherwise.

The wire for the secondary coil consists of 58 pounds of No. 34 B. & S. double cotton-covered magnet wire. Beeswax is much to be desired in the place of paraffine wax for the transformer, as there is a heavier current and greater stress between turns than in the induction coil. However, a compromise may be effected by using a compound of equal parts of paraffine and beeswax. Vacuum impregnation is very desirable —but not imperative.

The whole winding is divided up into 64 pies, each of 2,367 turns of wire, or a total of 151,636 convolutions in all. Each pie is to be ⅛-inch thick, with a depth of about 4⅝ inches and an outside diameter of 13½ inches. The center piece on the form winder, should be ⅛-inch larger all around than the dimensions of the oiled linen insulation on the core and of the same shape, with its corners a trifle rounded off.

When the 64 pies have all been prepared, they are to be assembled over the core leg containing 30 layers of oiled linen insulation. The total length of the completed secondary coil should not be over 10 inches, otherwise there is danger of the secondary current jumping to the iron core at the ends. This dimension leaves a clearance of 2 inches between the last pies and the iron, which should be filled up with oiled linen discs 1 inch greater in diameter than the wire pies and sufficient in thickness to take up 1 inch of the space, the balance being filled up by a 1-inch wood washer boiled in hot wax.

The insulating discs, placed between the pies in assembling the secondary, are also of oiled linen and are ½-inch larger in diameter than the outside diameter of the pies, i. e., ¼ larger all around. The inside opening in the insulating discs should be such that they slip nicely over the insulation on the core.

The pies are assembled in units of two each, after the manner indicated in fig.

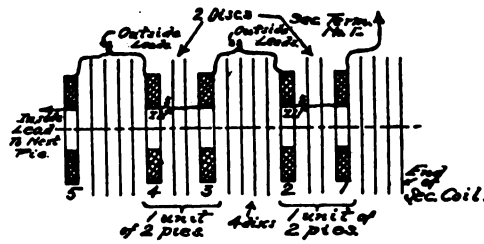


FIG. 20.—METHOD OF ASSEMBLING SECONDARY SECTIONS OR "PIES"

20, inserting two oiled linen discs between the two pies of a unit, and four discs between every unit and its neighbor.

The system of reversing every other pie in assembling should be adhered to as explained in the section on induction coils, taking great care that one pie does not "buck" another, or in other words, the arrangement must be such that the current travels continuously in one direction around the core. All joints or connections in the secondary coils should be soldered with a non-corrosive flux, such as Allen's soldering stick or No-Korode paste.

The transformer may be put together when the windings are finished and on the cores, completing the magnetic path of the core by one or the other of the two methods suggested above, clamping it tightly together by bolts, or straps and bolts.

The whole transformer can be mounted in a wooden case or cabinet and then filled with hot insulating wax; the best insulation being a mixture composed of beeswax 15 per cent., paraffine 23 per cent., and rosin 62 per cent. A lower amount of rosin reduces the brittleness of the mixture, if excessive, and a reduction of paraffine causes less softness.

Some makers place their transformers in oil, the container taking the form of the common wash boiler and is made of metal-lined wood, or sheet iron; in the latter case a clearance of 3 or 4 inches separates the iron wall from all parts of the transformer proper. The transformer is set on wax-impregnated wooden blocks and held in proper position by wooden wedges on the sides. The primary leads can be brought to binding posts on the side of the case, mounting them on a strip of fibre about ½ or ¾-inch thick, as depicted in fig. 21.

The secondary terminals can be led out of the metal case through heavy electrose or hard rubber bushings 3 to 3½ inches in diameter where they pass through the case, and extending 5 inches under the cover and 7 inches on top. A ⅛-inch brass rod passed through the center of each bushing serves to conduct the current to a binding post at its upper end.

The oil for filling the transformer case may be double boiled linseed oil, paraffine oil or regular transformer oil.

The three variable voltage taps from the primary coil are connected to a three-

(*Continued on page 638*)

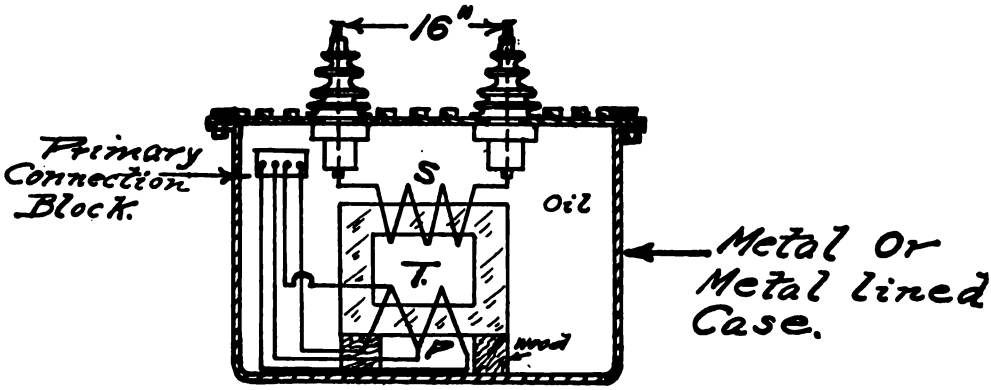


FIG. 21.—AN APPROVED METHOD OF MOUNTING THE TRANSFORMER IN A SUITABLE CONTAINER WHEN FINISHED

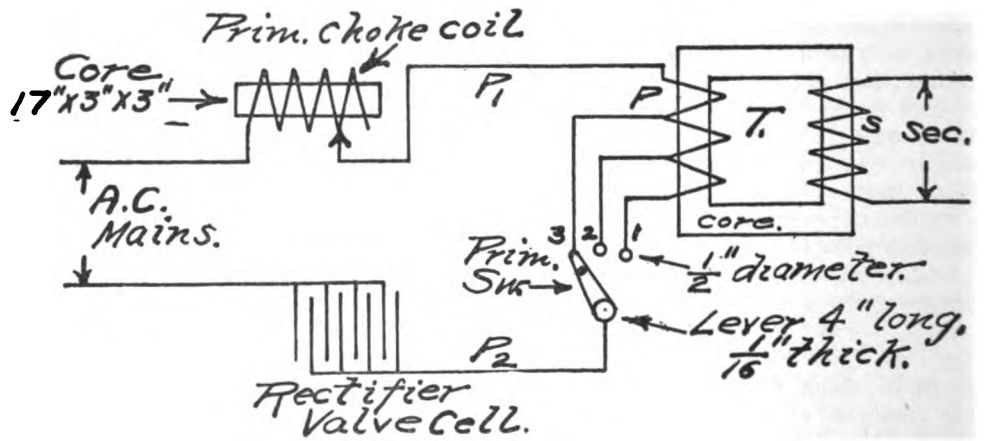


FIG. 22.—PRIMARY CONNECTIONS FOR 5 KW. TRANSFORMER

SIMPLE HOME-CRAFT FURNITURE

The Fourth of a Series of Articles Describing the Making of Various Pieces

By G. Lane

Illustrations from drawings made by the author.

NOTHING adds more to the attractiveness and service of the library table than a reading lamp. While not a large piece, the lamp offers a number of problems in construction not met with in most larger pieces. The lamp described in this article has a shade made of metal, preferably of No. 18 gauge soft copper, although brass might be used. A wooden shade offers far too difficult a problem in joinery for the amateur, while the metal shade is easily made, even if one has not had much experience in working metal. The lamp may be used for either electricity or gas, although a change in construction will be necessary if gas is to be used. This change will be explained in due course.

Very little oak is necessary for the construction of this lamp; be sure, however, that you pick out pieces with straight grain. One piece ½" x 8" x 3' and one piece ⅞" x 8" x 18" will be found sufficient, allowing plenty for waste. The post in the base is hollow, that is, it is made by gluing four pieces together, box shape. It will be seen in the drawing that the post is 2" wide at the top and 4½" at the bottom; also, that the vertical measurement is 12". As the ½" stock is to be used in constructing the post, two pieces will be 1" wide at the top and 3½" at the bottom, as the corners are to be lapped instead of mitering them. The best way to get the shape of these pieces accurately is to make paper or cardboard patterns first.

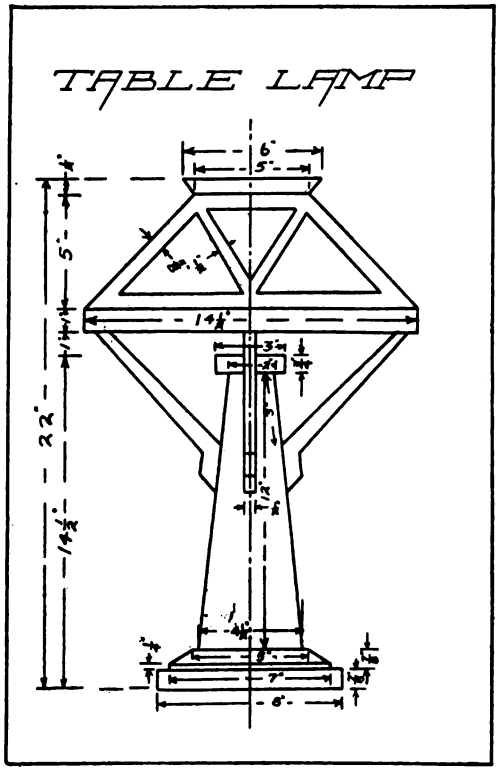
To make the pattern, begin by laying out a center line on the paper or cardboard. Then draw a base line perpendicular to it near one end, and lay out points 1¾" each side of the center. Measure 12¼" from this line and draw another, and lay out points ½" each way from the center. Connect the two points on each side, extending the lines further than the points. Cut out the pattern, leaving about an inch extra on each end. Smooth up the best side of the ½" stock, and trace around the pattern. Saw out carefully, allowing a little for planing up. Plane up the edges perfectly square, both pieces exactly the same.

Now lay out, directly on the wood or with a pattern, the two larger sides and saw out on waste side of line. Do not plane up the edges until after the pieces have been glued. Put the pieces together without glue, making sure that the joints are perfect. Glue together carefully and clamp well; pattern makers' tacks or pinch dogs would help to hold the pieces together, or four 1" brads might be put in each joint. After the glue has dried thoroughly, plane the edges of the larger pieces even with the surface of the other two.

Sawing off the ends of the post perfectly square is rather a particular job, and one cannot take too much pains in doing the job right. It will be noticed that each side is 1¼" smaller at the top than at the bottom, so take a thin piece of wood and plane to 1¼" and toe nail it to the post with fine brads just below the top line. An imaginary line from the outside of this block to the bottom of the post would be parallel with the center of the post, so we can put the post in the miter box, with the block down, and saw off square, just the same as if the piece were 4¼" square the whole of its length. Take off the sharp corners slightly with a sandpaper block.

In making the cap for the top, be sure all edges are square and smooth. In making the bottom piece, cut a round hole about 3" in diameter in the center, and bore a ⅜" hole from the center of one edge to this hole, to allow the wires to be run through to the post. Be careful in making the bevels on the 5" square piece, and make 2" hole in the center of this piece.

Next make the four arms supporting the shade. It would be well to cut out a paper pattern first. Do not have the grain of the wood run exactly parallel with the edge of the arm, but just a little

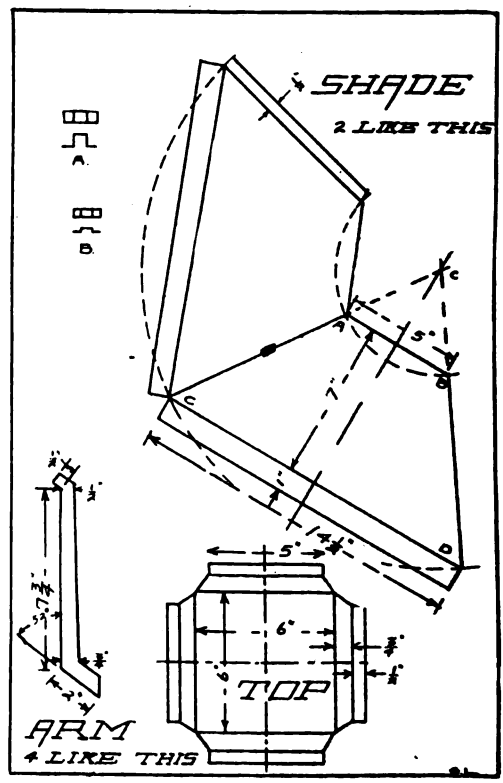


diagonal, giving the ends of the piece a little more strength. Saw out these pieces with a band saw or jig saw if possible, but if not, use strong coping saw. Smooth up carefully.

The entire base is now ready for assembling. Mark on the 5" square piece exactly where the post goes, and bore holes slanting sufficiently to allow the screws to go into the post parallel with the sides of the pieces. Use two No. 8 1½" flat head screws on each side. Fasten the bottom piece on with four screws and countersink the heads of all screws. Bore a ½" hole through the top cap, and nail the cap on carefully, first boring holes for the brads with a hand drill.

Now comes the entirely different matter of making the shade. No. 18 or 20 gauge soft sheet copper should be used, although brass may be substituted if preferred. Copper is richer in color and harmonizes far better with all shades of stain except the blacks and grays. A sheet 16" by 30" should be enough to make the sides, while a piece 9" square will suffice for the top. Make a paper or cardboard pattern first, in the following manner:

Draw a center line and a base line at one end perpendicular to it. Then measure up 7" and draw another perpendicular line. Measure on these lines, a half on each side of the center line, the width of one side at the top and bottom. Continue these lines until they meet. See lines CA and DB, meeting at O, on drawing. Point O is the center from which arcs are drawn with radii OA and OC. Lay off the distance AB on the smaller arc and CD on the larger arc, and connect the two points, thus forming another side. To this edge add a strip ½" wide to solder onto the side which will be next to it. Now add a strip 1" wide to the bottom of the two sides, as shown in drawing. All four sides might be made in one section, but there would be considerable metal wasted in this way,



so it is more economical to make two sections of this size and solder them together. The next matter to consider is the design to be cut in the copper, as the one illustrated in the drawing is only

suggestive. Work the design up on a sheet of drawing paper and trace on the pattern. In making the design, it should be kept as simple as possible, if it is planned to have different colored art glass placed under each opening. There should not be, ordinarily, more than five or six openings on a side. Cut the design out on the pattern with a sharp knife and trace the entire pattern on the copper with a sharp awl. The outside of the pattern can then be cut with a pair of tinner's snips, and the design sawed out with a jeweller's saw. Cut out and bend four little pieces as illustrated in fig. A, and quite a few shaped as in B. Bore a hole in both ends of pieces shaped as A to allow them to be soldered on more easily. The four pieces shaped as A are to be soldered on the center of each side piece, that is, the inch strip, up against the bend. The other pieces are for holding the glass in place and are bent U-shaped first, with a hole bored in the center space, then soldered on to the side of the shade between the holes or openings in the design; or around the edge, where it will not be necessary to have more than one prong. After the glass has been put in place, these prongs are to be bent down over the glass, holding it in place. If one is not experienced in soldering, it is better to have a sheet metal worker do the necessary soldering in putting on these pieces and in putting the two sections together. Before any soldering is done, however, the shade must be bent to the proper shape. When bending, hold the piece in the vise between two wooden strips, placing another strip against the line at which the metal is to be bent, and hammering this piece with a mallet until the desired shape is reached. Then lay out and bend the top piece, as shown in the drawing, if electricity is going to be used. But if gas is to be used, the flat part on the top will have to be omitted and four strips made instead for finishing off the sides.

Before the top has been soldered on the sides, however, a finish should be given the copper, provided that the top can be soldered on without discoloring the copper. Either way, the copper should be thoroughly cleansed and then revolved slowly in a hot solution of liver of sulphur, as it is too large to completely immerse. Wipe dry from time to time until the desired shade of brown is obtained and then lacquer. A variation of this finish may be had by hammering the entire surface of the shade with a very small pein hammer, giving more the effect of hammered work, and then colored. Unless one is experienced in cutting art glass, it is better to furnish the glass dealer with patterns and let him cut the glass to size. Be careful about getting too many colors in the shade; pick out soft, restful colors that will rest the eye rather than strain them.

The fixtures may be bought at any electrical supply store. The socket should have a short shank with a collar on it that may be fastened to the cap on the post. The shade is large enough to accommodate quite a large lamp.

INSTITUTE OF RADIO ENGINEERS

TWO papers were presented at the monthly meeting of the Institute of Radio Engineers held on March 4, 1914, at Columbia University. The first was entitled "The Effect of Inserting a Parallel Condenser in the Antenna in Receiving Sets," by Dr. L. W. Austin; the second, "A New Method for the Determination of Logarithmic Decrements," by Dr. Louis Cohen.

Dr. Austin's paper concerned the results he obtained in performing some experiments upon the effect of shunting a receiving antenna by a condenser, for the purpose of tuning to higher wave lengths; the circuit in question being that shown in Fig. 1. It will be recognized as the common "flywheel" arrangement used in many radio receiving sets, in which the inductance may be considered as in series with the antenna inductance and the condenser capacity in parallel with the antenna capacity. Thus, both condenser and inductance are being used to lengthen the wave length of the antenna. Whether this double arrangement is as efficient as would be the use of simply

an inductance alone (large enough to tune to the same wave length as the inductance and capacity together previously employed) was the question taken up by Dr. Austin.

Tables showing some of the observations are given below. A buzzer driven wave meter was used as an ex-

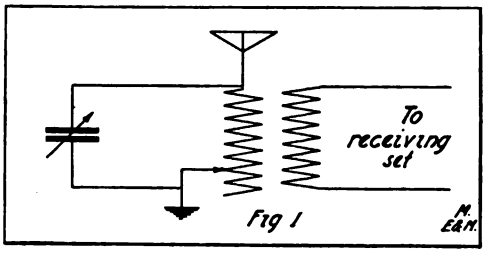


Fig 1

citer of two artificial antennae, each having the constants given at the top of the tables. A wave meter containing a detector and galvanometer was used as a measuring instrument. The experiments were also performed upon actual antennae and similar results were obtained.

It will be noted that, as the inductance was replaced by capacity (keeping the wave length constant) the galvanometer deflection grew smaller and smaller. This shows conclusively that the "parallel condenser" method of tuning an antenna is much less efficient than the use of an inductance alone.

Dr. Cohen's paper concerned a new method for measuring logarithmic decrements, using a known resistance in a wave meter circuit of known decrement. He showed some of the undesirable points in the hitherto used method of Bjerknes, the latter consisting of the following procedure:

A wave meter is brought to resonance with the circuit whose decrement it is desired to measure. The reading on the condenser pointer is noted (in microfarads) as is the deflection of the galvanometer or other indicator of the wave meter. The wave meter is now "detuned" by varying the condenser capacity until this deflection of the indicator is reduced to one-half its previous value. Then the position of the condenser pointer is noted and the sum of the decrements of both circuits (the circuit under test and the wave meter) is given by

$$d_1 + d_2 = \pi \frac{C_1 - C_2}{C_2}$$

when C_1 and C_2 are the condenser values which were noted. Then, if d_2, the decrement of the wave meter, is known (or is negligible compared to that of the tested circuit), d_1 is the decrement desired.

Antenna capacity = 0007 mfd. λ = 2000 m δ = .1			Antenna capacity = .002 λ = 3000 m δ = .1		
Parallel capacity. mfd.	Inductance microhenries	Galvanometer deflection	Parallel capacity mfd	Inductance microhenries	Galvanometer deflection
0	1330	230	0	1100	110
.00016	1180	210	.00034	980	105
.00032	1050	195	.00073	874	95
.00064	840	180	.00094	830	92
.00100	820	160	.00147	720	90
.00132	610	140	.00224	620	74
.00165	540	120	.00314	515	56
			.00422	415	42

The method advocated in this paper, however, involves the use of a wave meter containing a calibrated adjustable resistance, as well as some current indicator. The wave meter is brought to resonance with the circuit under test and the indicator reading is noted. Then the resistance is introduced until the current drops to one-half its original value; the amount of resistance necessary for this is observed. It can be shown, then, that

$$d_1 = \frac{K^2 - 2}{2 - K} d_2$$

where d_1 and d_2 are the decrements of the tested circuit and wave meter, respectively, and K is the ratio of the original wave meter resistance to the total resistance after adding in the amount necessary to produce the desired current drop.

The disadvantage claimed against the Bjerknes method is that it is not really accurate, since the decrement of the wave meter is changed in the "detuning" process.

In addition to this regular monthly meeting, a joint meeting was held with the American Institute of Electrical Engineers on March 13, 1914. Here Mr. E. W. Meyer delivered a remarkably interesting paper upon the "Goldschmidt High Frequency Alternator," with the system based upon its use. This apparatus has been installed at Tuckerton, N. J., and works regularly with a station in Germany. Further details regarding the paper will be published in a later issue.

PATTERN MAKING

(*Continued from page* 616)

you see it is very essential that the draughtsman should know the metal desired when making the drawings, for the particular casting wanted, as it will save extensive labor and expense. A great many times hundreds and thousands of castings are wanted of a certain piece. Sometimes several metal castings are made and smoothed up and fastened on to what is called a gate. Sometimes these patterns are made of cast iron and other times of brass. Then again, they are made of aluminum. To make a pattern for these different metals which are to be used for a metal pattern, there are still other shrinks used. Metal patterns are more profitable where several castings of the same thing are wanted, because they will not warp and twist as in the instance of a wood pattern if it has been in the sand a great many times. Sometimes several patterns are placed on a board for what is called plate work, and again, patterns are made for molding machines—a field that requires a still different treatment than regular or plate work patterns. There are several kinds of pattern work, such as Textile, Steam Engine, Steam Pump, Valve, Electrical, Architectural, Automobile and general odds and ends which take in almost everything. Take the textile work for instance, that has very little coring and is not difficult. On the other hand, in steam engine, steam pump, valve and electrical patterns there is considerable coring and some of it is very difficult. Automobile patterns are considered among most pattern makers to be the most difficult work to make, as they involve very hard coring and the metal is generally quite thin. The odds and ends take in mostly new ideas that are designed by inventors.

There are two classes of shops—corporation and job shops. Corporation shops generally make a specialty of one class of machinery, while a job shop makes anything that comes along. I have been asked a great many times which place I thought the best for a boy to learn the trade, a corporation shop or job shop. This is a question that a great many pattern makers differ on. Let us compare the difference between the two. We will suppose a young man starts in to learn the trade in a corporation shop. Some shops require that the boy deposit a sum of money, in some instances fifty dollars and in others one hundred dollars. There is no set rule for the amount to be paid. The boy must serve not less than three years. At the end of this time the money is returned to him with

interest. Some shops give part of it back and a fairly good kit of tools.

The course of study in a corporation shop is usually as follows: The boy is sent to the drawing room for six months, where he obtains a good knowledge of drawing, learns how to read plans, handle drawing instruments and the general

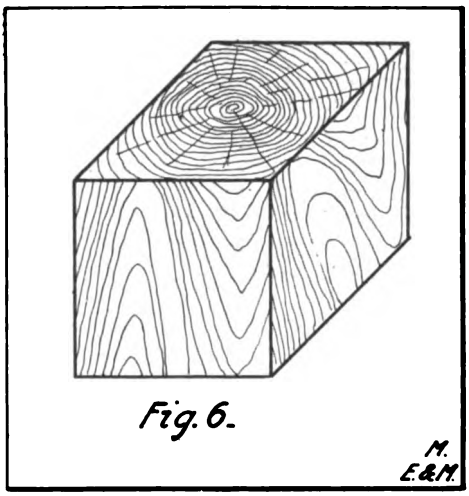


Fig. 6.

principles of draughting. From the drawing room he is sent to the foundry for a period of about six months. Here he obtains a good knowledge of how patterns are taken out of the sand, the reason for having plenty of draft on patterns, what cores are and what they are for, and how they are placed in the mold. He receives a general knowledge of foundry work which is one of the very important factors in pattern making. When he has completed his six months in the foundry he is sent to the pattern shop for the remainder of the course. Here he is made generally useful; his duties consisting of going on errands, sweeping the floor and varnishing patterns. After doing this for a while he is shown how to use tools. There is no set rule as to how the boy will start or what tools he will use first. In the case of the particular boy we are considering, we will start him planing the edge of two boards, making them straight and square. The sides A and B in Fig. 1, indicate the edges to be made straight and square. This is done with what is called a jointer plane. After the apprentice has worked some time on this and has it so the foreman says it is satisfactory, he is instructed how to plane the large surface of the board so it will be straight and out of wind as A in Fig. 2—not as shown by B where one end is above the other. We will now start him on the turning lathe. A great many shops have stock core prints of different sizes and shapes. Fig. 3 shows what is called a nowell print, which is made in various sizes, ranging from two inches in diameter by eighths down to one-half inch in diameter. These must all be turned alike for each size. Fig. 4 shows what is called a cope print and these are also made in different sizes, the large part ranging from two inches down to one-half inch by eighths. Fig. 5 shows a cope print that is square and tapers up smaller at the top, which is also made in different sizes as those shown in Figs. 3 and 4. Fig. 6 shows a nowel print which is also square and is made in various sizes, the same as others already shown. These last prints are fastened to patterns by gluing and nailing. Fig. 7 shows what is called a heel print. This class of print cannot be made up in very great quantities as the length A changes a great many times.

After he has done this class of work for some little time, the foreman has the apprentice help some of the regular pat-

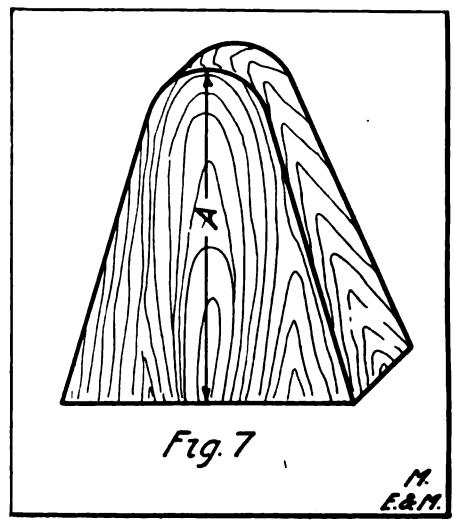


Fig. 7

tern makers. After a while, he is given jobs to work independently. His jobs are gradually made more difficult and at the end of his time he becomes a journeyman pattern maker. The boy in this corporation shop knows the "ins and outs" of the class of patterns made there. We

will assume that he is a first class man on their work. But let him go out and secure employment in another shop doing the same class of work and he will find that things are done differently than he has been accustomed to in the shop where he was taught his trade. Then again, he may go to a shop where an entirely different class of work is done, and experience difficulty in becoming accustomed to the new work.

Now we will start this same boy in a job shop and see if he has any better chance to learn the trade than he had in the corporation shop. In the job shop he does not have the chance to learn the drawing or the foundry work, for job shops, as a general rule, do not have these departments as parts of their establishment. The drawing part he must pick up himself or take private lessons or attend night school to obtain the same knowledge that he would by working in a draughting room. The same applies to foundry work. The boy starts in the job shop at the same stage as the boy does in the corporation after he has been in the drawing room and foundry. He has a chance to learn more in this class of shop because there are all kinds of work done. In a job shop he is taught the quickest ways to do work and shown how to make every move count, which is a very important point to make him a first class pattern maker. If a young man could obtain a position in a drawing room for six months and then obtain employment in a foundry for the same length of time, following which he went into the job shop for two years, he would know more, do work quicker and be a better all-around man than if he stayed in a corporation shop for three years.

The next chapter will be Drawing—how to read plans and why this subject should be known in pattern making.

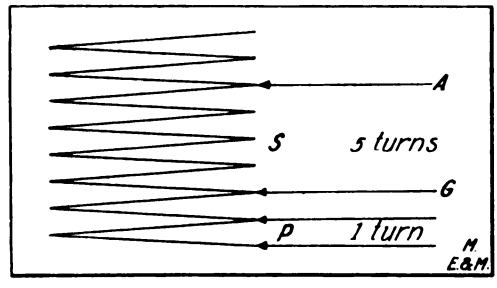
EFFICIENT AMATEUR TRANSMITTERS

By John V. Purssell

WHEN the wireless law was passed, many of the best equipped amateurs thought they could not operate successfully on a wave of 200 meters, and not only became discouraged, but dismantled their stations as well.

The writer shared the prevailing poor opinion of the short wave as a means of long distance communication, but arranged his antenna and other apparatus to comply with the law and resolved to make the best of the situation. Recently, however, while listening on a tune of about 250 meters, he picked up the signature of an amateur in Buffalo, N. Y., and upon inquiry found that the latter was only using a power of 508 watts. The distance was nearly 300 miles, and the character of the intervening country most unfavorable for wireless. Further investigation showed that it was only necessary to listen on 200 to 250 meters, on almost any good night, to hear amateur stations in distant parts of the country.

This discovery aroused much interest in local wireless circles and the writer resolved to find out what his own set would do in the way of long distance work. The set consists of a ¼ kw. closed core transformer giving 9,000 volts, large glass plate condenser, straight helix and stationary spark gap. The aerial consists of four No. 14 aluminum wires on



DEGREE OF COUPLING EMPLOYED FOR LONG DISTANCE TRANSMISSION

10-foot spreaders, about 60 feet above the ground. The wires are 80 feet long and there is a lead from the middle of each clear to the station.

The transmitter was tuned as shown in the accompanying diagram, with one turn of the helix in the primary circuit, and five adjacent turns in the secondary.

(*Continued on page* 652)

Here is our May issue—a big, full-of-interest number with something of especial interest to everyone, no matter what happens to be his particular walk in life or hobby. We are trying hard, *real hard,* to please everyone and from various reports received, it appears that we are succeeding.

Our leading article in this issue covers a phase of wireless that is comparatively unknown in the United States, and that is the equipping of fishing boats with radio apparatus. Dr. Gradenwitz, a frequent and versatile contributor to our columns, has described in an interesting manner the equipment aboard fishing boats in German waters, as well as the advantages that have been gained from a constant radio service between the boats and land station.

The instalment on the construction of small alternating current motors that appears in this issue covers probably the most interesting part of the work. Dr. A. E. Watson, the author of this series, has received many inquiries from readers who are building the motor. At all times he will be pleased to furnish any information that may aid readers in securing the necessary materials for the construction of the motor. His address is 30 Congdon street, Providence, R. I.

Our mechanically inclined friends will at least find one article especially intended for them, and that is the first instalment of the series on pattern making that appears in this issue. The series is being prepared by Mr. G. H. Willard, who possesses years of experience in this trade and has written extensively upon the subject. It is the aim of the present series to cover the field of pattern making so thoroughly that our readers will possess a good knowledge of the trade and its allied branches when the series shall have been completed.

There are several movements on foot at present to bring about efficient relay systems with chains of amateur wireless stations so that messages can be sent between different important cities. Already there have been established several such systems from which the different members obtain much benefit by their being able to transmit their messages through other stations to a distant point. But the chief value of these relay systems does not lie so much in the immediate benefit just cited. In flood times or other similar catastrophes, when telegraph and telephone lines are destroyed, a relay system may be the means of saving life and property, and its value cannot be estimated in such chaotic instances. Elsewhere in this issue will be found other mention of such relay systems which certainly represent a decisive and important step in amateur wireless.

There are several good things in store for the readers of MODERN ELECTRICS AND MECHANICS. For instance, in the June issue there will be an article on wireless telegraphy by Mr. A. S. Blatterman. It will cover the subject of radio communication in a thorough and exceedingly interesting manner. In fact, this article is really a review of the subject and brings forth many new points. Of course, this is only one of the several wireless articles that will be included in that issue.

The mechanical enthusiasts who read the June issue will find of no little interest the article describing the construction of a small cannon fitted with an electrical firing device. The publishing of this article in the June issue gives the readers ample time in which to construct the cannon for the Independence Day celebrations.

Mr. Alfred C. Pickells, U. S. Radio Inspector, has prepared a most absorbing treatise on a phase of wireless telegraphy that has been covered but little in the technical press before. In this article entitled "Do Radio Ghosts Exist?" he narrates the experiences of wireless operators who have encountered atmospheric conditions when it was almost impossible to receive or transmit radio signals. It might be compared to a blanket of fog through which the radio waves could barely penetrate—if at all. Mr. Pickells states in his article that this interesting and surely mystifying phenomenon is not confined to wireless waves, but is also experienced with sound waves. One interesting instance cited is that which occurred during one of the battles of the Civil War in 1864. It is said that the reports of exploding shells as well as cannon shots could not be heard two miles away, although men in the trenches could plainly see the flashes of light in front of them. After several hours of comparative silence, the phenomenon ceased and the detonation of bursting shells and gun and cannon shots became audible again. Similar experiences are noted with wireless waves and the author has endeavored to offer some suggestions as to the causes of the phenomenon. This article is certainly one to look forward to. Don't miss it!

FLYING SPARKS

CONCENTRATING HER EFFORTS

Simpson—Young's wife is certainly a good manager.

Sampson—Of household affairs generally?

Simpson—No; of Young.—*Chicago Ledger.*

RAINY DAY SUGGESTION

Dog gone it, the rain is starting in and I have just begun to enjoy myself. But I am going to finish this drink——

——— without getting wet.—*Le Pele Mele.*

NOT ANXIOUS FOR WOMEN

Mr. Upton—"Where's my hat?"

Mrs. Upton—"I declare, I never saw such helpless creatures as men are. Can't move a step without a woman to look after them. A woman can keep track of her own things, the children's, and her husband's, and run a boarding house besides; while a man can't so much as find his hat without making some poor, overworked woman jump up and get it for him. Here's you hat, just where you left it when you came in. On your way downtown, stop at the *Daily Allthenews* office, and leave this advertisement."

"What's it about?"

"Rooms and board for gentlemen only."—*Chicago Ledger.*

OVERHEARD AT A BARBER SHOP

Barber—"Have you ever been here before, sir?"

Customer—"Yes, I have been here once before."

Barber—"I don't seem to remember your face."

Customer—"Oh, it's healed up since

TRUE TO LIFE

Church—What part did he take in the play?

Gotham—He took the part of a janitor of a flat.

Church—Was it true to life?

Gotham—Sure; the house was cold.—*Yonkers Statesman.*

TURKISH-BATH SUBSTITUTE

The Doctor—What you need is to perspire freely. I'd recommend a Turkish bath.

The Plutocrat—I don't need it, Doctor. I can throw myself into a perspiration at any moment.

The Doctor—How?

The Plutocrat—By reading my income tax blank.—*Cleveland Plain Dealer.*

THE CONSUMER'S IRONY

The attorney for the gas company was making a popular address.

"Think of the good the gas company has done!" he cried. "If I were permitted a pun, I would say, in the words of the immortal poet, 'Honor the Light Brigade.'"

Voice of a consumer from the audience—"Oh, what a charge they made!"—*Chicago Ledger.*

CURING HUMAN ILLS BY MAGNECTIC WAVES

(*Continued from page 574*)

netic waves after an hour's experience with it. There is no danger of shocking the patient or producing burns, as is sometimes the case with the present widely used Tesla and Oudin coil sets of high voltage. Simply stated, just what occurs in the application of these magnetic waves is this: The alternating current, usually having a reversal of polarity or a periodicity of 60 cycles, or 120 alternations per second, passes into the large electromagnet coils of many turns of copper wire and causes them to produce at right angles to themselves a powerful alternating or reversing magnetic field of force. This magnetic field changes from north to south polarity very rapidly, corresponding to the frequency of the supply current, as mentioned above. For a 60-cycle current the duration of one magnetic impulse or wave is 1/120 of a second.

These magnetic lines of force, unlike the electric current, will penetrate any non-magnetic body as readily as air, such as glass, wood, fibre, the human body, etc. These so-called magnetic waves, when passed through the body, produce neither shock nor any other unpleasant sensation. They pass into and through the body with an even, undulating, vibratory, rythmic motion, thereby agitating all cells equally and reaching any deep-seated affected organ directly. It is well understood that electric currents are capable of burning and therefore it cannot be denied that a dessicating influence upon the tissues must accompany their use. On the other hand, the magnetic waves contain neither heat nor fire in themselves, but by setting up molecular activity in the bodies acted upon, possess the faculty of gently raising their temperature.

The high frequency electric current when permitted to pass over a conductor for no matter how long a time, when finally turned off leaves that conductor in precisely the same condition as it was before the current had been turned on. But any substance, especially the human organism, if exposed for even a short period to the influence of the magnetic waves, absorbs and re-

tains some of that magnetic force. In other words, it becomes charged with it, and in turn this force is transformed into vital energy that is expended in the various vital processes of which the most important is the resistance to and the combating of disease.

When the patient is placed between the magnetic wave producing coils of the Bachelet apparatus, a constant and periodically reversing magnetic field of force surges through his body. An inconceivable number of minute magnetic particles, each with its negative and positive pole, are thrown into space by each generator, exchanging polarity with each other within the space between the coils and penetrating all substances of a non-conducting nature. Powerful currents of low voltage and high amperage are set up in all electrical conductors, thereby exciting molecular and cerebal activity in the tissues of the human body, magnetizing at the same time the iron, oxygen, and other positive elements in the blood and tissues.

Normally, the magnetic field of the earth's atmosphere accomplishes this result. This magnetism constitutes what is termed "the electric potential" of the human body and without this magnetizing influence of the earth's atmosphere it is not improbable that life could not exist upon our planet. When the electric potential of the human organism is at its height, the body possesses the necessary vital force to ward off and combat disease. If this vital force becomes diminished the body loses its power of resistance to the attacks of disease and gradually the latter wins the upper hand.

It has been proven by numerous tests made with the Bachelet magnetic wave generator, that it does raise the electrical potential of the human body as much as 33 per cent. One-fourth of this increase is expended in the vital processes within 24 hours; three-fifths in 48 hours, and it has required at an average 72 hours—if no additional treatments were administered during the test period—before the body returned to its original potential. Numerous microscopical and analytical examinations of samples of blood, taken before and after one hour's treatment, have in every case shown a

marked and favorable morphological change. This system of electrotherapeutics has been used to advantage in raising low and reducing high blood pressure; as well as in numerous other diseases and ailments ordinarily treated by high potential currents.

UNITED STATES ARMY CAMP SWITCH BOARDS

(*Continued from page* 581)

weights, etc. The supervision employed is of the single bridged drop type; the clearing-out signals being mounted in the ebonized panel directly beneath the line signals. Double ringing and single listening keys are mounted flush with the key shelf upon a metal key frame. When the switchboard is set up ready for use the cords extend down through a trap door cut in the base of the trunk.

The operator's equipment is of particular interest. By referring to the view showing the front of the switchboard the reader will observe that the transmitter is equipped with a plug and cord in order that it may be readily detached and stored in the cover while in transit. The transmitter arm is arranged to fold across the face of the board, being secured in place by a catch when not in use. Two standard head-band receivers are furnished, one being held in reserve for emergency purposes. Receiver connections are made in the usual way with cord and plug to a jack mounted in the rail beneath the jacks. A five-bar hand generator is mounted in the rear of the board with crank shaft extending through to the front of the board to the right of the operator. An eight-day flush type clock completes this unique apparatus.

PONTIAC RADIO ASSOCIATION

The wireless amateurs of Pontiac, Mich., have formed a radio club known as the Pontiac Radio Association. The officers of this club are: Charles Burton, president, and Delbert Gottschalk, secretary and treasurer. The club has 12 members. All persons wishing to join the club should write to Charles Burton, 50 East Huron street, Pontiac, Mich.

HIGH FREQUENCY CURRENT APPARATUS

(*Continued from page 620*)

point dial switch as shown in the wiring diagram, fig. 22, the lever being made of 1/16-inch brass, 4 inches long, and the contact buttons ½-inch in diameter. The connection of the leads to the switch is so made that the least number of turns are cut in and the maximum secondary voltage obtained when the lever is placed on the No. 3 point; the lowest or normal voltage occurring when the lever is on point No. 1.

To regulate the value of the current applied to the transformer, a rheostat of sufficient capacity can be used, but an adjustable choke coil is the best. A good core for this purpose is formed of a laminated annealed sheet-iron core, 17 by 3 inches by 3 inches, insulated with several layers of empire cloth or heavy paper. The winding is composed of 130 turns of No. 4 B. & S. gauge, D. C. C. copper wire with taps lead off at every eighth or tenth turn to a contact button on a multi-point switch containing that many buttons and a single lever sliding over them in turn. The buttons are so spaced that no two are short-circuited when the lever is resting upon any one.

The core should be arranged to slide in and out of the coil to realize the greatest range of action, the maximum impedance being inserted in the circuit when the core is all the way in the coil and all the turns are switched in.

The rectifying valve cell is usually a glass vessel about a foot square and as high, into which are placed four iron plates 1/16-inch thick and 6 by 10 inches, together with four 1/16-inch aluminum plates, 6 by 10 inches, the plates being separated ½-inch. The electrolyte consists of 10 parts of distilled water to 1 part of sodium bicarbonate. To form the elements of the valve cell, the transformer should be allowed to discharge over an air gap for a few minutes. The iron and aluminum plates must alternate in position.

The best of care must be exercised in first trying out the apparatus on account of the danger of coming into contact with the high potential secondary current. To be immune from danger, always open the primary circuit before

making any alterations in connections. Also the polarity of the secondary discharge must be carefully noted, connecting the positive terminal to the anode of the X-ray bulb, the proper tube connection being manifested by a perfect hemisphere of light in front of the anode electrode, also the image on a fluoroscope will be clear and steady. Reversed current causes the X-ray tube to become filled with a flickering light and rings. It may be necessary to reverse the connections to the primary rectifier valve, in such an event.

A high tension valve tube should be inserted in the positive secondary lead to the anode of the X-ray tube, and also an oscillioscope; the former to eliminate as much inverse current as possible and the latter to denote its presence and quantity.

When first starting the X-ray bulb, its vacuum should be lowered a little or else rings may appear in it and lead to the false conclusion that the tube is connected improperly.

The transformer described above is also suitable for a rectifying machine of the "Interrupterless" type.

For 220-volt A. C. circuits, the transformer primary coil should be composed of 278 turns of No. 7 B. & S. gauge D. C. C. magnet wire, with taps taken out at the 1st, 160th, 250th, and 278th turns.

ENFORCEMENT OF WIRELESS LAWS

The Secretary of Commerce recently approved a penalty of $25 to be collected from an amateur wireless operator in San Francisco, for a violation of the 15th regulation of the wireless act of August 13, 1912, in that the wave length emitted by his wireless station exceeded by 370 meters the limit fixed by law for his class of station.

The amateur was given several warnings by the United States Radio Inspector and allowed a considerable length of time in which to properly adjust his station. There are several simple methods by which an amateur may determine the wave length he is using, with which all amateur station operators should be familiar.

A commercial wireless operator hold-

When writing, please mention "M. E. and M."

ing a license issued by the Department of Commerce should be very careful to have the service record on the back of his license properly filled in and signed by the captain or official under whom he is employed.

Recently a commercial operator, either through ignorance or intent forged the signatures of two captains under whom he had served, to the license board. The Secretary of Commerce has referred the papers in the case to the United States Attorney in order that prosecution for forgery may be instituted. Wireless operators must be taught to realize their responsibility under their licenses.

GRAPE BELT RADIO ASSOCIATION

The Grape Belt Radio Association, uniting the radio operators of the Lake Erie grape belt in New York and Pennsylvania, was organized March 14 at Fredonia, N. Y.

The officers of the club, with their addresses, are as follows: Herbert A. Hiller, president, Silver Creek, N. Y.; L. O. Buckner, vice-president, Brocton, N. Y.; George Mason, secretary, Fredonia, N. Y., and Arthur J. Macer, treasurer, Westfield, N. Y. These officers, together with Ralph Lilley, of Westfield, and George Munger, of Fredonia, constitute a board of directors for 1914.

The organization was founded to promote a more thorough knowledge of radio communication among its membership, as well as a closer adherence to Government rules for amateur stations.

A cordial invitation to join is extended to all amateurs living in the territory mentioned. Further particulars may be had from the secretary.

TIME RECEIVING WIRELESS SET

The firm of Wells Jewelry Company, of Savannah, Ga., is said to have been the first in the South to install a wireless time receiving set in its store. This set is used to receive standard time signals from the Government stations. It consists of a Clapp-Eastham receiving outfit with a galena detector. It was installed by A. J. Funk, a licensed operator attending the Savannah High School.

NEW THINGS

Electrical—Wireless—Mechanical

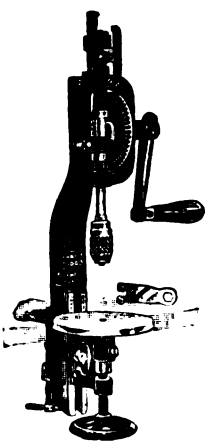
A Line of Bench Drills

The firm of North Bros. Mfg. Company, Philadelphia, Pa., has announced its new line of "Yankee" bench drills that are equipped with automatic friction and ratchet feeds.

The distinguishing features of these Yankee

VISE INTENDED FOR USE WITH BENCH DRILL

bench drills are their strength, convenience and rapidity of operation. By means of the automatic and friction feeds, the operator has the free use of one hand to hold the work—a very desirable point which is sadly lacking in most hand-driven drill presses. At the top of the feed screw is a ratchet which feeds when the lever is horizontal. On the inside is a friction feed which operates when the lever is vertical. The friction feed is adjusted to work quickly in moving the drill to and



THE SMALL SIZED "YANKEE" BENCH DRILL

from work, while the automatic ratchet feed is positive, fixed and without adjustments so that drills from No. 54 up will not be broken in use as is often the case in feeding by hand. A bracket at the top of the frame with right and left arms, disengages the ratchet feed at extreme up or down movements of the spindle, so that parts cannot be jammed. The table on which the work is placed can be adjusted progressively by means of a hand wheel and screw as well as by sliding the table bracket up or down. This feature of the design permits of unusual depth for a bench drill. The bracket and table are readily removed so that any high work can be supported on the floor or on a box, under the bench drill. This drill is made in two different sizes, one for drilling up to ¼ inch and the other up to ½ inch.

In conjunction with the above described bench drill, the manufacturers offer a convenient vise for holding various kinds of work. Its body and sliding jaw are of cast iron, accurately machined to hold the work square. A removable swivel jaw is also provided to hold taper work and is made of steel, case hardened. Two countersunk holes are provided in the base so that the vise can be screwed to a work bench if desired.

For further particulars concerning the above machinery, communications should be addressed to the manufacturers direct.

Increased Manufacturing Facilities

The Viking Electric Company, manufacturers of Viking Bell Ringers and other Viking Products, in order to take care of a rapidly growing business is moving its plant from Albany to 292 Taaffe Place, Brooklyn.

The new plant, containing twice the floor space of the old plant, will be equipped with additional machinery and more help will be taken on.

The present sales office at 150 Chambers street, New York, where a large stock is carried, will be maintained.

Automatic Telegraph Keys

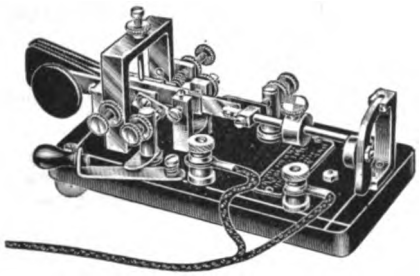
The sending of wireless messages hour after hour would not be a desirable task and would certainly be a very tiresome one were it not for the automatic sending keys now used by practically all operators handling important stations.

Perhaps the best known of automatic telegraph keys is the Martin Vibroplex, which is very similar in design and operation to the automatic high speed key described in the April issue of MODERN ELECTRICS AND MECHANICS.

The Martin Vibroplex is extremely simple in construction and has the minimum of parts—especially small parts that are liable to become deranged. The adjustments are few and easily made. Its operation is extremely simple and can be mastered after a few hours' practice. It has two levers, one for making dots and the other for making dashes. As long as the key to the right is pressed, the vibrating pendulum will cause dots to be made. Pressing the dash lever to the left, sends a

dash of any desired length depending upon how long the lever is held.

It is said that the Martin Vibroplex was the first sending machine ever used in the transmission of signals across the Atlantic Cable. It is the standard automatic key of all telegraph operators. Of late, wireless operators have been using the Martin Vibroplex



AN AUTOMATIC SENDING KEY FOR WIRELESS

more and more for sending, finding that same relieves much of the fatigue attending the sending of lengthy messages as well as making their Morse or Continental more exact. In fact, no wireless station, whether commercial or amateur, is complete without one of these automatic sending keys.

Several infringement suits have been recently brought against other manufacturers of automatic sending keys and have proven decisive victories for the Martin Vibroplex, which controls practically all the patents on such an instrument. This machine is made in several models, all of which are attractively finished.

Full particulars concerning automatic sending keys can be secured by addressing J. E. Albright, Sole Agent for the Martin Vibroplex and the Mecograph Company, 253 Broadway, New York City.

Boston School of Telegraphy

The fifteenth anniversary of the opening of the Boston School of Telegraphy—one of the oldest and largest schools teaching telegraphy in all its branches in the East—will take place in May.

This institution has stood the test of time—which is always the most trying one—and today is conspicuous for the students that have graduated from its class rooms.

The anniversary will be marked by a yearly catalog published by the school, giving the prospective student an idea as to what a successful institution can do for its students and graduates.

In taking up the study of wire or radio telegraphy, much depends upon the student's ability, but by far the greater factors are the knowledge and experience of the instructor as well as the equipment and surroundings of the school. For this reason, it has always been the aim of the Boston School of Telegraphy to be up-to-date in equipment, surroundings and system of instruction, as well as keeping in close touch with the advancement and success of the student. A course in this institution includes lectures, class instruction and individual instruction. The new radio station recently installed and the additional class rooms are worthy indications of its success.

All prospective students are invited to call or write for the new catalog before enrolling. All requests should be addressed to the Boston School of Telegraphy, 18 Boylston street, Boston, Mass.

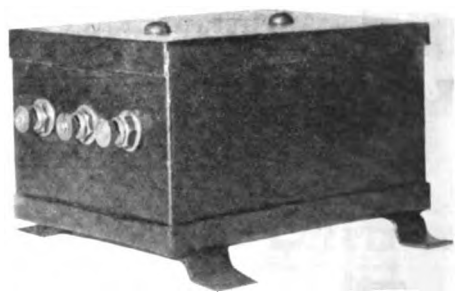
Small Step-Down Transformers

In the accompanying illustration is shown one of the line of small, low voltage transformers that has recently been placed on the market by the Fraasa Engineering Company, of Norwood (Suburb of Cincinnati), Ohio.

These transformers are designed for stepping-down the usual 110 volt alternating current to lower voltages which, although still alternating, will operate all classes of direct current apparatus.

The design of these transformers is in accordance with the most approved practice, properly proportioned to give the highest efficiency and operating characteristics. The materials entering into the construction of these transformers are of the very best—the magnetic circuit being made of silicon steel and the windings of enameled wire. The line includes transformers of 30, 50 and 100 watts capacity, with taps in steps of 2½ or 5 volts, making a wide range of voltage available.

By addressing the Fraasa Engineering Company, prices and further information concern-



A 30-WATT BELL-RINGING TRANSFORMER

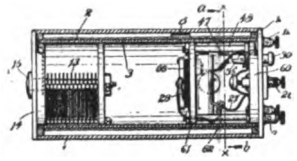
ing the construction of these transformers may be obtained.

A NEW WIRELESS ASSOCIATION

All wireless amateurs residing in Iowa who desire to join a proposed wireless association which is now being organized, are requested to write to Ralph Batcher, Toledo, Iowa. Any ideas or suggestions will be greatly appreciated.

RECENT NOVEL PATENTS

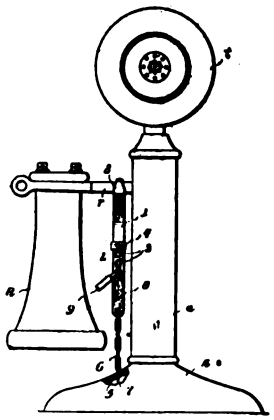
1,091,127. WIRELESS RECEIVING APPARATUS. ROBERT R. GOLDTHORP, Hartford, Conn. Filed Aug. 31, 1912. Serial No 717,993. (Cl 250—14.)



1. In a wireless receiving apparatus a casing, a hollow tuning coil fixedly secured within the casing and open at both ends, closures for the ends of said casing and coil, a condenser mounted on one closure and located within the coil, a detector, circuit connections and a detector switch mounted on the other closure and located within the coil, slides arranged in operative relation to the coil and movable longitudinally thereof, supports for said slides in electrical connection therewith, said supports electrically connecting said condenser with the detector and ground terminals.

1,090,053. TELEPHONE-LOCKING DEVICE JOHN W HARVEY, Sunset, Tex. Filed Apr 18, 1913. Serial No. 762,037. (Cl. 179—189.)

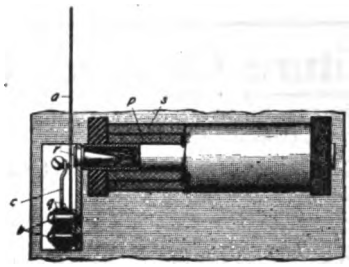
A telephone locking device formed of a strap formed of a single strip of metal bent upon itself approximately centrally of its length and having the bent portion thereof to provide a loop adapted to embrace the arm of the receiver fork, the parallel members of said strap being placed in face to face contact and formed with alining openings adjacent to the free ends thereof and spaced apart longitudinally of the strap, a collar embracing the limbs of said strap and adapted for sliding movement thereon to draw the free ends of the strap toward each other, a flexible element passed through an aperture in the base of the telephone and carrying at its lower end a cross piece



designed to prevent the withdrawal of such flexible element, a link carried by said flexible element and having the free end thereof apertured and adapted to be disposed between the free extremities of the limbs of said strap, the aperture in the end of said link being capable of interchangeable registration with the apertures in said strap whereby the flexible element may be drawn taut, and a lock adapted to be passed through the alining apertures in the limbs of said strap and link.

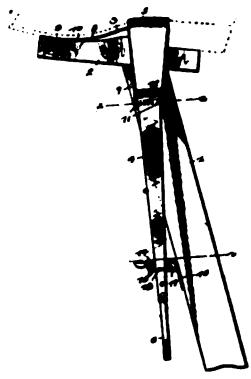
1,090,877 VIBRATING CIRCUIT-BREAKER. PAUL M. RAINEY, West Hoboken, N. J., assignor to Western Electric Company, New York, N. Y., a Corporation of Illinois. Filed June 17, 1910 Serial No 567,451. (Cl. 171—253.)

1. An interrupter comprising an induction coil, an armature, a support for said coil and armature, said armature being in the form of a long broad vane anchored at one end to said support and passing through and beyond the



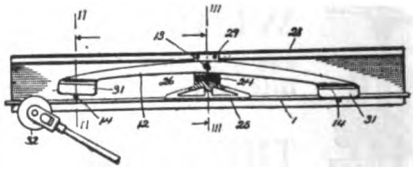
field of force of said coil, and a circuit including said coil adapted to be opened and closed by said armature in its movement.

1,090,022. SHOE-SHINER'S CLAMP. FRANK LESTER CAMPBELL, Chelan, Wash. Filed Apr. 18, 1913. Serial No. 761,995. (Cl. 15—58.)



1. In a shoe stand the combination of a foot rest, operating levers having pivotal connection with the foot rest and provided with jaws to grip the sole of the shoe placed in position upon the foot rest, said jaws being bodily adjustable by a swinging movement of the levers toward and away from the foot rest.

1,090,309. ELECTRIC RAILWAY-SIGNAL. JOHN B. HOWELL, Leavenworth, Kans. Filed Aug. 30, 1910. Serial No. 579,758. (Cl. 246—54.)

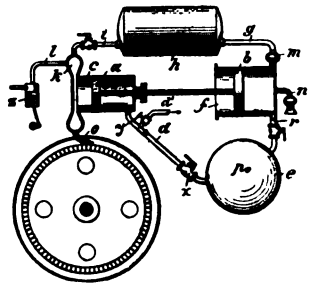


1. A signal controller for electric trolley railways, comprising, in combination with the trolley wire, a supporting wire extending across and above the trolley wire, an insulating block mounted on said supporting wire, a lever fulcrum mounted on said block, a switch lever pivoted on said fulcrum above the trolley wire, said switch lever having at each end thereof a portion adapted to be elevated by the passage of a trolley wheel therebeneath, an insulated contact device carried by each end of said lever, each of said devices being adapted to form electrical connection with the trolley wire when depressed, and flexible conductors connected to said contact devices respectively.

RECENT NOVEL PATENTS

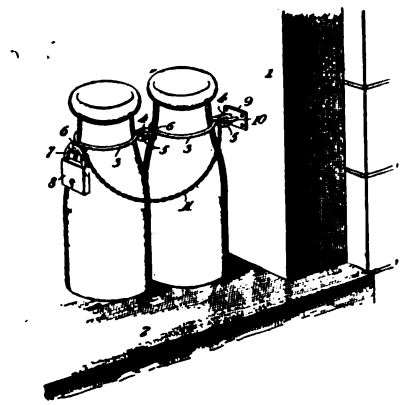
1,089,892 EXPLOSION GAS TURBINE HEINRICH ZOELLY, Zurich, Switzerland. Filed Jan. 6, 1913. Serial No 740,470 (Cl. 60—4.)

1. In an explosion gas turbine, the combination with a piston compressor, of a two cycle gas engine for impelling said compressor, the combustion gases of said engine expanding during the outward movement of its piston, an explosion chamber in continuous communication with the cylinder of said engine, nozzles connected to the combustion chamber, a rotor wheel, auxiliary means for expelling said combustion gases during the inward stroke of



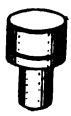
the piston of the gas engine at an approximately constant pressure and for causing these gases to flow during the whole working process through said nozzles at a speed of the greatest possible uniformity to said rotor wheel

1,089,985. MILK BOTTLE OR JAR PROTECTOR. JOHN J. TEHAN, Pittsburgh, Pa. Filed May 23, 1913. Serial No. 769,411. (Cl. 232—41.)



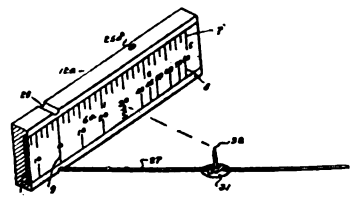
1. A milk bottle protector comprising a staple securely fastened to a suitable structure, a wire clamping frame having a lateral extension at one side thereof provided with a depending hook portion and terminal end portions, each end portion having an eye, and means for locking the said end portions together.

1,089,907 ELECTRICAL CONTACT. WILLIAM D. COOLIDGE, Schenectady, N. Y., assignor to General Electric Company, a Corporation of New York. Original application filed Mar. 20, 1912, Serial No. 685,113. Divided and this application filed Dec. 17, 1912. Serial No. 737,214. (Cl. 173—13.)



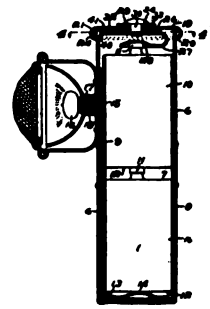
1. An electrical make-and-break contact of tungsten.

1,089,885. ANGLE-FINDER. GUSTAVE WALLACE, New York, N. Y. Filed Mar. 22, 1913. Serial No. 756,170. (Cl. 88—2.2.)



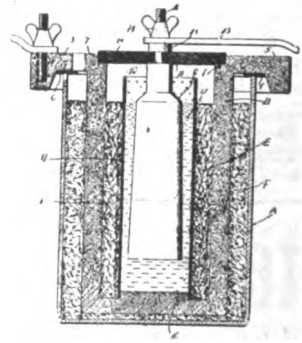
1. An angle finder comprising a frame adapted to stand with one of its edges on a primary support, a mirror having divisions representing inches and fractions thereof set into said frame, a cord attached at one end to said frame and adapted to be swung therefrom in front of the divisions on the mirror, and a sight on the cord co-acting with said divisions.

1,090,983. ELECTRIC LAMP. ELLSWORTH A. HAWTHORNE, Bridgeport, Conn. Filed June 25, 1913. Serial No. 775,636. (Cl. 240—8.5.)



1. The combination with a battery, of a battery casing, and means to complete the battery circuit including a member rotatably mounted on said casing, and means carried by said member to close the battery circuit and hold said member against rotation.

1,090,763 ELECTRIC-BATTERY CELL. HARRY A. THOMAS, Springfield, Ill. Filed May 17, 1912. Serial No. 697,948. (Cl. 204—41.)



1. An electric battery including an anode of zinc, bismuth, mercury and platinum, a suitable cathode and an electrolyte including hydrochloric acid, sulfuric acid, sodium silicate and water.

IN RE THE U. S. PATENT OFFICE

(*Continued from page 602*)

to every 1,716 of population; Connecticut, with only 968 patents, leading in proportion to population with one for every 1,152 of its citizens. In patents granted to foreigners, Germany was first with 1,433; England next with 908 to her credit.

The number of applications filed has practically doubled within the last generation, yet this important department of Government has only the same antiquated quarters, only the same available or unavailing space of 45 years ago, now overcrowded out of all proportion to health and comfort, and a *not* insignificant or inefficient but sadly *insufficient* corps of poorly paid experts to pass upon the most momentous business interests of the country in the embryo state. For instance, the present examining corps in the Patent Office is composed of two Law Examiners, forty-three Principal or Primary Examiners, and three hundred and thirty-four Assistant Examiners, of whom sixty-three are paid $2,400 a year, seventy-three are paid $2,100 a year, eighty-eight are paid $1,800 a year, and one hundred and ten are paid $1,500 a year. It will be noted that there are more Assistant Examiners receiving only $1,500 a year than the sum-total of the Law Examiners, the Primary Examiners, and those Assistant Examiners receiving $2,400 a year. This disproportion of the number in the lower grades to those in the higher grades slows down promotions, discourages talent and ambition, and causes the loss to the Department of many of the best and most competent Examiners. The stringent economy exercised by Congress as regards the Patent Office is, to say the least, "penny wise, pound foolish."

PROVING AN ALIBI

She—George, dear, why do you invariably go out on the balcony when I begin to sing? Does it make you sad, dear?

He—Not exactly that, dear, but I couldn't bear the neighbors to accuse me of wife beating.—*Chicago Ledger.*

EFFICIENT AMATEUR TRANSMITTERS

(*Continued from page 627*)

This gave a wave of a little less than 250 meters and the radiation was found to be almost as great as when the coupling was made close and many more turns included.

Although the set has not been tuned up this way long enough to give it a thorough trial, the writer has already succeeded in reaching a private station in Little Valley, N. Y.—a distance of 240 miles. Taking into consideration the size of the antenna and the small power employed, it would seem that the short wave is at least the equal of the longer one and perhaps its superior.

The best equipment for the station that is to do long distance work on a short wave length is specified in the following: First in importance is the aerial. This should be designed so as to radiate and receive the largest possible amount of energy and still have a short natural wave length. In other words, it should be high but short. If it is of the flat top type, it may have several wires, but should not be more than 80 feet long. If possible, the station should be under the center of the aerial and the wires should be tapped midway from the ends; the lead-in wires coming down as directly as possible to the apparatus. The "T" aerial will collect as much energy as an aerial of the same size that has the lead-in from the end, and has the decided advantage of a shorter natural wave length. This enables the operator to use more of his tuning coil in receiving and in the case of the short waves, such as are used by private stations, greatly increases the efficiency.

The same principle holds good in sending, for more inductance and larger condenser capacity may be used without exceeding the wave length limitations.

The "T" aerial also has the advantage of being less directional. In instances where the station is situated under the end of the aerial, however, nothing will be gained by leading in the latter from the middle, as the length of the leads will be so great as to offset any advantages that might be gained otherwise. The choice of wire will depend on circumstances. Any moderate sized wire

will be strong enough for an aerial of the length described. Stranded copper will probably give the best results, but where this is too expensive or too heavy for the available supports, single stranded copper or No. 12 to No. 14 aluminum may be used.

Next to the aerial in importance are the connections. These should be as short and direct as possible and especially for the transmitter, very heavy. Copper strip ½-inch wide is none too large. As the current only flows on the surface, the thickness of the strip is of no importance. Another point deserving of attention is the condenser. The plates should be immersed in oil or their edges covered with paraffine or some other insulating compound. Otherwise the brush discharge may cause a loss of power of as high as 30 per cent. The condenser connections should be made with broad pieces of copper.

One of the leading Government experts has told the writer that the ordinary helix will give as good results in every way as the oscillation transformer; the only advantage of the latter being the ease with which the proper degree of coupling may be found. A suitable helix should be 8 to 10 inches in diameter and have from 6 to 10 turns of heavy strip or other conductor.

Finally, the right wave must be found and the set brought into resonance. It is hardly possible to do this without a hot-wire meter and a wave meter. In fact, one great advantage of forming a wireless club is that the club may own these instruments and all the members tune up with little expense to each individual.

To tune your set, first disconnect the aerial and ground, and adjust clips on the helix till the wave meter indicates the desired wave, then connect the aerial and ground. Vary the number of turns of the helix in the circuit till the hot-wire meter shows the maximum radiation. It may now be found, however, that the radiated energy is divided between two wave lengths. This indicates that the coupling is too close and the two aerial and ground clips must be moved—still keeping the same number of turns between them—away from the primary connections till the wave meter shows that the two waves have merged into one.

In doing this the radiation will fall somewhat, but as all the energy will be in one wave the range of the station will probably be increased.

The writer has found that little dependence can be placed in the size of the spark in the aerial switch for indicating when a set is properly tuned. The hot-wire meter is the only accurate indication to go by. Nor does the fact that you are not heard as loud by other stations, when tuned to 200 meters, necessarily indicate that your efficiency has been decreased. It is often caused by the fact that the distant station is using a long aerial which can not be brought into proper resonance with a 200-meter wave. In this case the receiving station should use a variable condenser in series with the ground or aerial, or, better still, a shorter aerial.

The short aerial will bring in the stations using long waves almost as well as a longer antenna, while the short wave stations can be received a great deal better. And it should be borne in mind that the stations using short waves are in the vast majority.

RADIO APPARATUS ADJUSTMENT RECORD

The Department of Commerce, Bureau of Navigation, has recently issued Form 776, which is to be filled in by radio inspectors and posted in all wireless stations, thus identifying the equipment licensed as well as the lawful adjustments of the station. This record is quite complete and covers all the data regarding the transmitting outfit. On its reverse side there are nine diagrams depicting how different forms of helices and oscillation transformers as well as the degree of coupling should be drawn. On the front of the record there are several cross-ruled spaces in which the inspector draws in the connections used on the coupler or oscillation transformer for various wave lengths.

This record is exceedingly useful for it furnishes the operator with all the necessary information concerning his transmitting set. At all times he can determine whether the set is being operated according to the law, and can also make adjustments for different wave lengths if necessary.

The Interchangeable Platen as one Feature of the

Victor Typewriter

ILLUSTRATES the wonderful elasticity of Victor service. Suppose you want to get off a rush letter—a telegram—a communication that must make special connections. Your stenographer has some half completed statement and a half a dozen carbon copies in the machine; to move it means hopeless disarrangement.

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If you have an additional platen, the platen in the machine can be removed in a "jiffy," the other one substituted, and the "rush" work "goes ahead" on the "clean" machine.

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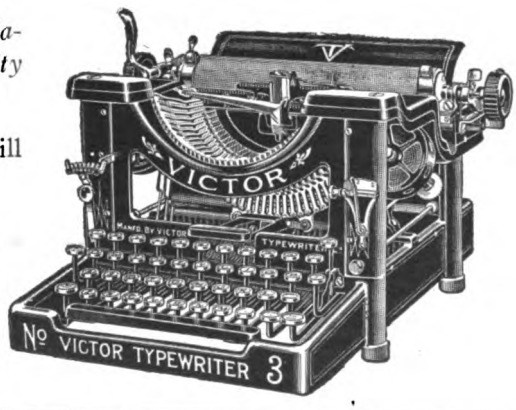
Aside from this the Victor has many other features not found in any other machine.

Speed, Ribbon Economy, Dependability, Improved Escapement, Quality of work, are a few of these.

A five minute demonstration will convince you.



Victor Typewriter Company

NEW YORK

OHIO VALLEY RADIO ASSOCIATION

The Ohio Valley Radio Association was organized on February 1, 1914, at Cincinnati, Ohio. This organization was formed with the intentions of promoting a more general interest in wireless and to establish relay stations. The idea of establishing this chain of stations is to avert the isolation of large cities during floods or other disasters that have occurred in the past in the Ohio Valley and adjoining territory.

The officers of this club are: J. H. Flynn, Jr., president; L. K. Burkhart, vice-president; T. H. Kroeger, treasurer; Ira S. Holden, corresponding secretary, and E. W. Reuter, recording secretary.

There are 80 members at present, although the club has held but four meetings. The meetings are held in the Ohio Mechanics Institute, a well-known Cincinnati school.

The association and its officers are very progressive, having already established a system of stations through which a message could be relayed to the Pacific Ocean in case of absolute necessity. One of the members, Mr. Kroeger, who has one of the finest amateur stations in the State, has already transmitted to Montreal, Canada. He only employs a ½ kw. transformer, but has a transmitting range very seldom covered with less than twice that power.

The association will be pleased to hear from other organizations who desire to become a part of the relay system. Anyone desiring further particulars concerning this association should write to E. W. Reuter, 34 East Sixth street, Cincinnati, Ohio.

MONEY WASTED

With a weary sigh she tossed the magazine aside.

"What is the matter, dear?" her husband asked.

"I've read nearly every story in this thing," she said, "and I haven't found a line that I should not wish my daughter to see, if I had one. It's 15 cents wasted."—*Chicago Record-Herald.*

BOOK REVIEWS

Any book reviewed in these columns may be secured through our Book Department.

The New Philosophy

In a rather voluminous work, Calvin Samuel Page has covered the theories of modern philosophy in an interesting and thorough manner. This work is not an elaboration of the older hypotheses, but is an explanation of the new theories offered for physical phenomena.

Electricity, gravitation, repulsion and the new atomic element Rex are explained for the first time. Explanations are also offered for sound, heat, light, cohesion, magnetism, atmosphere, astronomy and nervous force. The theories offered for various phenomena are indeed startling if compared to the older ones that have grown so familiar to us, yet are evidently justified by very convincing reasoning.

This work should be read by those who are interested in learning more about this world in which we live and the remarkable phenomena which surround us and apparently—until the appearance of this work, at least—have baffled any attempts at analyzing them.

**The New Philosophy*, by Calvin Samuel Page. Published by the Science Publishing Company, Chicago, Ill. Contains 800 pages. Substantially bound in cloth. Price, $3.50.

Popular Science Books

Four popular little volumes now constitute the Arts and Science series. Briefly, these are as follows:

No. 1.—"Amateur's Wireless Handy Book," containing a list of ship and land stations as well as the licensed amateur stations at the present time. It also has a table of the abbreviations adopted by the International Radiotelegraphic Convention, abbreviations in general use, the Morse and Continental Codes as well as a Learner's chart, and 17 pages of hook-ups for both receiving and sending outfits. These hook-ups are quite complete and cover almost any combination of instruments. Two pages are devoted to outline wiring plans, which the amateur can fill in and mark the date when such a hook-up was employed.

No. 2.—"Model Flying Machines" is a work devoted to the construction of model aeroplanes. The construction of the various parts as well as different models is covered at length.

No. 3.—"Lessons in Wireless Telegraphy," as its name implies, constitutes a series of lessons in wireless telegraphy, beginning with the principles of magnetism and electricity, and covering each piece of apparatus in turn employed in radio communication. It is a most commendable book for a beginner in wireless, for it explains many points that may be somewhat vague to him.

No. 4.—"The Operation of Wireless Telegraph Apparatus" is intended for the wireless amateur who desires to obtain the maximum efficiency from his apparatus. It furnishes a mass of information relating to the various instruments. This work is also recommended to the wireless beginner.

The above books of the Arts and Sciences series contain from 60 to 75 pages each. They are well illustrated throughout with attractive views and diagrams. The series is published by Cole & Morgan, New York, N. Y. Price of each work, paper covered, $0.25.

Practical Mathematics

One does not have to be intimately acquainted with electricity to immediately realize that mathematics play an important rôle in the work of the electrical engineer. In fact, even the electrician who lacks a fundamental knowledge of electrical calculation is very seriously handicapped in his daily work.

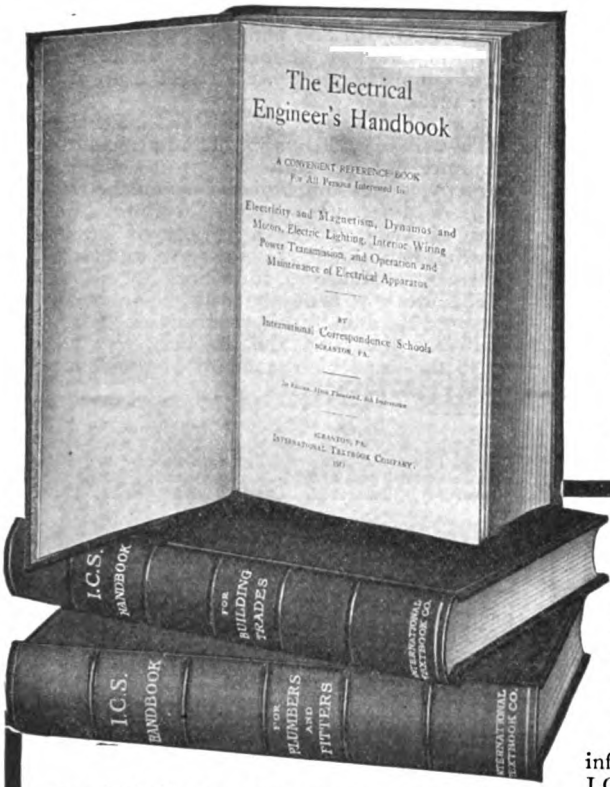
It is with a view to furnishing the electrician and the practical electrical engineer with a foundation in the mathematics encountered in electrical work that the authors have prepared the work entitled "Practical Mathematics for the Engineer and Electrician." * The book is not a course in elementary arithmetic, for the reader is expected to have a grounding in the subject beforehand. It is a handy reference volume in which the mathematics encountered in electrical work are covered in the simplest and most explicit manner.

The work can be recommended without hesitation to the engineer, electrician, student or anyone else interested in electricity. The ground which it covers is unique, for the information could not be secured in any single volume on electrical engineering. Perhaps several works would have to be referred to in order that the desired formulæ be located, only to find then that these were too difficult to understand.

**Practical Mathematics for the Engineer and Electrician*, by Elmer E. Burns and Joseph G. Branch. Published by The Joseph G. Branch Publishing Co., Chicago, Ill. Contains 143 pages and many illustrations and tables. Cloth bound. Price, $1.00.

Attractive Furniture Design

Under the title of "Furniture Design for Schools and Shops," a companion volume to "Problems in Furniture Making" has been published. Although the latter volume has well served its purpose as an instruction book on the making of furniture, it failed to bring forth any initiative that might be possessed by the builder. Since originality and initiative are two of the qualities that furniture building should serve to develop in students, it follows that if the instructions and designs are followed concisely, the work has partially failed



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Mechanics': Tables; formulas; measurements; belting; mechanical powers; hydromechanics; specific gravity; strength of materials; shafting; boiler design; care of boilers; power of boilers; chimneys; exhaust heating; machine design; machine tools; slide valve; pulleys; horsepower; cylinders and steam chests; pistons; gearing; dynamos and motors; batteries; transit surveying; curves; radii and deflections; earthwork; trackwork; etc. Contains 330 pages and 174 illustrations.

Electrical Engineers': Tables; chemistry; mechanics; electricity; electrical units, symbols and quantities; physical and electrical properties of metals and alloys; wire gauges; magnetism; dynamos and motors; armature winding; electrical batteries; alternating current apparatus; alternators; transformers; wattmeters; transmission; electric lamps; wiring; electric heating and welding; electromagnets; controllers; car wiring; etc. Contains 414 pages and 238 illustrations.

Chemists': Definitions and fundamental laws; atomic weights; pressure; volume and temperature of gases; weights and measures; specific gravity; hydrochloric-acid, nitric-acid, and sulphuric-acid solutions; solubilities of chemical compounds; heat measurement; qualitative analysis; special tests of acids; general table for analysis; classification of rare metals; the spectroscope; nitrogen; blowpiping; determination of gold and silver ores; methods of assaying; composition of alloys; tables; antidotes of poisons, etc. Contains 332 pages and 11 illustrations.

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—in that sense at least. It was to overcome this danger that the author of "Problems in Furniture Making" prepared his latest work,* which emphasizes the necessity of using one's own ideas.

"Furniture Design for Schools and Shops" opens with an explanation of the principles of furniture design, followed by many pages of attractive plates and explanations on the treatment of different pieces of furniture. Each piece is illustrated in a variety of designs, showing how simple changes serve to alter the general appearance of furniture.

This work is certainly instructive for anyone interested in furniture making. It is attractively illustrated and in every way quite up to the usual high standard of the Manual Arts Press publications.

* *Furniture Design for Schools and Shops*, by Fred. D. Cranshaw. Published by the Manual Arts Press, Peoria, Ill. This work, a companion volume to "Problems in Furniture Making," contains 127 pages and is profusely illustrated. Cloth bound. Price, $1.00.

Illumination and Artificial Lighting

A most interesting reference work has been published on the subject of illumination under the title of "The Elementary Principles of Illumination and Artificial Lighting." *

To say the least, the work is certainly thorough in its treatment of the subject. It has been primarily intended for engineers and students, but it will be found equally valuable to anyone interested in the subject of illumination. A few of the topics discussed are: The Nature of Light; Units and Standards, and the Laws of Illumination; The Methods and Apparatus Used in Measuring Illumination; Illumination Calculations; Reflectors, Globes and Shades; Indoor and Outdoor Illumination; the Properties of Illuminants; and the Mathematics of Illumination and Formulæ. While all the necessary formulæ have been included in the work, they have been rendered as simple as possible.

Illumination is daily becoming a more important factor and no technical library can afford to be without a copy of this excellent work on that subject.

**The Elementary Principles of Illumination and Artificial Lighting*, by Arthur Blok, B. Sc. Published by Scott, Greenwood & Son, Ludgate, London, England. Contains 248 pages and 126 illustrations. Leather bound. Price, $1.25.

Furnace Efficiency

The seventh edition of the work entitled "How to Build Up Furnace Efficiency" * has just been published. It has been considerably enlarged and revised over the previous editions.

This work fills an important niche in present day technical literature, for here is a practical reference book on a subject that is all-important in these times of high efficiency. It is a well-known fact that the largest degree of inefficiency in a power house or steam plant is in the boiler room, and it was with a view of improving these conditions that the author prepared "How to Build Up Furnace Efficiency."

The work is divided into five parts, viz.: Why Your Fuel is Wasted, How Your Fuel is

Wasted, How to "Spot" Your Fuel Wastes, How to Stop Your Fuel Wastes, and How to Keep the Wastes Stopped.

Space forbids us to do justice to a review of this little volume, for there are many praiseworthy points about it that could be mentioned. It is written in a style quite out of the ordinary and one cannot fail to enjoy the author's unconventional frankness—a feature so seldom found in technical works.

This little book should be in the possession of everyone having supervision over steam plants of any description, for it will enable them to effect savings in fuel and other directions.

**How to Build Up Furnace Efficiency*, by Jos. W. Hays. Published by Jos. W. Hays, Rogers Park, Chicago, Ill. Contains 126 pages and is profusely illustrated. Paper covered. Price, $1.00.

CANADIAN CENTRAL WIRELESS CLUB

At the annual business meeting of the Canadian Central Wireless Club the following officers were elected: H. E. Mott, president; Alex. Polson, vice-president; E. A. Dunn, secretary and treasurer; Suite I, Braemor Court, 472 Balmoral street, Winnipeg, Man.

At the meeting the receiving set which the club has recently installed was put in operation for the first time. For the few weeks that it has now been in operation excellent results have been obtained in long distance reception. The aerial for this set is 130 feet high at one end and 120 at the other. It is composed of four copper wires 100 feet long.

At the present time only a 2-inch coil is being used for city work, but a high-powered transmitting apparatus is to be installed during the coming year.

All the members have certain nights each month in which to receive on the high aerial that the club possesses, as well as the use of the up-to-date instruments.

All those interested in wireless telegraphy in Western Canada are invited to join. All communications should be addressed to the secretary, and those living in the City of Winnipeg can call up Sherbrooke 3496 on the telephone.

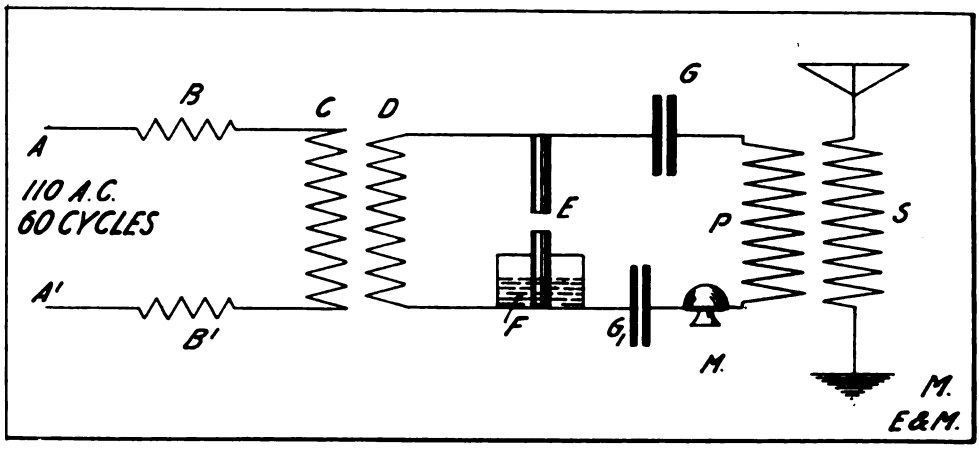
When a man wishes to depreciate another man he attacks his intelligence; he calls him a rool or an idiot. But when a woman attacks a woman, she always goes for her face.

A WIRELESS TELEPHONE FOR THE AMATEUR

By E. M. Nielsen

THE transmission of articulate speech without wires has for many years held the attention of the leading scientists of the world. Of the numerous systems described in the scientific press few are adaptable to the wireless experimenter. The following is a description of a very simple and inexpensive wireless telephone that can be made by those owning a wireless station.

If we produce a rapid train of almost undamped oscillations separated by an interval of time very small in comparison with the duration of each group, by varying from instant to instant the energy of a wave in accordance with the variations of air pressure acting against a transmitter diaphragm a transference of such energy variations is effected between two stations. The voice current waves superimposed on the transmitting wave will actuate a receiving device, such as is used in all wireless stations, in accordance with the spoken words at the sending station.



Earl Hanson and Professor Twining, of Los Angeles, have successfully used the system they devised, and numerous stations in Southern California have been using the system with the connections shown in the accompanying diagram. AA^1 is a source of 60-cycle a. c. current. BB^1 are choke coils to keep the high frequency current from being kicked back into the lines AA^1. They are made by winding 50 turns of No. 10 cotton-covered copper wire over a core of soft iron wire. Current passes through choke coils to primary C of any sized transformer, thence by induction to secondary D. Shunted across the secondary is a micrometer carbon gap E. One terminal of the gap may be water cooled, as shown by the tub of water F. Leads are taken from this gap to condensers GG^1, each made of four plates of 10x10 glass. One terminal of the condenser G^1 connects with a transmitter of any make M, then through the transmitter and primary of an oscillation transformer to the other condenser terminal G. The transmitter can be put in the aerial lead, ground, or as a shunt around the secondary of the oscillation transformer.

Mr. Hanson and Professor Twining have attained surprising results with this 60-cycle a. c. telephone, and amateurs throughout the country can communicate with each other by this same simple means. It may be well to state here that a number of transmitters can be connected in parallel or multiple series and connected to a common mouthpiece, thereby allowing more power to be used. Again, very little insulation will be required as the gap, being of a micrometer size, eliminates high potentials. A key may be used instead of the transmitter M, and a number of gaps in series substituted for the single one shown at E.

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THE ELECTRIC TELEGRAPH. By Chas. Thom, Chief Quadruplex Department, Western Union Telegraph Co., and **A. Frederick Collins,** Author of "Wireless Telegraphy, Its History, Theory, and Practice." 160 pp., 81 illus. Cloth binding. Simple apparatus; codes; the Morse code; messages; press service; cipher messages, etc.; abbreviated telegraphy; railway telegraphy; forms; junction stations; switchboard; batteries; systems; single-line repeaters; multiplex telegraphy; duplex; the quad; phonoplex; wireless telegraphy; construction of apparatus; wireless systems. Price..... **$1.00**

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Wireless Telegraph Contest

The Wireless Station and Laboratory contest is a regular monthly feature. The best photograph submitted each month is awarded a first prize of Three Dollars; second best, Two Dollars; third best, One Dollar.

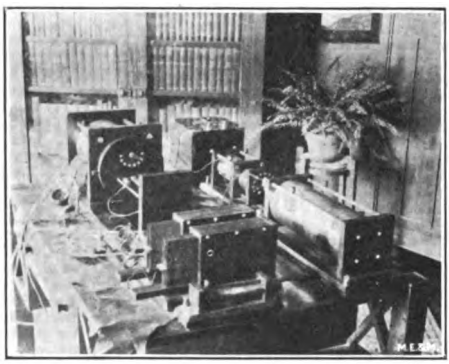
The description of a station should not exceed 250 words. Write on one side of the paper only, using as many separate sheets as are necessary. Descriptions should be written in ink—not pencil. Typewritten descriptions using double spacing are preferable to any. It is advisable to send two prints of the photograph whenever possible—one toned dark and the other light—in order to permit of choosing the one best adapted for reproduction. Prints should be sharp and distinct.

This competition is open to all, irrespective of whether they are subscribers or not.

FIRST PRIZE

Of genuine relaxation of the mind, nothing can surpass wireless. The instruments may be thoroughly amateurish both in design and workmanship, and if so, the interest will be the greater.

My station has been designed for receiving only and is strictly of my own



RECEIVING APPARATUS OF E. A. BAIRD

design and making. Each part has been shaped from the rough; being cut, fitted, soldered and wound in my apartment home during the long winter evenings. Most satisfactory has my apparatus been, not because of scientific treatment of the subject, but rather because it has proven restful and brings even greater wireless results than anticipated.

The aerial is a flat-top, composed of six wires of seven-strand copper, each 160 feet long and 70 feet high. The lead-in is 40 feet and the installation complies with the National Code rules. Two-slide loose coupler of large capacity rendering a loading coil unnecessary, two variable condensers, fixed condenser, variometer, potentiometer, three-slide tuning coil, small loose coupler, and galena and electrolytic detectors, comprise the entire set.

All the woodwork is in birch, mahogany finish.

Each night, with only part of these instruments and the galena detector, I recline in an easy Morris chair in the quiet of my den and compare time with Arlington—note the position of derelicts and pencil the winds from the four quarters.

Sayville (WSL) with her press and transatlantic exchanges with Berlin (KAL) fascinates, while Cape Cod with peculiar low vibrating tone, manipulated by that staid old operator (an automatic transmitter) holds the mind from business perplexities of the day. At this juncture, for it is usually past midnight, a cruel wife compels one to forsake reveries.—*E. A. Baird, Pittsburgh, Pa.*

SECOND PRIZE

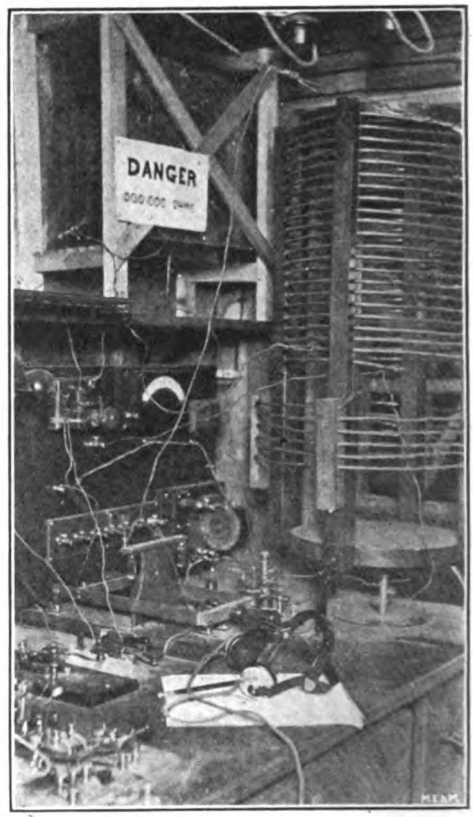
The accompanying illustrations are of our wireless station and serve to show our apparatus and arrangement of instruments.

The receiving set consists of a large two-secondary type of interference preventer, Murdock receiving transformer, loading coil, two Murdock variable condensers, a large sliding plate variable condenser, two fixed condensers, perikon, galena and silicon detectors, Brandes

"Navy Standard," and Brandes "Transatlantic" 'phones, buzzer test and switches. With this set we can tune from 175 to about 7,000 meters.

The sending set consists of a 1 kw. transformer, a ¼ kw. transformer, oscillation transformer, glass plate condenser, magnetic key, rotary, series and quenched gaps, aerial switch, hot wire ammeter, wave-meter, high frequency buzzer and the necessary switches to change transformers.

We also have a wireless telephone which was constructed after the description in MODERN ELECTRICS several months ago and is similar to that set, with the addition of a hydraulic microphone. The latter was added for the purpose of using higher power. Both the carbon and mercury vapor gaps are used.



TRANSMITTING APPARATUS OF MESSRS. HESS AND ROGERS

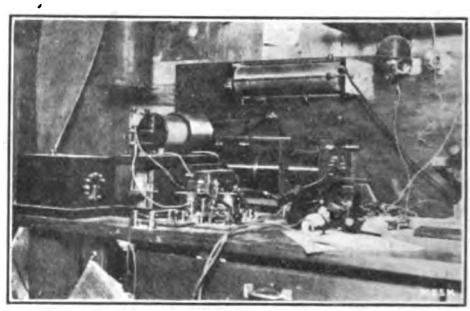
Although we have devoted but little time to the wireless telephone and have made only rough instruments, we have

had it working nicely here in town. The nearest stations that we worked with are 100 miles away, so we do not know at present the maximum range obtainable.

Our aerial is 160 feet high at one end and 50 feet at the other. It consists of ten wires 150 feet long, spaced on 27-foot spreaders, each wire being composed of seven strands of No. 20 copper. The pole, which is 165 feet high, is triangular in section, and is built up of three 4-inch corner pieces, cross braced with 1 by 2-inch pieces. It is stayed by five sets of 3/16-inch guys.

The station house is 12 by 18 feet; one half of it being partitioned off for a sleeping room.

We get Honolulu and Alaskan stations regularly, and on several occasions have heard Arlington, Va., Key West, Fla., and Colon, Panama. With the sending set we have always kept our power down so as to reach Portland (100 miles), without interfering with commercial and



COMPLETE RECEIVING OUTFIT OF MESSRS. HESS AND ROGERS

Navy stations, and we have sent this distance with the ¼ kw. transformer.

We attribute most of our success to the local conditions, which are exceptionally good.—*G. F. Hess and W. L. Rogers, Corvallis, Ore.*

THIRD PRIZE

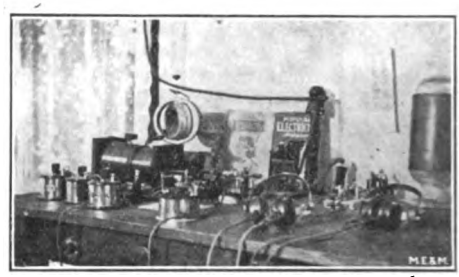
The accompanying illustration shows my experimental wireless telephone receiving station.

Any of the apparatus may be interchanged by suitable switches for making various tests. Three Murdock variable condensers and one of the large Clapp-Eastham type are used for changing the capacity of the different circuits. Fixed condensers are also employed. A galena, silicon and valve detector may be em-

ployed as desired. For inductance a receiving transformer and variometer are employed. Telephone receivers wound to 1,500 and 2,000 ohms are used with the above detectors to advantage.

The aerial consists of two No. 18 silicon bronze wires each 150 feet long and elevated 40 feet above the earth. Electrose strain and lead-in insulators are used on the antenna system. The ground connection is made by placing No. 10 copper wire in trenches 18 inches deep. As the wires are spread over a considerable area, a very efficient "earth" is afforded.

The 60-cycle wireless telephone described in the August, 1913, issue of MODERN ELECTRICS is employed at the transmitting station. Music and conversations are transmitted very efficiently



EXPERIMENTAL WIRELESS TELEPHONE RECEIVING STATION OF E. C. HANSON

by the 60-cycle phone system, considering the low frequency utilized.—*Earl C. Hanson, Los Angeles, Calif.*

HANNIBAL WIRELESS CLUB

A wireless club has been organized in the Hannibal High School, with the following membership: Ernest Mounts, Alfred McCartney, C. A. Cruikshank, Norman Paradise, William Youse, Bailey Mayes, Herbert Tomlinson, Edwin Brashears, John Stillwell and William Jackson. The following officers were elected: C. A. Cruikshank, president; William Youse, vice-president, and William Jackson, secretary and treasurer.

At the first business meeting there will be discussed the theory of wireless telegraphy and the characteristics of Hertzian waves. Mr. Van Winkle started the movement for organizing the club and he will meet with the boys.

Questions and Answers

Questions and queries pertaining to electrical and mechanical subjects and of general interest to all readers, will be answered in this department. Name and full address of the sender should accompany all inquiries. Questions that are not deemed by the editor to be of general interest, will not be published and no answers will be given by mail.

MOTOR.

(55) J. A. H., Chicago, Ill.:

Q. 1.—Sends a sketch of an 8-pole fan motor, and states that he wound the stator with No. 26 wire, and tried to use it on a 110-volt, 60-cycle circuit. It heated greatly, and would run at only about 800 revolutions per minute. He asks what would be a correct winding.

A. 1.—With 8 field poles the synchronous speed of a 60-cycle motor is 900 revolutions per minute, and the 800 you actually obtain is about the maximum for such a "split-phase" machine. You should have but four poles, which call for a synchronous speed of 1800, and a motor speed of about 1650. The motor will run in somewhat better manner than at present if you will reconnect the field coils so as to have two adjacent poles N, the next two S, the third pair N, and the remaining two S. This will approach the condition of four poles, but in consequence of the gap in the center of each pair, the motor will permit more than normal current to flow. In any case you cannot well use a fan motor for power, for in the absence of the fan the windings will get very hot.

AERIAL WIRES.

(56) J. Adelard Brusseau, Mass., asks:

Q. 1.—How far apart should the wires on a 400-foot span aerial be spaced? There are to be only two wires.

A. 1.—The wires should be spaced as far apart as convenient, and in any case should be kept ten feet apart for the best results.

Q. 2.—Would several small wires be better than one large one?

A. 2.—A conductor of several small wires would be better than a single one of the same cross section. This is because the cable made up of the several small wires has the greater surface area.

Q. 3.—Will it be possible to use the same wire that the antenna is grounded to, to operate the set on?

A. 3.—Yes, if the ground is any good.

WIRELESS.

(57) M. E. Dietz, Brooklyn, N. Y., asks:

Q. 1.—How does a series condenser reduce the wavelength of an aerial?

A. 1.—By using a series condenser you place a capacity in series with a capacity, thus reducing the net value of the system. By reducing the capacity you reduce the wavelength since the wavelength is proportional to the square root of the inductance and capacity. If your condenser had exactly the same capacity as the aerial it would cut the effective capacity of the system in half.

Q. 2.—Is a five-wire 60-foot aerial better for amateur installations than a three-wire 100-foot one?

A. 2.—If you have a wave meter and can measure the wavelength of the aerial and find that it is less than 185 meters including all leads and the ground, then the three-wire one would be preferable if the wires covered the same area as would be devoted to the five wires. In all probability you will find that the five-wire aerial will be the best when you consider the length of lead and ground. The three-wire aerial probably would not allow enough inductance for coupling and yet keep down to 200 meters without a series condenser.

Q. 3.—What is the meaning of K and OFM?

A. 3.—K is the international abbreviation meaning to go ahead, and OFM is the U. S. Navy abbreviation meaning Official Message.

REACTANCE.

(58) J. E. Talcott, Cleveland, O., asks:

Q. 1.—Whether it is the ohmic resistance or the choking effect that determines the amount of current that flows in the primary of a transformer. He has, for instance, a bell-ringing transformer in which one ounce of No. 34 wire is used for the primary. This has only 136 ohms resistance, yet is used on a 110-volt alternating current circuit. If Ohm's law holds, the current would then be .8 ampere, but such a fine wire is good for about .005 ampere. Still, the wire does not heat in the least. Also asks what is the principle of operation of electrically operated street car track switches.

A. 1.—Most assuredly it is the choking effect, or to be more technical, the "reactance" of the electric circuit. The alternating magnetism of the iron sets up a counter electromotive force in the coils. The case is much like that of the operation of a direct current shunt motor. In such a case it is not the ohmic resistance of the armature winding that determines the current, but the counter electromotive force set up in the revolving con-

ductors as they cut the field flux. In the motor the lines of force stand still and the conductors do the moving; in the transformer the conductors stand still and the lines of force do the moving. The operation of both motor and transformer would be improved if it were possible to adopt a wire that had no resistance at all. As regards the electrically operated street car switch, a small current will not operate the electromagnet of the switch, so a car that is to keep on straight coasts over the section, or else should have only a moderate current flowing. To operate the switch, the motorman turns on a good rush of current, perhaps applying the brakes besides, so as to demand still more current. The current then travels through the special section of trolley wire through the electromagnet before getting to the rails. You can easily imagine how such a magnet could be made to move the tongue of a switch.

SECRECY OF MESSAGES.

(59) J. W. R., Homesdale, Pa., asks:

Q. 1.—Is it against the law to publish the weather bulletins sent out by Arlington or other Naval Stations?

A. 1.—It is not a misdemeanor to publish those messages which are sent broadcast without designation to any special station or stations.

Q. 2.—I am using a cable constructed of 30 No. 24 copper wires for my lead-in. Does this fulfil the requirements?

A. 2.—As far as actual service goes this cable should be large enough, but it is not equal in carrying capacity to a No. 4 wire. You should use about 110 strands to equal the cross section of a single No. 4.

TUNING COIL.

(60) A. H., Syracuse, N. Y., writes:

Q. 1.—A friend of mine insists that a loose coupler wound on a tin can would be just as good as one wound on a cardboard tube provided that the wire was properly insulated. I have disagreed with him. Who is right?

A. 1.—A loose coupler wound on a tin can would not be satisfactory because the coils would be in a condition which might be best described as magnetically short circuited. Tell your friend it is his treat.

(*Continued on page* 680)

WIRING FORMULA.

(61) R. E. Turner, Newton, Mass., asks:

Q. 1.—How to figure the voltage drop in an electric circuit? (2) What is meant by "open" and "closed" when referring to the ampere capacity of a motor? (3) What is the operation of a "universal" motor for both alternating and direct current circuits?

A. 1.—The resistance of an imaginary copper wire one foot long and one-one-thousandth of an inch (.001") in diameter is about 10.8 ohms. This is the unit used for referring to any other wire, whatever may be its length and diameter, provided its length be in feet and its diameter in thousandths of an inch, or more conveniently, in "mils." Of course there are two wires required for a circuit, so one foot of circuit means two feet of wire. The number to use in the formula is therefore 21.6. By combining Ohm's law with this definition, you can get an equation that shows the voltage drop in a given circuit to be found by multiplying the length of circuit by 21.6 and by the current, and then dividing by the square of the diameter of the wire. For instance, to send 50 amperes to a point 100 feet distant through two No. 6 wires, the voltage required would be $100 \times 21.6 \times 50 \div 26{,}250 = 4.1$. (No. 6 wire has a diameter of .162", or 162 mils, and consequently 26,250 "circular-mils," for the latter number is merely the square of the other, and the sizes of circles vary as the squares of the diameters.) (2) A motor that is open is better exposed for ventilation, and can then carry more current without overheating than one that is enclosed. (3) Such motors usually have laminated poles and a series field winding.

A. C. VS. D. C. FOR WIRELESS.

(62) D. J. G., Waterbury, Vt., asks:

Q. 1.—I have access to either direct or alternating current. Which would you advise me to use for wireless work?

A. 1.—While there is good reason to believe that the direct current installations, such as the "Hytone" sets, give service equal to, if not better than, the alternating current sets, for all around experimental work the alternating is far the preferable, especially if the frequency is 60 cycles.

Q. 2.—What is the nearest station from which I could expect to receive the time signals?

A. 2.—Arlington, Va., at noon and ten P. M.

Q. 3.—Is a rotary gap to be preferred to a common ball discharger?

A. 3.—Yes.

SUNLIGHT EFFECT.

(63) C. A. L., Newcastle, Ontario, Can., asks:

Q. 1.—I should like to know if there has been any accepted theory in regard to the sun's effect on wireless signals? Can you tell me where I can find any reference on this subject?

A. 1.—In the May, 1913, issue of *Electrician and Mechanic* you will find an extracted article by Dr. Marconi on this subject. There

are several theories, and he carefully explains what seems to be the most probable one. It is the ionization theory.

Q. 2.—Where can I get information on Ozone apparatus and its applications, and where can I discuss some theories on the subject and its applications?

A. 2.—Write the General Electric Co. at Schenectady, New York, U. S. A. You can receive bulletins from them and they will be glad to discuss with you any installations that you suggest.

HYDRO-PNEUMATIC PRESSURE.

(64) V. J. Seavils, Loma, Neb.:

Q. 1.—Sends a sketch showing tubes for carrying water to the lower portion of a closed tank whereby air would be compressed into the upper portion and available for any desired application if only the water could be made automatically to get itself out again. He asks if any such arrangement is possible?

A. 1.—Though apparently impossible, there are conditions under which such a principle may be employed to yield commercially successful results. The whole difference consists in utilizing the velocity rather than the mere pressure of the water. An experimental plant was originally erected in Canada, and another was later built near Norwich, Conn., and is still in regular operation. Water is taken from above a dam and directed down a vertical pipe in such a manner as to entrain a great deal of air with it in the form of bubbles. When the bottom of the shaft is reached, perhaps 200 feet down, the air enters a chamber, but is now under pressure due to that height of water, that is, about 90 lbs. per sq. in. The water itself rises in another shaft to the level of that below the dam and runs quietly away. The compressed air is piped to neighboring manufacturing and other industrial concerns. The principal defect of such a system is that it does not utilize the entire flow of the stream so economically as would an electrical development. An article on such a compressed air system appeared in the February issue of MODERN ELECTRICS AND MECHANICS.

HETERODYNE RECEIVER.

(65) P. M., New Orleans, La., asks:

Q. 1.—In the October issue you gave a description of the Heterodyne receiver and as far as I can see the wave trains should differ but little from the frequency set up at the receiver. The local wave train is said to be above the limit of audibility which is about 10,000 cycles per second. Suppose you are receiving from a station having a frequency of but 200 per second, how is it possible to bring the local wave train down to say 250 cycles per second without making it audible?

A. 1.—It is not. But when you have a frequency of but 200 cycles per second you may as well string a line circuit and be done with it, for such a frequency would require a wavelength of 1,500,000 meters or 7,500 times as long as now permitted for amateur use. The frequencies used by every system of radio telegraphy are above audibility.

Q. 2.—I have an alternator giving a frequency of 10,000 cycles per second. Is there

any way to raise this frequency by capacity and inductance using tuned circuits? The generator delivers 0.1 volt at a current of 0.05 ampere.

A. 2.—The Goldschmidt method of radio telegraphy makes use of tuned circuits for raising the frequency, but it is not possible to employ this for amateur service. Your generator is unavailable for wireless transmitting work.

GROUND WIRE.

(66) J. H. A., Washington, D. C., asks:

Q. 1.—Is it true that the Underwriters' Rules do not apply to the District of Columbia? If so, what size wire would you advise me to use for my ground?

A. 1.—We never heard of the Underwriters' requirements being exempt in the District of Columbia. They are not laws passed by Congress. Use No. 4 copper wire or larger by all means. We cannot see why the amateurs want to avoid this requirement when it is a sane and safe guard against their house being struck by lightning.

Q. 2.—I have No. 6 copper-clad wire for my lead in. How can I make it equal to No. 4?

A. 2.—If it is a No. 6 equivalent add a second strand. If it is only the diameter of a No. 6 you will have to get its equivalent conductivity from the manufacturers, or else measure it yourself, and then add enough strands to equal a No. 4 copper.

Q. 3.—What material should I use for a ground switch?

A. 3.—Marble is preferable, but if the spacing is large slate will serve.

ALTERNATING CURRENT MOTOR.

(67) John Snoven, St. Paul, Minn.:

Q. 1.—Sends a sketch of a laminated field and armature structure that he desires to utilize in making a motor to operate on a 110-volt 60-cycle circuit. Outside diameter of field is 6½", inside, 3⅜", with four poles. Armature is 3 5/16" in diameter, with 12 slots. Thickness of stack of iron, 2½". Commutator has 6 segments. He wishes to use an open circuit armature winding.

A. 1.—Wind four coils of No. 16 d. c. c. wire for the poles, getting on as many turns as possible. Though you may wind them on a straight form, they should then be bent somewhat to fit the curvature of the field structure. This will permit the coils to be much larger than otherwise. To hold the field together be sure to use insulated brass bolts, not iron, for the latter would get very hot from flow of eddy currents. Armature can be wound with No. 18 wire, as many turns as possible, but you should have twice as many coils as slots, and employ 24 commutator segments instead of 6, or else disastrous sparking will result. As it is, you ought to seek still further to diminish the sparking by making the connections between the coils and segments with thin German silver strips instead of directly soldering in the copper wires. The segments thus bridged by a brush will thereby not be entirely short-circuited. This is the scheme regularly adopted in large alternating

current series motors, and yours will be one of this sort. Be sure to use carbon brushes. An "open" circuit armature winding is impracticable. A shunt motor will not operate on such currents. There is the alternative construction possible, and that is to make your machine into an induction motor. In this case you can wind the field with No. 20 wire, and use a short-circuited rotor similar to the one described in A. E. Watson's articles. An odd number of rods would be preferable to the 12 you have. The motor could be started by hand, or by cutting slots in the center of each pole and winding in some additional coils, such as we could describe, for "splitting the phase," the motor could be made feebly self-starting. As a series motor there might be an output of 1/8 h.p., as an induction motor perhaps 1/16 h.p.

IGNITION DYNAMO.

(68) C. H. T., Elmira, N. Y., asks:

Q. 1.—Can an ordinary 3-bar telephone generator be rewound and adapted for ignition use on a motor-cycle?

A. 1.—Such magnetos usually have only a single coil on the armature and thereby deliver a pulsating current. This sort of current is not satisfactory for operating an induction or flash spark coil. If you can substitute a drum armature for the present one, you will be successful. Perhaps you can get the necessary material from some of our advertisers.

BURNED OUT TRANSFORMER.

(69) A. L. J., Winchester, Mass., asks:

Q. 1.—I have a one-half K.W. transformer in which there is a broken wire in the primary. How would you advise me to fix it? The transformer is inclosed solid in about one-quarter inch of tar.

A. 1.—When such a transformer is broken down it is usually a good subject for the scrap heap. Since, however, it is the primary that is gone, by using due patience you may be able to melt the tar off, and if it is an outside wire, repair it. If the break is inside of the winding it will be better to use a new primary if the old one has to be unwound. It would be a good idea to melt the tar off on the kitchen range on a day when no one is at home, otherwise there may be one less transformer in existence.

AUDION BATTERY.

(70) C. E. L., Sheepshead Bay, N. Y., asks:

Q. 1.—Can Edison primary cells be used to light an audion detector?

A. 1.—It is possible to use Edison primary cells, but there are two objections. They are expensive for this kind of service, and as the voltage changes somewhat during the period when they are first connected to the audion, the resistance in series with them has to be adjusted more frequently than it does for storage cells. If you have no means to charge storage cells it might be best to use the Edison primary cells.

Q. 2.—How many would be necessary to light the audion?

A. 2.—As the voltage of these batteries is only about two-thirds of a volt it would be necessary to use nine cells.

STATIC ELECTRICITY EFFECTS.

(71) J. W. N., Galletzin, Pa.:

Q. 1.—Writes about the curious behavior of incandescent lamp filaments near the apparatus in the sub-station in which he is employed. There are plenty of high-tension wires in the station, but the effects are particularly manifest by touching any one of six lamps that are supplied from a small 2300-115 volt transformer. Only when lighted, however, is the disturbance set up, and then by touching, holding, or even almost touching a lamp, the filament will bend, deflect, spread, or vibrate. What is the reason?

A. 1.—Evidently the transformer case or wiring is sufficiently near some of the high-tension wiring to have induced in it a static charge. Both wires of the lighting circuit are trying to get rid of the charge, and when the lamp is held in the hand, the ground connection is made over the surface of the glass. When the lamp is lighted, the alternating current in the filament is either attracted or repelled by the alternating static discharges at the surface. When the lighted lamp is near the conductor that is carrying the 800 amperes, the vibration is due to the magnetic action of the current, for a current in a conductor sets up a magnetic field—a principle illustrated in all electrical machinery, clearly so in measuring-instruments. If a direct current were used in the lamps, there would be motion in one direction only.

MOTOR TROUBLES.

(72) F. J., Jerseyville, Ill., asks:

Q. 1.—What is likely to be the trouble with his ¼ h.p. "Century" single phase motor when the brushes fail to make the desired automatic release?

A. 1.—Of course there may be any one of several reasons, or several reasons combined. First, we would advise you to make a thorough cleaning of the motor, especially of the sliding portions. Lubricating oil thickens and dries on exposed surfaces and instead of aiding motion, prevents it. You may find the surfaces where the short-circuiting ring makes contact burned, scored or rutted. Again, the tension of the spring that opposes the centrifugal weights may be wrong. If you fail to find the trouble, you had better communicate with the manufacturers.

HEATER COILS.

(73) F. C. S., Detroit, Mich.:

Q. 1.—Has been trying to make some electric heaters, using No. 23 German silver of standard 18 per cent. grade, but the expansion of the wire when heated loosens the turns and permits the coils to short-circuit with each other. He asks if the 33 per cent. grade would be better, or should he use some of the special alloys?

A. 1.—Your own suggestion really answers the question, for the more modern alloys not only have a higher electrical resistance than German silver, but their expansion is less and they will withstand higher temperatures. The Driver-Harris Wire Company, Harrison, N. J., will be able to help you.

AERIAL WIRE.

(74) R. S., El Dorado, Kansas, asks:

Q. 1.—What wavelength does Key West, Florida, use when sending the weather at a little after ten o'clock in the evening?

A. 1.—1800 meters.

Q. 2.—What wavelength does Sayville, Long Island, use?

A. 2.—2800 meters.

Q. 3.—Is hard drawn copper wire good for an aerial?

A. 3.—Yes, it is very satisfactory.

STORAGE BATTERIES.

(75) H. J. K., Skidmore, Mo., writes:

Q. 1.—I am contemplating making a storage battery installation for house lighting. I have a 2-kw. 50-volt dynamo and would ask what apparatus will be necessary in connection with it?

A. 1.—First, you should make sure of the particular voltage of the lamps to be used. Of course, you desire standard grades. This information you can get by enquiry at the stores, or by writing directly to the manufacturers. There are several firms making such in St. Louis. Again, the dynamo should be shunt and not compound wound. If the batteries are to be at some distance from the house you must allow for loss in the transmission, but if possible, have the batteries in the house, near the distribution cabinet. If you use 50-volt lamps, and further permit a loss of one volt in the house wiring, and require full pressure even when the battery is at the lowest allowable point—1.8 volts per cell—you will require 29 cells. Of course, you wish to preserve the 50 volts on the lighting circuits even when charging, and as about 2.5 volts per cell will then be required, you should have a dynamo able to give 73 volts, and nine of the cells should be cut off by means of the end-cell switch. Thus you see your 50-volt machine will not suffice for such lamps. Twenty cells will be all you can charge, and when this number is down at the minimum point, you will get but 38 volts. We think you will find standard lamps of about this voltage.. Evidently we cannot give sufficient direction in the space of these columns, but can refer you to the article by A. E. Watson in the July, 1911, issue of *Electrician and Mechanic*, or to his more complete treatment of the subject in a book on "Storage Batteries."

SPARK COILS ON D. C.

(76) E. K., St. Cloud, Minn., asks:

Q. 1.—Could I use any sized coil from one-inch up to ten-inch on a direct current lighting circuit?

A. 1.—As far as theoretical reasons go this would be possible, but if you were to use the coils of ordinary voltage your losses in the resistance when the large sized coils were used would be very excessive. In addition to

this you would blink the lights badly if you were to take such sudden loads as would be necessary with the large coils. It would not be practicable to take over ten amperes from the line. You could not plug in to a lamp socket and draw the necessary current except for small coils. The rating of the socket will be marked on each one.

Q. 2.—Would a duplex aerial of the umbrella type 120 feet high exceed the 200 meter requirements?

A. 2.—Yes, it probably would.

RESISTANCE OF HUMAN BODY.

(77) E. W., Mount Ida, Ark., asks:

Q. 1.—What is the electrical resistance of the average person at normal temperature? (2) Would a current of 15 amperes at a pressure of 2000 volts be more likely to kill than ⅛ or ¼ ampere at the same pressure? (3) What are the most important inventions or discoveries of Tesla, Edison, and Steinmetz?

A. 1 and 2.—Measured from hand to hand, using an ordinary Wheatstone Bridge, the body offers about 5000 ohms resistance. Therefore, if that resistance were permanent, a person taking hold of a 2000 volt supply would permit a current of only 2/5 of an ampere to flow. However, the physical disturbance is such as to set up a perspiration which at once reduces the resistance and permits the current to increase. This increased current may readily burn through the relatively tough skin of the hands into better conducting portions, so the current may rise to still greater values. Frequently the accidental contact is initially in some tender part of the body, between which the resistance is far from the 5000 ohms mentioned. Only by means of specially applied wet electrodes can the body be made of low enough resistance to permit even as much current as 8 amperes to pass through when the pressure is at 2000 volts, and these are the figures obtained from electrocution records. The small currents you propose might stun but would not be likely to kill a person. (3) The induction motor, and the incandescent lamp, for inventions, and the discovery of the law of magnetic behavior of iron under the action of alternating current, by the three, respectively.

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MODERN PUBLISHING COMPANY.
(Signed) ORLAND J. RIDENOUR,
Business Manager.

Sworn to and subscribed before me this 13th day of March, 1914.
[SEAL] HARRY S. WALLENSTEIN,
Notary Public, N. Y. County, No. 4011.
(My commission expires March 30th, 1915.)

AN AMATEUR DISTANCE RECORD

Here is a little encouragement and stimulus for amateurs who think that all distance work has stopped with the advent of oscillation transformers and other requirements necessitated by the new Radio Laws.

Just think a little over this long distance record made "in spite of" the new apparatus required. A few weeks ago, the author, an operator on a coastwise ship, while off Barnegat Light (60 miles south of New York), picked up the call "8DK" following a bit of the usual amateur "fat chewing." The signals were clear and moderately strong. Upon consulting the U. S. official call list, the owner was found to be Mr. R. Whitmoyer of Detroit, Michigan. Confirmation by mail was made and the following description of his sending set given by Mr. Whitmoyer:

Five-wire antenna, 45′ by 45′, two-inch coil run on storage batteries, a home-made oscillation transformer, condenser and gap. The writer's receiving set was the familiar De Forest "Type D" with carborundum detector.

Of course the conditions were exceptionally good, but, even with that consideration, it was *some* working, was it not? Seven hundred miles with a two-inch coil, or approximately 18 miles per watt, and *not* on the west coast where most records are made.

A point most strongly brought out by the incident was the evident advantage of registered stations, for, without an official call, the origin of these signals would probably never have been ascertained.

Better get a license and use the call allotted you, for who knows but that you may be next on the "record list."—*HY.*

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Advertisements should be addresed to "Apparatus Exchange Department," care *Modern Electrics and Mechanics*, 32 Union Square, New York.

Advertisements for the June number should reach us on or before April 30th.

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IN THIS VALUABLE BOOK WILL BE FOUND everything that is necessary for the study of telegraphy. Rules are given for the guidance of operators in all different kinds of services, and they are very clear and comprehensive. "Telegraphy Self-Taught: A Complete Manual of Instruction," by Theo. A. Edison, M.A. 12mo., 170 pages, fully illustrated. Price $1.00 postpaid. Modern Publishing Co., 32 Union Sq., East, New York.

WILL EXCHANGE A RECEIVING SET CONsisting of two slide tuning coils, silicon detector, a fixed condenser, a 75 ohm phone and switch, all mounted on a polished wood base, for a good loose coupler. J. Schmelzeis, 320 Sixth St., New York.

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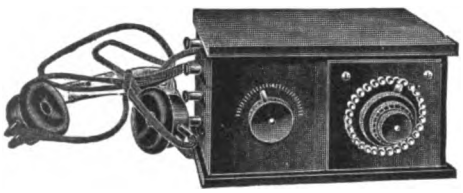

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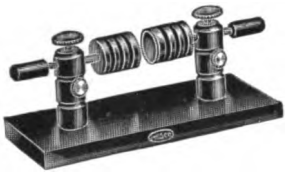

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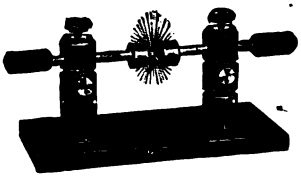

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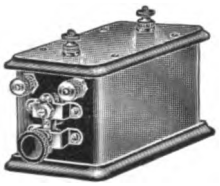

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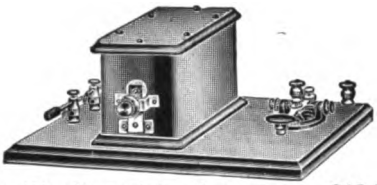

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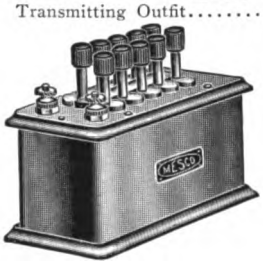

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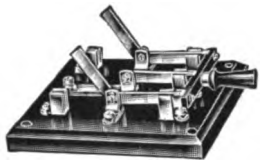

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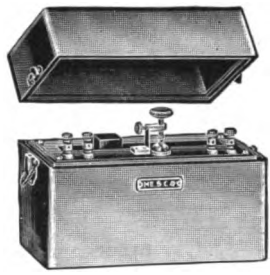

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