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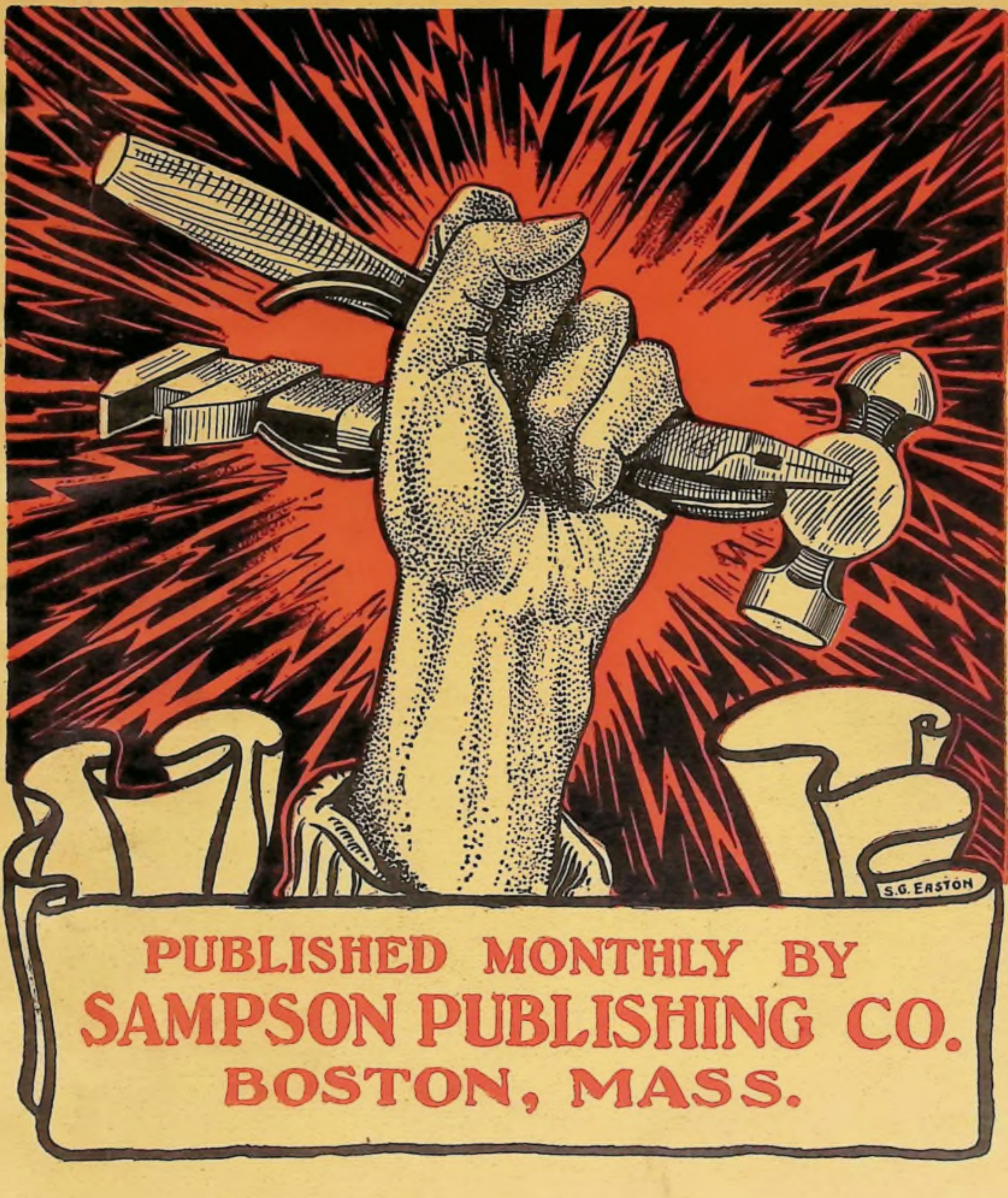
# ELECTRICIAN & MECHANIC



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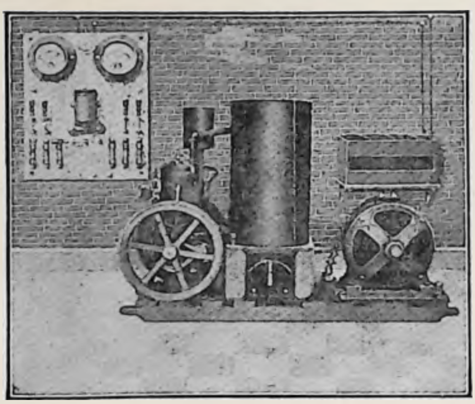

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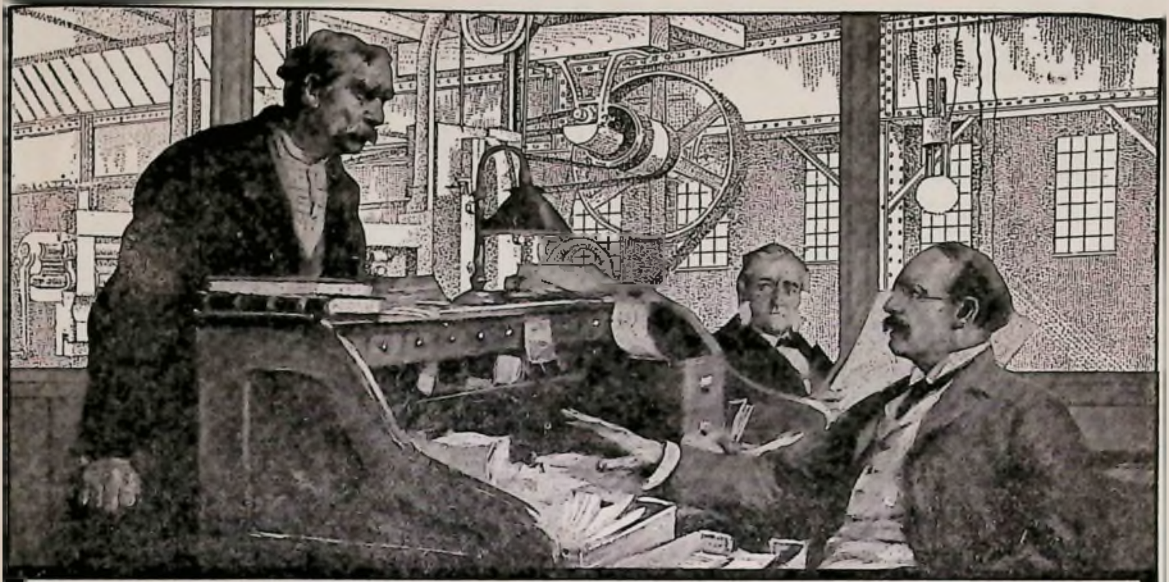

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# ELECTRICIAN & MECHANIC

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VOL. XXII — MAY, 1911 — No. 5

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VOLUME XXII — MAY, 1911 — NUMBER 5

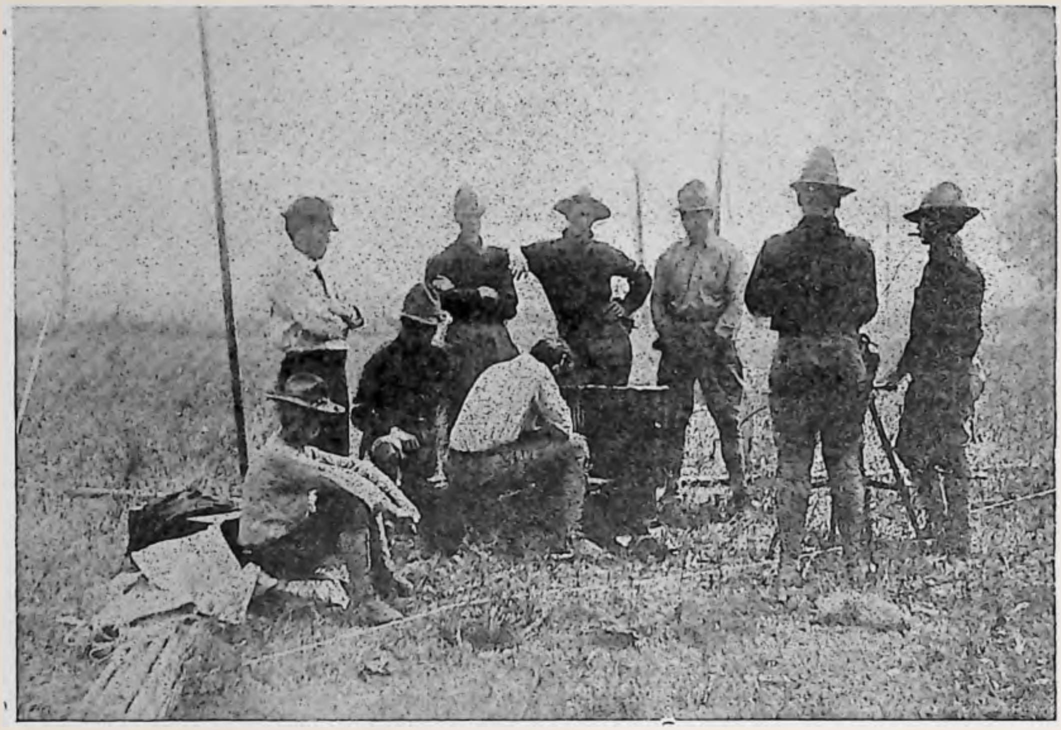
## WIRELESS IN WAR

G. C. WILLIS

In ancient times when armies were relatively small bodies of men engaged in short range struggles of the hand-to-hand variety, it was then possible for the commanders of the various forces to be directly on the field of battle, and in fact, to often lead the fight in person.

Even as recently as the Civil War, in certain instances, the commanding officers lead the troops. From the romantic standpoint this is to be desired, since we still have the element of barbarism left in us which desires that the leader of any body of men should be physically able to make a good "grand-stand" play. However, from the military view, such procedure in the present-day methods of warfare would spell certain defeat.

Outside of the high rate of mortality necessarily incurred at the front in actual warfare, the fact that an engagement may, and generally does, extend over a territory of several miles, precludes the commanding officers from being in the thick of the fighting. For



"CATCHING THE MESSAGE"
Signal Corps Men Operating Field Wireless Set

*Photo by Co. "A" S.C. Ind., N.G.*

Signal Corps Field Buzzer set

with the confusion of battle it would be impossible for an officer to have a clear idea of the conditions on parts of the field other than in his own immediate vicinity.

For that reason chiefly, as well as the necessity of protecting from physical injury the best equipped officers of a campaign, the headquarters from which the battle is directed may be and is quite frequently miles from the actual scene of warfare, where there is no confusion, and, what is most important, where an unbiased "view" of the entire front of the battle, unaffected by local conditions, may be had.

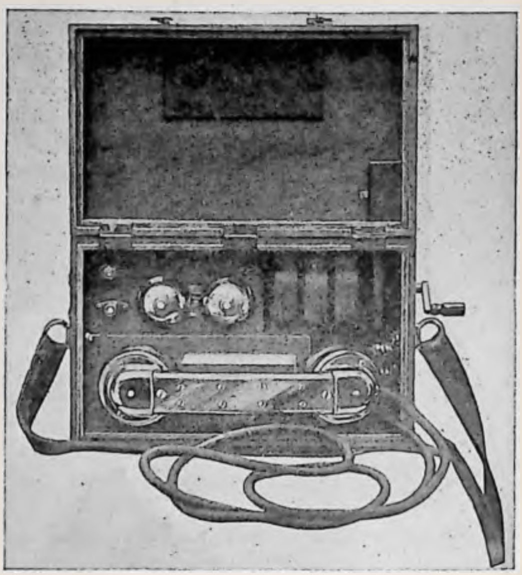
In order to have the headquarters so situated, it is necessary to have lines of communication and trained men to operate these lines, since it is absolutely necessary that the communications be rapidly and accurately transmitted. For this purpose, the Signal Corps of the Army, consisting of a body of men especially trained in the various methods of transmitting communications, has been organized, and on this body of men rests the success or failure of every campaign.

The early forms of signaling as use in the mediaeval periods, and as still practiced by certain tribes in uncivilized regions, was on the order of the drum or "tom-tom." In fact, even at present, many of the savage tribes can quickly call their fighting men from the various villages together by beating the "war-drum" from the chieftain's village, which is relayed on from each successive village until, in a remarkably short space of time, the entire district is at the chieftain's command.

Our American Indians employed signal fires at night, and smoke columns in daytime, for the purpose of signaling between the tribes. By intercepting the light or smoke with a blanket held by two men, definite signals were transmitted.

To now treat with the methods employed by the Signal Corps of the Army, we have our first systems of signaling based on those employed by the Indians. From this, the hand torch was developed for night signaling and was used until comparatively recent times. By means of a code, the signals could be used for the transmission of accurate communications and could be relayed on for miles by signal men stationed at proper intervals.

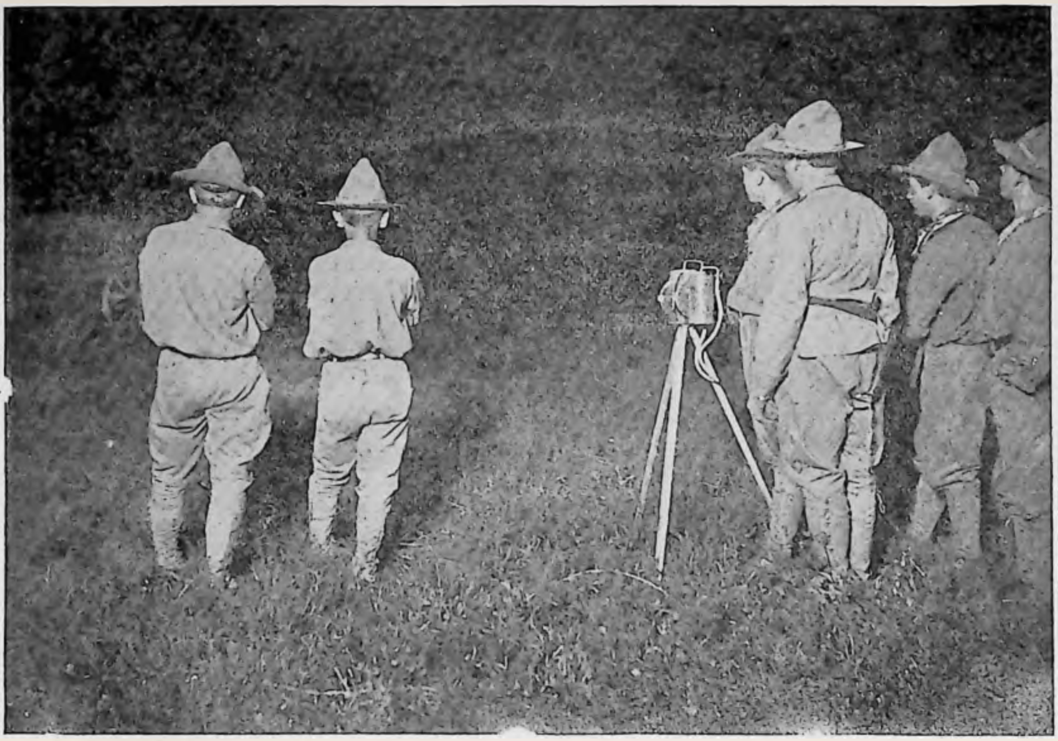
To come to the present-day methods of the Signal Corps, we will first consider the visual signaling equipment. The most prominent of these is the flag signal. The flags are square in shape, one having a red centre with a white border and the other with a white centre and a red border. The one with



Signal Corps Field Telephone

"REPORTING THE ENEMY'S POSITION"
Mounted Patrol Using Field Telephone Connecting to Headquarters through Fence Wire

*Photo by Co. "A" S.C., Ind. N G.*



"WAITING FOR THE O.K."
Signal Corps Detachment Using the Acetylene Lantern

*Photo by Co. "A" S.C., Ind. N.G.*

OPERATING FIELD TELEGRAPH STATIONS

the white centre is used when the signalman is against a dark background like woods, etc., and the one with the red centre is employed when he is in the open with a sky background.

These flags are attached to short sticks, and are "wig-wagged" by the signalman from one side to the other. What is known as the Myer's Code, consisting of a combination of left and right strokes, with a position at front between the letters and a downward front position for the ends of words, is employed, these various positions corresponding to the letters of the alphabet.

Signaling with the flags is extensively employed in the army, and while applicable only within the range of vision, extremely rapid results are obtained. In this respect it is a most valuable means—wherever a man can go, he can carry a signal flag, and unless he is hit by a sharpshooter, he can continually communicate without interference. Of course the enemy can read the messages, but there has never been a successful and rapid system of signaling yet invented that a third party cannot eventually copy. By the use of cipher codes, of which it is necessary to employ a key to translate same, secrecy will be maintained no matter what the means of communication.

LAYING FIELD WIRE

The heliograph is next on the line of signaling devices. Its range of operation is much greater than the signal flags, but it has the disadvantage of being only capable of operation while

OPERATING FIELD WIRELESS STATIONS

REELING UP WIRE WITH AUTOMATIC CARTS

the sun is shining. By an ingenious combination of mirrors, the heliograph may be operated in any direction regardless of the position of the sun.

Succeeding the hand torch, the acetylene lantern is used for night signaling. This lantern throws out an intense light that can be seen for miles. A needle valve is controlled by a lever similar to a telegraph key. When the key is up, only enough gas to maintain ignition is allowed to pass to the burners. When the key is depressed, however, a full flow of gas is immediately admitted, and the intense light is then thrown out. By operating the key to correspond to the Morse or Myer code, messages can be quickly and accurately transmitted for considerable distances.

All of the above methods of communication have their limitations, and are generally restricted to the actual scene of battle, or to keep small bodies of men in touch with the field commanders. To furnish the more rapid and uninterrupted lines of communication to the headquarters, it is necessary to utilize the services of electricity.

The field telegraph represents the most highly developed adjunct to the Signal Corps. Special field telegraph wagons provided with the necessary materials for rapidly constructing lines are employed. These wagons are built for rapid work, and can keep up with the advance of a troop of cavalry or a battery of field artillery—and, what is more important, an operator on the

RECEIVING MESSAGES BY FIELD TELEGRAPH

SENDING MESSAGES FROM MOVING TELEGRAPH CARTS

RECEIVING MESSAGES FROM MOVING TELEGRAPH CARTS

wagon can keep in constant communication with the end of the line even while the wagon is moving.

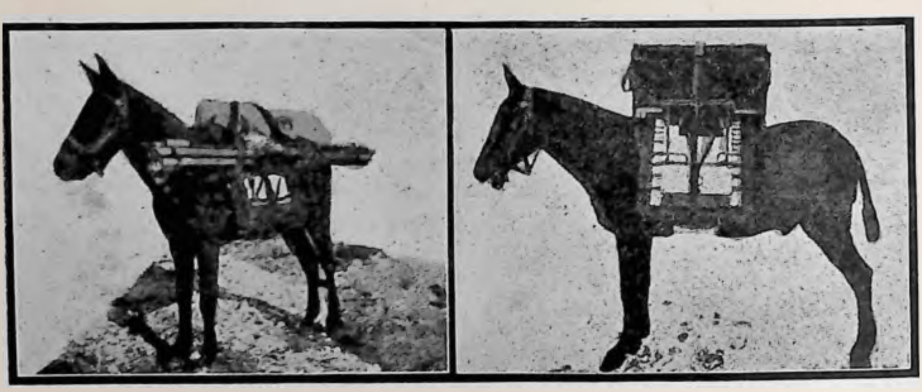
On the field of battle, light wire, known as field buzzer wire, which is placed on reels, each of which contains a half-mile of wire, and which are so light that a man on horseback can carry several reels, distributing the wire while at a gallop, forms the means of keeping the field commanders, who are constantly on the move, in touch with the more permanent lines leading to headquarters.

Reel carts carrying a heavier wire known as field telegraph wire can rapidly lay or reel up this wire in rear of the battle-front. Instead of a regular telegraph instrument, what is known as a "buzzer," is used. This instrument will work under conditions which the regular telegraph would be dead. The messages are received with a telephone receiver, the sound being considerably like the wireless signals. Should the field wire even be broken for 10 or 20 ft., the "buzzer" will "work through," and readable messages can be transmitted.

As we get nearer headquarters from the field of war, we find that several of the field telegraph lines may terminate at a field office, and the operator is equipped with a field telephone set connecting with headquarters.

The field telephone will in turn connect to a field switchboard in headquarters, from which a number of telephone lines may radiate to the various telegraph and telephone stations, etc. In actual warfare it is frequently possible to utilize existing telegraph lines, wire fences, etc., for communicating purposes, thus conserving the line material where it will be more greatly needed in other places.

We have now traced the lines of communication from the front of the battle, where the signal flags and heliographs are employed, to the field commanders, where the operator on horseback has the hand-reel with the buzzer wire; thence to the telegraph wagon; from there to the field telegraph office; and thence over field telephone to headquarters. But it is frequently necessary that at headquarters it is desired



WIRELESS OUTFITS ON PACK MULES

to keep in touch with reserve forces at a distance, or, if the war is waged near a seacoast, with a fleet of war vessels. And the enemy may hold strongly guarded territory between the headquarters and these places over which it would be impossible to get a field line or a relay of men for visual signaling.

LIEUT. FOULOIS OF THE SIGNAL CORPS
and Aeroplane Equipped with Wireless Transmitting and Receiving Apparatus

The field wireless telegraph set then comes into service. A special wagon, accompanied by expert wireless operators, which carries a portable transmitting and receiving outfit, sectional mast, antenna and ground wires, is used. The mast is in 8 ft. sections. The antenna is on suitable hand reels for quick unreeling; a counterpoise ground is used.

In operation, it requires about two minutes from the time the wagon arrives at the proper position to get out the apparatus, erect the mast, connect the instruments, and start sending messages. The station can be dismantled just as quickly.

To generate the current, on the small

SENDING MESSAGES BY FIELD TELEGRAPH

outfits hand-generators are employed. On the larger wagon-sets, a gasoline engine connected to an alternating current generator is used. Storage batteries are also employed in connection with the small sets.

Where the condition of the land makes it unsuitable for a wagon to go, special pack sets have been designed which can be placed on the pack mules. A complete wireless outfit consisting of hand-generator transmitting and receiving instruments, mast sections, antenna and counterpoise ground can be carried by two mules. These mules can usually go anywhere where a human being can.

The sectional mast used is extremely light, and was developed in the Signal Corps laboratories in Washington, D.C., after extensive experiments. One man can easily raise an 80 ft. mast, and with men at suitable points to guy it, section after section is slipped in position and raised up until it is at the required height.

The antenna is of phospher bronze stranded cable, and is made especially for the Signal Corps. The counterpoise is used as it can be quickly spread out, and on dry soil is much more effective than any ground connection that could be made in a short time.

The transmitting outfit contains a set of condenser tubes, a spiral inductance, a step-up transformer of the induction coil or open core type, and suitable key and switches for controlling the current.

The receiving outfit consists of a double-slide tuning coil, silicon or perikon detector, fixed condenser, high resistance receivers, and a suitable battery bridged with a fixed potentiometer for the detector. All these instruments are built to stand rough service, and it must be remembered that in warfare, the conditions on the field are vastly different from the conditions in a wireless station. The instruments must work with a drizzling rain coming down; must be able to stand getting dropped 10 or 15 ft. down an embankment when a wagon rolls over; must be simple as possible with as few parts to adjust when tuning.

In concluison, a few remarks will be made on the use of the aeroplane in warfare. Lieut. Foulois' recent trip with Aviator Parmalee, along the Texas border, fully demonstrated the value of the aeroplane for patroling regions inaccessible to cavalry without great difficulty.

Wireless has been and can be applied to aeroplanes, and while the limitations of the size of the set will necessarily cut down the radius of operation to narrow limits, it will play an extremely important part for giving instant advice on local conditions to near by headquarters.

---

In the recent New York examinations for chauffeurs' licenses was this perfectly civil question:

"If you were going along the road and met a skittish horse, what would you do?"

To which one candidate replied—our authority saw the examination paper:

"I would stop the car, then the engine, and then, if the horse was still skittish, I would take the machine apart and hide it in the grass until he got safely by."

—*Everybody's.*

# ELECTRICITY IN HOME AND OFFICE

## DESIGN AND CONSTRUCTION OF A PRIVATE LIGHTING PLANT—Part IV

STANLEY CURTIS

The construction of the circuit-breaker will next claim our attention. These automatic switches are comparatively simple to build, and, where they are not called upon to open a circuit carrying a heavy current at high voltage, are quite reliable in operation. Even the simplest form of breaker, if constructed intelligently and with ordinary care, will prove to be far more efficient as a safeguard to the battery, than a fuse would be.

In commercial instruments of this type, the final opening of the circuit comes between carbon surfaces which are not destroyed by the arc to the same extent that copper would be. When they eventually become burnt and roughened they are easily and cheaply replaced. In our little instrument, the carbon break is not used, as the arc on opening is not so serious. Another reason why the carbon was not deemed necessary in this case was because the breaker was very seldom called upon to do its work. The rupture of the circuit comes so quickly and the voltage is so low that very little burning is noticeable on the blades and clips. An occasional smoothing-up with a flat file will keep the contacts in excellent condition.

The breaker consists essentially of a double-pole, single-throw knife switch, with which is combined a solenoid of coarse wire, a plunger and trigger, and

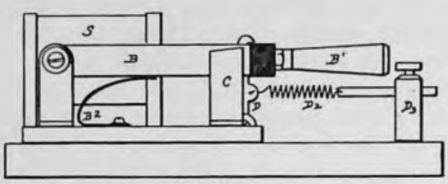


FIG. 38

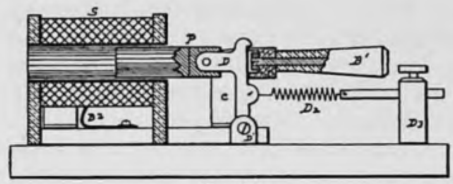


FIG. 40

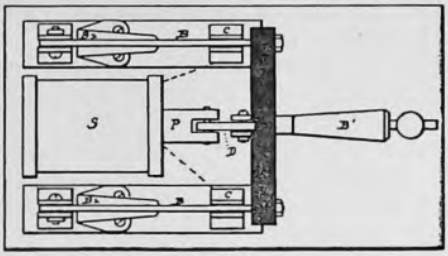


FIG. 39

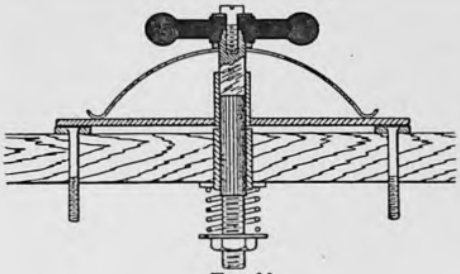


FIG. 41

FIG. 42

FIG. 43

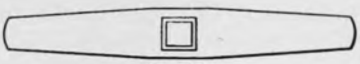


FIG. 44

FIG. 45

STANLEY CURTIS 1911

a couple of flat springs to open the switch when the trigger is drawn back by the plunger. It is absolutely imperative that the joints of the switch be free but not loose. The blades must swing smoothly and without binding. The plan in Fig. 39 will give a general idea of the arrangement of the parts. Fig. 38 gives a side elevation and shows the block of fiber on which each blade and clip of the switch is mounted. This is merely to raise the switch from the base in order to give the trigger (*D*, Fig. 40) a longer arc through which to swing. This is necessary on account of the somewhat restricted coupling between trigger and plunger.

The base is preferably of slate. No dimensions are given in the drawings, as many workers will find sufficient material around the shop with which to construct most of the apparatus described. The drawings, however, are to scale and the reproductions here shown are just one-third actual size. By making a paper scale on which ⅓ in. equals 1 in., the builder will be enabled to secure the exact dimensions of the writer's instruments.

The switch having been procured and its joints "limbered up," it may be mounted on the base as shown. The nut, which secures the handle to the yoke, should be countersunk into the yoke as suggested in Fig. 40.

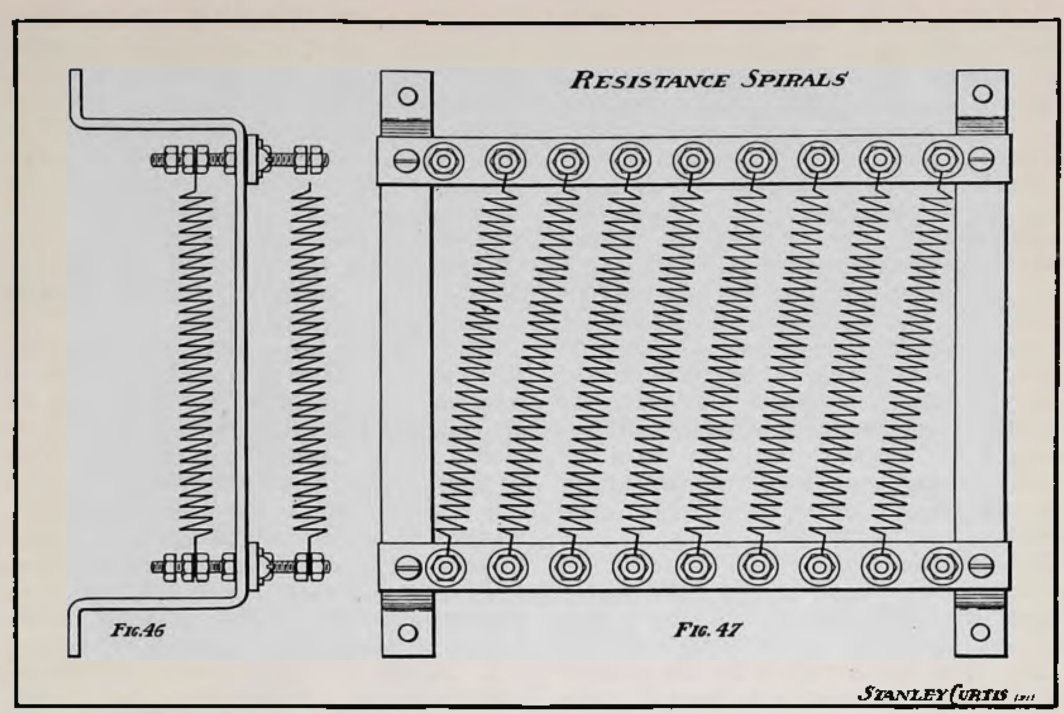
The solenoid is best made on a fiber bobbin and is composed of twenty turns of No. 10 s.c.c. wire. The two ends of the coil are connected to the clips as shown by dotted lines in Fig. 39. The blades of the switch are connected in series with the circuit. This makes the breaker essentially a single-pole type, but the arc is divided between the two clips.

The plunger is a short piece of soft iron rod and it should be an easy sliding fit in the fiber tube of the solenoid. The trigger is cut from a piece of ⅛ in. brass sheeting. Its shape is clearly shown in Fig. 40 as is also the method of linking it to the plunger. The projecting edge, which catches on the yoke of switch, should be very short. A spiral spring, the tension of which may be adjusted by means of the rod in post *D*3, holds the trigger against yoke. A stop should be provided at the pivot, on which trigger works, to prevent trigger being pulled too far forward when switch is open. The springs, *B*2, Figs. 38 and 39, are best made of several strips of spring steel, or, in other words, they should be laminated. They should be sufficiently stiff to throw the switch open when trigger is pulled back. No stop is provided for the switch.

The construction of the regulating switch for field rheostat is illustrated in Fig. 41, which shows a cross-sectional view of the complete device. This controller may be mounted directly on the switchboard, the long screws which fasten the contact pieces to the board passing entirely through for connection to the resistance coils on other side.

The rheostat may be considerably simplified in design if the builder so desires; for instance, it may be merely an 18-point switch, with the resistance coils connected between points and the armature connection to the lever. The chief advantage of the design herewith illustrated lies in the fact that no moving joint is called upon to carry current. The contacts are cut from a ring of sheet brass in the form of segments as shown in Fig. 45 and the current passes from these through the arm and directly across to a complete half-circle of sheet brass on the other side. The general view of the switchboard in the March issue shows this still more clearly. In addition to this advantage, the design shown presents a very pleasing appearance and it looks business-like on the switchboard.

Fig. 42 gives details of the main spindle of the rheostat mechanism. The centre portion of a piece of square brass rod is turned as shown and the end is threaded to take a hexagon nut (Fig. 41). Figs. 43 and 44 give details of the cross-piece or contact lever, and very little description is necessary. The stock may be of brass or copper bar and the square brass tubing is soldered in place. This tubing is, of course, a sliding fit over the square portion of the spindle. A handle may be taken from an old steam-cock or other valve, to be fitted to the end of spindle. The round portion of spindle passes through a piece of brass tubing which is tightly fitted into a hole in




the switchboard. A flat, bowed spring passes over the top of spindle and serves to keep the cross-piece in contact with segments and circle on the board. A spiral spring under the washer and nut as shown in Fig. 41 completes the rheostat.

The method of mounting the resistance coils is shown in Fig. 47. The frame is built of 3/16 in. cold rolled steel bar. The entire back of the switchboard should be covered with several thicknesses of asbestos, and the resistance coils may then be mounted directly on the board in back of the controller. There should be at least 6 in. between the coils and the board, however, to insure safety. The spirals do not get very hot in use but it is well to be on the safe side and rheostats should always be regarded as sources of heat. The coils are supported on pieces of threaded 1/4-20 brass or iron rod and are clamped between hexagon nuts as shown. A third nut is added to the inner side under which to connect wires from the segments of the controller.

The coils are 18 in number to correspond with the number of segments in controller. Each spiral is 6 in. in length and is wound on a roller or rod 1/2 in. in diameter. There are 30 turns of No. 18 German silver (18 per cent.) in each spiral. The supporting rods are insulated from the iron frame by means of fiber, or better, mica bushings and washers. Fig 47 shows the coils in position on one side of the frame. On the other side they are placed in a vertical position instead of being inclined. The reader will readily see that this places all of the coils in series. Fig. 46 suggests this. On the left, the coil is seen to be connected at top and bottom to the supporting rods. On the right the lower end is fastened, but the top would go to the next rod as shown in Fig. 47, therefore, it appears to be left free in the drawing. This is merely to simplify the sketch.

The amount of resistance in this rheostat is sufficient to bring the voltage of the generator practically to zero when all of the coils are inserted between armature and field.

A rheostat of this type is very useful for other purposes such as experimental work in the shop where it is desired to reduce the lighting circuit voltage to one better suited to the operation of electrical apparatus of small size. If No. 15 wire is used in the spirals, the rheostat may be used in series with a small home-made arc lamp on a 110 volt direct current circuit. About 4 amperes would be taken from the line, and a surprisingly brilliant light obtained.

The recording watt-meter illustrated in Figs. 48 to 52 is used to determine approximately the amount of current which has been drawn from the battery after an evening's use and it will be found to be comparatively easy to construct. The design is directly copied from the standard Thompson meter which is familiar to most readers in all probability. The home-made instrument is necessarily crude, but it is far more satisfactory than the pendulum type which is somewhat easier to construct.

The principle is exactly that of an electric motor, and, indeed, the watt-meter is nothing but an electric motor without any iron in its magnetic circuits. The fields represent an ammeter and the armature a voltmeter; the product of the amperes and volts giving us the watts. The chief requisite in such an instrument, as in any meter, is to have the smallest possible amount of friction in its bearings. Jeweled bearings are used in commercial instruments, but the amateur will most likely have to rely upon a hardened steel screw taken from the works of a clock. The entire clock plays an important role in the construction of this meter, therefore, a small one should be procured at the start. By "noting the time" on the face of clock we are enabled to take a reading of the meter. The usual chain of gears and dials is thereby dispensed with.

The meter consists of an armature, two field coils, commutator, brushes, and a copper disc revolving between two permanent magnets, the function of which is to prevent the meter from "racing." When the copper disc revolves between the poles of magnets, eddy currents are set up in it, thus making it act as a brake against the rotation of the armature.

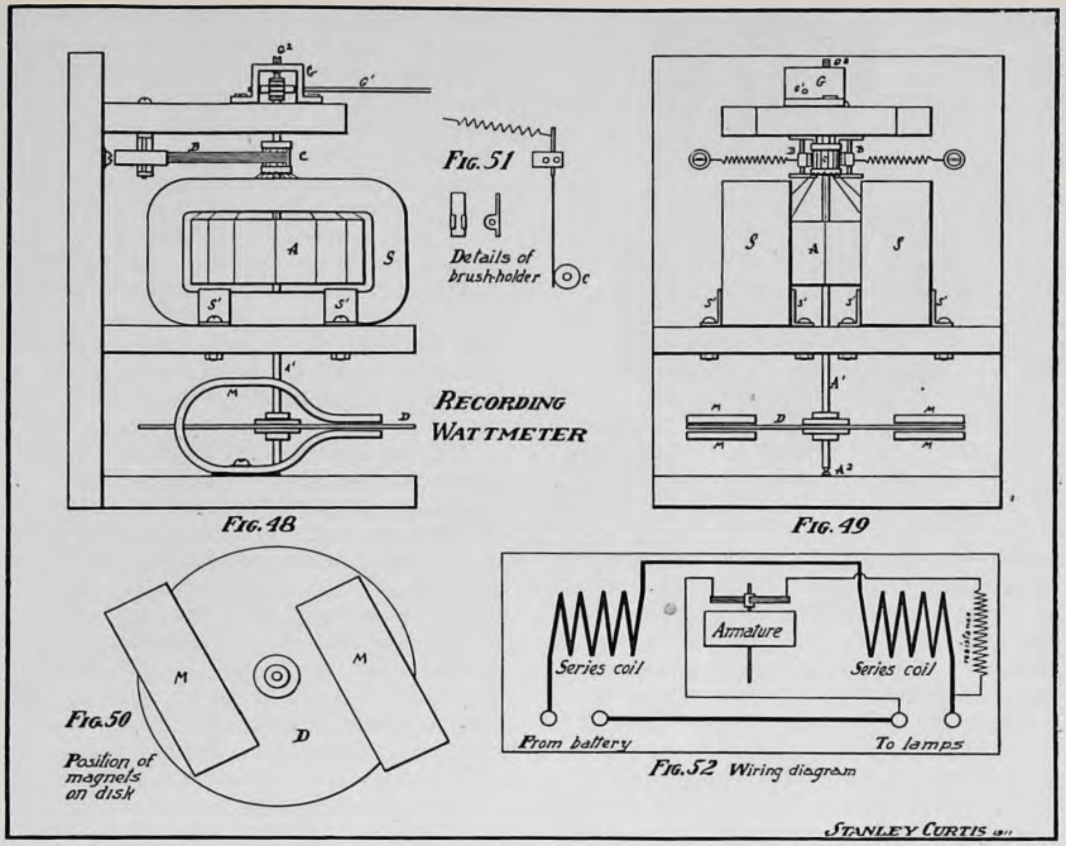
The armature may first claim consideration. It consists of two light discs of wood, having a cylinder of paper placed over them. A piece of ⅛ in. steel rod passes through the exact centre of the wooden discs and forms a spindle for the armature. Dimensions may also be taken from these reproductions which are one-third actual size. The ends of the spindle should be pointed and the steel tempered at these places. The armature is wound in the same manner as a drum armature in twelve sections with No. 34 d.c.c. wire. The leads are brought to a 12 segment commutator mounted on the spindle as shown at *C*, Fig. 48.

The commutator may be built up from a piece of thin brass tubing which has been sawed into 12 segments on the milling machine, or with a jeweler's saw. After cleaning up the edges the segments are assembled around a cylinder of fiber which has been previously treated to a coat of shellac. The segments must not touch each other. Binding with thread will hold them in place until the shellac is hard, after which a permanent binding of strong silk thread at either end will insure non-loosening. The commutator should not be over ⅜ in. outside diameter and the surface should be perfectly smooth. As it is not required to carry scarcely any current, the metal may be very thin. The insulation, however, must be perfect, as a potential of 40 volts will be maintained across the brushes.

Details of the brush holder and brush are given in Fig. 51. The brush is composed of several strands of No. 24 copper wire. The bare hard-drawn wire is just the thing. The tension of the brush is governed by the spiral spring, and it must be very light. Brushes are placed in the position shown at *BB*, Fig. 49.

The upper portion of spindle carries a worm which engages a gear on the shaft *G'*, which in turn goes to the clock mechanism. A strap of brass *G* carries the shaft and also the upper bearing screw *G*2.

In the position shown at *D*, Fig. 48, the copper disc is fitted to the spindle. The disc may be 1/16 in. thick or even thinner. It must run true with the spindle. The magnets *M* are formed up from magnet steel and magnetized on the dynamo fields. A single screw secures each magnet to the baseboard, thereby allowing some adjustment to be made. In commercial instruments




three magnets are used. The writer intended to use three also, but broke one in forging it. The instrument was tried out with the two placed in the position shown at *M,M,* Fig. 50, and results were so pleasing that they have never been altered. The damping effect of the magnets is increased by turning them so that the poles are nearer to the edge of the disc. If the meter is too slow, the reverse may be produced by turning magnets so that they face more toward the centre of disc.

The series or field coils each contain 40 turns of No. 10 d.c.c. wire and they must be connected so that the current flows in the same direction through both when they are placed side by side on the wooden support. The coils should be taped and mounted on the support by means of brass straps, *S'S'*.

To simplify the drawing, Fig. 49, the magnets are represented merely by their pole pieces. The other diagrams sufficiently denote their proper location.

No attempt has been made to indicate connections in the drawings of the instrument, but instead, the wiring diagram is given in Fig. 52. This should make clear the various connections and the only point which requires explanation is the resistance coil on the extreme right. This is a length of No. 34 German silver cotton-covered wire, and is wound non-inductively on a wooden spool. In the writer's instrument this resistance coil contains 32 ft. of wire. The resistance is merely to prevent too much current passing through the fine wire on the armature.

Connection is made between the upper shaft *G'* and a lengthened spindle of one of the fast gears of the clock. The spring is, of course, removed from the clock. By passing various loads through the meter and noting results on the clock dial the instrument may be given what may be called its "constant" and direct readings taken. This feature will receive due attention in the article on the operation of the plant.

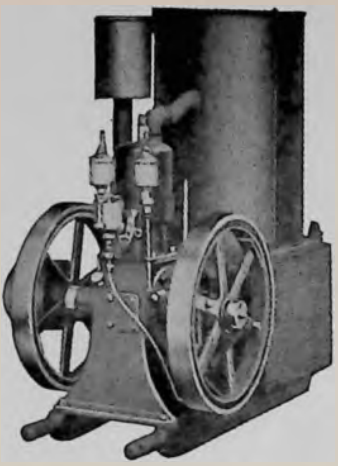


Fig. 5

In a previous article mention was made of a small, air-cooled engine which was used to run the dynamo in the original plant. This engine was good for little else than to give the generator a test. The engine plays such an important part in a plant which is intended for practical work that it is poor economy to purchase any but a good one. It is possible to pick up a good second-hand engine occasionally, but in doing so, the purchaser should insist that the engine be given a thorough trial before completing the bargain. Whenever a useful article such as a gasoline engine is offered for sale at a low figure, there is sure to be a good reason for the sale. One of the few good reasons for such a sale is when the owner wishes to purchase a larger engine. Even in this case the purchaser of the second-hand machine should make sure that it is really a *larger* engine which is required. It is frequently the case that a comparatively large engine will not do the work required of it simply because it is not delivering the rated horse-power. Lack of efficiency in a gasoline engine may be traced directly to just a few primary causes. One of the most common ones is loss of compression through worn piston-rings, leaky valves and leakage around the spark plug or cylinder head. In most instances, these defects are eliminated with very little trouble and expense, and the purchase of such an engine at a low figure may be regarded as a wise one. If the defect is due to poor design or poor material, the bargain will be a costly one in the end.

In the purchase of an engine from one who has used it for some time, the owner should be willing to show the intending purchaser the condition of the cylinder, piston and rings, the crank shaft, connecting rod and valves. It is well to regard a second-hand engine, which is freshly painted and decorated, with some suspicion. Better to get a machine which shows traces of actual use and to see it in actual operation under a test load than to purchase one which is pleasing to look at and is *said* to be a wonder for the price.

By the foregoing the writer does not mean to be harsh on the dealers who make a specialty of selling such machines, but merely means to give a word of warning which an honest dealer will sanction. If a man is selling goods for value received, he will not hesitate to accede to any reasonable requests which may tend to substantiate the claims he is making for his goods. That is the whole story. Probably the best recommendation a second-hand machine can have is the nameplate of a reliable manufacturer cast on it. This will at least insure the workmanship and material and if the working parts do not show signs of abuse, the engine may be confidently purchased providing the price is reasonable.

It is unwise to purchase an engine of too large a capacity, as it would be unnecessarily wasteful of fuel, and it is, practically speaking, the cost of fuel which governs the cost of current our plant is to supply. An engine of 2 h.p. will be found ample. A smaller engine will tend to "race" when the load is removed from the dynamo, and in the case of a sudden full-load or overload, it is apt to stop entirely.

The choice of the various kinds of fuel will depend somewhat upon local conditions. Gas is very satisfactory, but the power obtained will be somewhat less than that delivered by the same engine when operated on gasoline or kerosene. The use of gasoline is attended with some danger, and it possesses no advantages over kerosene when a suitable engine is used. After considerable experimenting, the writer has come to the conclusion that there is no fuel superior to kerosene under favorable conditions. The engine should certainly be water-cooled, as it will most likely be set up in a basement which becomes rather warm in winter time, when the heater for the house is in operation. Heavy flywheels must be provided, and there should be two of them. This will be conducive to smooth and even running, and in the event of the engine missing fire, the momentum will help to carry it over. A two-cycle engine is preferable to a four-cycle in many respects. It has the advantage of extreme simplicity and freedom from valves, and it is also steadier in operation. A sensitive governor is absolutely essential to keep the speed uniform. The ignition system deserves considerable attention, and, by concensus of opinion, the jump-spark system is by far the most satisfactory. Its very simplicity and the elimination of working parts passing through the cylinder, where leaks are apt to occur, are its chief advantages. The ease with which the speed may be controlled by advancing or retarding the spark with this form of ignition still further commends it to the notice of the builder of a small lighting plant.

In the writer's plant, a 2 h.p. "Detroit" engine was used. This machine has stood up under some of the most exacting conditions. In addition to furnishing power for lighting the residence, the plant supplied current for various experimental purposes and in this capacity it was called upon to stand some actual abuse. The plant was in in the basement and its operation could scarcely be heard on the ground floor of the house. These engines are equipped with a base as shown in the accompanying halftone, and are shipped complete ready to be started as soon as unpacked.

A feature which deserves particular attention in the engine is the ingenious device which replaces the usual carbureter. This valve literally squirts the fuel into the cylinder under pressure, producing a perfect mixture and subsequent total combustion. Kerosene is used as readily as gasoline, and the usual difficulty in starting is entirely dispensed with. The device is shown at the left of the sectional view in Fig. 54. This view also gives a good idea of the simple, rugged construction of the engine.

The next article will suggest the selection of the storage battery and the setting-up of the plant.

*(To be continued)*

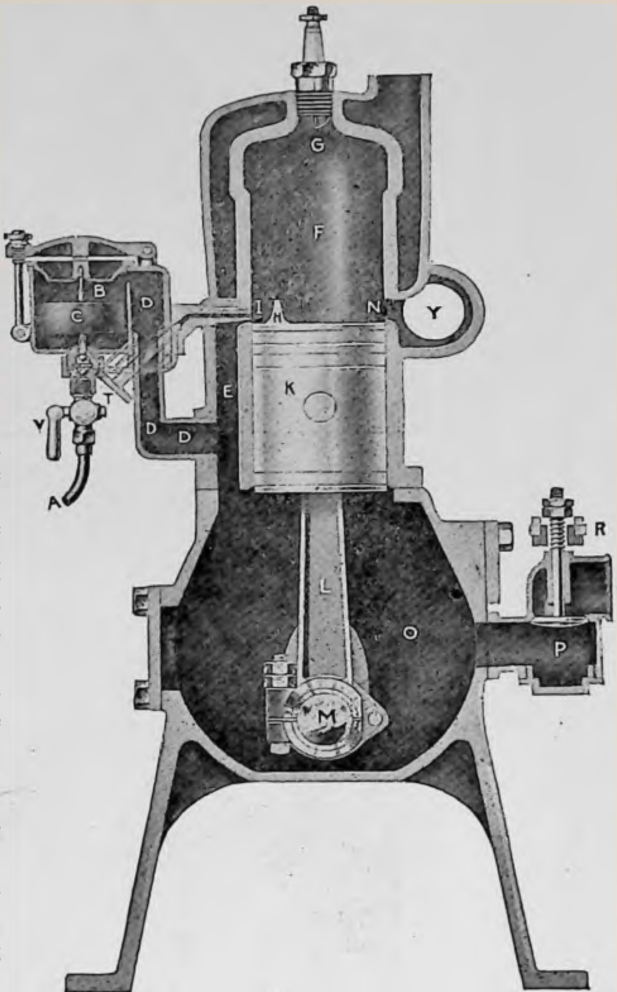



Fig. 54

The decrease in the drawbar pull of a locomotive as the speed increases, is more rapid than is generally understood. It is estimated that a 2,000 h.p. compound locomotive of the Mallet type will exert a tractive force when it is hauling a train at a speed of 5 miles per hour of 150,000 lbs. At 10 miles the tractive force will have fallen to 75,000 lbs.; at 30 miles, it will be 25,000 lbs., and at 50 miles per hour, it will be as low as 15,000 lbs.

# HOW A MAGNETO MAKES ELECTRICITY

## The Principles Involved and Method of Operation Explained and Illustrated. How Sparks are Produced Mechanically for Ignition Purposes.—Part II

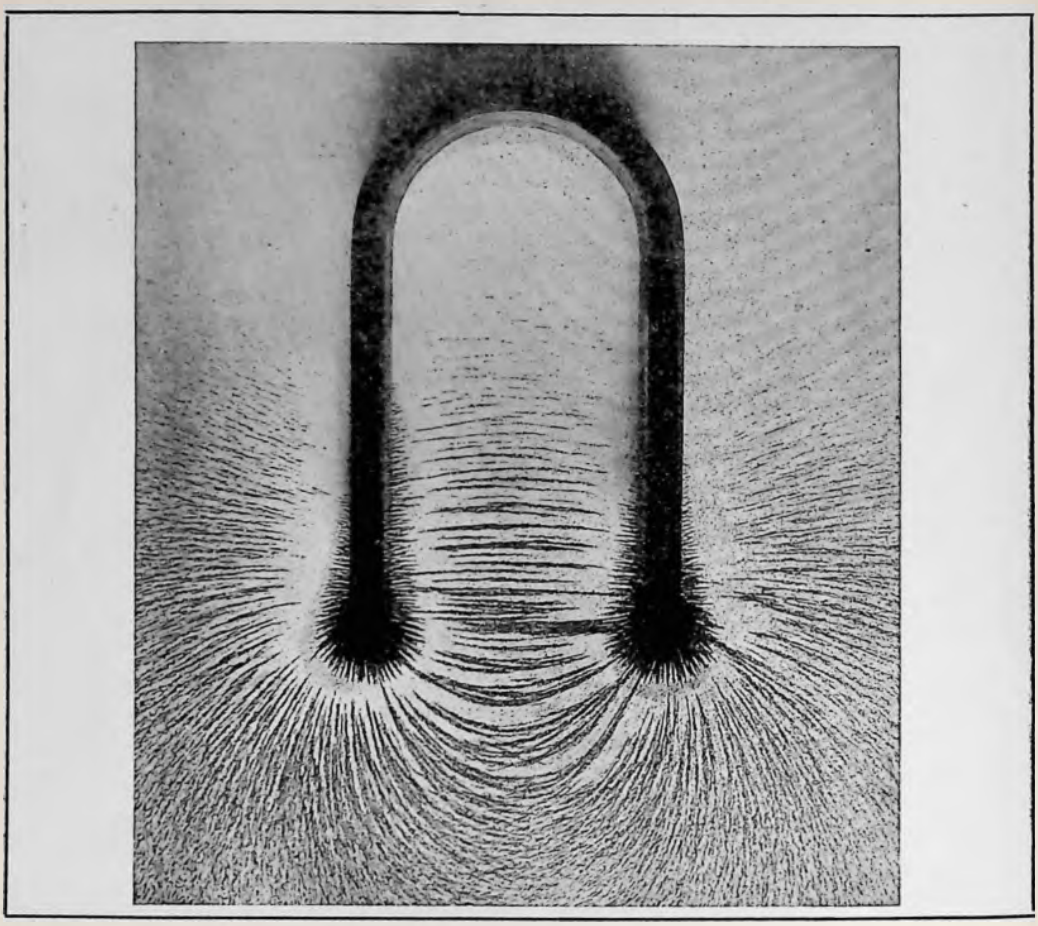
P. S. TICE



### APPLICATION OF PRINCIPLES

Since the value of the electrical pressure or current induced electro-magnetically is dependent upon the number of lines of force cut through by or cutting the conductor of a circuit in unit time, it is obvious that there are several ways in which the number of lines cut can be increased to a maximum for a given case: (1) by making the magnetic field in which the conductor is moved as intense as possible; (2) by making that portion of the conductor within the magnetic field of the greatest permissible length, and (3) by moving that part of the conductor which is within the magnetic field, or shifting the lines of force of the field with reference to the conductor, as rapidly as possible.

In magneto practice, each of the three methods above is limited in its individual extensions, although it is usually endeavored to extend (1) and (2) to the farthest limit consistent with compactness of the complete magneto, (3) is apparently the most limited of these



*Copyright by "Motor Boating"* Fig. 8 Showing field of a U-magnet

Note the difference in the shape and intensity between this field as shown by filings and that of the bar magnet in Fig. 2, April issue. A U-magnet such as those used in a magneto is merely a bar magnet so bent as to bring the poles into close proximity, thus reducing the extent of the field and increasing its intensity.

methods, but its limitations are overcome to such an extent in practice that it is in reality the most flexible and readily extendable of the trio, as will be explained.

The method designated as (1) provides a large field for endeavor. A great step is made toward intensifying the magnetic field by bending the bar magnet, Fig. 2, into the U form shown in Fig. 8. Here it will be noted that the lines of force through that part of the field lying between the poles is so intense, compared with the field of the bar, that the induced magnetism in the iron particles is sufficient to cause those lying in adjacent lines to pull together and leave apparently blank spaces in the map. By increasing the number of U magnetse mployed in creating a single field, the intensity or number of lines of force in the field is further increased. Experiment has proven that a high-grade alloy steel with a considerable percentage of tungsten will most readily retain magnetism, after it has once been hardened and magnetically saturated, see Fig. 3, by inserting it within the

*Copyright by "Motor Boating"* **Fig. 9. How a current is induced in the armature winding (a)**

In this photograph the armature or revolving member of the magneto is shown in the position in which the greatest possible number of lines of force pass through its core and thus through the centre of the windings of wire in the same manner as the lines of force were shown to pass through the centre of the wire helix in Fig. 7, with the difference that the lines of force in this case are produced by permanent magnets instead of by an electric current as in the other case

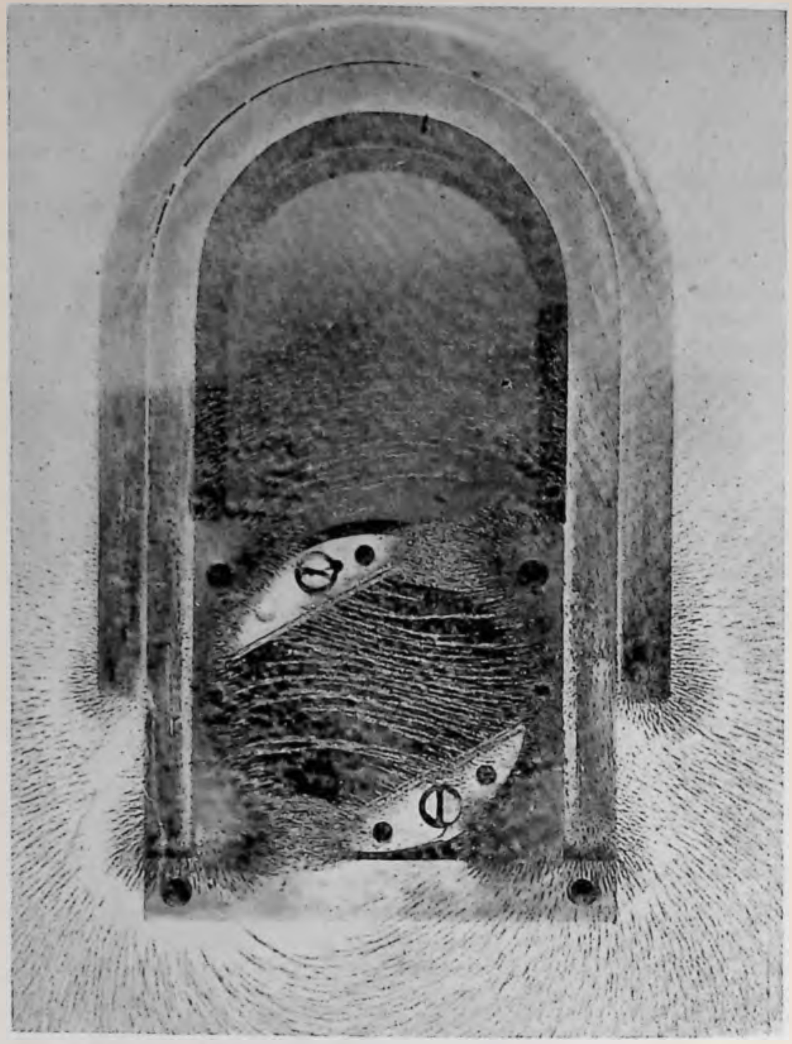


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**Fig. 10. How current is induced (b)**

Armature midway between extreme positions shown in Figs. 9 and 11, assumed in process of generation. The photograph shows how the lines of force are distorted from their naturally direct paths from one pole of magnet to the other to pass through armature core and thus through centre of winding. The lines are actually distorted to a greater degree than can be shown photographically. The number of lines passing through the winding is not, therefore, reduced from the maximum, as shown in Fig. 9, to any appreciable extent when the armature is in the position here shown.

magnetic field of a solenoid, as in Fig. 7, of a great many turns of wire, and through which a heavy current of electricity is passed. This tungsten steel is used almost exclusively for magneto field magnets.

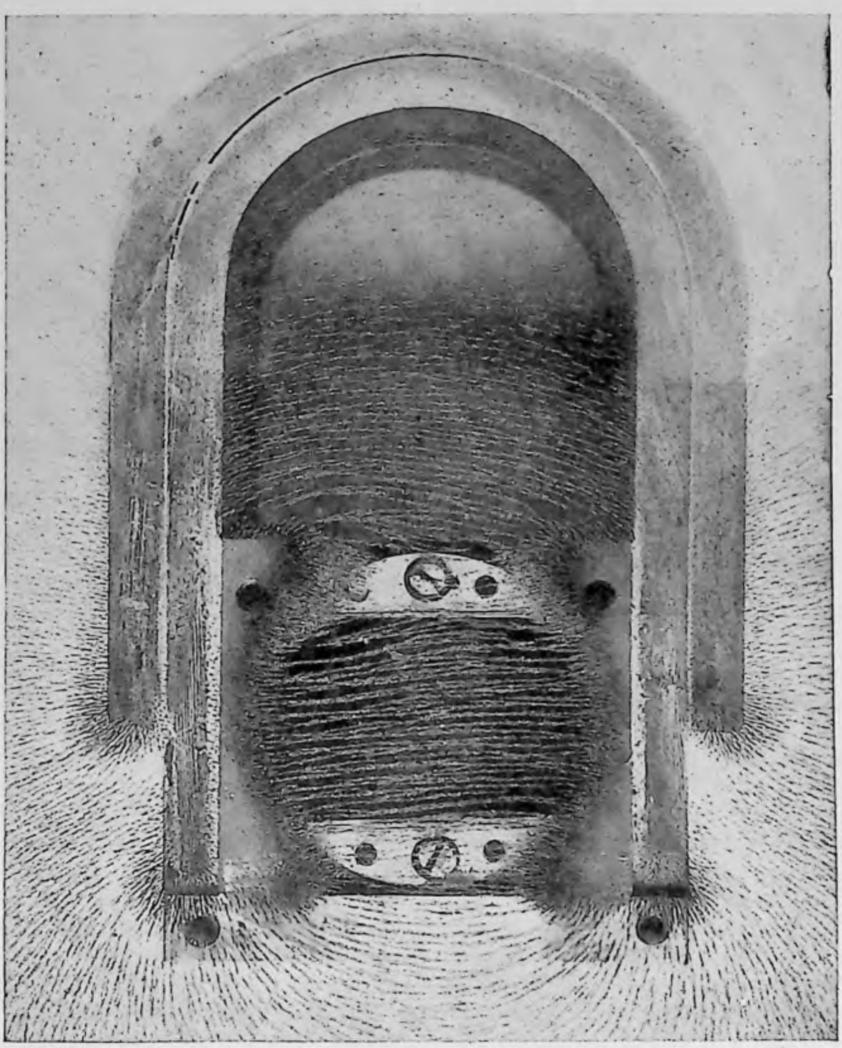
The readiness with which magnetic lines of force traverse any substance is measured by the unit of permeability, which refers to the number of lines of force passing through a given sectional area of a substance. When it is considered that all the lines shown in Fig. 2, or Fig. 8, and millions that are not thus shown as passing through surrounding space, all traverse the body of the magnet in completing their circuit, it appears that the permeability or magnetic capacity of steel is many thousands of times greater than that of air. Likewise, as in the above, the permeability of soft iron is greater than that of steel. For these reasons, the intensity or number of lines of force in the field in which the conductor is moved is highly increased by so filling the field space with soft iron that only sufficient room is left for the conductor.

By using the above high-grade magnet steel for the field magnets, and attaching pieces to their poles, as shown in Fig. 9, and at the same time placing between the pole pieces a body of soft iron, called the armature, the field between the magnet poles is made of the greatest possible intensity. It is to be noted in Fig. 9 that although the field between the poles of the magnet is greatly intensified by thus almost completely filling it with magnetic material, there is a very considerable leakage or loss in the effective magnetic field.

For method (2), it is usual to form the conductor of the circuit into a helical winding which places the greatest possible length within the smallest possible space. Also, in order that the moving portion of the conductor may be located in the most intense part of the magnetic field, it is wound in the form of superimposed helises upon the soft iron armature.

In Figs. 9, 10 and 11, of a magneto kindly loaned by C. F. Splitdorf, the armature is shown in three characteristic positions. Fig. 9 shows the armature in such a position that its main body of metal lies directly across the magnet poles, and therefore conveys

*(Continued on page 349)*



*Copyright by Motor Boating* **Fig. 11. How the Current is Generated (c)**

The armature is shown in the position where no lines of force are passing axially through the winding. It is at instants at which the lines of force enter and leave the core that current is induced in the winding and passes through the external ignition circuit to produce the spark.

## THE MOTION PICTURE—Part VII

### Small Transformer for Stereopticon Arcs

STANLEY CURTIS

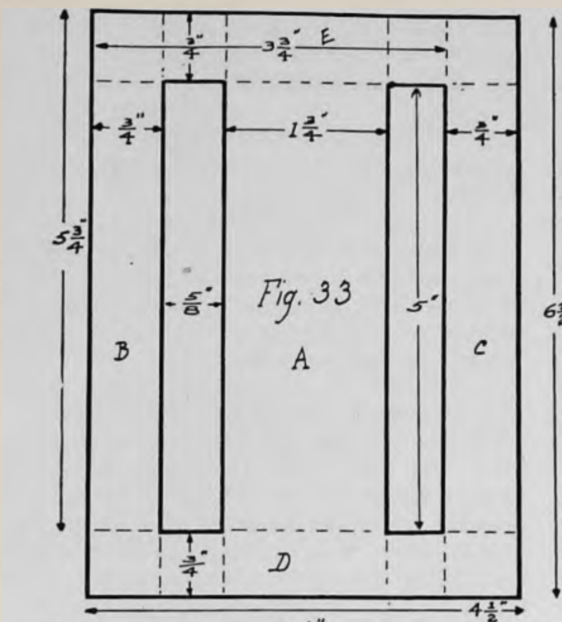
No doubt many lanternists have met with some of the difficulties previously referred to while using alternating current to operate their stereopticon arc lamps. The windings herein described will give a secondary voltage suitable for the stereopticon arc and the transformer may be connected directly to any outlet capable of carrying 5 amperes. The convenience of this will be readily understood, for the stereopticon may thus be operated in a private house or other place without the necessity of having any special wiring done. If a rheostat was used in place of the transformer, the wires would have to be heavy enough to carry from 12 to 15 amperes, and the extra 500 to 700 watts would be entirely wasted. The transformer can only be used on alternating current circuits.

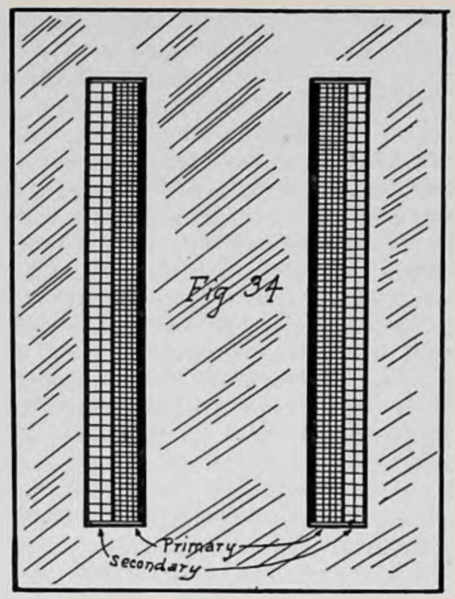
If "transformer iron" can be obtained it should by all means be used for the core. This iron is extremely soft and pure and comes in very thin sheets. It is used in the cores of commercial transformers and can sometimes be obtained in small quantities from a central station manager who will sell the core of a burned-out transformer for the price of so much scrap iron. The writer was fortunate enough to secure a complete core of just the right size in this manner, and it proved to be more efficient by far than a core built up of "stove-pipe" iron, which is the next best substitute. This iron may be purchased in sheets and the thinnest gauge should be chosen. The sheets may be cut up into strips, but a far better form of construction is to cut it up into sheets 4½ x 6½ in., enough to make a pile 3 in. high when tightly clamped together. Taking just one-half of the pile, a slot is to be cut through from the end *E*, in Fig. 33, on either side of the centre piece *A*. The dimensions of these parts are given in Fig. 33. When these slots have been cut, there will be three legs, *B*, *A* and *C*, joined at one end by a yoke *D*, each of the two outside legs being ¾ in. in width and the centre leg *A*, 1¾ in. in width, the length being 5¾ in. There will be a pile of strips 5¾ x ⅝ in. which have been cut from the sheets. A few of these may be cut up into small rectangles, ⅝ x ¾ in. These will fit into the space between *B* and *A*, and *A* and *C*, to close the magnetic circuit when building up the core.

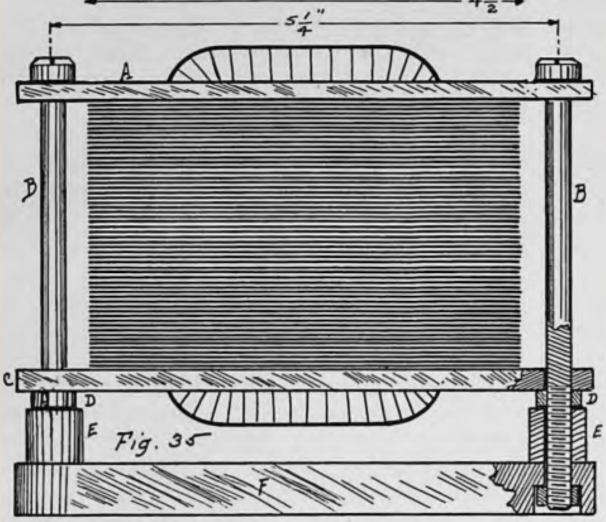
The remaining pile of sheets of 4½ x 6½ in. iron is now to be cut to shape. In this lot, the end *E* is to be cut entirely off before cutting the slots. When this is done the pile of 4½ x ¾ in. strips thus formed is placed away for future reference and slots are cut in the sheets as before. The legs in this case, however, will be 5 in. in length instead of 5¾ in., as in the former pile. This completes the work on the core with the exception of the insulation to prevent "eddy currents" in the iron. This is easily done by dipping each one of the sheets of iron into a tray containing thin shellac, afterwards standing the iron on edge to dry.

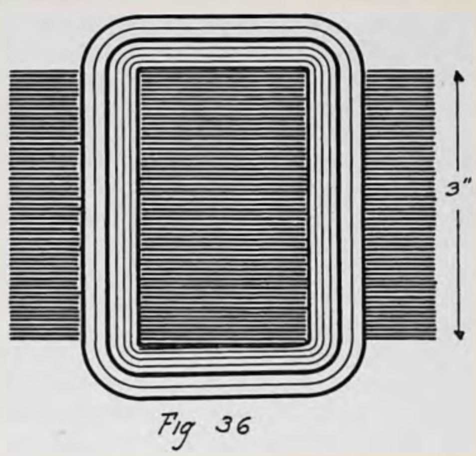
The winding is done on a former similar to the one described for the choke coil in a previous chapter. However, for the present coil it should measure 3 x 1¾ in. in cross-section and 5 in. in length. The primary is placed on first and consists of four layers of No. 16 B. & S. gauge double cotton-covered magnet wire, 80 turns per layer, thus making 320 turns in all. This winding is for a 110 volt circuit; for 220 volts, 640 turns of No. 19 wire should be used.

The primary is now to be covered with three layers of heavy paper and well soaked with shellac. A layer of paper should be placed between each two layers of wire as well, to insure good insulation. The secondary is wound directly over the primary and consists of two layers of No. 12 B. & S. double cotton-covered wire, 50 turns per layer. This is given a coat of shellac on completion and the whole may then be taken from the former and taped. Care must be taken in winding, to get the turns of wire close together, and a

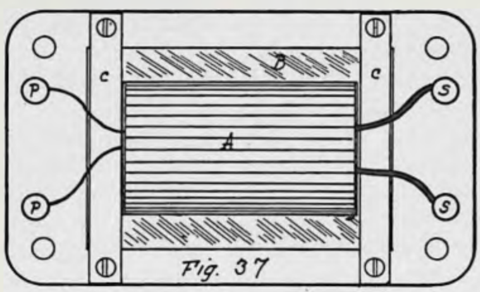



Details of Construction




Stanley Curtis 1919

wooden mallet should be used to gently tap the sides of the winding. The space in which the coil is to go is decidedly limited, and close winding is therefore essential.

The winding having been taped, it may be treated to several coats of thin shellac and then placed in a moderately warm oven for two or three hours.

The core may now be assembled.

Sheets having alternate short and long legs are to be placed together until the pile represents a mass of iron 3 in. high with a centre core 1¾ x 5¾ in., over which the winding is to be slipped. There will be a space between each two sheets at the end to receive the pieces which have been cut 4½ x ¾ in. When these spaces have been filled, there will be room between the outside legs and the centre leg for the small rectangles, ¾ x ⅝ in., to be packed in. Thus the end of the core will be practically solid and a closed magnetic circuit is formed. The position of the coil is shown in the cross-sectional view in Fig. 36. Paper should be shellacked over the iron at the points where the coil touches, and all sharp points or projections removed with a file.

The transformer is secured to the slate base by means of long bolts and cross-pieces of cold rolled steel, as shown in Fig. 35. The nuts *D* must be brought up tightly, otherwise the transformer will emit a disagreeable humming sound while in operation.

The primary leads are brought out to binding posts, at one end of the base and the secondary at the other, as shown in Fig. 37, which is a plan of the completed transformer. By starting the primary winding at one end and the secondary at the other, this arrangement is effected.

The ratio of the number of turns in the primary to those in the secondary is 3.2:1, therefore the secondary voltage will be approximately from 35 to 40 volts and the current available 12 amperes. This is sufficient to operate a stereopticon arc quite successfully, providing good carbons of a small diameter are used. The V-shaped groove should be filed along one side of each to hold the arc, as mentioned in a previous chapter. The carbons must not be very long, or their resistance will dim the light somewhat. If they project 3 in. from each holder a two hours' run may be had and the resistance will not be too great.

It is of course understood that the terminals, *PP*, Fig. 35, are connected directly to the 110 volt supply and the lamp is connected to *SS*.

The greatest care must be used to keep the insulation perfect while winding the coils. If by any chance two adjacent turns of wire were short-circuited, the ring of wire thus formed would complete a secondary circuit of very low voltage, but exceedingly high amperage and the wire would shortly melt in two.

### A CHAT WITH YOU

It has been the aim of the writer to give, in this series of articles, a general idea of the perplexing situations encountered by the motion-picture operator in the daily routine of his work, and to point out, in a necessarily brief manner, the way out of the difficulty. In addition to this he has endeavored to give the electrical information which an applicant for operator's license must possess in order to pass the State examination. The hints given throughout the series are based upon actual experience and not upon theory. Doubtless many points have been overlooked, and others—unimportant ones, probably—have been omitted owing to limited space.

Perhaps a word here, regarding the incentive which prompted the writer to give to his fellow-workers and those interested in this field the foregoing chapters, may not be amiss. In the summer of 1909 a "literary gem" entitled "A Moving Picture Guide and Educator," was issued by a well-known New York firm making a specialty of motion-picture supplies and accessories. The book purported to tell how to open a picture theatre, and on the first page there appeared a list of questions and answers for the edification of an operator. The list is reprinted *verbatim* below, and the intelligent reader will have no difficulty in detecting the innumerable errors.

### INFORMATION AN OPERATOR SHOULD KNOW

*Q.*—What is Alternating Current?

*A.*—A current that alternates Burns around the carbons.

*Q.*—What is direct current?

*A.*—Direct current is a current that flows even and burns evenly.

*Q.*—What is a Volt?

*A.*—Unit of Strength.

*Q.*—What is an Ampere?

*A.*—Unit of Quantity.

*Q.*—What is an Ohm?

*A.*—Unit of Resistance.

*Q.*—What is a Watt?

*A.*—Unit of Electrical Activity.

*Q.*—What is a Killawatt?

*A.*—1,000 Watts

*Q.*—What is a Polarity?

*A.*—The arrangement of your wires in the lamp house so the positive will be on top and negative on the bottom.

*Q.*—What is a Rheostat?

*A.*—An instrument used to create a resistance on a circuit.

*Q.*—What is a Potential?

*A.*—The ability of anything mechanical to do work electrical

*Q.*—If you had 52 Volts how would you hook up your rheostats?

*A.*—In Multiple.

*Q.*—If you had 220 Volts how would you hook up your rheostats?

*A.*—In Series.

*Q.*—What do you mean by Multiple?

*A.*—Running your both wires parallel, and connecting on each side of each rheostat.

*Q.*—What do you mean by Series?

*A.*—Connecting at one end to one rheostat and using a jumper or jumpers to your end rheostat with one side of your line, and letting the other side go direct.

*Q.*—What kind of fuses can you use in booth, according to law?

*A.*—Amp. Screw fuses in a porcelain cut out.

*Q.*—What size Cable is allowed?

*A.*—No. 6 B. & S. Gauge (standard), Stage Cable.

*Q.*—Where would you set your rewinder?

*A.*—Positively outside the booth.

*Q.*—What are the principal qualifications a good operator should possess?

*A.*—Cleanliness, Carefulness and Mechanical ability.

*Q.*—What would you do in case of fire?

*A.*—Pull enclosed switch, put on house lights, and dismiss the audience.

And this from one of the oldest manufacturers and *operators* in the city of New York. The writer will not attempt to correct the answers here, as all of these points have been covered in former chapters.

A word now to the prospective operator. You cannot learn to *operate* a motion-picture machine by reading a book, but you can obtain the technical and theoretical knowledge which you must have in order to grasp the practical mechanical details. After you have a good understanding of the theory and general principles of the business, you are ready to go to work in an intelligent manner on the other end. If you have gone this far, you may request some licensed working operator to sign an assistant operator's application for you. In the State of Massachusetts the fee for this is $1.00. It differs slightly in other states. The assistant's license grants you the authority to stay in the operating booth; to rewind films, trim lamps, thread up, etc., but not to operate a machine. Your cue is, watch every move the operator makes; note the speed of the crank; how often he feeds his light and also if it keeps steady or "blows" frequently. After a few weeks of this, if you have made good use of your time and feel equal to the ordeal of an examination, you may make application for an operator's license with the Inspection Department of the District Police. The fee in Massachusetts is $3.00, and it ranges from this sum to $10.00 in other states. A day will be appointed for your examination and in case you fail to pass, the license fee will be returned. If you are successful, you will be given a card stating that you have the necessary qualifications to take charge of a moving-picture machine. This license is good for one year, and it may be renewed at the expiration of that time for $1.00 without further examination.

Assuming that you have passed the examination and are a licensed operator, you should feel the responsibility of your position. The railroad engineer holds a license showing that he is capable of taking his train through in safety. He fully realizes that he holds the lives, practically speaking, of his passengers in his hands. He does not stop to consider what he would do in case of an accident,—*he does his best and strains every nerve to prevent an accident.* That is the point. Operators, you must compare yourselves with the engineer. *In your hands* rests the safety—perhaps the lives—of hundreds of women and children. Do not dwell upon the question, "What would you do in case of fire?" as our New York friend puts it. Instead, *Do your best to prevent a fire.* The actual damage done by the fire itself is usually trifling,—perhaps a few hundreds of dollars. It is the panic which almost invariably follows that does the real damage,—that to life and limb.

Therefore, you should appreciate the importance of careful and conscientious attention to every detail of the work. If you are too indifferent or indolent to give your work the attention it requires,—give up the business before the accident comes. Once an operator has had a film fire, he is stamped as a careless man, and his future career in that particular vicinity is ruined.

The writer does not mean to reflect discredit on the average operator by the foregoing; rather the discredit goes to the manager of the theatre. And right here it may be well to state that the writer is taking an unbiased view of the question, as he has been both operator and manager. In some theatres the operator is treated as a prince and in others he is simply an untiring machine which is given an occasional kick by the up-to-date manager with the admonition to "grind her through faster." It is in the latter case that the operator gets careless and indifferent, and the inevitable fire is the result. Perhaps one of the above-mentioned up-to-date managers in reading this paragraph would say that he could not take in enough nickels to make the house pay, if he followed the right policy. If that is the case, why is it that the houses which always give the people their money's worth are the ones that keep open winter and summer and are always full of patrons, while the other "money-making" houses close down, one after the other?

Go into the operating booth of one of the better houses,—one of the theatres where the picture is always sharp, clear, and brilliant and always neatly framed; where a cracked condensing lens is never seen showing through the song slides; you will find a bright, quick, intelligent young man, who knows his business. Go below to the manager's office. You will find a man equally sharp and decisive in every particular. This is the combination that keeps the seats filled. An operator who knows his business will not work for the hog-manager, and the *live* manager will not keep an operator who does not know his business.

The motion-picture business is not on the decline,—it is simply settling down to a steady pace and slowly but surely developing into a good, wholesome, and legitimate form of amusement. In every case, however, whether it be film producer, theatre manager, machine manufacturer or operator, it will be the "survival of the fittest."

In conclusion, the writer will be pleased to answer any inquiries or to render any assistance in his power to "The Boys."

(*The End*)

### Electric Pen for Newspaper Men

FELIX J. KOCH

It was a case of necessity being the mother of invention.

Again and again some newspaper errand had sent us reporting a speech, a lecture accompanied with stereopticon projections, so that the hall was darkened, and one had to feel the way for his pencil, not to run line into line. When it came to taking notes we wished to preserve for all time, it meant a few hours recopying, when we got home.

So we took up the matter with a local electrician, a man named Stenger, and he got to work. On the fountain-pen we were using he mounted a wee electric light, so tiny that only those seated each side of us could see. Then, where our fingers naturally clasped the pen, he put two bits of metal to form the contact. When we didn't want the light, we held the pen a bit farther up the stem, that was all. When we did, we held it on these flanges.

On the cap of the pen a scroll of wire protected the lamp against breakage in the pocket.

Attached to the pen was a thin wire, green insulated, so as to make it inconspicuous. This could run down the sleeve if we wished, more often it was simply run out of the coat, between buttons.

Then, in an upper vest pocket, there was a little dry battery, costing only a quarter. The whole outfit took no more room than three or four cigars in that pocket would. And it has saved us our eyes, and our time, again and again. Theatrical critics, art editors and reporters of lectures might learn a lesson from the wise, and do likewise.

# HOW TO MAKE A "SYNCHRONOME" ELECTRICAL TIME TRANSMITTER

THOS. POWELL

In response to many enquiries from our readers on the subject of electric time transmitters, we now publish detailed drawings and full instructions for making what is undoubtedly the simplest and best article of this class. It is the invention of Mr. F. Hope-Jones, M.I.E.E., of the Synchronome Company, of London, England. He is willing to favor amateurs with the full permission to make same.

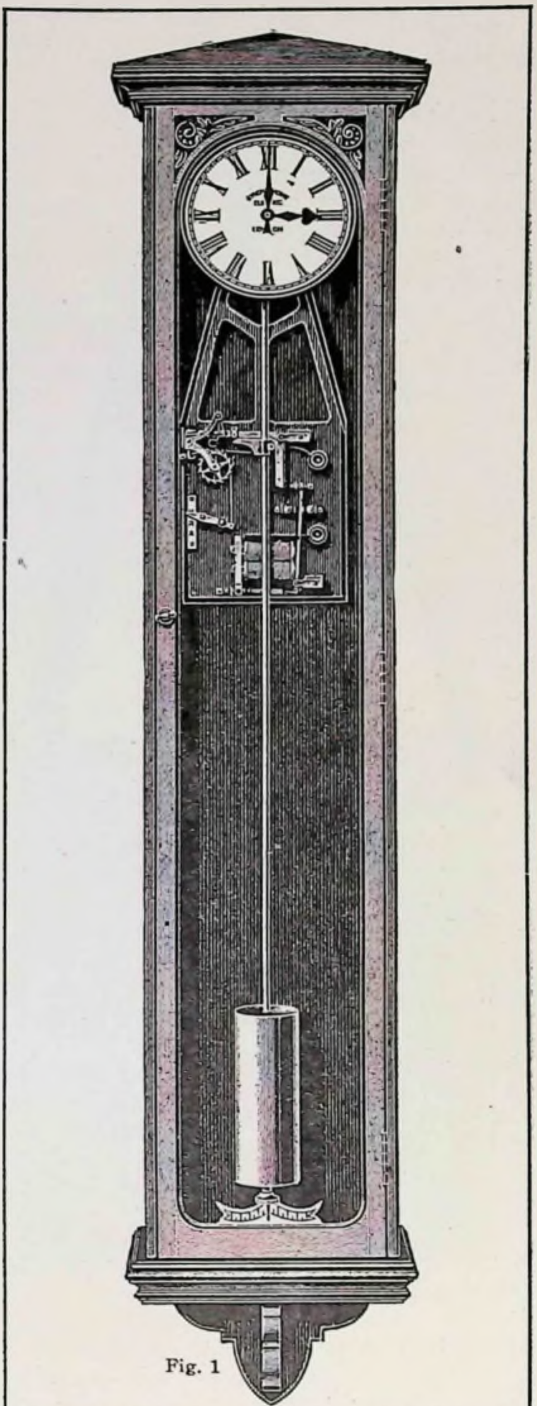


Fig. 1

In this issue we give (Fig. 1) a woodcut of the complete masterpiece with dial; Fig. 2, the complete mechanism, less the dial and case; Fig. 3, a working drawing of Fig. 2, less the top part of casting, which is shown broken off; Fig. 4, details of parts shown separately.

We will commence with the baseplate (Fig. 3), which is of cast iron. First, file up the flat part, chalk the bosses on all four sides and scribe all round, giving the heights of boss A $1\frac{15}{32}$ in., *B* $\frac{7}{8}$ in., and *C* $\frac{3}{4}$ in., then file dead to these lines, and unless this is done the bearing brasses will not fit firm and truly, says *Model Engineer*.

Next file up the magnet yoke boss and centre punch in the positions shown, then drill the two $\frac{7}{32}$ in. holes for the magnet cores and the hole for the armature tailspring screw, which is to be tapped 5*BA*.

To drill these holes, if ordinary twist drills are used, it will be necessary to lengthen them by taking a length of, say, $\frac{5}{16}$ in. round brass, chucking it in the lathe, and drilling a hole up the end with the drill to be lengthened, then drop a little soft solder into the hole, and after having cleaned the shank of drill and filed a small flat near its end apply a little flux, then heat up the rod sufficiently to melt solder, and insert drill in hole in the rod and allow to cool, care being taken not to draw the temper of drill.

Next drill the boss *A*, and tap 5*BA* for the small back stop pillar *D* at a distance of $1\frac{1}{16}$ in. from base, and the

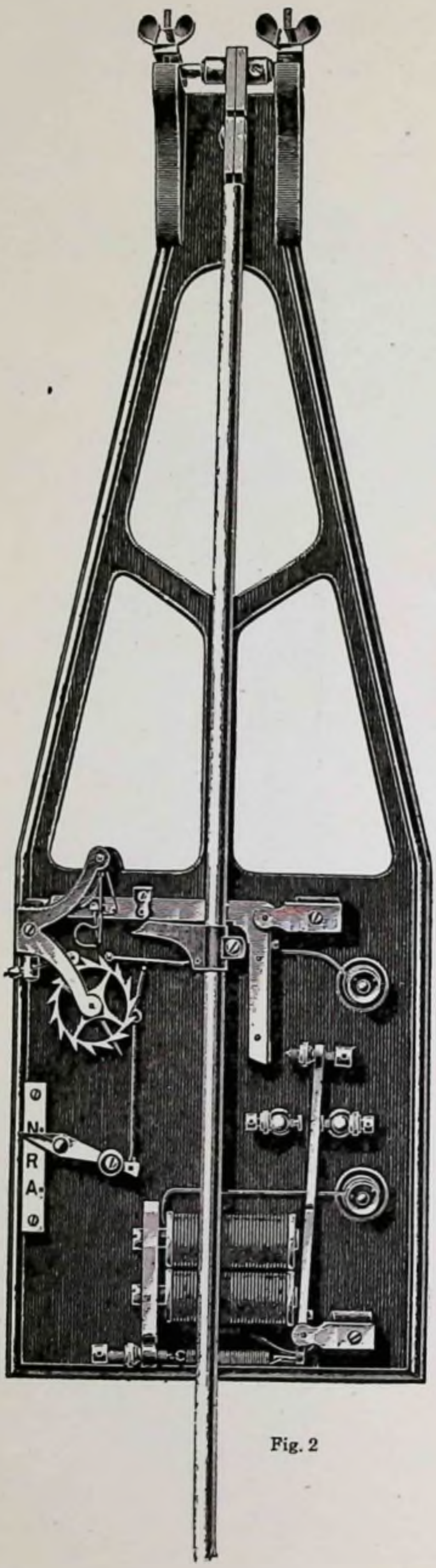



Fig. 2

most difficult drilling, which should be carefully and neatly done, is finished.

We now turn our attention to the bearings for the pivots $E$, $F$, $G$, $H$. These are to be formed in the baseplate by drilling and tapping 4*BA* at the points shown, and fitting brass screws which have a 3/64 in. hole drilled up from the end about 1/8 in. deep. This must be done accurately, otherwise the spindles will tend to bind. Fitted with lock-nuts at back of baseplate, these screws form ideal bearings, and should they become worn after a few centuries' working, the wear can readily be taken up.

To enable us to fit the front bearing brasses it will be advisable to make a jig. Take a piece of 5/16 in. square brass about 5 in. long, cut into two parts, and with the aid of a flat surface and soft solder make an approximate right angle (see $A$, Fig. 4). File or grind flat on one side, and mount on faceplate of lathe. With a graving tool start a hole near corner of angle, and drill a 3/64 in. hole right through; alter the position on faceplate, and drill a similar hole at a distance of 2 3/32 in. further along one arm. If we now insert a straight length, about 2 in. long, of 3/64 in. silver steel wire into each of these holes and let them project on the true side of jig for about 1/16 in., and place these projections into the holes in bearing screws in base, we shall be able to set the outer bearing brasses correctly. The two projections will be required in setting the bearings for $E$ and $F$ (Fig. 3), as, noted on page 317 opposite and only one for the others.

The bearing plates $E$, $F$, $G$, $H$, may now be filed to shape, and have the bearing and fixing holes drilled; then by placing the bearing hole over the 3/64 in. rod of jig we shall be able to mark off the respective bosses for fixing screws. In addition to the fixing screws, locating holes are to be drilled right through brass and into boss to a depth of about 3/16 in. to take brass steady pins, which will stop any tendency on the part of the bearing-plate to swivel round its fixing screw, and will ensure accuracy in replacing bearing if at any time same should be removed. The pillars for the armature stroke limiting screws $P$ and $P^1$ (Fig. 3) are fixed by screws

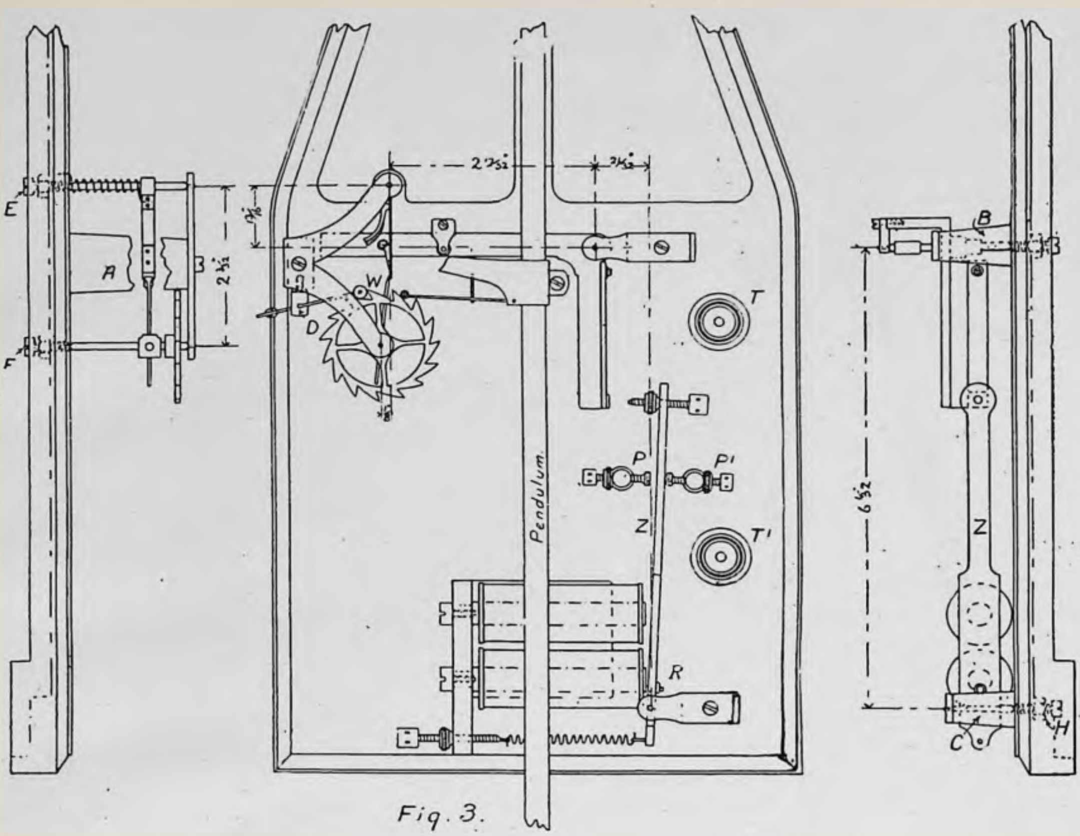



Fig. 3.

passing through baseplate from back, and the two main terminals $T$ and $T^1$ (Fig. 3) in the same manner; but these must be insulated from base by means of short ebonite or vulcanized fiber tubes and washers or similar insulators.

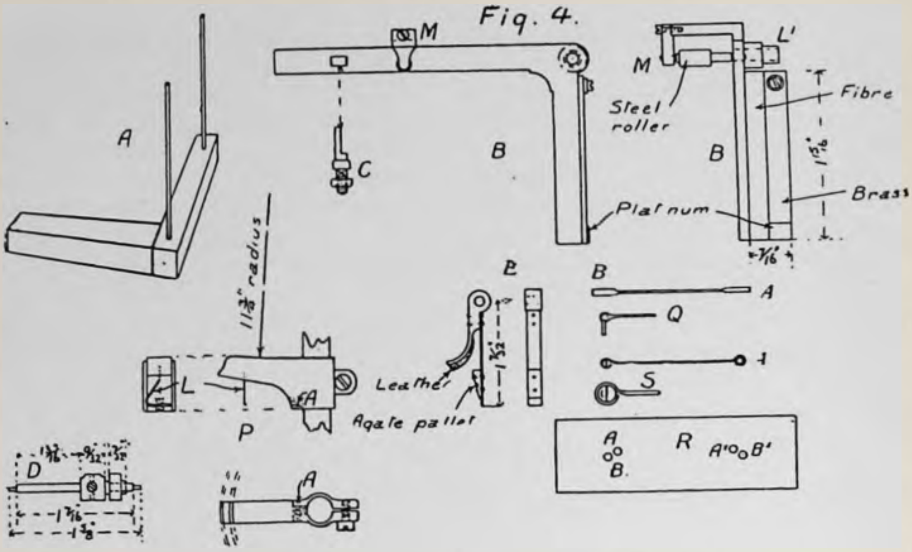
We will now clean up the magnet cores, which are 2⅜ in. long by 5/16 in. in diameter, and project 2 3/16 in. from yoke. One end of each is turned down to 7/32 in. for a distance of 3/16 in., and is drilled and tapped to take the cheese-head iron screw which is used to hold it to the yoke. The brass bobbin cheeks should be turned 25/32 in. diameter, and bored a tight fit for magnet cores.

The insulation for winding will be satisfactory if carried out as shown at $I$ (Fig. 6), the discs being bored a tight fit on fiber tube, and the centre disc at the end where three are shown, having a slot cut from its centre to periphery to accommodate the starting end of winding.

The gravity arm $B$ (Fig. 4) may be taken in hand next. First, file flat on front surface, mount on lathe faceplate, and drill a ⅛ in. hole truly through centre of boss $L^1$ to take pivot. At a distance of 2⅝ in. from this centre, cut an oblong slot right through the arm ⅛ in. full wide, and about 5/16 in. long, to take the catch peg $C$ (Fig. 4), which is made of 3/16 in. tool steel filed square where it passes through slot, and screwed and fitted with a nut to fix it to gravity arm. The square part ensures the under flat side of the projecting part keeping horizontal, and the slot allows of slight adjustment. Regarding the front bearing-plate for roller $M$, it will be advisable to rebate as shown, and fix to the projection on arm provided for the purpose, then clamp all together on lathe faceplate, and starting the hole truly drill 3/64 in. right through plate and arm; this will ensure accuracy.

On the back of vertical part of arm fix a piece of ebonite or vulcanized fiber 1 15/16 in. x 7/16 in. x ¼ in. by means of two countersunk headed brass screws

Fig. 4.




passed through from back of fiber and riveted over on front of arm; when these are filed flush, they will not be noticeable. Cut a 1 15/16 in. length of ¼ in. x 1/16 in. brass, and at one end solder a small square of platinum, and near the other end drill and tap to take a cheese-head screw and washer for binding the flexible insulated wire which leads from the insulated terminal *T* (Fig. 3). Fix this plate by countersunk brass screws to fiber block at right-hand side and touching back edge, as shown at *B* (Fig. 4); of course, the screws in this plate must be so spaced that they do not come near the two which hold fiber block to gravity arm.

We will now take the length of ½ in. x ⅛ in. iron for armature, and shape as shown in front and side elevation *Z* (Fig. 3), and fix the small hook at the lower end to take the tail-spring. At a distance of ½ in. from this end and edgewise drill a 1/16 in. hole right through to take pivot; at the other end 4 in. from pivot centre and on the face of armature a hole is to be drilled and tapped to take the contact screw, the end of which is drilled 1/16 in. and has a piece of 1/16 in. platinum wire fixed in. Near the pivot end of armature will be seen a small cheese-head screw and washer *K*; these are to clamp a short length of insulated flexible wire which leads to the magnet windings. The other end of coil passes through a large hole in the baseplate behind the magnet, and is clamped to the underside of terminal $T^1$ (Fig. 3). The 15-tooth wheel had better be polished now, and it will be found to have a 5/32 in. hole in its centre; chuck a piece of 5/16 in. brass rod, and drill a 3/32 in. hole centrally ¼ in. deep; now turn the outside down for a distance of 1/16 in. to 5/32 in. diameter to tightly fit hole in wheel, and part off 7/32 in. total length. Now, from a piece of 5/16 in. silver steel turn the pivot *D* (Fig. 4) 1⅝ in. length over all, turn down at the ends to 3/64 in. bare for a distance of 3/32 in. to fit bearings; from one of the shoulders thus formed, and for a distance of 5/16 in. bare turn down to 3/32 in. to fit the hole in the bush for 15-tooth wheel. Now, from the shoulder at the other end, and for a distance of 13/16 in., turn down to 3/32 in.; the next 5/32 in. is to be left 5/16 in. diameter, and the remaining space between this and the wheel bush may be reduced or left full as taste dictates. Drill a 3/64 in. hole diametrically through the centre of the thick part, and drill and tap a hole at right angles to this to take a small steel grub screw for holding the vane, which is a piece of 3/64 in. steel wire flattened out for about ⅛ in. at one end, and filed square where it comes in contact with the lower extremity of catch *E* (Fig. 4). Now tin the inside of collar which carries the 15-tooth wheel and heat up sufficiently to melt solder, then press same on to spindle up against shoulder; do the same to the outside, and fix 15-tooth wheel so that it will revolve truly, and care must be taken that when vane is fixed all is perfectly balanced, so as not to throw unnecessary work on pendulum. At $E$ (Fig. 3) is shown another pivot, 3/32 in. diameter, reduced to 3/64 in. where it fits its bearings, and carrying a piece of brass, shaped like $E$ (Fig. 4). This is to be drilled a tight fit, and has the catch spring riveted to it, as shown. The lower end of this spring has the agate pallet fixed to it by carefully riveting in such a position that the upper face is 25/32 in. from centre of pivot. The curved tail of the brass, which is easily adjusted by bending, ensures the agate pallet being in its proper position to catch the peg $C$ (Fig. 4), and so prevent the switch falling, and is faced with hard leather on its inner surface to damp the upward jump of the gravity arm. A light spiral spring coiled round the spindle $E$ (Fig. 3) keeps the pallet in contact with the catch peg, and so assists the leather-covered tail $E$.

## THE EVOLUTION OF ARTIFICIAL ILLUMINATION

### One of the Greatest Achievements of the Past Hundred Years

For not more than one hundred years has there been any systematic means of artificial lighting, writes J. J. Forbrick, in *Building Management*. Before the year 1800 our forefathers had to resort to tallow dips, rush lights, pine knots, wax candles and oil lamps. Rich as well as poor were obliged to use one or other of these means of lighting. In only a few of the larger cities was an attempt made to illuminate the streets by oil lamps. Up to the year 1850 oil lamps were really the only practical and partly efficient means of lighting. About this time gas light sprang into existence, and, of course, soon took the place of the lesser efficient methods before mentioned.

Practically all illumination of an artificial nature that could be considered at all efficient dates back to this time, or within the compass of the last half century, as even kerosene lamps were not widely known until the latter part of the sixties.

#### THE ARC LIGHT

About 1870 the electric arc light was experimented with for lighthouse and exhibition purposes, but did not attract a great deal of attention until about 1880, to which time our modern arc lamp practically owes its birth. About 1878 or 1879 Edison made his first successful electric incandescent burner. It was clearly understood at this time by men who were working on lighting problems, and who had an intelligent conception of the difficulties yet to be surmounted, that the one thing that yet remained to be discovered was a method of making an incandescent conductor which would, without disintegration, stand a much higher temperature than platinum or iridium, two metals that were largely used in experimentation up to that time. We men of the present day, of course, know that the final solution of the problem of incandescent electric lighting was found in the substitution for the metallic conductor, a conductor formed of carbonized structural material forming a filament of horse-shoe shape.

#### EDISON'S FIRST CARBON

It might here be interesting to show the method of Mr. Edison in the manufacture of his first carbon filament. He cut from cardboard very thin pieces in the form of small horseshoes, about 2 in. in length and 1/8 in. in width. These strips were laid flat in an iron mould and separated from each other by tissue paper. The mould was then covered and placed in an oven where it was gradually raised to a temperature of about 650 degrees Fahrenheit. This was done to allow the volatile substances of the paper to pass away. The mould was then placed in a furnace and raised to a white heat, after which it was allowed to cool gradually. The little carbon horseshoe-shaped filament which remained after this operation had to be handled with the greatest of care, and after working for hours and days, this great genius had solved the problem.

The difficulties, apparently so innumerable, melted away and the electric lamp was completed. A piece of charred paper, so delicate that it looked like a fine wire, proved to be the long sought combination.

#### OSMIUM LAMP

From this time up to about 1895 the changes in incandescent lighting units were very little, if any. In 1898, or thereabouts, the Osmium lamp, invented by Auer von Welsbach, who also invented the gas mantle which is known by his name, came on the scene; but owing to great difficulties in construction, its fragility, and impossibility of making a lamp for a higher voltage than 50 volts, it did not come into general use. Lamps with filaments of iridium—a metal I think belonging to the same class as osmium—were made with little more success than the former, but, owing to the difficulty of making lamps for high voltages, could be used for storage battery use only.

Graphitized filaments were made, but came into being just a little too late to compete with the new metallic filament lamps. Their consumption was about 2.5 watts per candle. Filaments made out of lamp-black, from the combustion of vegetable oils mixed with Chinese ink, have also been experimented with. It has been claimed that lamps of this character will burn 1,000 hours at a consumption of only 1 watt per candle.

The Hopefelt lamp, which at one time bid fair to be a great success, has not come into general use.

#### HELION LAMP

The Helion Lamp, invented by Parker and Clark, is a wonderful piece of lamp mechanism. The filament of this lamp is composed mostly of silicon, which is deposited on a carbon core by a special process, and seems to be very strong, the inventors claiming that it may be heated to full incandescence in the open air without a vacuum. A life of 1,000 hours or more, with a consumption of 1 watt per candle, is claimed for this lamp.

Tungsten lamps were, of course, the crowning glory of incandescent lamp achievement. The process of the manufacture of these lamps is very complicated. The filament in its first stage was a carbon which was impregnated with some agglutinant and then drawn through the Tungsten powder, after which, without vacuum, a much higher voltage than that used in the perfected lamp was passed through the filament, thereby heating it to a very high white incandescence in an atmosphere of volatile compounds, so that the metal gradually replaced the carbon until practically all traces of the carbon had disappeared.

The Tantalum lamp came on the scene somewhat earlier than the Tungsten, but, owing to its higher consumption per candle, was not a great competitor. It was also found that the Tantalum lamp was not as efficient by practically one-half as to life on alternating current, as when using direct current, thereby limiting its field.

#### THE MAZDA LAMP

The Mazda lamp is our latest and greatest incandescent burner, with an efficiency of from 1 to 1¼ watts per candlepower. It is the cheapest source of artificial illumination we have today. The Mazda is a Tung ten lamp, differing only from it in respect to the manufacture of its filament. In the Mazda lamp the Tungsten metal in a very fine powdered form is mixed with an agglutinant to the consistency of putty, and then under a very high pressure forced through a tube, in the end of which is a genuine diamond drilled with a hole of about 1-1,000 in. in diameter, then the loops undergo practically the same treatment as the Tungsten filament, thereby driving out every trace of the binder and leaving a filament of approximately pure Tungsten metal.

The Nernst lamp, although introduced about 1895, did not bid fair to any great prominence until about 1903. At this time this lamp took approximately the form that it has today. With the advance in lamp manufacture, the Nernst lamp was lost track of as a factor in economical lighting, some of its drawbacks being its fragility and length of time it took to light, but of late a model has appeared which I think will be a competitor of the Mazda lamp. This new model is made in a small unit, having its four parts—the body, the lamp, the burner, the resistance coil and its globe—all self-contained so that it may be screwed into the ordinary socket or receptacle. The time required for lighting has also been reduced so that now it takes only from ten to fifteen seconds. The life of this lamp is not quite as long as that of the Mazda and Tungsten lamps, but, owing to the cheapness of renewing glower, the cost of maintenance is about the same.

### IMPROVING THE ARC LIGHT

Experimenting on the electric arc in all this time has not been lost sight of, but has been carried on with just as great zeal as has the work in incandescent lights. The greater part of the light in a carbon arc is produced by the positive electrode, the lighting value of the negative carbon and the arc being relatively small. The old style arc is not now much in use. The modern arc lamps, commonly known as flaming arcs, are as much ahead of the old-time arc as the Mazda lamp is of the original Edison carbon lamp. Many experiments have been made in the arc lighting fields by impregnating the carbons with chemical solutions and coating them with various substances, also by adding metallic cores to the carbons. In order to increase the illuminosity the addition of these substances was necessary to produce incandescent vapors. The addition of the luminous vapor to the arc increases the light and practically does away with the negative carbon shadows.

### THE FLAMING ARC

Of late still another stride has been made in arc lighting: the inclined position of the carbon in our flaming arcs made them unsuitable for street lighting, so a flaming arc has been introduced with vertical carbons and a reflector. Aside from every other advantage for lighting great areas, the flaming arc is the most economical illuminant we have, figuring down to about 2-10 watts per candle, with clear globe. One of its great drawbacks is the rapidity of its carbon consumption, having a life of only 15 hours per trim. The experiments have been carried on by enclosing the carbons in globes, but have not been very successful on account of the rapid darkening of the globe by the deposit of soot.—*The Keystone.*

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## A PIECE OF HAND WORK IN THE MACHINE SHOP

STUART K. HARLOW

I. Square Block of Cast Iron.
  *A.* Size and thickness.
  *B.* First step.

II. Filing.
  *A.* How to begin.
    (1) How to hold the file.
    (2) Method of getting work square.
  *B.* How to secure partly finished work in the vise.
    (1) Method of filing top face.
  *C.* Copper Plating of the filed surface.
    (1) How the work is marked.
      (*a*) Surface plate and the surface gauge.
      (*b*) How used.

III. Chipping.
  *A.* Method of chipping.
    (1) Beveled edges.

IV. Drilling.
  *A.* Method of drilling.
    (1) To change drill to the exact centre.
  *B.* Finishing the work.

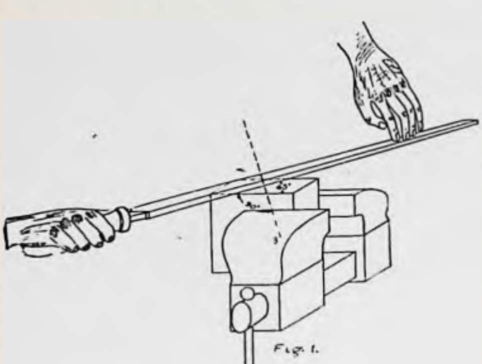

Fig. 1.

In making this piece of hand work one starts with a square cast iron block, about 3¾₆ in. square and 1⅛ in. in thickness; first decide which side shall be the bottom, marking it (*B*) with a steel letter punch.

This piece is sized up roughly with a square to determine where it needs immediate filing. It is then clamped in a vise with ½ in. of the piece projecting above the vise jaws. The vise jaws should have first been covered with copper jaw pieces. Take hold of the handle of a coarse bastard cut file, with the right hand, and press down upon the top surface of the file, about 2½ in. from the end with all the fingers of the left hand, as shown in Fig. 1. The file is gripped in this manner so that it can be held firmly, securely, and level upon the work in the vise, and is therefore under perfect control by the hands. Now proceed to draw the file backwards and forwards over the work in the vise, with a long, slow, and powerful stroke. The file should be held so as to be moved across the work at 45 degrees with the edge, see Fig. 1. When a series of file marks have been made across the work at this angle, then step to the opposite side of the vise, and file across the first file marks at a 90-degree angle, as shown by the dotted line *AB* in Fig. 1. By this means you can easily see where your work is not prefectly true or level. Proceed in this manner, reversing position and angle of filing at frequent intervals, until this side of the piece is shown to be true by the use of a small steel square, held against the bottom (*B*), then against one of the filed sides, at three or four different points distributed over the entire surface of this filed side. Now finish the side with a second cut bastard file, in order to get a smoother surface. When this side is perfectly true and square, the work is turned to the left through a quarter of a revolution to place the second side in position for filing. First determine by the use of the square just which points should be filed off first. When this side is finished, the work is revolved into position for the third side and proceed thus until all four sides are filed true and square.

The piece is then turned face up and gripped in the vise between jaws which have been padded by the insertion of a piece of ¼ in. thickness of leather belting on each side of the work. This precaution is to prevent marring the sides by the rough vise jaws. Now look at your second cut file edgewise and determine which side is slightly convex.

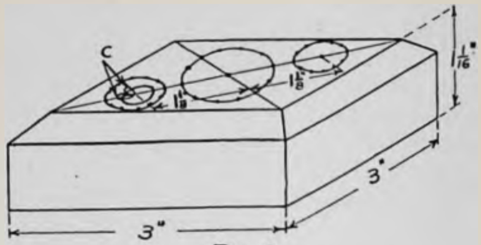


Fig. 2.

Draw the convex side of the file across the top face of the work clamped in the vise, until all depressions are removed. This operation requires great skill and care in the holding of the file to prevent rounding the edges of the work. This is because the file travels over a large surface, namely, equal to the width of the file and 3 in. long. The pressure must be exerted on the cutting part of the convex surface of the file and as the file is drawn across the work this cutting edge must move across the work always with the same pressure and consequently there will be no rounding of the edges.

When the top face is filed up smooth and square, the filed parts of the work are cleaned with emery cloth and then copper-plated by painting them with an aqueous solution of copper sulphate. This is for the purpose of easily marking the dimensions on the piece. Lay the work face downwards upon a smooth surface, preferably a smooth cast iron surface plate made for the purpose. Next adjust the marker of the surface gauge to the proper height above the surface plate, so that by drawing the gauge across the surface plate a parallel line is marked off, ¼ in. below the top face. Turn the work on one side and draw a line on the top face ¼ in. from the edge, all the way around. Draw the diagonals of the square top face and at their point of intersection make a slight depression with a centre punch for the leg of the compass to rest in while describing a 1 in. diameter circle for drilling, as shown in Fig. 2. Lay off on the diagonal the centres of a ⅝ in. diameter circle and a ½ in. diameter circle for the same size of drill, on each side of the 1 in. circle. Punch the centres deeper after the circles have been described. Make a ring of centre punch marks around on the circumference of each circle drawn, to help find the exact centre when working at the drill press; see Fig. 2.

Next clamp the work in the vise again and proceed to chip off the edges at a 45-degree angle all the way around the square block, with a chisel and ball-pein hammer. When chipping is finished, the edges are filed smooth with a second cut file.

The work is now taken to the drill press, and the three holes are drilled clear through as marked on the top face. To bring the drill back to the centre of the work, a small groove of the metal is chiseled away, as illustrated at *C* in Fig. 2. This takes away the resistance of the metal at this particular point, so that the drill is deflected into the true centre of the marked hole.

When the work has been filed and drilled it is then rubbed with a coarse emery cloth, mounted on a stick, and oil, and finally with the finest emery cloth and oil. The use of lard oil on the emery cloth causes the emery to cut faster than it would if no oil was used. First begin on the ends, then on to the beveled edges and lastly on to the top surface, when the block is finished.

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**Mysterious Window Clock**

Window displays of the hypnotic sort are universally admitted trade-pullers, and, of course, the more unusual their features are, the stronger their attraction for the crowd, writes De Lysle Cass in *Novelty News*. A St. Louis man has evolved a special intensifier of window appeals in his "Mysterious Clock" and its supplemental suggestions for "four weeks of booming business."

The clock itself is peculiar. Handsomely finished in brass, with silver-plated dial numbers, the mechanism is so devised as to puzzle even expert jewelers as to what makes it run and keep time. The most baffling thing about it, however, is that both hands and dial may be whirled in opposite directions simultaneously, and when they come to rest will still show the correct time, and continue to do so, irrespective of the number of times they may have been turned that way. This feature gives rise to many odd questions among onlookers, all of which makes it of increasing value as an ad.

The inventor of the Mysterious Clock has numerous suggestions by which it can be used to the best advantage and trade boomed for at least four initial weeks. For the first week's use, he says, the clock should prove of great publicity value as a window attraction alone. If some clerk enters the window every now and then and gives the hands or dial of the clock a whirl, the attention of the puzzled onlookers will be called to the fact that when through spinning the indicators will always register the correct time, without any wheel or other mechanism being connected with it.

In harmony with this display device is the scheme of placing a show card in the window beside the clock, reading as follows:

"We will give you a card explaining why this mysterious clock is running." These cards to be given out should have a similar explanation on the back:

*Why the Mysterious Clock is Running*

> The mysterious clock is running at Blank's store because we want you to become better acquainted with the fact that our *up-to-the-minute* styles in men's clothing and furnishings are of unusual interest to every one who wishes to be well dressed and doesn't object to saving money. It also runs to call your attention *Now is the time* to purchase while the selection and values are at their best.

This wording, of course, may be revised to suit local conditions.

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Perhaps the first practical adaptation of the aeroplane for freight-carrying purposes in the world is shortly to be made by A. A. Williams, an aviator of Douglas, Arizona, he having contracted for the transportation of mining machinery. The machinery in question consists of pieces which can be made into 100 lb. lots. The machine which Williams will use is a monoplane.

# THE HOME CRAFTSMAN

RALPH F. WINDOES

### WOODEN APPLIANCES

There are a number of wooden appliances which the craftsman should include in his equipment, that can be purchased or constructed at home. Most of those here illustrated are necessities, but there are some among them that can be omitted at the expense of considerable labor saved and accuracy of results; so it is advised that they all be made.

In a well equipped home workshop there should be one mitre box, four furniture clamps, two glue clamps, one bench hook, one chute board and two saw horses. It is for these numbers that the following list of lumber sizes needed has been prepared. All of the pieces should be ordered cut to exact dimension.

#### MITRE BOX

1 pc. 7/8 in. x 5 in. x 38 in., oak or maple
2 pcs. 7/8 in. x 6 in. x 38 in., oak or maple

#### FURNITURE CLAMPS

4 pcs. 7/8 in. x 3 in. x 48 in., oak or maple
4 pcs. 7/8 in. x 4 in. x 4 in., oak or maple
12 pcs. 7/8 in. x 3 in. x 8 in., oak or maple

#### GLUE CLAMPS

2 pcs. 7/8 in. x 3 in. x 42 in., oak or maple
4 pcs. 7/8 in. x 3 in. x 3 in., oak or maple

#### BENCH HOOK

1 pc. 1/2 in. x 6 in. x 12 in., oak or maple
2 pcs. 7/8 in. x 2 in. x 4 1/2 in., oak or maple

#### CHUTE BOARD

1 pc. 7/8 in. x 12 in. x 30 in., oak or maple
1 pc. 7/8 in. x 8 in. x 30 in., oak or maple
1 pc. 7/8 in. x 8 in. x 8 in., oak or maple
1 pc. 7/8 in. x 2 in. x 8 in., oak or maple

#### SAW HORSES

2 pcs. 2 in. x 4 in. x 36 in., white pine
8 pcs. 7/8 in. x 4 in. x 19 in., white pine
4 pcs. 7/8 in. x 4 in. x 13 in., white pine

In addition to the hardware purchased for the bench, the following will be needed and kept on hand for future use.

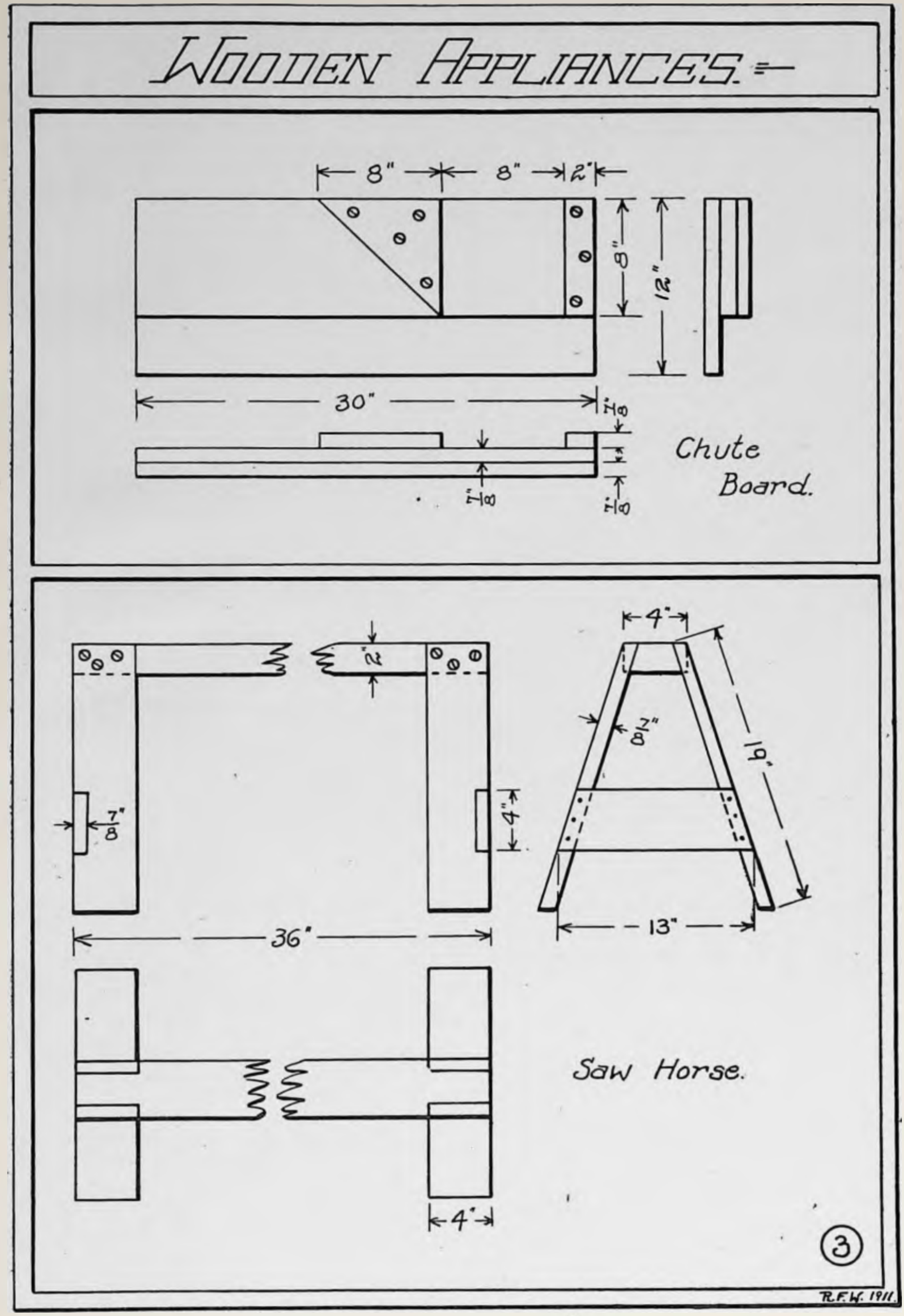
8 1 1/4 in. stove bolts
4 3 in. bolts, with washers
2 2 in. bolts, with washers
1 box 1 1/2 in. 10s flat head screws
1 box 1 1/4 in. 10s flat head screws
3 lbs. 8d steel wire nails
8 pcs. wrought iron 1/8 in. x 1 in. x 6 in.

#### MITRE BOX

Examine one of the 6 in. pieces and see that the long edges are parallel. Screw the other pieces on to this, using 2 in. 10s and countersinking the heads. Have the wider piece drop an inch below the bottom for bracing against the edge of the bench. Cut out a perfect square from a piece of cardboard, making the sides exactly 8 in. long. Draw a line from one corner of this square, diagonally to the opposite, and with a sharp knife, cut straight through this line. This makes two triangles, each one of which has one right angle and two angles of 45 degrees, or half right angles. Lay one of these triangles on the box and mark out as shown in the drawing. Square down the sides. Also mark the straight saw-cut with the square. Saw on these lines, being very careful to have the cuts accurate. Use the longest cross-cut saw for work in the box, and press the piece to be sawed in it flatly against the side.

#### FURNITURE CLAMPS

First saw the notches in the bar as shown in the illustration. The left-hand block is movable and should be set so that the grain runs perpendicular to the bar. Have holes drilled in the pieces of iron, making them a little larger than the stove bolts used. Fasten these bolts through the blocks and the irons as illustrated. Screw two pieces of the 8 in. length opposite each other and near the other end of the bar. Use the 1 1/2 in. 10s for this, and countersink the heads. A better way is to bore holes through the two pieces and the bar and insert dowel pins therein.


WOODEN APPLIANCES
8"
8"
2"
8"
12"
30"
Chute Board.
4"
2"
36"
13"
19"
7/8"
4"
Saw Horse.
3
R.F.W. 1911

Form the lever to shape and fasten it in place with one of the 3 in. bolts. In using the clamp, be sure to insert a piece of wood between the work and the lever, so as to prevent marring.

### GLUE CLAMPS

These clamps are used largely in gluing up table or tabouret tops, and if the craftsman has his tops glued up at the mill, he may omit them from his equipment. The method of using is shown at the right of the working drawing.

Prepare the bars by boring a number of holes, a little larger than the 2 in. bolt, down the centre of the piece near one end, and about 2 in. apart. Screw one block on one end of each of the bars and bore a hole through the centre of the others, through which the bolt passes. Pressure is exerted on the work by the means of wedges as shown.

### BENCH HOOK

Screw one small piece at each end of the 6 in. board, and on opposite sides. Use the 1¼ in. 10s. Be sure that the pieces are in the positions shown on the drawing, unless the user is left-handed. In that case they may be reversed.

To use the hook, fit it in place along the edge of the bench and hold the piece to be sawed against the stop on the upper surface. Saw it off with the back saw, being careful that the teeth run into the hook and not in the bench top. When one side is considerably worn, the hook can be turned over.

### CHUTE BOARD

The chute board, sometimes known as the shooting board, is used for squaring the ends of short pieces of stuff, the plane being laid on its side and pushed forward. The illustration shows a chute board and a mitre board combined; when used as a mitre board the plane is pushed in the same way, but the wood is planed at an angle of 45 degrees.

To construct the chute board, the first thing to do is to glue and screw the 8 in. board on to the 12 in., keeping them flush on one edge. Use the 1½ in. screws for this, the heads of which are countersunk into the 12 in. piece. Screw the 2 in. strip on to the 8 in. board, at exactly right angles to its edge. Screw the triangular piece into place as shown on the drawing, keeping its left-hand edge at exactly 45 degrees with the edge of the upper member.

### SAW HORSE

The saw horse, or the saw horses, for there should be two of them, are very useful around the home workshop. They are generally used when working up large pieces of furniture, like a library table, and when sawing long pieces of lumber. Their other uses are innumerable, and unless very cramped for space, the craftsman should include them in his equipment.

Begin the construction of a horse by nailing one of the braces, with one nail in an end, to a pair of the legs, at a reasonable height from the bottom of the legs. Pull the opposite ends toward each other until the proper angle is obtained. Mark this on the ends of the 2 by 4, and saw on these lines 4 in. back from the ends. Cut places in the legs for the braces to fit in and nail them in place. Screw the legs on to the 2 by 4 with 2 in. screws and bevel off the ends of the legs so that they are flush with the top of the horse and the floor.

None of the pieces require a finish, but their appearance is much improved by a coat or two of shellac.

In the next issue designs for a tool cabinet and a screw and nail holder will be given.

*(To be continued)*

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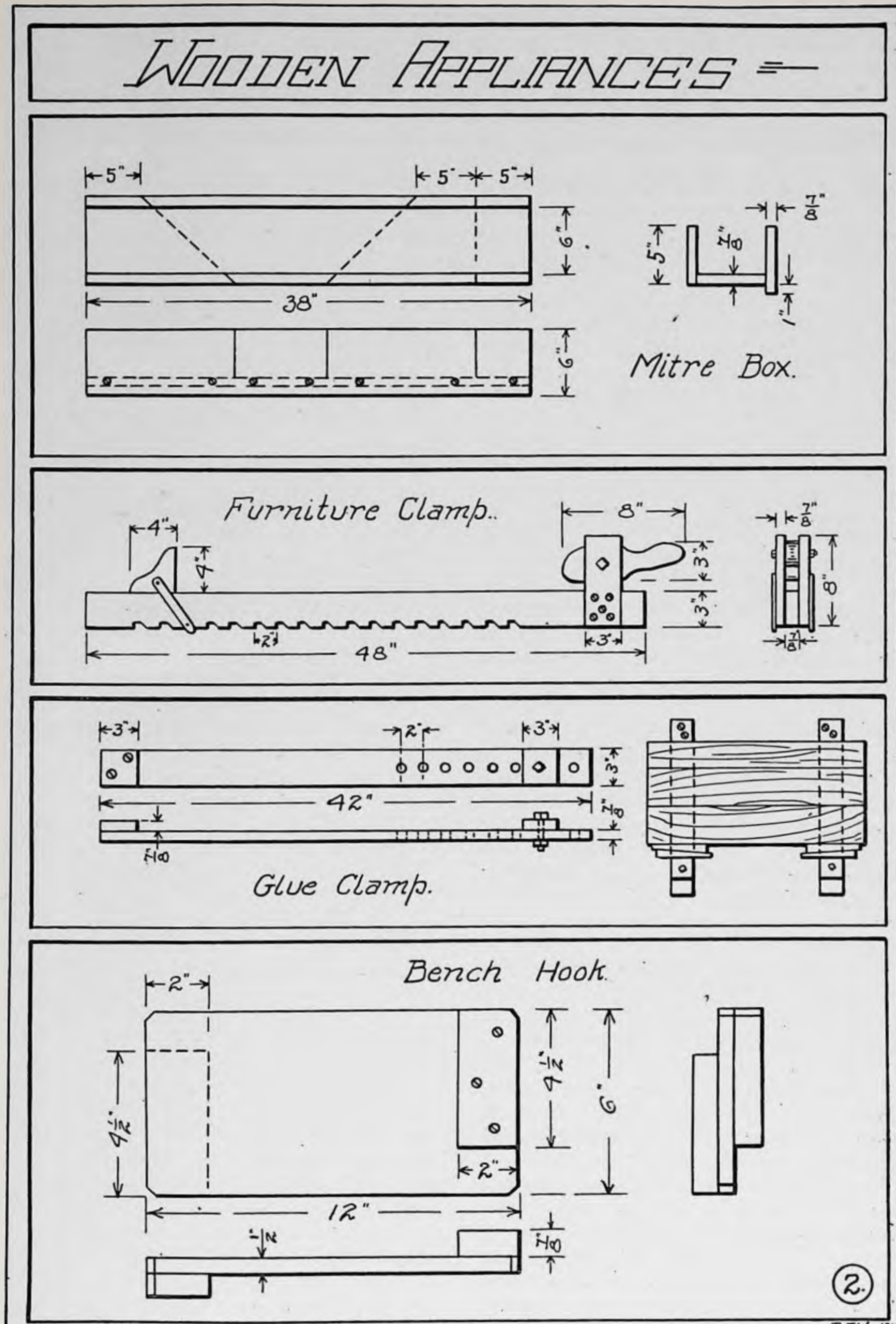
## How to Fix a Leaky Gauge Cock

DANIEL GADDIS

Take the cock apart and thoroughly clean the seat and stem of the valve. Procure a dowel pin just large enough to go into the tem under the seat far enough down so that the babbit can gain a hold on the side of the stem below the seat. Now pour in sufficient babbit metal to cover the seat about ⅛ in. Then countersink the babbit to form a new seat for the stem, but do not cut it down to the brass or it will cause the valve to leak again. The set should only be bored sufficiently to allow a tight fit of the valve stem.



Wooden Appliances
5"
5"
5"
6"
38"
6"
Mitre Box.
Furniture Clamp.
4"
4"
8"
3"
3"
2"
48"
3"
8"
3"
2"
3"
42"
Glue Clamp.
Bench Hook.
2"
4½"
6"
4½"
2"
12"
2.
R.F.W.

# FOR THE LABORATORY

## CONSTRUCTION OF A SIX-INCH INDUCTION COIL—Part IV

THOS C. STANLEIGH

*The Apparatus described in this series of articles has actually been constructed, and is in use at the* ELECTRICIAN AND MECHANIC *Laboratory.*

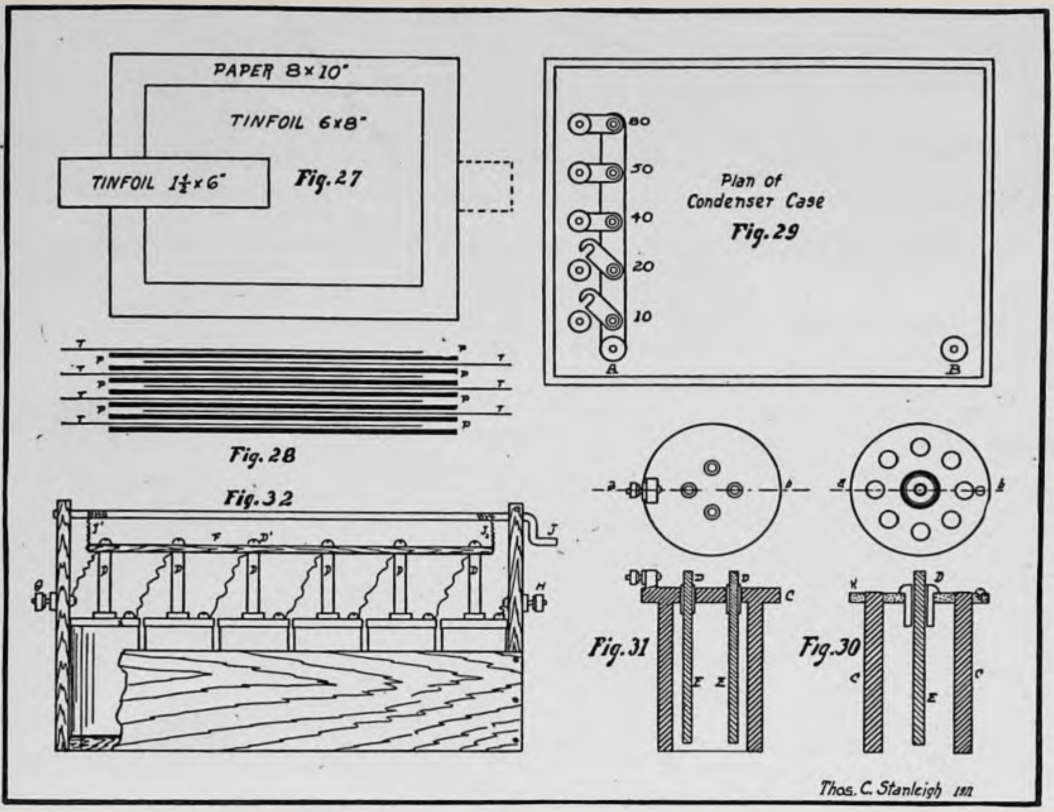
A condenser is nèeessary with all forms of interrupters with the exception of the electrolytic. The condenser for this coil should have two hundred sheets of tinfoil 6 x 8 in. when using either of the two simpler forms of mercury interrupters described. With the Mackenzie-Davidson type, less condenser is necessary. Tinfoil comes conveniently in strips 48 in. long by 6 in. wide, so that 6 sheets may be cut from each strip. The strips average five to the pound, therefore there will be 30 sheets to the pound. This is fairly heavy foil. The dielectric is two sheets of manila paper cut to 8 x 10 in., carefully dried and waxed and placed between each tinfoil sheet and its neighbor. Lugs of foil 1½ x 6 in. are laid alternately to right and left as the condenser is built up, and the foil and paper sheets are frequently pressed down with a warm smoothing iron during the process. The scheme of assembling is illustrated in Fig. 28, wherein the thin lines represent the tinfoil and the heavy lines the paper.

The sheets are divided into five groups containing 80, 50, 40, 20 and 10 sheets respectively. The lugs on one side are all joined together and a lead of flexible lamp cord soldered to them. This lead is connected to the post *B*, Fig. 29. The lugs of each group are joined to pieces of flexible cord and are brought to their respective binding posts on the case. They must be carefully insulated from each other and after making sure that the connections are all correct, it is a good plan to fill the case with melted paraffin. A copper strip carries binding posts along its length as shown and the connection at *A*. By means of the short copper strips, any number of foil sheets may be brought into circuit. The interrupter may be permanently mounted on top of the condenser case and all necessary switches, etc., are also mounted there. The condenser is shunted across the break.

The only really efficient and useful source of battery power is the storage battery. A battery of four cells of 60-ampere hour capacity will provide ample current. The ordinary 6-60 ignition battery has considerably less than 60 ampere-hour capacity when discharged at a higher rate than 2 or 3 amperes, and is therefore far from serviceable unless two or more are used in multiple.

For short periods of use the single-fluid bichromate type of primary battery will give good results. It is hardly better than the good makes of dry cells now on the market, but in use it is somewhat less expensive. Fig. 30 suggests a simple way to make a fairly powerful bichromate cell. The carbons *C,C* are of the familiar arc lamp type. They are cast into a leaden cover to fit the top of a quart preserve jar. A porcelain insulator *D* supports an ordinary Leclanche zinc which has been amalgamated with mercury. A battery of these cells may be arranged as shown in Fig. 32 so that the zincs may be raised out of the solution when not in use. The solution is made as follows: dissolve 9 oz. of pulverized bichromate of potash in 1½ pts. of cold water and to this add 8 oz. of sulphuric acid. The acid need not be chemically pure.

Fig. 31 suggests a way to use the ordinary "carbon cylinder" type of




open-circuit cell. Holes are bored in the top of the carbon cylinder to take pieces of glass tubing through which the zincs pass. By using 4 zincs in a cell of this kind with the above solution, a strong current can be obtained as the internal resistance is low. The zincs should all be connected in multiple in each cell.

Dry cells may be used for short lengths of time, providing they are connected in series multiple. If 24 cells are available they may be connected six in series and four in multiple. This arrangement will give a fairly uniform pressure of about 9 volts and a current of 5 or 6 amperes will be available for a few minutes at a time.

The lighting circuit of 110 volts may be used if suitable resistance is inserted, but it is well to use three thicknesses of waxed paper between tinfoil sheets in this case in the condenser, for otherwise it is almost sure to be broken down. If alternating current is available, a step-down transformer and electrolytic rectifier may be used. However, on alternating current circuits it is preferable to build the coil as an open core transformer, using heavier secondary wire, and if long sparks are desired, to use a Tesla coil. This does away with the troublesome interrupter entirely and it is by far the more practical method. This detail will be fully taken up in the next article of the series.

*(To be continued)*

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## Soldering Flux

H. M. NICHOLS

The soldering flux used by the armature winders of the General Electric Company consists of a heavy paste of resin. This paste is made by dissolving as much resin in benzine as the benzine will take up. The paste works the best on tinned copper and for this reason all leads and commutator bars are tinned before soldering. The paste is most easily applied with a stiff paint brush.

## MULTIPLEX TELEPHONY

WINFIELD SECOR
*Associate Member Institute Wireless Engineers*

When wireless telegraphy was placed on a practical commercial basis, a few years ago, by Marconi, experimenters and savants everywhere devoted their whole energy to developing its many promising features, but who ever thought of coupling this new art to the older art, in other words, coupling the wireless to the wire system.

It remained for a United States soldier to make this enlightening discovery, Major George Owen Squier, Ph.D. and Assistant Chief Signal Officer, U.S. Army, and the value of his discovery can hardly be reckoned in dollars and cents. It has brushed away, with one single stroke of genius, all the obstacles that have baffled solution ever since the invention of the telephone, by Alexander Graham Bell, over a quarter of a century ago. And the most surprising fact of all is, that the four patents covering the invention (U.S. Patents Nos. 980,356 to 980,359, inclusive), have been dedicated to the public; in other words, anyone in the United States may use them. This is more readily appreciated, when one remembers that Major Squier is a soldier, and as he has said, "when an army man begins to think about money, he begins to forget about the army."

As has been generally known, it has been possible for some time to have multiplex telephony, so far as operating three talking circuits over two regular circuits is concerned, which is accomplished by connecting up the third talking circuit as a "phantom circuit," by which name it is known to telephone men; but who ever tried to operate 10, 50, or 100 distinct talking circuits over a single wire? Surely a great many master minds, but they have never succeeded. In fact until this invention came to light, it was impossible to operate a single talking circuit over one wire, utilizing the ground as a return path, for any appreciable distance on account of the multitudinous noises existing on such a system, which made it simply out of the question to use it for talking over. Ever since the first long distance telephone was established between Boston and Providence, in 1880 (which at first was a flat failure, there being only one wire, earthed at both ends), up to the present time, electricians and scientists alike, have grappled with the problem of making the one wire talk as clear as a full metallic circuit with two wires, but to no avail.

Now comes Major Squier, with his patents on "Wired Wireless," as it has been called, and vouches that he will stretch a wire from Nome, Alaska, to Patagonia, South America and talk over it, the current returning through the earth. This fact is acknowledged by engineers, who have examined it, and pronounce it perfectly feasible. Not only this, but, if desired, it is possible to arrange for a dozen or more distinct parties to converse over the same wire at the same time. A seemingly impossible feat, yet accomplished in a very simple manner, which I have tried to elucidate in the following paragraphs.

The heart of the system may be said to be the high frequency alternating current generator, which is of the same type as the "Fessenden" high frequency alternator used for wireless telegraphy and telephony, with the exception that the voltage is less, which adapts it to use with standard telephone transmitters. The rotor of this alternator, built in the form of a flywheel, revolves at the tremendous speed of 20,000 revolutions per minute, and as the diameter of the rotating member is 1 ft., a point on its circumference travels at a speed exceeding 12 miles per minute. An alternator suitable for this purpose, may be obtained in the open market; one preferably delivering about 25 volts, at a frequency of over 20,000 alternations per second, as it has been ascertained that above this frequency, no trouble is experienced by audible disturbances in the talk.

As stated above, the principal object was the combination of the wireless with the wire system, so that the high frequency waves set up by the alternator are guided in their travels, by providing paths in the ether for them, in the words of Major Squier, who has made a thorough study of the subject. He says that the currents being of such a high frequency, do not traverse the wire at all, but in the ether immediately surrounding it, identically as wireless waves travel, which may account for the extraordinary carrying power of this current.

The scheme of connections, as given in the patent drawings, are illustrated by Figs. 1, 2, 3, and 4. As will be evident at the first glance, they are quite simple, the main feature being the proper arrangement whereby the high frequency current is impressed on the line without interfering with the regular direct current talking current. This considers that the regular battery telephones are operated as usual, but of course the whole system may be composed of high frequency A.C. telephones if desired.

In a multiplex telephone system, where more than two talking currents (say the regular D.C. and one A.C. high frequency), are to be used, the A.C. instrument would be tuned by means of adjustable inductances, condensers and loose-couplers, the same as a wireless system, so that any two stations will transmit and receive vibrations of a certain wave length only. All interference of one alternating current with another being avoided.

The fundamental frequency for each talking current is, of course, obtained by having a number of A.C. generators, each running at a different speed. Any number of alternators, each of a different frequency, may be connected to a single wire, without interfering with each other in the least.

Some of the new and valuable features belonging exclusively to the A.C. high frequency telephone are: extremely clear transmission of speech, there being no buzzing or external noises and the labial or consonant sounds are as distinct as the vowels in the ordinary telephone; talking distance practically unlimited; one wire only required; readily adaptable to all existing telephone systems; and most important of all, perhaps, the successful working of as many stations as desired on one wire.

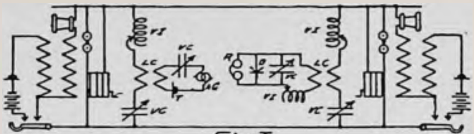


Fig. I.

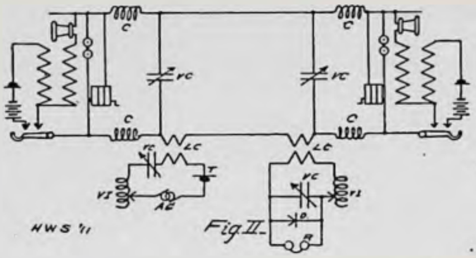


Fig. II.

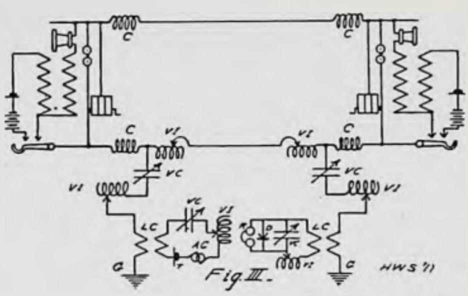


Fig. III.

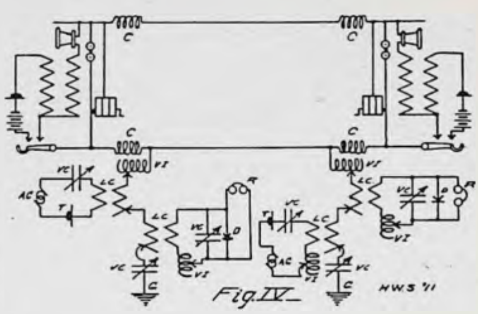
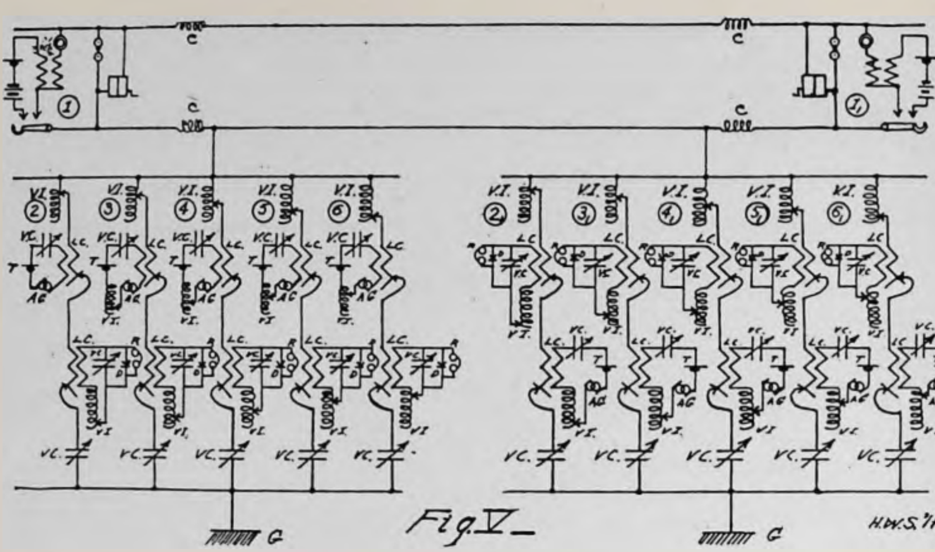


Fig. IV.

If a telephone exchange, having 1,000 trunk lines connected to it, should place in its power room 10 A.C. high frequency generators, each with a different frequency, its capacity would be increased eleven fold. Where one message travelled over the wire before, eleven messages could now be carried over the same wire simultaneously. Certainly an invention worth as much, considered as a practical and commercial asset, as the telephone itself.

Referring to the patent drawings again: V.I. represents a variable inductance; V.C. a variable condenser; L.C. a loose-coupler or transformer; A.G. the high frequency alternator; T. a microphone transmitter; D. a




regular wireless detector; C. is a choke coil, to prevent the A.C. from backing around through the D.C. apparatus; and R. is the receivers. The A.C. talking and receiving connections are the same as in wireless work.

The patent drawings show systems provided with two talking currents only. A diagram showing the connections for a system containing five A.C. telephone sets, besides the regular D.C. instrument, is depicted in Fig. 5, this system having an increase in its capacity of six times its former value.

It is difficult to foretell the possibilities of such an invention as this, but suffice it to say, that it will not lie idle very long before it is put to work in annihilating time and distance in the telephone world.

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## REPAIRING TUNGSTEN LAMPS

In a communication to the P.A.R.D. Bulletin a correspondent signing himself F. M. A. gives the following advice regarding the repairing of tungsten lamps:

For the benefit of those members of our association who may be using tungsten lights, with which to illuminate their places of business, it may be pertinent to offer a few suggestions concerning the possibilities of repairing the lamps, at practically no cost, gathered from practical experience. It is advisable to purchase a lamp socket and a plug, with about 10 ft. of black, flexible, double cable cord, so that advantage can be taken of the force of gravitation, as needed. Sometimes it is absolutely necessary to invert a lamp in order to get the broken ends of the filament in juxtaposition before carefully turning on the current, thereby welding them securely together, thus renewing the life of the lamp.

Caution must be exercised that the end of a filament may not come in contact with another filament, so as to shorten the circuit in the lamp, otherwise the reduced circuit will overload the lamp, causing the lamp to glow very brilliantly for a short time, but darkening the inside of the globe, and in a very short time becoming valueless and beyond redemption.

Get the broken ends of the filament into their original places before turning on the current, and it is natural to infer that it is necessary to avoid all jars when they are once brought into contact with one another, as they originally were parts of one complete filament. The writer has one lamp in service at present that has been welded at least ten times, thereby having added to the life and usefulness of the lamp very materially, and saved the cost of several lamps.

# WIRELESS TELEGRAPHY

In this department will be published original, practical articles pertaining to Wireless Telegraphy and Wireless Telephony

## THE CONSTRUCTION OF A WAVEMETER AND A HOT WIRE METER FOR USE WITH WIRELESS TRANSMITTING INSTALLATIONS.—(Continued)

W. C. GETZ

We will therefore use the following formula, in the remaining illustrations for obtaining the wave-length:

$$W = \frac{(M'-M'') \times P}{100} + M''$$

in which $M'$ is the maximum wave-length in meters for a given fixed condenser unit; $M''$ is the minimum wave-length in meters for the same unit; $P$ is the number of the point on the scale of the variable condenser at which the wave-length is found; $M''$ and $M'$ being of the unit that is in, when the wave-length is found.

In operating the wavemeter the coil of the meter is brought within several feet of the circuit to be measured, and the detector adjusted to a sensitive condition. The telephone receivers are then put on, and the variable condenser rotated until a buzzing sound is heard. Frequently the experimenter gets his meter at first too close to the circuit being measured, and the buzz is heard over the entire scale. It is always a good plan to get as far from the circuit as the instrument will pick it up, or to place the inductance coil nearly at right angles to the circuit, and thus cut down the signals to a faint point. Then adjust the variable condenser until you reach a point where it comes in loud.

If you cannot get anything with no units of the fixed condenser in, cut in a unit at a time, try the condenser through the full scale slowly for each unit until you get the buzz. The buzz may extend over ten units of the variable condenser, but by careful listening, the point at

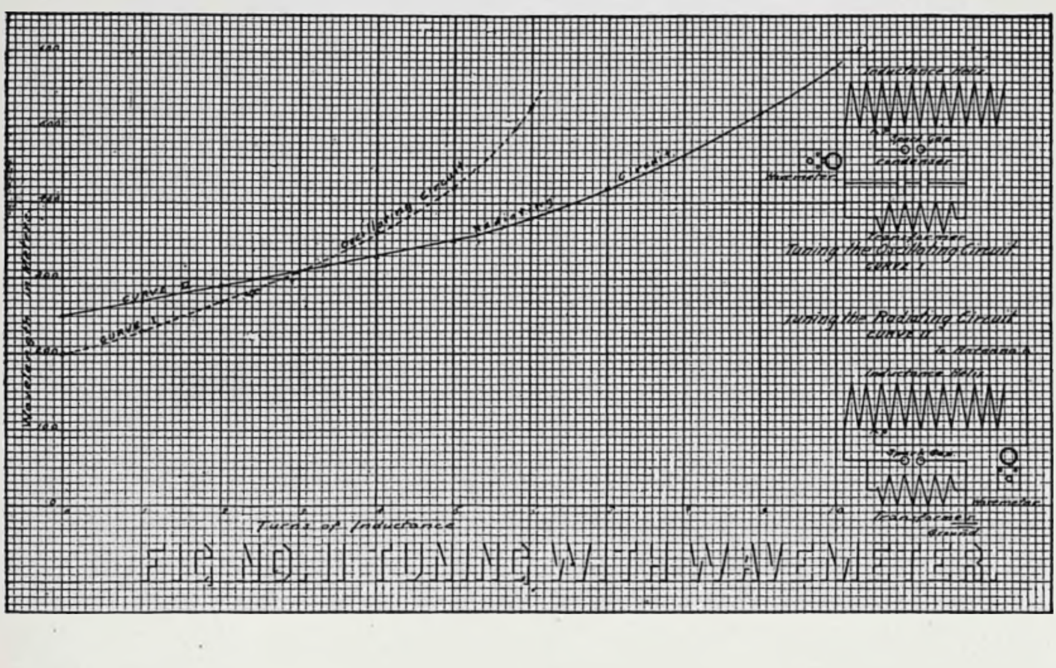
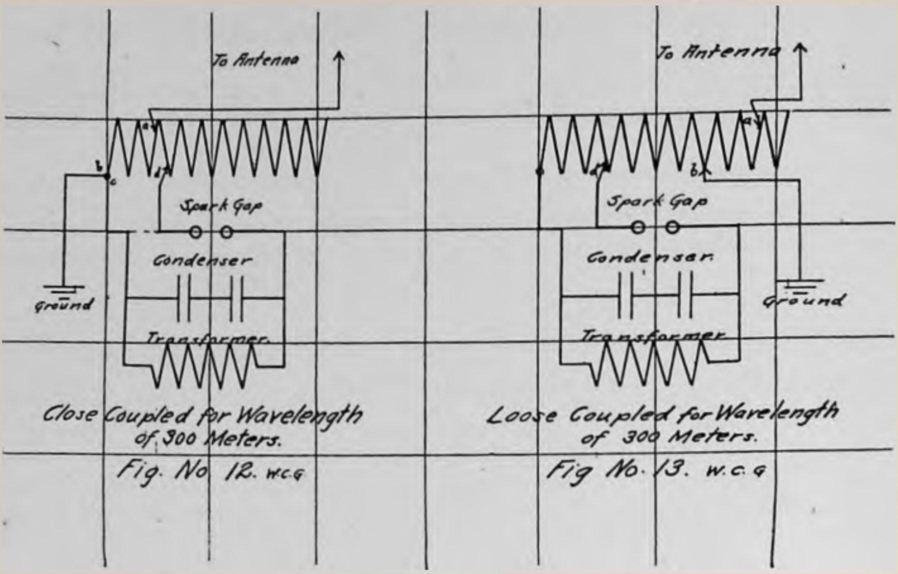



FIG. NO. 11 TUNING WITH WAVEMETER.




Close Coupled for Wavelength of 300 Meters. Fig. No 12. W.C.G.

Loose Coupled for Wavelength of 300 Meters. Fig No. 13. W.C.G.

which it is *loudest* in the telephones can be determined.

Then refer to the table to the wave-lengths under the number of units of fixed condenser you are using. Subtract the difference between the maximum and minimum, multiply the result by the point of your variable condenser, and divide by 100 and add to the minimum reading, as stated in the previous formula: this will give you the wave-length of the circuit you have measured.

It is of course understood that each circuit we are measuring contains a suitable arrangement for giving off oscillations, or is in other words a transmitting circuit, and is operated at the time we are measuring, as otherwise there would be no method of actuating the wavemeter.

Let us try a concrete example of this tuning. In Fig. 11, the top wiring diagram, we have a closed oscillating circuit consisting of an inductance helix, a condenser and a spark-gap. The condenser is charged by an alternating current transformer (primary not shown) and discharges through a portion of the inductance and across the spark. This spark-gap is connected to the inductance helix so that two convolutions of the helix are included in the path of the condenser discharge.

We now bring our wavemeter in the position as shown, and start the transormer to charging the condenser, which, as stated, discharges across the gap through the convolutions of the helix. With no units of the fixed condenser in, we rotate the variable condenser, but fail to get any buzz. We then cut in one unit of the fixed condenser, and when we again rotate the variable condenser we get a buzz loudest at 100. Looking up our table, we find that under 1 unit of fixed condenser, the maximum reading (corresponding to 100 on the adjustable condenser) is 270 meters, with No. 1 coil. With the formula we would have had

$$W = \frac{270—240 \times 100}{100} + 240$$

whence $W = 270$

We will now consider the tuning of a transmitting outfit. By tuning, we mean so adjusting the closed and open oscillating circuits that they are in resonance, or equal in wave-length. First, we will get a sheet of cross-section paper similar to that on which the curve in Fig. 11 is plotted. This is the type with the divisions 1 in. square, and sub-divided into tenths of an inch.

Along this sheet horizontally, at the intersection of each vertical division, we will lay off numbers from 0 to 10 each, to represent one turn of convolution in the helix. Vertically, along the right-hand edge, we will lay off at the intersection of each division, numbers from 0 to 600 (100 to a division), to represent the wave-lengths in meters.

We will first obtain the readings on the closed oscillating circuit, as shown in the upper diagram in Fig. 11. With the terminal *P* placed on the end of the helix at 0 turns, we adjust our wavemeter as described, and measure the wave-length. We will say that it is found to be 200 meters. This is the *natural* wave length of the oscillating circuit. Now on the intersection of the vertical line through 0 turns and the horizontal line through 200 meters on the chart, we put a dot. Now change *P* to turn 1, and proceed as before. Say we obtain in this case 230 meters. As before, on the intersection of the vertical line through 1, and the horizontal line through 230 meters, place another dot. Do this for as many convolutions, or turns, as the helix contains, at each intersection of the values, placing a dot. (In this case only six turns were measured in the oscillating circuit, as more would give wave-lengths that were not needed.)

Now through this series of dots draw a curve, such as shown on the chart in Fig. 11 as curve 1. This represents the wave-length for any position of P, as all that is necessary, is to follow up the vertical line corresponding to the turns at which P includes, and where it intersects the curve to follow the horizontal line over to the side, where the wave-length can be read off.

We will now measure up the radiating circuit in the same manner. To do this, we must first change the wiring to conform with the lower diagram in Fig. 11. This places the spark-gap across the transformer secondary, does away with the condenser, and connects one side of the spark gap to the ground, the other side being connected to the aerial through the inductance helix.

The wavemeter being placed near the antenna, as shown, the transformer is started, with the terminal P at 0 turns as before. We then measure the wave-

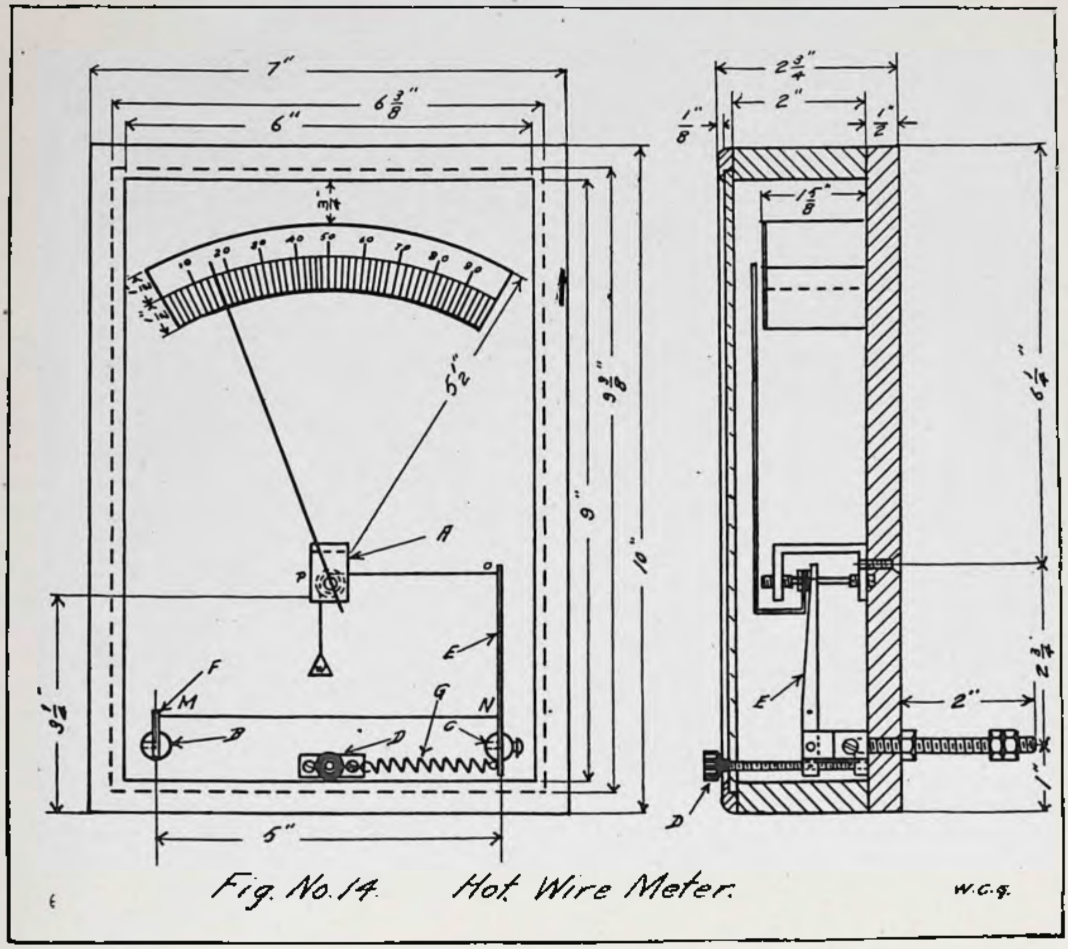


Fig. No. 14 Hot Wire Meter.

length and get say 250 meters. This is the *natural wave length* of the radiating circuit, and, as before, a dot is placed on the intersections of ordinate 0 and the abcissa 250. Then $P$ is placed at 1 turn, and so on, until we have another series of dots for the ten turns of the inductance, and through which we draw curve 11, as shown in full lines on the chart.

We have now two curves which show the exact number of turns of inductance required in our oscillating and radiating circuits for any wave-length within the limits of our antenna. Therefore to have our circuits in resonance, we must choose such turns of inductance in our oscillating and radiating circuits that correspond where the curves for the oscillating and radiating circuits cut the line of the given wave-length.

Say we decide that we want to couple the circuits for a wave-length of 300 meters. Referring to the chart, we find, that the oscillating curve cuts the horizontal line through 300 meters at a point in the line 2.8, and the radiating curve cuts at a point 2.4. Hence in our oscillating circuit we will require 2.8 turns of inductance, and in our radiating circuit, 2.4 turns.

Now referring to Fig. 12, we have the diagram showing the set connected for that wave-length. The oscillating circuit, connected to the helix between $c$ and $d$ embraces 2.8 turns, and the radiating circuit connected between $b$ and $a$ includes 2.4 turns of inductance. But now, if the wavemeter is brought to the aerial, two wave-lengths will be found: one slightly less than 300 meters and the other greater than 300 meters.

To eliminate this to a great extent, we can "loosely couple" the circuits. In Fig. 12 it will be observed that the turns included in both the oscillating and radiating circuits are in common. This is what is known as "close" coupling, and will show greater radiation on a hot wire ammeter in the aerial than when the turns are placed as shown in Fig. 13.

In the latter figure it will be observed that while each circuit has the same number of turns of inductance, as in Fig. 12, the turns are not in common. This decreases the damping effect, and increases the selectivity to a similarly coupled receiving outfit. Also, with the proper degree of "looseness" in the coupling a "peaked wave" is obtained instead of two broad humps as found with the tight or close coupled sets.

The extremely loose coupling obtained with an inductively coupled helix, such as described in the February issue of this magazine, is being found of a much greater efficiency than the close coupling, for the reasons outlined above. To sum it up:

Close Coupling gives:
1. A two humped broad top wave.
2. Greater radiation.

Loose Coupling gives:
1. A single peaked wave.
2. Greater selectivity.
3. Sharper tuning, hence less disturbance by interference.

The experimenter who intelligently uses a wavemeter can frequently increase his station efficiency far beyond that of higher-powered rivals who fail to understand why his modest equipment can secure better results than their expensive installations.

We will now take up the construction of a suitable hot wire meter for use with the transmitting set, described in the February, 1911, issue. In the issue of this magazine for February, 1909, I gave full directions for making both an inexpensive hot wire meter for station use, and also a more elaborate type for the use of wireless inspectors.

In Fig. 14 is given the front and side views of still a different type of meter, which is designed for mounting on a switchboard in a vertical position. A platinoid wire $M$-$N$ is stretched between the arms $E$ and $F$, which are supported by the terminal posts $C$ and $B$. These terminal posts are provided with No. 14-20 machine screws which extend through the back of the case a sufficient distance to pass through the instrument board and make connection with the jumpers.

The details of these posts are shown in Fig. 15. The post $C$ is made in two parts, so that the top containing the arm $E$ may revolve. A tension spring $G$ which connects to the short end of $E$ keeps the wire $M$-$N$ taut. This spring is regulated by the adjusting stud $D$, the handle of which extends through the cover, so that the operator may vary the setting without removing the cover.

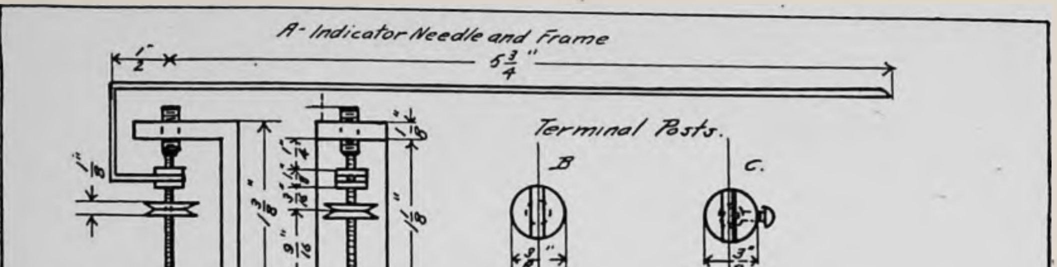



Fig. No. 15. Details of Hot Wire Meter.

At the upper end of *E* a silk thread *opw* is carried over the wheel indicator axis *A*, and thence drops down to a position below as shown, a small weight of about ½ oz. being tied to the end.

In operation, when the current passes from *M* to *N*, thereby heating the wire *M-N*, thus allowing it to expand, the spring *G* pulling on the end of *E* takes up the slack in *M-N*. At the same time, the end of *E* pulls up the thread *opw*, raising the weight *W*, and causing the indicator to revolve, thereby carrying the needle around the scale a proportionate amount.

When the current is off, the wire *M-N* contracts, bringing *E* back to the former position, allowing the weight to sink down and the needle to return to zero.

The meter is built on a wood mounting board, with wood sides, and in the front is placed a glass cover. This cover contains a small hole to accommodate the stud of the adjusting screw *D*. A beading of wood, as shown, serves to hold the glass in position, and gives an ornamental finish to the edges.

The needle and frame *A* are made as shown in the photograph in Feb., 1910, issue, this being a particularly sensitive jeweled movement. The shaft or axis is of hardened steel, the frame of brass and the needle of aluminum wire. The wheel is not shown in the photograph, but as the axis is provided with screw threads, in actual practice, the wheel can be adjusted between lock-nuts to any desired point.

The reader is advised to consult both the February, 1911, issue, and the 1909 issue, so that he may be familiar with both the situation of the meter in the circuit and the construction of the other types of meters referred to.

In conclusion, I will quote two passages taken from the "Manual of Wireless Telegraphy for use of Naval Electricians," 1909 edition, that particularly and aptly apply to what has been said in this article:

1. "As the coupling is increased (close coupling) the readings of the hot wire meter in the antenna increase up to a certain point, beyond which the increase in closeness of coupling either makes no difference in the reading of the hot wire meter or causes a decrease. Under no circumstances should the coupling be made closer than the point where the antenna meter ceases to increase its readings."

2. "The exact degree of coupling for greatest efficiency depends largely on the losses in the primary circuit, for it is clear that, if the primary circuit were entirely free from resistance and other sources of energy loss, and the only escape of energy were in the antenna, even with the loosest coupling the energy must finally all pass into the antenna and be radiated. In practice it is found that where the losses in the closed circuit are reduced to a minimum by the use of a proper form of spark gap, and condensers of a small energy absorption and free from brush discharges, there is no diminution in the strength of the received signals when the coupling is made loose enough so that the energy radiated from the antenna is of a single wave-length. One of the best ways to test the proper adjustment of the sending circuits is to place a wavemeter circuit containing a hot wire meter so that it is acted upon by the antenna alone, care being taken that it is not at all affected by the closed circuit. Then when the largest deflection is produced on the meter, the antenna is in the best sending adjustment."

In the latter case, the hot wire meter is inserted in series with the inductance coil and condenser of the wavemeter, and the detector and telephones disconnected. This of course requires a very sensitive hot wire meter, but the type described in this article with about No. 40 wire will do.

The next article of this series will describe some of the recent types of receiving apparatus, together with the construction of suitable instruments for the wireless outfit considered in this series.

## WIRELESS STATION FOR TECHNOLOGY

Under the direction of President Symmes the Wireless Society of the Massachusetts Institute of Technology will soon have a powerful sending station with which it is expected to establish wireless communication with many of the eastern colleges.

Harvard University, Worcester Tech, Princeton, Columbia, Cornell and Pennsylvania, all have wireless organization with well equipped stations, and the institution hopes to maintain communication at least with Harvard, Worcester Tech and Columbia.

The wireless society of the institute was the first college organization formed for the radio communication by students. It now numbers over 100 students.

The officers are: president, Ernest M. Symmes, 1911, Winchester. Vice-president, James Ellis, 1912, Covington, Ky. Secretary, P. L. R. Flansberg, 1912, Albany, N.Y. Treasurer, Edward M. Mason, 1912, Winchester. Directors, the officers and J. P. Fish, 1912, Boston.

The transmitting station now in process of erection will be located in the electrical engineering laboratory of the Lowell building. As the outfit will be a powerful one it will be under the personal direction of Prof. Harold Pender, of the electrical engineering department, and the members of the club will be allowed to handle the large transformers only after careful instruction.

During the past month President Symmes has been negotiating with the officials of the wireless department at the Charlestown Navy Yard, and has obtained from them a written approval of the proposed transmitting station at M.I.T. This includes the provision that the students at Technology are to stop sending at any and all requests from government wireless operators afloat or ashore.

A series of lectures on "Radio-Telegraphy," with experiments has been given in alternate years by Prof. Charles R. Cross, head of the physical department.

Officers of the Wireless Society are of the opinion that a regular course in wave telegraphy will soon be organized in the regular work of the institute.

## ALPHABETICAL LIST OF CALL LETTERS OF WIRELESS STATIONS OF THE WORLD

*(Concluded)*

### (Including Shore Stations, Merchant Vessels, Revenue Cutters and Vessels of U.S. Navy)

| | |
|---|---|
| MPS | Ponza Island, Italy |
| MPT | S.S. Patris |
| MPW | S.S. Balmoral Castle |
| MQC | S.S. Persic |
| MR | S.S. Bunker Hill |
| MRA | S.S. Caronia |
| MRB | S.S. Roma |
| MRC | S.S. Cretic |
| MRD | S.S. Sindoro |
| MRE | S.S. Regina Elena |
| MRF | S.S. Sannio |
| MRG | S.S. Regina d'Italia |
| MRH | S.S. Campania |
| MRI | S.S. Re d'Italia |
| MRJ | S.S. Ophir |
| MRK | S.S. Kawi |
| MRM | Monte Mario, Rome, Italy |
| MRN | S.S. Grampian |
| MRO | S.S. Re Vittorio |
| MRP | S.S. Principe di Piedmonte |
| MRQ | S.S. Soentuer |
| MRM | S.S. Rindjani |
| MRS | S.S. Tomasodi Savoia |
| MRS | Three Rivers, Canada |
| MRT | Father Point, Quebec |
| MRU | S.S. Principe Umberto |
| MRV | S.S. Principe di'Udine |
| MRW | S.S. Willis |
| MRY | S.S. Tambora |
| MRZ | S.S. Lazio |
| MS | S.S. Ancon |
| MS | S.S. Massachusetts |
| MSA | S.S. Saxonia |
| MSB | Cape Sable, Nova Scotia |
| MSD | Sable Island, Nova Scotia |
| MSC | Siasconsett, Mass. |
| MSE | Sea Gate, N.Y. |
| MSF | S.S. San Giovanni |
| MSH | S.S. San Georgio |
| MSJ | St. John, Pattridge Island, New Brunswick |
| MSK | Sagaponach, N.Y. |
| MSL | Santa Maria di Leuca, Italy |
| MSL | S.S. St. Louis |
| MSN | S.S. San Guiseppi |
| MSN | S.S. Hesperian |
| MSO | S.S. San Gugliemo |
| MSP | S.S. St. Paul |
| MSW | Wellfleet, Cape Cod, Mass. |
| MT | S.S. Minto |
| MTA | S.S. Ultonia |
| MTC | S.S. Teutonic |
| MTD | Cross Sand lightship, England |
| MTE | East Goodwin lightship, England |
| MTG | Gull lightship, England |
| MTH | S.S. Themistocles |
| MTI | S.S. Athinai |
| MTK | Steam yacht Florence |
| MTK | Sunk lightship, England |
| MTL | Montreal, Quebec |
| MTN | S.S. Tunisian |
| MTP | Torre Piloti di Malamocco Italy |
| MTR | S.S. Trotona |
| MTS | South Goodwin lightship, England |
| MTT | Tongue lightship, England |
| MU | Musil, Austria-Hungary |
| MUA | S.S. Umbria |
| MUC | S.S. Titanic |
| MUF | S.S. Francesca |
| MUG | S.S. Argentina |
| MUL | S.S. Alice |
| MUN | S.S. Sicilian |
| MUO | S.S. Oceania |
| MUR | S.S. Laura |
| MUS | S.S. Sophia |
| MUW | S.S. Martha Washington |
| MV | S.S. Advance |
| MV | S.S. New Haven |
| MVA | S.S. Argentina |
| MVB | S.S. Bresilia |
| MVC | S.S. Italia |
| MVD | S.S. Vaderland |
| MVD | Montevideo, Uruguay |
| MVE | S.S. Europa |
| MVF | S.S. Savoia |
| MVI | Venison Island, Labrador |
| MVK | Steam yacht The Viking |
| MVN | S.S. Victorian |
| MVO | S.S. Oceania |
| MVQ | S.S. Viking |
| MVR | S.S. Nord America |
| MVS | S.S. America |
| MVT | Viesti, Mount Gargano, Italy |
| MVZ | S.S. Venezia |
| MW | S.S. Maurence |
| MW | Manitowoc, Wis. |
| MW | Wilhelmshaven, Germany |
| MW | Vladivostok, Siberia |
| MWA | S.S. Aaro |
| MWC | S.S. Runic |
| MWI | S.S. Ionic |
| MWN | S.S. Athenic |
| MWO | S.S. Oslo |
| MWR | Whittle Rocks, Quebec |
| MWS | Withernsea, England |
| MWT | S.S. Corinthic |
| MX | S.S. Colon |
| MXC | S.S. Medic |
| MYC | S.S. Afric |
| MZ | Mazatlan, Mexico |
| MZA | S.S. Zealandia |
| MZB | S.S. Bornu |
| MZC | S.S. Megantic |
| MZD | S.S. Zeeland |
| MZL | S.S. Florizal |
| MZN | S.S. Parisian |
| MZR | S.S. Rosalind |
| MZV | Venice, Italy (Arsenal) |
| N | Gjedser Reef lightship, Denmark |
| NA | Nauen, Germany |
| NAB | Cape Elizabeth, Me. (naval station) |
| NAC | Portsmouth, N.H.(navy-yard) |
| NAD | Boston, Mass. (navy-yard) |
| NAE | Cape Cod, Highland Light, Mass. (naval station) |
| NAF | Newport, R.I. (naval station) |
| NAG | Fire Island, N.Y. (naval station) |
| NAH | Brooklyn, N.Y. (navy-yard) |
| NAI | Philadelphia, Pa. (navy-yard) |
| NAJ | Cape Henlopen, Lewes, Del. (naval station) |
| NAK | Annapolis, Md. (Naval Academy) |
| NAL | Washington, D.C.(navy-yard) |
| NAM | Norfolk, Va. (navy-yard) |
| NAN | Pivers Island, Beaufort, N.C. (naval station) |
| NAO | Charleston, S.C. (navy-yard) |
| NAP | St. Augustine, Fla. (naval station) |
| NAQ | Jupiter Inlet, Neptune, Fla. (naval station) |
| NAR | Key West, Fla.(naval station) |
| NAS | Pensacola, Fla. (navy-yard) |
| NAT | New Orleans, La. (naval station) |
| NAU | San Juan, P.R. (naval station) |
| NAV | Culebra, W.I. (naval station) |
| NAW | Guantanamo, Cuba (U.S. naval station) |
| NAX | Colon, Isthmian Canal Zone (naval station) |
| NAY | Porto Bello, Isthmian Canal Zone (naval station) |
| NBH | U.S.S. Ajax |
| NBI | U.S.S. Alabama |
| NBJ | U.S.S. Albany |
| NBM | U.S.S. Alexander |
| NBU | U.S.S. Arethusa |
| NCF | U.S.S. Bailey |
| NCG | U.S.S. Bainbridge |
| NCH | U.S.S. Baltimore |
| NCK | U.S.S. Barry |
| NCM | U.S.S. Biddle |
| NCN | U.S.S. Birmingham |
| NCT | U.S.S. Brutus |
| NCU | U.S.S.Buffalo |
| NCV | U.S.S. Burrows |
| NCZ | U.S.S. California |
| ND | S.S. Northland |
| NDA | U.S.S. Castine |
| NDB | U.S.S. Celtic |
| NDC | U.S.S. Charleston |
| NDE | U.S.S. Chattanooga |
| NDF | U.S.S. Chauncey |
| NDG | U.S.S. Chester |
| NDI | U.S.S. Chicago |
| NDL | U.S.S. Cincinnati |
| NDM | U.S.S. Cleveland |
| NDN | U.S.S. Colorado |
| NDQ | U.S.S. Connecticut |
| NDU | U.S.S. Culgoa |
| NDY | U.S.S. Cyclops |
| NE | S.S. Nushagak |
| NEH | U.S.S. Dale |
| NEJ | U.S.S. Decatur |
| NEK | U.S.S. Delaware |
| NEM | U.S.S. Denver |
| NEN | U.S.S. Des Moines |
| NEP | U.S.S. Dixie |
| NEQ | U.S.S. Dolphin |
| NER | U.S.S. Don Juan de Austria (Michigan Naval Militia) |
| NET | U.S.S. Drayton |
| NEU | U.S.S. Dubuque |
| NFC | U.S.S. Eagle |
| NFP | U.S.S. Farragut |
| NFS | U.S.S. Flusser |
| NGD | U.S.S. Galveston |
| NGF | U.S.S. Georgia |
| NGH | U.S.S. Glacier |
| NGJ | U.S.S. Goldsborough |
| NGK | U.S.S. Gopher (Minnesota Naval Militia) |
| NGU | U.S.S. Hannibal |
| NGV | U.S.S. Hartford |
| NGX | U.S.S. Hector |
| NGY | U.S.S. Helena |
| NH | S.S. Wilhelmina |
| NHC | U.S.S. Hopkins |
| NHE | U.S.S. Hull |
| NHN | U.S.S. Idaho |
| NHO | U.S.S. Illinois |
| NHQ | U.S.S. Indiana |
| NHT | U.S.S. Iowa |
| NHU | U.S.S. Iris |
| NI | S.S. Klamath |
| NIE | U.S.S. Jupiter |
| NIF | U.S.S. Justin |
| NIO | U.S.S. Kansas |
| NIP | U.S.S. Kearsarge |
| NIQ | U.S.S. Kentucky |
| NIW | U.S.S. Lamson |
| NIY | U.S.S. Lawrence |
| NIZ | U.S.S. Lebanon |
| NJA | U.S.S. Leonidas |
| NJB | U.S.S. Louisiana |
| NJH | U.S.S. Macdonough |
| NJI | U.S.S. Machias |
| NJL | U.S.S. Maine |
| NJQ | U.S.S. Marietta |
| NJR | U.S.S. Mars |
| NJS | U.S.S. Maryland |
| NJT | U.S.S. Massachusetts |
| NJU | U.S.S. Mayrant |
| NJV | U.S.S. Mayflower |
| NJW | U.S.S. McCall |
| NJZ | U.S.S. Michigan |
| NK | S.S. Pequonock |
| NKA | U.S.S. Milwaukee |

| | |
|---|---|
| NKD | U.S.S. Minnesota |
| NKE | U.S.S. Mississippi |
| NKF | U.S.S. Missouri |
| NKM | U.S.S. Montana |
| NKN | U.S.S. Monterey |
| NKO | U.S.S. Montgomery |
| NKV | U.S.S. Nanshan |
| NLA | Nantucket Shoals lightship |
| NLB | Diamond Shoals lightship |
| NLC | Frying Pan Shoals lightship |
| NMA | U.S.S. Nebraska |
| NMB | U.S.S. Nero |
| NME | U.S.S. New Hampshire |
| NMF | U.S.S. New Jersey |
| NMG | U.S.S. New Orleans |
| NMH | New York nautical school ship Newport |
| NMI | U.S.S. New York |
| NMN | U.S.S. North Carolina |
| NMO | U.S.S. North Dakota |
| NMW | U.S.S. Ohio |
| NMX | U.S.S. Olympia |
| NO | Nonendamm, Germany |
| NOG | U.S.S. Paducah |
| NOJ | U.S.S. Panther |
| NOL | U.S.S. Patapsco |
| NOM | U.S.S. Patuxent |
| NON | U.S.S. Paulding |
| NOP | U.S.S. Paul Jones |
| NOT | U.S.S. Pennsylvania |
| NOX | U.S.S. Perkins |
| NOY | U.S.S. Perry |
| NPA | Cordova, Alaska (naval station) |
| NPB | Sitka, Alaska (naval station) |
| NPC | Bremerton, Wash. (navy-yard) |
| NPD | Tatoosh Island, Wash. (naval station) |
| NPE | North Head, Wash. (naval station) |
| NPF | Cape Blanco, Ore. (naval station) |
| NPG | Table Bluff, Cal. (naval station) |
| NPG | North Post, Trinidad |
| NPH | Mare Island, Cal. (navy-yard) |
| NPI | Farallon Islands, Cal. (naval station) |
| NPJ | Yerba Buena Island, Cal. (naval station) |
| NPK | Point Arguello, Cal. (naval station) |
| NPL | Point Loma, Cal. (naval station) |
| NPM | Honolulu, Hawaii (naval station) |
| NPN | Guam, Marianas (naval station) |
| NPO | Cavite, P.I. (naval station) |
| NPT | Nieuport, Belgium |
| NQ | S.S. Holland |
| NQF | U.S.S. Pompey |
| NQM | U.S.S. Prairie |
| NQN | U.S.S. Preble |
| NQO | U.S.S. Preston |
| NQP | U.S.S. Princeton |
| NQR | U.S.S. Prometheus |
| NRA | U.S.S. Rainbow |
| NRB | U.S.S. Raleigh |
| NRC | Massachusetts nautical school ship Ranger |
| NRE | U.S.S. Reid |
| NRI | U.S.S. Rhode Island |
| NJR | U.S.S. Decatur |
| NRM | U.S.S. Roe |
| NRZ | U.S.S. Salem |
| NS | S.S. New Hampshire |
| NSF | U.S.S. Saturn |
| NSG | U.S.S. Scorpion |
| NSQ | U.S.S. Smith |
| NST | U.S.S. Solace |
| NSW | U.S.S. South Carolina |
| NSX | U.S.S. South Dakota |
| NTA | U.S.S. Sterling |
| NTB | U.S.S. Sterrett |
| NTC | U.S.S. Stewart |
| NTF | U.S.S. St. Louis |
| NTI | U.S.S. Stringham |
| NTK | U.S.S. Supply |
| NU | S.S. J. S. Chanslor |
| NUA | U.S.S. Tacoma |
| NUG | U.S.S. Tennessee |
| NUI | U.S.S. Terry |
| NUN | U.S.S. Tonopah |
| NUS | U.S.S. Truxtun |
| NV | S.S. Charles S. Nelson |
| NVK | U.S.S. Vermont |
| NVL | U.S.S. Vestal |
| NVN | U.S.S. Vicksburg |
| NVR | U.S.S. Virginia |
| NVT | U.S.S. Vulcan |
| NW | S.S. Northwest |
| NW | Nawiliwili, Kauai, Hawaiian Islands |
| NWD | U.S.S. Warrington |
| NWE | U.S.S. Washington |
| NWG | U.S.S. West Virginia |
| NWH | U.S.S. Wheeling |
| NWI | U.S.S. Whipple |
| NWK | U.S.S. Wilmington |
| NWM | U.S.S. Wisconsin |
| NWP | U.S.S. Worden |
| NXB | U.S.S. Yankton |
| NXD | U.S.S. Yorktown |
| NY | New York, N.Y. (42 Broadway) |
| N2 | Tug Fearless |
| OA | S.S. Hamilton |
| OAA | S.S. Atlanta |
| OAC | S.S. Columbia |
| OAH | S.S. Sophia Hohenberg |
| OB | S.S. Princess Anne |
| OC | S.S. Jamestown |
| OD | S.S. Jefferson |
| OHX | New York, N.Y. (Herald ship news office, The Battery) |
| OKY | S.S. Kayo Maru |
| OL | Pernambuco, Brazil |
| OM | S.S. Munroe |
| OR | U.S. Artillery harbor tug General Randall |
| OV | S.S. Olivette |
| OW | S.S. Mascotte |
| OW | Berlin, Germany |
| OX | Oxford, England |
| OZ | S.S. Miami |
| P | New York, N.Y. (Hotel Plaza) |
| P | Isle of Pines, Cuba |
| PA | Seattle, Wash. (University grounds) |
| PA | S.S. Prince Albert |
| PB | Ketchikan, Alaska |
| PB | Pemba Island, Zanzibar |
| PC | Astoria, Ore. |
| PD | Tampa, Fla. |
| PD | Friday Harbor, Wash. |
| PD | Port Said, Egypt |
| PF | Providence, R.I. |
| PF | Aberdeen, Wash. |
| PG | Westport, Wash. |
| PG | Payo Obispo, Mexico |
| PGD | Point Grey, British Columbia |
| PH | San Francisco, Cal. |
| PI | Avalon, Catalina Island, Cal. |
| PIA | Fort Frank, P.I. |
| PIB | Fort Drumm, P.I. |
| PIC | Fort Wint, P.I. |
| PID | Fort William McKinley, P.I. |
| PJ | Point Judith, R.I. |
| PJ | Los Angeles, Cal. (Boyle Heights) |
| PK | San Diego, Cal. |
| PK | Porthcuno, Cornwall, Eng'd. |
| PK | Port Tewfik, Egypt |
| PK | Peking, China (Italian embassy) |
| PM | Eureka, Cal. |
| PM | Bahia Blanca, Argentine Republic |
| PM5 | Pere Marquette car ferry No.5 |
| PN | Alpena, Mich. |
| PN | Katalla, Alaska |
| PN | Manila, P.I. |
| PNA | Ponta Negra, Brazil |
| PO | Cordova, Alaska |
| PPZ | Kronstadt (Fort Menschikoff) Russia |
| PQ | Monterey, Cal. |
| PQ | S.S. City of Chicago |
| PQL | Parkeston Quay, England |
| PR | North Vancouver, British Columbia |
| PRD | Prince Rupert, British Columbia |
| PS | San Francisco, Cal. (Presidio) |
| PS | Port of Spain, Trinidad |
| PT | Fort Bragg, Cal. |
| PTB | St. Petersburg, Russia |
| PU | Bellingham, Wash. |
| PU | S.S. Mobilla |
| PV | S.S. Providence |
| PW | Victoria, British Columbia |
| PX | Los Angeles, Cal. (Examiner) |
| PY | Olympia, Wash. |
| P1 | S.S. Enterprise |
| P2 | S.S. Hilonian |
| P3 | S.S. Portland |
| P4 | S.S. Col. E. L. Drake |
| P5 | Standard Oil barge 3 |
| P7 | S.S. Buckman |
| P8 | S.S. Watson |
| P9 | S.S. Bertha |
| Q | Quebec |
| Q | Bluefields, Nicaragua |
| QDH | Alderney, England |
| QK | Washington, D.C. (Elliott Woods) |
| QR | Antwerp, Belgium |
| QWC | Bermuda |
| R | Reggio, Italy |
| RAG | S.S. Algerie |
| RB | S.S. Governor Cobb |
| RC | Lightship Recalada, La Plata River, Argentine Republic |
| RCA | U.S. revenue cutter Algonquin |
| RCB | U.S. revenue cutter Bear |
| RCD | U.S. revenue cutter Androscoggin |
| RCE | U.S. revenue cutter Seneca |
| RCF | U.S. revenue cutter Snohomish |
| RCG | U.S. revenue cutter Gresham |
| RCH | U.S. revenue cutter McCullough |
| RCI | U.S. revenue cutter Itasca |
| RCJ | U.S. revenue cutter Woodbury |
| RCK | U.S. revenue cutter Tahoma |
| RCL | U.S. revenue cutter Tuscarora |
| RCM | U.S. revenue cutter Mohawk |
| RCN | U.S. revenue cutter Manning |
| RCO | U.S. revenue cutter Onondaga |
| RCP | U.S. revenue cutter Apache |
| RCQ | U.S. revenue cutter Perry |
| RCR | U.S. revenue cutter Rush |
| RCS | U.S. revenue cutter Seminole |
| RCT | U.S. revenue cutter Thetis |
| RCU | U.S. revenue cutter Acushnet |
| RCW | U.S. revenue cutter Windom |
| RCY | U.S. revenue cutter Yamacraw |
| RD | S.S. La Rapide |
| RFR | S.S. France |
| RFS | S.S. Formosa |
| RHN | New Haven, England |
| RIF | S.S. Ile-de-France |
| RIO | S.S. Russie |
| RIT | S.S. Italie |
| RJ | Tug Relief |
| RJ | Rio de Janeiro, Brazil |
| RJI | Rijo, Brazil |
| RJF | Corkbeg, England |
| RH | Santa Rosalia, Mexico |
| RLA | S.S. Plata |
| RN | S.S. Puritan |
| RN | S.S. Calvin Austin |
| RNA | S.S. Atrato |
| RND | Magdalena |
| RNJ | S.S. Nile |
| RNK | S.S. Clyde |
| RNM | S.S. Thames |
| RNO | S.S. Orinoco |
| RNQ | S.S. Ortona |
| RNR | S.S. Trent |
| RNS | S.S. Tagus |
| RNV | S.S. Orotava |
| RNU | S.S. Oruba |
| RNX | S.S. Berbice |
| RP | S.S Premier |
| RPP | S.S. Pampa |
| RPR | S.S. Parana |
| RQ | S.S. I. J. Merritt |
| RQ | S.S. Marquette |
| RQW | Dover, England |
| RRX | Rixhoft, Germany |
| RS | S.S. Rescue |
| RS | Rio de Santiago, Argentine Republic |
| RS | Pinar del Rio, Cuba |
| RST | Rost, Norway |
| RU | Port Arthur, Tex. |
| RV | S.S. Governor Dingley |
| RW | U.S. Artillery Harbor Tug Captain Rowell |
| RX | Mexican cable ship Relay |
| RY | S.S. Yale |
| RZA | Raza, Brazil |
| S | Cambridge, Mass. |

| | |
|---|---|
| SAL | S.S. Salvor |
| SAT | S.S. Satellite |
| SB | S.S. Prinz August Wilhelm |
| SBA | S.S. Birma |
| SC | S.S. Indiana |
| SC | S.S. Tasco |
| SC | Washington, D.C. (Signal Corps laboratory) |
| SC | Bari, Italy |
| SCF | S.S. J. F. Tietgen |
| SCH | Scheveningen, Holland |
| SCQ | Felixstowe, England |
| SD | Santo Domingo City, Santo Domingo |
| SEA | S.S. Estonia |
| SF | San Francisco, Cal. |
| SF | S.S. Prinz Eitel Frederich |
| SG | S.S. Prinz Sigismund |
| SH | Sault Ste. Marie, Mich. |
| SK | S.S. Oceana |
| SKD | Cape Lazo, B.C. |
| SKE | Skegness, England |
| SJ | San Jose del Cabo, Mexico |
| SLA | S.S. Litunia |
| SM | S.S. Sierra |
| SM | San Martin, Argentine Republic |
| SMG | Ponta Delgado, San Miguel, Azores |
| SMP | Windmill Hill, Gibraltar |
| SN | Charleston, S.C. (Hampton Park) |
| SN | Santiago de Cuba, Cuba |
| SNA | Barge Shenango |
| SND | S.S. Wm. P. Porter |
| SNW | S.S. Wiplen |
| SOR | S.S. King Oscar II |
| SOT | Sorvaagen, Norway |
| SP | S.S. Prinz Joachim |
| SRN | S.S. Russia |
| SQ | S.S. Puritan |
| ST | S.S. Stanley |
| STM | Santa Maria, Azores |
| SV | Savannah, Ga. |
| SW | Southwest Pass, La. |
| S2 | Seattle, Wash. |
| TAF | Ajacio, Corsica |
| TBS | La Valetta, Malta |
| TCF | Cherbourg, France |
| TCY | S.S. Chito Maru |
| TDF | Dunkerque, France |
| THM | Tobermory Island, Scotland |
| THN | S.S. Hong Kong Maru |
| TLD | Triangle Island, British Columbia |
| TLF | Lorient, France |
| TLK | Port Patrick, England |
| TMC | S.S. America Maru |
| TMO | Tjomo, Norway |
| TMP | Rame Head, England |
| TN | S.S. Tennessee |
| TN | Tientsin, China |
| TNF | Toulon-Mourilion, France |
| TNP | S.S. Nippon Maru |
| TOF | Oran, Algeria |
| TOG | South Coast of Tobago |
| TQF | Brest, France |
| TR | S.S. Rosina |
| TRF | Rochefort, France |
| TTY | S.S. Tenyo Maru |
| TU | Tempelhofer, Germany |
| TVK | Kiel, Germany (torpedo station) |
| TVP | Scilly Islands, England |
| TW | Tangier, Morocco |
| TWQ | Portland, England |
| TWT | New York, N.Y. (111 Broadway) |
| TY | S.S. Jos. Vacarro |
| TZF | Bizerta, Tunis |
| T2J | Tacoma, Wash. |
| UA | S.S. Ellis |
| UB | S.S. Preston |
| UBL | Boulogne, France |
| UBO | S.S. Buffalo |
| UC | S.S. Cartago |
| UCL | S.S. Ucayali |
| UD | S.S. Lansing |
| UD | S.S. Parisiana |
| UDI | S.S. Idaho |
| UE | Rama, Nicaragua |
| UF | S.S. Abagarez |
| UFO | Fort d'l Eau, Algeria |
| UG | S.S. Admiral Schley |
| UGO | S.S. Galilee |
| UH | S.S. Heredia |
| UHF | S.S. Herman Frasch |
| URG | S.S. Noruega |
| UHL | S.S. Highland Laddie |
| UHP | S.S. Highland Pride |
| UHR | S.S. Highland Rover |
| UJ | Cape San Antonia, Cuba |
| UJA | S.S. Acre |
| UJB | S.S. Sergipe |
| UJC | S.S. Orion |
| UJG | S.S. Bahia |
| UJH | S.S. Marnhao |
| UJI | S.S. Olinda |
| UJK | S.S. Brazil |
| UJM | S.S. San Salvador |
| UJN | S.S. Goyaz |
| UJO | S.S. Para |
| UJP | S.S. Saturno |
| UJQ | S.S. Manaos |
| UJR | S.S. Jupiter |
| UJV | S.S. Ceara |
| UJY | S.S. Alagoas |
| UJZ | S.S. Sirio |
| UK | S.S. Turralba |
| ULA | S.S. Huallaga |
| UM | S.S. Antenas |
| UM | S.S. Santa Maria |
| UMD | S.S. Druid |
| UOS | Ouessant, France |
| UPG | S.S. Prince George |
| UPQ | Porquerolies, France |
| UPR | S.S. Prince Rupert |
| US | S.S. Santa Rita |
| US | Swan Island, off Honduras |
| USD | Estevan Point, B.C. |
| USK | S.S. Eskimo |
| USM | St. Marie de la Mer, France |
| USV | S.S. St. Vincent |
| UV | S.S. Admiral Dewey |
| UVD | S.S. Verdi |
| UVR | S.S. Vasari |
| UW | S.S. Admiral Farragut |
| UW | S.S. Pectan |
| UWK | S.S. San Paulo |
| UWN | S.S. Minas Geraes |
| UWR | S.S. Rio de Janeiro |
| UXS | S.S. Texas |
| U2 | S.S. Lurline |
| V | San Giovanni, Italy |
| VA | S.S. Apache |
| VB | S.S. Arapahoe |
| VC | S.S. Comanche |
| VD | S.S. Villa de Douvres |
| VDS | Yacht Vanadis |
| VF | S.S. Iroquois |
| VFM | Sheerness, England |
| VG | S.S. Algonquin |
| VH | S.S. Huron |
| VJ | S.S. Seminole |
| VK | S.S. Cherokee |
| VL | Wyl lightship, Denmark |
| VM | S.S. Mohawk |
| VSD | Victoria, British Columbia |
| V2 | Victoria, British Columbia |
| WA | New York, N.Y. (Waldorf-Astoria) |
| WA | S.S. China |
| WB | S.S. W. B. Davock |
| WB | S.S. Beaver |
| WB | Wiborg, Italy |
| WC | S.S. Morro Castle |
| WD | S.S. Bear |
| WD | Bayonne, N.J. |
| WE | S.S. City of Lowell |
| WE | S.S. Manchuria |
| WEN | Escuela Naval, Chile |
| WFT | Playa Ancha, Chile |
| WG | S.S. Seguranca |
| WH | S.S. Havana |
| WK | S.S. Korea |
| WLS | Las Salinas, Chile |
| WM | S.S. Merida |
| WN | S.S. Mongolia |
| WN | Wilson's Point, Conn. |
| WQ | Eastport, Me. |
| WQ | S.S. City of Traverse |
| WS | New London, Conn. |
| WT | S.S. Asia |
| WU | S.S. Siberia |
| WV | S.S. Vigilancia |
| WX | S.S. Mexico |
| WY | S.S. Monterey |
| WY | Motor yacht Sea Otter |
| WZ | S.S. Esperanza |
| X | U.S. Artillery harbor tug Reno |
| X | Port Limon, Costa Rica |
| XA | S.S. Hendrick Hudson |
| XA | S.S. Arizona |
| XA | S.S. City of Philadelphia |
| XAS | New York, N.Y. (66 Broadway) |
| XAV | New York, N.Y. (Metropolitan tower) |
| XB | S.S. City of Wilmington |
| XB | S.S. Robert Fulton |
| XBG | Philadelphia, Pa. |
| XBM | Washington, D.C. (Evans Building) |
| XD | S.S. Walter Adams |
| XF | S.S. Florida |
| XG | S.S. Alabama |
| XK | S.S. Virginia |
| XK | S.S. Alaska |
| XKA | Duluth, Minn. |
| XKD | Houghton, Mich. |
| XKG | Sault Ste. Marie, Mich. |
| XKJ | Cheboygan, Mich. |
| XKS | Toledo, Ohio |
| XKW | Cleveland, Ohio |
| XM | S.S. Mindora |
| XMB | Escanaba, Wis. |
| XMH | Milwaukee, Wis. |
| XMJ | Chicago, Ill. |
| XMQ | Michigan City, Ind. |
| XMV | Ludington, Mich. |
| XN | S.S. J. L. Lawrence |
| XN | S.S. City of Norfolk |
| XO | S.S. City of Baltimore |
| XP | Xcalac, Mexico |
| XQ | S.S. Louise |
| XQ | S.S. Quick Step |
| XW | S.S. Jos. Wharton |
| YA | S.S. S. V. Luckenbach |
| YA | S.S. Paraguay |
| YA | S.S. Thalia |
| YAK | S.S. Aki Maru |
| YAW | S.S. Awa Maru |
| YD | S.S. Toledo |
| YIB | S.S. Inaba Maru |
| YIY | S.S. Iyo Maru |
| YKG | S.S. Kaga Maru |
| YN | S.S. Illinois |
| YSN | S.S. Shinano Maru |
| YTB | S.S. Tamba Maru |
| YTG | S.S. Tango Maru |
| YTS | S.S. Toso Maru |
| ZB | S.S. Ossabow |
| ZK | S.S. Ogeechee |
| ZM | S.S. Satilla |
| ZQ | S.S. Altamaha |
| ZR | Zanzibar |
| ZU | S.S. Ocmulgee |

## HOW PAPER IS MADE

*An Address Delivered before Detroit Adcraft Club*

ANSEL T. DENISON

The three standard web-making machines of today are the cylinder, Fourdrinier and Harper. The drying and calendering parts of all three are very similar, the difference in them being entirely in what is called among mill men, at the "wet end," or part where the formation of the web takes place from the raw pulp.

### FROM PULP TO PAPER

The wet end of the cylinder machine consists of one or more vats, each containing a cylinder covered with a fine mesh of copper wire, different in its mesh according to the stock being made. The cylinder varies in length and proportion to the width of the machine, but is usually about 40 in. in diameter, and takes up about two-thirds of the width of the vat. It revolves on bearings in the centre of the vat. On each of these vats is what is called a side box, through which the stock flows. This box also has a gate regulating the flow of water from the cylinder. This water is kept below the stock on the outside of the cylinder, thus creating a suction of drawing the fiber to the wire, where it is formed into the original web.

This formation takes place at the back sides of the cylinders, being carried around through the vats, gaining additional fiber and strength. When the newly formed sheet reaches the top of the cylinder, it comes in contact with an endless felt running in the opposite direction, and held with some pressure on the cylinder by means of a wooden roll about 12 in. in diameter, thickly wound with felting and technically called the "couch" or coucher roll. The felt picks up the sheet and carries it over to what is called the second felt, passing through in the meantime two sets of heavy press rolls, interlacing and weaving the fibers and squeezing out the water. It passes from the second set of press rolls to the driers—here the paper is thoroughly dried and goes to the calenders or large stacks of steel rolls where the surface of the paper is applied.

### HIGH RATE OF SPEED

The Fourdrinier, the best known machine, and used in all the fast running new mills, attains in some cases a speed as high as 600 ft. a minute—this being an increase in speed of at least 350 ft. in the past twenty years. The width of these machines has also increased during that time from 96 in. to 164 in., the average width in the modern news mill being about 138 in. These machines will trim 128 in. of paper, the shrinkage being about 10 in. from the wet end to the finished product.

The wet part of this machine consists of long, endless composition wires about 72-mesh, driven by two large rolls and supported between them by numerous hollow brass rolls of about 2½ in. in diameter, running on an iron frame which has an oscillating movement. At the end of the smaller roll, before reaching the large driving or breast rolls, are suction boxes. These are of metal, covered with a sheet of perforated brass and attached to suction pumps. Their use is to draw the water from the stock as it flows over the wire, reducing the pulp to a thicker consistency. The stock flows on the wire from the screens, appearing to the onlooker as ordinary soapsuds, and by the time it reaches the suction boxes, owing to the oscillating movement of the wire, one can see the formation of the sheet distinctly.

### MAKING "LIGHT WEIGHTS"

After reaching the breast roll, the paper is taken from the wire, goes through heavy press rolls to the felt, and is handled as on a cylinder machine.

The Harper machine is a Fourdrinier in principle, with the addition of a long felt running back and over the entire length of the wire, and is used almost exclusively in the manufacture of light weights.

In this connection I might say that there is one mill in New York state running two Harpers, 110 in. in width, 24 hours daily, six days in the week, on paper for the Sears-Roebuck Company.

Print is manufactured from mechanical wood and sulphite with from 6 to 10 per cent. clay, the usual proportion being about 75 per cent. of ground wood and 25 per cent. of sulphite, the apparent surplus of clay making up the waste or shrinkage of stock in manufacture. The wood used is mostly spruce, pine and hemlock. Pine is used almost exclusively for the mechanical wood, while spruce and hemlock are used for sulphite. In the manufacture of soda, hard woods and poplar are also used. Mechanical wood and ground wood is made by the very simple process of holding the barked stick, generally cut in 2 ft. lengths, by hydraulic pressure against gigantic grindstones incased with iron and having three pockets in which the wood is placed. During the grinding a constant stream of water is run on the stone mingling with the fiber and reducing it to a fluid state.

### PULP AT $20 PER TON

This is the cheapest pulp manufactured, and the present price is in the neighborhood of $20 per ton. This stock is of brownish color and can always be discovered in paper by the nitric acid test, although when used in small proportion the presence of an unbleached sulphite has very much the same appearance, especially to the novice.

The ordinary sulphite mill uses either hemlock or spruce. The wood is taken from the yard or the car to the wood room, where it is barked, cleaned, knotted, and cut into chips 1 in. square or more, and of about ⅛ in. in thickness. It is then carried by conveyors to the chip loft at the top of the digesting room, run from there by gravity into the digestor, a large steel tank lined with brick and cement to keep the acid from the steel shell.

### ENTER STEAM COOKER

Sulphurous acid with a bi-sulphite of lime in solution is pumped in, the manhead put on, steam applied, and a pressure of 85 lbs. raised with a temperature of 130 to 140 degrees centigrade. It is cooked from seven to ten hours, until practically all the bi-sulphite of lime has been taken up and the wood reduced to pulp. It is then blown into large, sealed wooden blow-pits at a pressure of 85 lbs. After emptying, these blow-pits are then filled with water until the acid is partially washed out. Then the doors are opened and the stock washed out by men with fire hose to a screening apparatus, where it is screened through brass plates with slots of 12 to 14-1,000 cut through them. From there it runs over a cylinder machine similar to the wet part already described, and is taken from the couch by a large blade of wood called a doctor and run into the stuff-chest below.

From these chests it is pumped into the heating or mixing engines, where the mechanical wood that has had the same treatment is also pumped in right proportion. Clay and sizing is added and the stock is ready to be beaten up. The beaters or engines, as the paper-maker calls them, are large oval tubs holding stock enough for from 1,500 to 2,000 lbs. of finished paper. They have a partition running through the centre, leaving a space of about 3 ft. at each end.

### BEATING AND COLORING

The stock is kept in motion by a revolving beating roll, a large wooden roll running in adjustable bearings. This roll is filled with iron knives fitted lengthwise, and about 2 in. apart. Directly beneath this roll is the bed-plate, a plate of slotted iron. The beating roll is then adjusted by the engineer to the desired height from the bedplate. By this means the stock is brushed out and cut in short or long fibres, as the paper to be made requires. The time required for beating, in an ordinary news mill, is about 25 to 35 minutes. The stock is then dumped into a large wooden chest in which an agitator is slowly revolving. This is called the stuff-chest. In here the stock from the several beaters and coloring matters are thoroughly mixed, and it is then pumped through a refining engine for the purpose of cutting the stock still shorter and in quicker time than it can be done in the beater.

### FINISH IN THE CALENDERS

From the refining engine it flows generally by gravity to the machine chest, and is now ready to be made into paper. The stock is pumped once more to the machine stuff-box, where the flow and weight of stock is partially regulated. From there it passes to the screens, the clots in this set being from 10 to 12-1,000. It then flows on the wire, the final flow of stock being regulated by the machine tender, according to the required weight of paper, the pulp being formed into web as heretofore described. It is now handled by the hands for the first time.

After leaving the felts and press rolls it runs through the driers and into the calender stacks. This is done by hand and is what the boys call "carrying it over."

The paper being thoroughly dry, enters the calenders, where the final finish is put on; it is wound on reels and then rewound to the necessary size for newspaper requirements. It is then wrapped and labeled for shipment.

With a perfecting press at the end of the machines, in ten hours from the time the wood enters the wood room you could be printing your daily paper.

In other grades of paper, such as book, etc., the process is practically the same, except that rags and wood are used in varying proportions to produce the different grades.

## ELECTRICAL SCIENCE

### Largest Storage Battery in the World

An enormous storage battery plant, to be the largest in the world, according to vice-president Herbert Wagner, of the Consolidated Gas Electric Light and Power Company, of Baltimore, will be installed as soon as the building to hold it can be constructed adjoining the property of the company in that city. "This storage battery," said Mr. Wagner, recently, "will have a capacity sufficient to take care of the peak load in the entire business district for nearly half an hour, should an accident occur at the time of maximum consumption. Should an accident occur at any other time, the battery would take care of the entire business district for several hours, and might be able to take care of the entire city for that length of time. Naturally, the forces of the company would not be idle in event of an accident, and it is scarcely probable that the accident could not be repaired before the storage battery ran out. The expenditure of this amount by the company is made solely as an insurance precaution against a break in the service, and is not made with any view to cutting down the cost of production in the peak load period each day by storing up the current in the light-load period each day. We expect to have the plant in operation inside of six months. The company will also build a garage and will charge electric-driven commercial vehicles with current and store vehicles for such owners as desire it, taking care of the trucks and making repairs. The garage will be ready for business in two weeks, since work has been progressing rapidly on it. In addition to the storing and charging and repairing of electric-driven vehicles, the company proposes to enter the sales end of the motor vehicle business and has obtained the Baltimore agency of the General Vehicle Company of Long Island City, New York."

### Wireless Telephony on Moving Trains on the Union Pacific

An account was given before the New York Railway Club the other day of research work in the application of wireless telephony to moving trains by Dr. Frederick H. Millener, the inventor. The work was undertaken by the Union Pacific Railroad, and it is expected that the system will be put into practical operation before the end of the year.

In the course of his address Dr. Millener said: "We have been prosecuting these researches for four years. The conclusions we have reached have been satisfactory. We are not prepared to state in detail the methods we have followed, for the work is not yet absolutely completed. I may say, however, that wireless telephony from a moving train is more than a practical probability and that within a year or so from now it will be a feature of the daily operation of trains on the Union Pacific. If we save one fruit train from freezing, it will pay for the cost of practically the whole installation. More than that, however, it will make travel by rail even safer than it is now on the safest of railroads. With properly constructed wireless stations there is no chance of failure. There will be no more trouble with the block signals, no delays or annoyances because wires have been blown down by storms, or anything of that sort.

"Two of these wireless stations will be established soon, one at Sidney, Neb., and the other at Cheyenne, Wyo., 103 miles apart, where the line is a single track. We expect to keep up communication with moving trains between these two stations and others that are to be established. These wireless stations will be close to the train despatcher's offices, so that communication may be established quickly whenever it is necessary. We have discovered through our experiments that wireless waves will follow the direction of the rails farther than in any other direction, and more closely. It is well known that they will follow a stream of water or metallic conductors better than they will pass over a wooded country, or even a treeless plain, and that these waves work better in stormy weather than when the skies are clear.

"The wireless telephone that we have devised and have been using in Omaha is sufficiently powerful that messages may be received from a considerable distance simply by attaching the receiving apparatus to an ordinary umbrella which is held over the head of the person who gets the message. He may be on top of a moving train or walking about the yards. The tones of the human voice are reproduced perfectly—far better than by the ordinary telephone. The ordinary telephone 'head set' is used by the person receiving. The ribs of the umbrella correspond to the antennae or aerials.

"During our investigations in wireless telephony we made a thorough study of what is called the 'speaking arc' in connection with generators capable of producing currents of as high as 350,000 alternations per second. As a result of these researches we developed a bank of six arc lights which we caused to talk and give forth musical sounds when persons spoke or musical instruments were played into the telephone transmitter. At the Land Show in Omaha, recently, we lighted these arcs first by wireless. Some of them we placed in a reflector of a locomotive headlight. This greatly increased the range of distance through which they could be heard. This 'speaking arc,' however, seems destined to be nothing more than a scientific toy.

"Another thing that we did in the course of our research work was to take an electric truck weighing 5,500 lbs. and run it around the shop yards at Omaha by wireless waves. The car was equipped with an aerial, and we ran it at four different speeds, forward or backward, under perfect control."

## A NEW FIRE ALARM SYSTEM

**It Acts Without Human Aid, and is a Deadly Foe to Incendiarism. Operates in New York City, Where the Municipal Government has Granted it a Franchise.**

A franchise just granted in New York works a new and revolutionary departure in fire alarm methods. It is not an experiment, but a complete and operating success. The fact that D. G. Reid, the Rock Island Railroad magnate, is in control of the new plan evidences its stability.

The new system is styled the Air Alarm. Its basis consists of a small hollow wire of copper alloy, ⅛ in. in diameter, and containing a tiny insulated wire.

The hollow wire acts as a conductor for the air whose expansion causes a fire alarm to sound. The tiny wire is known as the trouble wire. If for any reason the hollow wire is cut or broken, the result is that an electric circuit is also broken, which causes the little wire to send a "trouble alarm" to the headquarters of the alarm company. Fire headquarters hear nothing, unless there happens to be a real fire at the time the wire breaks, or is cut.

Loops of this inconspicuous hollow wire are strung around the ceiling or carefully concealed behind the molding of the rooms, houses and buildings to be protected, the loops ending in a detector, which consists principally of a disc, containing a delicate diaphragm.

If fire starts in a room the air in the hollow tube expands under the influence of the heat and operates a sensitive diaphragm in the detector, causing it to close an electrical circuit which sets in operation all the marvelous fire alarm machinery.

All the older systems are held largely defective, due to the use of what is known as a "thermostat," placed at intervals on the ceiling. These are constantly exposed to the effects of the air, and the electrical contacts become oxidized, or clogged with dust, and when needed, fail to operate at all, or only after a raging fire is in full blast.

Briefly, the new system scores its main success in the principle that the best way to solve the great fire hazard problem of the day is to deal with incipient fires instead of conflagrations.

The new system gives an almost instantaneous alarm. If a pair of curtains catch afire, or even a newspaper, an effective alarm is given within ten to forty seconds. Moreover, another alarm is rung on a box outside of the building, which also indicates the exact location of the fire. Thence the alarm goes on and directly into the fire headquarters, where the exact location is also announced.

From beginning to end the system is altogether automatic. This elimination of the human element also eliminates the danger of error.

It might well be imagined that so sensitive a mechanism would be also affected by ordinary changes of temperature, as for instance, from steam heat or a cooking-stove. But the detector is influenced, not merely by the presence of heat, but rather by the sudden rise of heat within a fixed period of time.

For instance, the thermostats now commonly used to give fire alarms are only affected by extreme degrees of heat, say 160 degrees F. The new system would work just the same if a fire started in a room the temperature of which was zero. An incipient fire is accompanied by a certain rapid rise in temperature, which the National Board of Underwriters puts at only 4 degrees per minute. The new system works only on this rapid rise principle.

It is also fool and mischief proof. If the hollow wires are injured, accidentally or otherwise, that fact is immediately indicated, not at fire headquarters, but at the office of the company. No false alarms are possible.

Because of its instantaneous alarm and complete efficiency, it is claimed that the new system will practically do away with the horrors of incendiarism, so common in the tenement districts of large cities.

The system in its entirety is the product of the minds of a staff of engineering specialists in this field. The patents, over two hundred in all, are owned by the International Electric Protection Company, of New York. The president of the company is Robert Walker, also president of the holding company of the Rock Island system.

D. G. Reid, long prominent in railroad operations, and one of the governing minds in modern railroad development and big finance, is the controlling interest in the new system. This fact lends special importance to the enterprise, because Mr. Reid is known for the shrewdness with which he cultivates success and avoids failure. His handling of the famous tin plate merger is a matter of history, and aside from his share in the operation of several great railroad systems of the country, he is today a financial power in the railroad world.

The patents, which cover every civilized country in the world, were secured by Parke Benjamin, the eminent patent attorney, at a cost of nearly $100,000.

The new system is absolutely protected from dust, and never loses its responsiveness. It is always ready for action.

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### Hot Bearings

Hot bearings usually result from one of the following causes: Too tight belts oil rings not in place; the oil of inferior quality or insufficient in quantity; the bearing surface of the shaft marred and causing excessive friction. Bad commutation will sometimes heat the bearing on commutator end of the shaft. —*The Generator.*

# THE BULLETIN'S FREE WIRELESS COURSE

By the COLLINS' LABORATORY STAFF

*Introduction*—The object of this series of instruction papers is to fit young men and women to become practical wireless operators. It is a rational course designed to teach not only the beginner the elementary principles of electromagnetic phenomena as utilized in the wireless arts, but to enable the practical telegraph operator to acquire a thorough working knowledge of this newest and most promising branch of applied electricity.

To become thoroughly familiar with the subject in the shortest possible time it is advisable for two or more students to discuss the theory involved and to perform the experiments described. Where time will permit, the making of various pieces of wireless apparatus will be advantageous but since it is not an operator's business to build instruments, this is not an essential part of a wireless telegraph course; but the installation and operation of an equipment is of exceeding importance and it is here that theory and practice should go hand in hand. The present paper should be thoroughly studied, since it treats of not only the theory of transmitters but the practical aspects of installation as well and thus begins the actual work which determines the capabilities of an operator.

Next to a familiar knowledge of the elementary principles the manipulation of the wireless telegraph instrument and the sending of the codes are most desirable.

With a thorough grasp of the former and a fair skill with the latter, the other and more complex things a wireless operator must know will come quickly and easily, and with them—success.

## ELEVENTH PAPER

## LOCATION AND INSTALLATION

*Stations.*—A wireless station comprises the following elements, namely: (1) the operating room; (2) the mast; (3) the aerial wire system, and (4) the sending and receiving instruments.

Obviously wireless stations must be located either on land or on board ship, and stations may be classified under two general headings: (1) where the current can be had from a commercial lighting and power circuit, and (2) where the current must be obtained from an isolated engine-driven generator.

*Location.*—Where long distances are to be covered the stations should be located on an eminence, if possible; and if it is a shore station, it should be as near the water's edge as may be convenient, and there should be no other metallic or vegetable obstacles between it and the seaway. For short distance work such untoward objects need be given little thought, though it is always the better plan to have a direct visual line between the complementary stations.

*The Operating Room.*—The size of the operating room is not of course a matter of great importance, provided that the floor space is not less than 7 ft. on the side. The room should be well lighted and ventilated and kept dry and clean. A cabin built expressly for the purpose and isolated from all other buildings will prove more satisfactory than a room not especially adapted to the requirements imposed.

Where the energizing current must be generated at the station a special cabin should be built to accommodate the engine and the dynamo at a distance of, say, 80 or 100 ft. from the operating cabin.

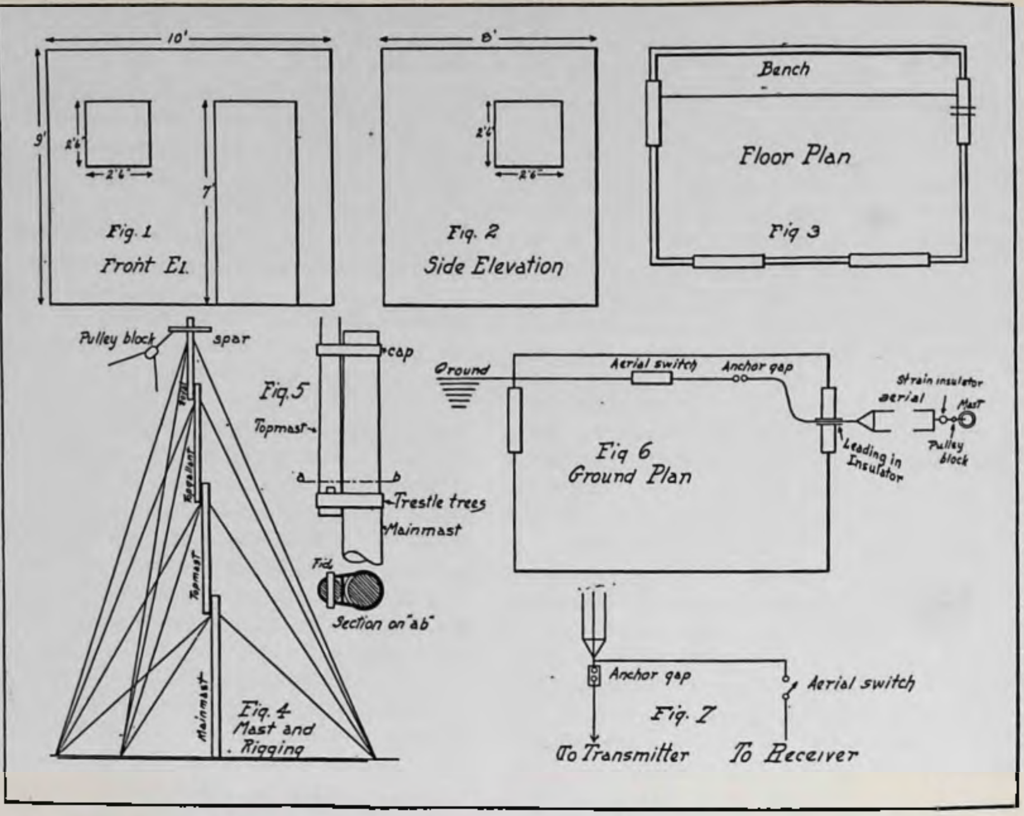
*The Cabin.*—Where it becomes necessary to erect a cabin the interior dimensions may be 8 ft. in width, 10 ft. in length and 9 or 10 ft. in height. The foundation for the building should be substantial and the structure may be built of either wood or concrete—the latter material being the more preferable. The roof may be of wood, slate or other material which will insure its being water-tight.

In order to properly light the interior of the station a large window should be placed in front and on each side of the cabin, and, finally, a small vestibule may be built at little additional expense; it will be well worth while, since it will serve as a protection against rain and dust, both of which are detrimental to the proper working of the instruments. Figs. 1, 2 and 3 show the front and side views and floor plan, respectively, of the cabin.

When the apparatus is installed on board ship, the operating cabin may be built on the upper deck either fore or aft or between the foremast and the mizzenmast, or it may be placed between the upper deck and the next one below.

A substantial bench for the instruments must be built up and secured to one of the walls of the cabin, preferably the rear one. A few drawers beneath the bench will be found a convenient place for tools and instruments which may be required for repairing and adjusting the instruments.

*The Mast.*—Where stations are erected on shore the mast is preferably made of wood, though iron or steel is largely used. The height of the mast must be commensurate with the distance over which it is proposed to signal, and this depends again upon the power of the sending apparatus. Roughly, the law of transmission is, assuming other things




to be equal, that the effective distance varies directly as the square of the mast height.

A mast may be of any height up to 200 ft. If under 130 ft. it should be joined of two sticks; under 170 ft., of three sticks; and over 170 ft., of four sticks, when it will comprise a lower mast, top-mast, top-gallant mast, and a royal mast. These sticks are set in fids or shouldered cross-trees of wood passed through a square mortise near the heel of the top-mast, top-gallant mast and royal mast to hold them in place. See Fig. 2.

To properly sustain the mast where the height is less than 130 ft., three sets of rigging will suffice; but for greater heights, four sets of rigging will be required in order to insure a sufficient safety factor. The rigging may be of hemp rope, steel cable or wire; where either of the latter strain, insulators should be spliced in at intervals. The braces must be well sunk in the ground, and if the mast is erected on a sandy coast it will be necessary to sink these 15 or 20 ft. deep at least.

Where a single mast is used to support the aerial a yard-arm or long slender spar is suspended from the royal mast and to the end of the former a pulley-block is secured. If the mast is on board ship the yard-arm need not be used since the aerial can be strung directly between the top of the masts. If other wire rigging of the ship is strung near the aerial there will be considerable losses due to induction, and hence the former must be changed to hemp rope or insulated by means of hemp lanyards. Where a single mast is used it should be placed 50 or 100 ft. away from the station, and where two masts are employed for a T aerial, the station should be located midway between them if this is possible.

*Leading-in Insulators.*—The aerial wire is insulated from the masts by strain insulators made of hard rubber or composition. The rat-tail of the aerial is led through the window of the cabin by means of a hard rubber insulator, and from this it connects to what is termed an *anchor-gap*, a little spark-gap which automatically connects the high tension circuits of the transmitter with the aerial wire when messages are being sent and to insulate the transmitter from the receptor when the incoming waves are being received.

*Arrangement of the Apparatus.*—The transmitting apparatus should be, preferably, located on the right hand side where the aerial wire enters the window—and the receiving instruments on the left of the bench. Where an induction coil is used it may be placed either on the rear of the bench or it may be attached to the wall. If a transformer is employed it will be more convenient to set it under the bench. The aerial switch should be placed between the sending and the receiving aerial.

The aerial is connected to one side of the anchor-gap, as shown in Fig. 7, and from this side a lead runs to the aerial switch. The opposite side of the gap is connected direct to the transmitter, while the transmitter and receptor are grounded by means of the earth plates, or with the hull of the ship by means of a flexible cable, and this need not be insulated from the woodwork of the cabin.

## Plating Tanks and How to Improve Them

Twenty-five years ago plating tanks were built of soft, white pine and the sides and bottom were each of one piece with a knot in them, says a writer in the *Brass World*. When mortised and put together with white lead in the joints they would need little if any lining to keep them tight. Today this quality of lumber is very high in price and exceedingly difficult to obtain. It has become so scarce that other woods have replaced it, and cypress is now the material most extensively employed for the manufacture of such tanks. It has practically replaced pine. It is not as satisfactory as pine, however, as the sides of a tank are usually made of two or three sections, and they must be lined with coal tar pitch or asphaltum to prevent their leaking, and even then they frequently cause more or less trouble from leakage.

Plating tanks made from poor lumber or old tanks that leak badly may be lined with wire-cloth tacked on 3/10 in. strips of wood nailed on the sides of the tank. These strips serve to raise the wire cloth away from the tank. Good cement is then plastered on the wire gauze to a thickness of about 3/4 in. The cement should be made of a mixture of two parts of sand and one part of cement, mixed dry and then wet down until a stiff mass is produced that will adhere to the sides of the tank and the wire cloth.

After drying thoroughly it is advisable to give the cement a thin coating of hot coal-tar pitch so as to render it waterproof. If desired, cheap cement tanks may be made by running the cement into moulds, and if reinforced with wire cloth or expanded metal it need not be over 2½ in. in thickness. Use the same mixture as previously given (two parts of sand and one part of cement,) but thin down with water until it can be poured. These tanks should also be lined with hot pitch after drying.

For hot cyanide solutions, such as those of copper, brass, and bronze, tanks of boiler iron are the cheapest in the end, as they will not rust when such solutions are used in them and will last for many years.

## How a Magneto Makes Electricity

(*Continued from page* 309)

the greatest possible number of lines of force through the coils of the movable conductor. In Fig. 10, the armature has been displaced through 45 degrees, and shows in what manner the lines of force, which extend from one magnet pole to the other, are distorted and tend to follow the direction of the main body of metal.

Almost all the lines which traverse the armature in Fig. 9 still do so in Fig. 10, and therefore there has been no very appreciable electric pressure induced in the conductor winding, since a current depends for its induction upon a cutting of the lines of force. Between the positions shown in Figs. 10 and 11, however, all of the lines which are shown as traversing the armature and its winding in Fig. 10 have been caused to assume new courses and leave the armature winding without lines of force running axially through it. At this point, Fig. 11, the cutting of the lines of force by the coil has been extremely rapid, as is readily seen, and an electric pressure has been induced in the conductor winding.

(*To be continued*)

# WIRELESS NOTES

Boston, Mass.

Editor of *Electrician and Mechanic*.

Dear Sir: I am enclosing a photograph and description of my wireless station. The aerial is 65 ft. long and 75 ft. high, consisting of a 25 ft. steel mast and 7 No. 18 copper wires.

In the centre of the photo is the antenna switch. On the left of this is the sending and on the right is the receiving. The helix at the extreme left is 10 in. in diameter and 10 in. high, containing 27 ft. of No. 4 wire. On top of the helix is the spark gap. The plugs of the gap are nickel-steel ¾ in. in diameter. The spark coil is of the wireless type made by E. S. Ritchie & Sons, giving about ½ in. fat spark. The sending condenser is composed of 20 5 x 7 photo plates and tinfoil. The whole condenser is sunk in oil and is of three capacities. The current for the coil is supplied by 12 Columbia dry cells in series.

The receiving consists of a receiving transformer at right, such as is made by the Long Distance Co. The detectors are silicon and perikon. Under the silicon detector is the fixed condenser. Next the receiving transformer to the left is a variable condenser of 4 x 5 plates with tinfoil on both sides. The phones are Western Electric Co.'s 1,000 ohms.

With this set I have been able to get Cape Hatteras, N.C., 570 miles; Eastport, Me., 290 miles, and have been able to send about 7 miles. I have made all apparatus with the exception of the spark coil, phones and switches. All the woodwork is of mahogany. I get *Electrician and Mechanic* every month, and I think it is a very helpful magazine to the wireless experimenter. Call "QF"

Yours respectfully,
WILLIAM VAN BROCKLIN.

Wireless Station of Wm. Van Brocklin

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San Francisco, Cal.
March 10, 1911.

Editor of *Electrician and Mechanic*.

Dear Sir:—Enclosed you will find a photo of my wireless station which I would like placed in the wireless section of your magazine. The whole station is built according to the ideas of your periodical. The instruments from left to right are a 1,500 meter tuning single slide coil, a .0003 mfd. variable condenser, two detectors, silicon improved and galena, which give very good results, and a pair of 2,000 ohms receivers which is the complete receiving outfit.

The sending outfit comprises the double throw aerial switch which is seen near the detectors. The sending instruments are a small transformer coil seen in the picture operated on 110 volts. Next to the transformer is a double-pole single-throw switch for cutting off the currents from the key and transformer. I used an electrolytic interrupter, but I can get better results with one designed in your magazine. My spark gap is of zinc which gives good results, but I use no helix because I can get results without it.

I have tried to get several amateurs to send photos of their stations to arouse your section on wireless. As a magazine, I think it excels all others on the subjects of wireless, because its issues are edited by scientific authors. I am a reader of your magazine for two years, but not a subscriber, and a member of your Wireless Club. I think that your magazine will excel all periodicals if the wireless amateur get the merits that I have gotten out of your valuable periodical. My call is "HC." My radius in receiving is 500 miles; my radius in sending, 2 miles. Yours,

HANS CUNFERMANN.


San Francisco, Cal.

Editor of *Electrician and Mechanic.*

Dear Sir:—The photo shows my wireless receiving set which employs the instruments described in recent issues of *Electrician and Mechanic.*

The set is composed of the following instruments: doughnut transformer; rotary variable condenser (February, 1910, issue of *Electrician and Mechanic*); potentiometer; fixed condenser; two detectors of standard make, one is a peroxide-of-lead and the other a silicon, which is partly home-made; and various switches arranged to give the best results. The picture shows the parts very clearly; the variable condenser and tuning coil are in larger portion of case. I use this set as a portable most of the time, as it is only 15 x 15 x 9 in. and can be slipped in a case and carried anywhere; using the gas pipe for an aerial I can get all near-by stations, such as Mare Island, and can also hear the Poulsen station operating their wireless phone.

I have a compact transmitting set with which I can send about 7 miles.

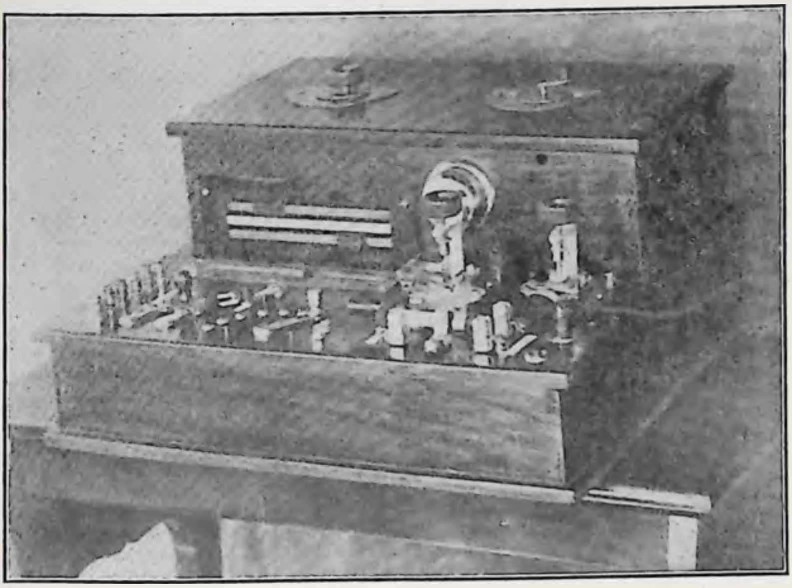
Respectfully,

HARDIN SANDERS.

The wireless station at Fort Riley, Kans., on which Mr. W. C. Getz was engaged for several weeks this summer, has been completed by Mr. J. S. Murphy, wireless engineer of the Signal Corps, and is in excellent shape. The station is at present equipped with a 3 k.w. transmitting outfit, and has a wave length of about 1,000 meters. The call letter is FZ.

The Sacramento, Cal., Wireless Club has elected the following officers: Elwood Rackliffe, president; William Archibald, vice-president; Louis Huber, secretary; Elwood Miller, chief operator; John Murry, assistant operator; Fred Strader, sentinel. The object of the Club is to stop all interference among government, commercial and amateur stations.

Conditions have been very favorable along the coast.



Hardin Sander's Receiving Set

The Manchester Radio Club, an amateur wireless association, has been organized in Manchester, N.H., with a membership of fourteen. The following officers were elected: president, Earl McKewin; vice-president, Clarence Richardson; secretary and treasurer, Earle Freeman. The object of the club is to further the art of wireless communication and electricity in general. Any information concerning the club may be obtained by addressing the Secretary at 759 Pine St. They will be glad to hear from any other clubs within or without the state.

EARL McKEWIN, Pres.
EARLE FREEMAN, Sec.

# CORRESPONDENCE.

As you have asked your subscribers to give their views, here goes. Am glad you are going to go in for aeronautics. I have dropped my automobile journal and was going to drop yours with the rest, in favor of some paper devoted to aeronautics. We are not *all* heavy on wireless. The article in September issue, on rubber motors was valuable. The article on cast iron brazing in a previous number was only interesting, as you were no wiser about doing a job after reading it than before. Give us some valuable as well as interesting articles. *With many others, here,* I would like to know what carbureters do they use on the aeroplanes? Are they able to adjust them for the different altitudes? Santos Dumont uses an opposed motor developing 1 h.p. for every 4 lb. or a little better; where did he shave the weight off. I have never seen any description of the wonderful little Gnome motor. One more thing: don't, like some, be afraid of taking trade away from the manufacturers, who I am grateful to, as I am fully aware that without their ads we could never have such a good little magazine as the *Electrician and Mechanic*. Several of us in the shop looked in magazines and planned the cheap auto we were going to build. Well, one has an E.M.F., another a second-hand Columbia; one has a Reo, and one has compromised on a Merkel motorcycle. It mostly winds up that way; besides you will find that the more valuable articles, the more subscribers and so better for your advertisers. Your pardon if I am long-winded. You asked for opinions. I have given mine.

S. SHIPP.

Fort Bragg, Cal.

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I see you want your old subscribers to subscribe for five years; hence, the enclosed five dollars. I have not received your paper for the last two months on account of freeze-up, but, expect to get them in a bunch when trails are good.

Some time during the following spring, will send for "Slide Rule," and other books that I have in mind. Last order got here O.K. just before freeze-up. No packages, except papers, magazines and first class are carried in over the ice. That is why I cannot order what I want now. In the spring as high as thirty tons of mail moves from White Horse, the head of navigation on the Yukon for down river points. Lots of mail is lost at that time. Our only time to get parcels is from May 15th to October 10th. If you ever have occasion to send me, or anyone in Alaska, books or packages, other than *Electrician and Mechanic*, rush the later orders in the fall so that they reach Seattle not later than September 15th, which is the last date the Post Office officials accept articles of that class for direct connections with the White Pass Railroad at Skaguay, Alaska.

Yours truly,
T. E. PHILLIPS.

Steel Creek, Alaska.

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I have been already and I am still subscriber to several technical magazines, but none has pleased me more than yours. I find therein the very thing I need, wherefore I am convinced that my interest will grow greater by the increased size of it and so I hope to remain for long years a true subscriber to your valuable magazine. The distance between your country and Java is great, but in our modern life with its rapid means of conveyance, no distance is too great; and hoping to receive therefore henceforth the numbers regularly, I remain,

Very truly yours,
F. LUDEURS.

Weltevreden, Java.

# HERE AND THERE

### Spotted Him

A chemist, who was for many years the manager of a concern in Massachusetts manufacturing various high-grade explosives, recently revisited the place of his former employment. During a talk with his old friends of the institution, he made inquiry with reference to a certain colleague by the name of Jenkins.

"By the way," said the chemist, "what has become of Jenkins? Fine fellow."

"Fine chap, indeed!" agreed the foreman, "and very skillful in the use of chemicals. But a little absent-minded—Jenkins. See that discoloration on the wall over there?"

"Why, yes; but what has that to do with Jenkins?"

"That is Jenkins."

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### Getting Even

"You know that fellow, Jim McGroarty, the lad that's a'ways comin' up an' thumpin' ye on the chest an' yellin', 'How are ye?' "

"I know him."

"I'll bet he's smashed twinty cigars for me—some o' thim clear Havannys—but I'll get even with him now."

"How will ye do it?"

"I'll tell ye. Jim always hits me over the vest pocket where I carry me cigars. He'll hit me there just once more. There's no cigar in me vest pocket this mornin'. Instead of it there's a stick of dynamite, d'ye mind!"—*Cleveland Plain Dealer.*

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Chick Sale has a bit of arithmetic which he springs on the patrons of Keith's, and which contains quite a little philosophy. When the curtain goes up on his act there is shown on the wall's blackboard, on which is written, "3 grins make 1 smile, 3 smiles make 1 laff, and 3 laffs make 1 happy."

### Good Scheme

"How do you manage to get customers to pay their bills so promptly?"

"I send out the bills by mail with an announcement that if they are not paid in ten days the collector will call with a megaphone.

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### The Demand for Civility

An irate old lady, the wife of a prosperous farmer on the outskirts of Philadelphia, stepped off a train in Broad Street Station, the other day, with a face like a thunder cloud. Any one could see in that scowling countenance the smouldering fire that might break forth at any minute. Stamping excitedly on the platform, she gnashed her teeth in a struggle to keep back the tears.

Finally, she buttonholed the first person that would listen to her tale of woe. "What's all this here talk of educating young men to be civil engineers?" she screeched, indignantly.

"What we need in this here country is more civil conductors and less sassy brakemen."—*Philadelphia Times.*

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### The Philatelist in Love

The normal young man is generally desirous of meeting a girl of the right stamp, yet the Figaro advertisement below wears the air of novelty:

"A collector of postage stamps, possessing 12,544 specimens, desires to contract a marriage with a young lady, also a collector, who has the blue Mauritius stamp of 1847. No other need apply.—*Youth's Companion.*

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The freshman class in trigonometry was reciting.

"And have you proved this proposition?" asked the "math. prof."

"Well," said the freshman, "proved is rather a strong word, but I can say that I have rendered it highly probable."

—*Everybody's.*

# PRACTICAL HINTS

## Clock Keys

FRED N. BLAKE

Clocks without removable keys are fitted with what may be called fixed keys, projecting through the backs and usually jointed, the object being to reduce cost and secure greater compactness. This folding key considerably reduces the ease of winding the clock because it is prone to slip from the fingers at every half turn and again assume its folded position.

After more than thirty years of wrestling with the jointed key it occurred to me that it could be kept in position for easy and rapid winding by soldering the joint, and considering the fact that clocks of the above class require winding every day it is well worth the small amount of trouble this simple improvement involves in order to make the daily winding easier and quicker.

## A Simple Air Moistening Arrangement

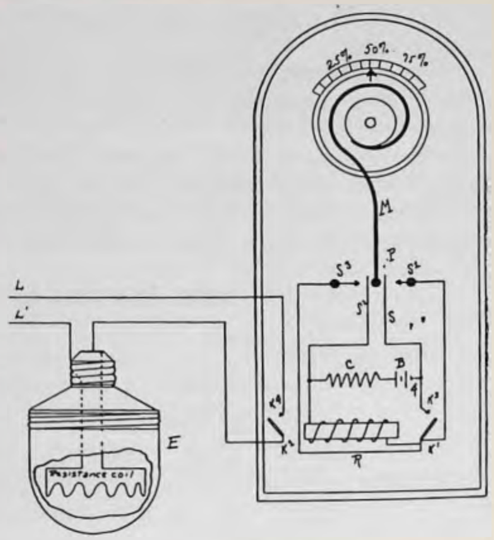
HENRY P. CLAUSEN

It is only during the past few years that the great benefit produced by having the air of living rooms saturated with a proper amount of moisture has been adequately appreciated.

There are, however, no appliances available which can be made to cheaply humidify the air of the room and require no special attention. Arrangements have been built consisting of a motor-driven appliance, in which water held in suspension by cloth vanes is evaporated by the surrounding air being set in motion when the fanning motor is in operation. Such devices, however, call for considerable attention and cannot be left to operate automatically.

The arrangement shown herewith, consists of a strip of material $M$, made from suitable substance, and operating so that when the air becomes dry the tendency is for the coil of material to move outward, resulting in the contact point $P$ striking the spring $S$ and closing the normally open circuit existing between the points $S$ and $S^1$.

Upon examining the diagram, it will be observed that we have the relay $R$, together with its contact points $K^1$ and $K^2$, provided with normally open front contacts $K^3$ and $K^4$. The battery $B$ is provided, as is also a resistance coil $C$.




When the air in the room becomes too dry, or sufficiently dry for causing the contact $S^1$ to close, relay $R$ is energized, causing the armature $K^1$ to be drawn up, closing upon itself through the following circuit: contact spring $K^1$, contact $K^3$, wire 4, battery $B$, wire 5, resistance coil $C$, and through the windings of the relay $R$ back to spring $K^1$. This locks the relay up in its operating position, and the contacts $K^2$ and $K^4$ being closed, results in the evaporating apparatus $E$ receiving current from the lighting mains $L$ and $L^1$, whereupon the water contained within the receptacle $E$ is evaporated by a suitable arrangement of resistance coils contained within $E$. The process of evaporation will continue until the air is saturated with a sufficient amount of moisture, which will be indicated by the contact piece $P$ moving to the left and closing the connections between springs $S^2$ and $S^3$, which, owing to short-circuiting, the winding of the relay $R$, causes the armature $K^1$ to drop away, and since the contact point $S$, $S^1$ is open, the relay will not again draw up its armature until the point $P$ moves over against spring $S$ and closes the circuit, as described above.

It is thus observed that the operation of this device is practically automatic. It is also to be observed that the purpose of automatically causing the relay $R$ to lock up its contacts is to prevent arcing of the current at contacts $S$ and $S^1$, and also between $S^2$ and $S^3$, for the movement of the indicator arm $M$ is naturally very delicate and a firm electrical contact cannot be expected to be obtained at the first approach of the spring, but as arranged it only requires a slight touch to cause the relay to draw up its armature, and likewise to release when the reverse movement of the arm $M$ takes place.

## A Simple Drill Press

JAS. P. LEWIS

Everyone who has tried it, knows the difficulty of drilling the harder metals when only a hand brace is available. Those who have not sufficient use for a drill-press to warrant the outlay necessary for the purchase of one, or like to make their own tools, can easily make a satisfactory one for light work, and the time saved in using it a few times will soon cancel the time necessary to construct it. Around almost every home there is part of an old useless lawn-mower and the gears necessary may be taken from this.

To a baseboard of 2 in. material 8 x 24 in. near each end about 12 in. apart is bolted two wooden uprights 4 x 4 in., and about 10 in. high. One of these uprights and one end of base is shown in cross-section at *b* and *a*, Fig. 1; the bolts are omitted. At the top of the inside face of *b* is bolted another block *d* 4 x 4 in. and 2 in. thick.

Referring to Fig. 1, which shows a cross-section view of the feeding device, etc., *c* is the main shaft taken from the lawn-mower, and formerly carried the knife or cutter, having small gear wheels or pinions at each end which engaged with the traction wheels usually by means of gear teeth cast on the inside of them. For a bearing for this shaft a rather long one will be necessary. A piece of iron pipe *f* 3 or 4 in. long and with an inside diameter just large enough for the shaft to turn in it freely, answers the purpose. This is mounted by boring a horizontal hole in *b*, near top, of such a size that the pipe may be driven in tightly. A small hole should be bored through *b* and this pipe from top for oil. To meet the inside end of this bearing through *d* and part of *b*, another hole is bored slightly larger than the outside diameter of *f*. *G* is another piece of pipe the same size as *f*, but threaded for its entire length. Except for a distance of 1 in. at the outer end it is filed flat along one side about half way through the pipe. Close to the flat side of this piece in *d* a spike or bolt *m* is

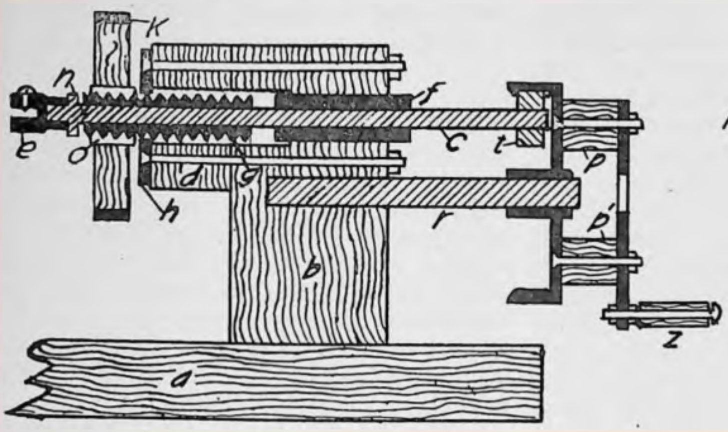



Fig. I.

Fig II



Fig III.

driven. All this is made clear by Fig. 2, which shows a cross-section view at right angles to the length of pipe and just back of *h*, *h* being a heavy washer or plate bolted to *d*. The purpose of the foregoing is to allow *g* to slide in and out along the shaft, but to prevent it from turning with it.

To make the handwheel, proceed as follows: Secure a circular iron ring *k* 6 or 8 in. in diameter, about 1/8 in. thick and with a 1 in. face. Such a ring may be taken from the hub of an old heavy wagon wheel. A block of hard wood *l*, 1½ in. thick with ends cut to the curvature of inside of ring is fastened therein by large wood screws passing through the ring into the block as illustrated in Fig. 3. A hole is then bored in the centre of this block large enough so that *o* may be driven in tightly; *o* being a 1½ in. length of pipe threaded on inside to take *g*, a coupling for pipe the size of *g* and *f* is the thing. This has opposite sides filed flat and two bolts pass through *l* close to these flat sides, and prevent it from turning in the block. This is also shown in Fig. 3.

In *b* at the right distance below *e* is sunk a piece of pipe or large bolt *r* of the correct size to serve as a bearing for the mower wheel or large gear wheel, the teeth of which must engage properly with those on the small gear *t* which is keyed to end of shaft *c*. Two blocks *p* and *p'* are bolted to this wheel to which is fastened the crank arm, and the handle *z*, which may be a 3 in. length of a broom handle turning on a bolt fastened at right angles to the crank arm. Unless the crank arm is placed to one side a hole will have to be bored in it in such a position that *r* may pass through easily when working with the wheel up close to *b*, as will be the case as the drill is fed up. A chuck *e* of some kind completes the press.

As will be seen when the hand wheel is turned up on *g*; bearing against plate *h*, it draws *g* out, the end of which bearing against the collar *n* as it turns, forces the shaft, chuck and drill up to the work which is placed against the other upright before mentioned. As *c* will turn five or six times to the crank's once, the drill will cut very fast.

Of course it might be better if *o* and *g* were of steel, but I have found the press works very well as described above.

If no gears are available a crank could be fastened direct to shaft *c*.

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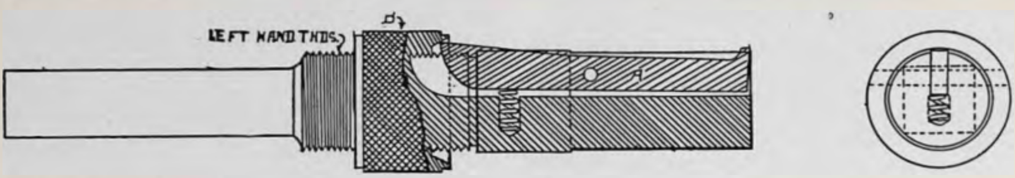
## Special Cutting Tool

H. D. CHAPMAN

The question of special tools has received careful attention by the readers of mechanical magazines. The line cut shows a very simple form of a slotting tool. This tool is used for cutting the keyways in small holes, such as worm wheels, etc., and is very easily made.

The tool itself is in the form of a lever with a hooked end *A*, which is pivoted in the body of the tool. The end of tool being the size of the hole in the job will prevent the spring of tool while it is being operated. After the tool has been pushed into the hole, the nut *B* is turned by hand and forces down the back end of the cutting tool *A*, at the same time. When the depth of the key has been gotten, the nut *B* is run back, thus causing cutting end of tool to clear the work and another job is then placed in the machine for the same operation.

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## Explosions of Lead

This is a common trouble which almost every mechanic has had at some time or other in his career. It always tries one's patience and not infrequently causes a severe burn. This trouble is caused when pouring lead around a damp or wet joint, the result being an explosion, blow-out or scatter from the effects of steam generated by the heat of the lead. The whole trouble may be avoided by putting a piece of resin, the size of a man's thumb, into the ladle and allowing it to melt before pouring.

## WORKSHOP KINKS

H. W. H. STILLWELL

### To Prevent Rust on Tools

To prevent rust on tools use Naseline, to which a small amount of powdered gum camphor has been added; heat together over a slow fire. This gives excellent results.

### To Cover Blow-holes in Castings

Blow-holes in castings are not only troublesome, but very unsightly, and unless covered, often mar what would otherwise be a fine piece of work. Many metals are used to fill these holes, some good and others not so much so. There is an alloy which has given excellent results in many cases and may be prepared in the following manner: 9 parts of lead, 2 parts of antimony, and 1 part of bismuth. This metal will expand upon cooling and in doing so will become secure in the blow-hole and may be machined or dressed off by hand to the required finish.

### Relative Weight of Metals

The weight of wrought iron being 1, cast iron will be .95; steel, 1.02; copper, 1.16; brass, 1.09; lead, 1.48. These figures may often be of value in figuring out many things in connection with metals.

### Weight of Castings

If you have a pattern made of soft pine, put together without nails, an iron casting made from it will weigh 16 lbs. to every lb. of the pattern. If the casting is of brass, it will weigh 18 lbs. to every lb. of the pattern.

### To Detect Iron from Steel

Aquafortis, applied to the surface of steel, produces a black spot; on iron the metal remains clean. The slightest vein of iron or steel can be readily detected.

### Solder for Metal, Glass and Porcelain

A soft alloy which adheres to metal, glass and porcelain and can be used in the same manner as soft solder, is prepared from finely powdered copper—copper dust—which is obtained by shaking a solution of blue vitriol with granulated tin. The solution becomes considerably heated and a fine brown powder is precipitated. Of this copper dust, 20, 30, or 36 parts by weight, according to the desired hardness of the solder, are mixed in a cast iron or a porcelain mortar with sulphuric acid of 185 specific gravity to the consistency of paste, and 70 parts of mercury added with constant stirring.

When the amalgam is thoroughly mixed, it is carefully washed with water to remove all traces of acid, and then cooled off. In ten or twelve hours the mass becomes harder than tin. When the solder is to be used, it is heated to about 1300 degrees Fahrenheit, and can be kneaded like wax in an iron mortar. In this plastic condition it is applied to the surface to be joined and the latter pressed together. After cooling, the solder is hard and adheres very firmly.

### Bluing

It is often desirable to blue small steel pieces to give them a color finish. This may be accomplished in a simple manner and at very little expense. Put core sand in a Babbitt ladle, heat hot, put work in, shake the ladle over the fire until the required color is obtained.

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Sir George Clarke, the governor of Bombay, in inaugurating a scheme to supply Bombay with 30,000 h.p. from a storage of reservoirs in the Western Ghats, protested against the ignorant croakers who belittled Indian progress and enterprise. The scheme, which is interesting as the greatest yet attempted in India, consists of damming the valleys in the Ghats for the storage of water power convertible into electric power. The dams will be 8,900 ft. in length and from 32 ft. to 70 ft. in height, creating lakes 2,521 acres in extent, with a capacity of 3,000,000,000 cubit ft., with a fall of 1,730 ft. The power output will be transmitted to Bombay, 43 miles away. The cotton mills will be the chief consumers. Not the least interesting feature is that the capital is exclusively Indian. It will be completed probably in 1913.

# QUESTIONS AND ANSWERS

Questions on electrical and mechanical subjects of general interest will be answered, as far as possible, in this department, free of charge. The writer must give his name and address, and the answer will be published under his initials and town; but, if he so requests, anything which may identify him will be withheld. Questions must be written only on one side of the sheet, on a sheet of paper separate from all other contents of the letter, and only three questions may be sent at one time. No attention will be given to questions which do not follow these rules.

Owing to the large number of questions received, it is rarely that a reply can be given in the first issue after receipt. Questions for which a speedy reply is desired will be answered by mail if fifty cents is enclosed. This amount is not to be considered as payment for reply, but is simply to cover clerical expenses, postage, and cost of letter writing. As the time required to get a question satisfactorily answered varies, we cannot guarantee to answer within a definite time.

If a question entails an inordinate amount of research or calculation, a special charge of one dollar or more will be made, depending on the amount of labor required. Readers will, in every case, be notified if such a charge must be made, and the work will not be done unless desired and paid for.

1581. **Wireless on Aeroplane.** E. A. S., Nashville, Tenn., says: Was very much pleased with the article on aeroplanes, and will be glad if you will describe to me, through the "Questions Answered" column, of the *Electrician and Mechanic*, how wireless telegraphy is accomplished on an aeroplane in flight, without a ground connection, giving diagram if possible. Ans.—This is accomplished by suspending a vertical wire from the machine for 40 or 50 ft., which forms the aerial. The "ground" is made by placing a wire netting on one of the planes in a horizontal position which acts as a "counterpoise" or "capacity ground" similar to that invented by Lodge, and utilized in the early Lodge Muirhead wireless system.

1582. **Wiring Diagram.** J. C. W., Topeka, Kans., asks: (1) Please give connections for the following instruments: loop aerial, double slide tuning coil, doughnut transformer, one fixed and two variable condensers, pericon detector, 1,000 ohm phones, potentiometer and battery, connected so that by means of D.P.D.T. switches either the tuning coil or transformer may be used. (2) Will a variometer work efficiently with a doughnut transformer? Ans.—(1) See diagram in article by Mr. W. C. Getz in January, 1911, issue. By connecting your outfit as shown in that diagram very efficient results may be obtained. Remember that you don't want to have any more apparatus than is needed, as each additional piece makes it all the more difficult for rapid work. (2) Yes, but it is unnecessary as no advantage is obtained in using both. The experimenter should realize that each additional instrument cuts down the efficiency and the nearer you can approach the simple loop-coupled circuit, the better it is to operate.

1583. **Condenser.** T. E. C., Indianapolis, Ind., asks: (1) Is a condenser any material aid to a wireless spark coil across the vibrator and in what way? (2) Why is a ground necessary from the positive side of a jump spark when it seems to work as well without as far as the spark appears. (3) Give diagram how to connect up a coil to 110 alternating current (coil has no vibrator). (4) How much amperes, etc., does it take to fill up two layers No. 14 B. & S. wire 18 in. long; also No. 10 gauge same as above. Ans.—(1) A condenser is usually made of tinfoil and paraffined paper, and is connected across the vibrator of the induction coil. It greatly increases the secondary spark length and absorbs the destructive spark at vibrator. (2) For wireless work the ground is as necessary as is the aerial, in order that the high frequency oscillations may be liberated. For automobile coils, it is necessary so that the spark be between the spark plug electrode as one pole and the engine cylinder as the other. Connect primary of coil, in series with adjustable resistance and the 110 volt A.C. mains, using fuses in the circuit. (4) No. 14 wire will carry 10 amperes safely without undue overheating. No. 10 wire will carry 20 amperes.

1584. **Current from Lighting Circuit.** L. M. B., McComb, Ohio, asks: (1) For current to run my wireless induction coil I use the lost current from the electric lights. I use a good ground and the positive line of the lights, which give me between 50 and 75 volts; the main current being 220 volts D.C. I will, of course, need another ground connection, but how far had it ought to be away from the former to be safe? (2) Do you think my way of getting current is at all practical? It is sometimes, especially in wet weather, very irregular, but then I use small water rheostats. Ans.—(1) This is both a very poor and dangerous way to obtain power, as it is impossible to tell at what time a ground or short circuit in the power line will cause a primary feed, perhaps severely injuring you. At the same time, the variation of current would make it nearly useless for wireless work. (2) No.

1585. **Morse Recorder.** C. H., New York, asks: (1) Kindly let me know if there is a book on "How to Build a Morse Recorder, where I can get it; and price? (2) How many ohms are there in a bell or buzzer coil? (3) How far can I receive with a silicon detector, one pair of receivers consisting of one 70 ohm and one 1,000 ohm receiver, an aerial, 4 strands of No. 14 aluminum wire, one pole 35 ft. high, the other 15 ft. high, and a tuner 14 in. long, 1½ in. core wound with No. 24 enameled wire. (5) How much greater would the receiving distance be with above apparatus with an aerial of 4 strands 100 ft. long, one pole 48 ft. high on a building six stories high, the other pole 15 ft. high? (6) How can I tell if I have a 1,000 ohm receiver? Ans.—(1) J. H. Bunnell & Co., 20 Park Place, New York City, will supply you. (2) Usually about 4 ohms. (3) See article by Mr. W. C.

Getz in February, 1910, issue of this magazine. The 75 ohm receiver is useless for wireless work. (5) See answer to No. 3. (6) Take it to a telephone office and get the wire chief to measure it for you with his test set.

1586. **Commutator.** O. E. H., Baltimore, Md., asks: Kindly tell me where I can buy a commutator similar to the one described by Stanley Curtis in the January issue. Ans.—The author of this series of articles is preparing sets of parts for the apparatus described and his announcement appears on our advertising pages. We would suggest that you write to him.

1587. **Lightning and Antenna.** K. C. P., Buchanan, Mich., asks: Will you please tell me how to connect up my antenna with a lightning cut-out? I wish to have a switchboard with my antenna switch and lightning cut-out on it. Ans.—We should advise you to use the form of protection from lightning which has been described several times in past issues. This is essentially a 100 ampere single-pole, single-throw knife switch on the outside of the building where the aerial lead-in enters. One side of this switch is connected to the aerial while the other side is connected with a ground wire (No. 4), which runs down the side of the building and forms a good ground. When a storm approaches, the switch is closed, thus cutting out the instruments and forming a direct path from aerial to ground. Lightning plays peculiar tricks at times, and it is desirable to dispense with its presence entirely on the inside of the building so far as is possible.

1588. **"Tomato Can" Battery.** H. C. B., Langdon, Kan., asks: (1) How many "tomato can" batteries will it take to charge a 6 volt, 60 ampere hour storage battery? (2) The cheapest and best primary battery with which to charge a 6 volt storage battery? (3) The best way to renew old dry batteries? Ans.—(1) We presume you are referring to the simplified form of Bennett cell, sometimes known as the "tinpot" battery. This cell has an e.m.f. of rather less than 1 volt. The current available will depend somewhat upon the construction you use. Ten cells in series will give you a sufficiently high voltage, and if you require a heavier charging rate, requiring less time, you may connect several sets in multiple, using ten cells in series in each set. (2) The battery you suggest is cheap and very useful for the purpose Gravity cells may be used, and they are also cheap, both in construction and maintenance. The same directions apply to them, and the multiple connection is almost imperative in this case as the internal resistance of the gravity cell is high. (3) Punch the zinc cover full of holes if a subsequent "wet cell" is not objected to, and immerse the dry cell in a jar containing a saturated solution of sal-ammoniac and water. If the cell is to be kept "dry," remove the sealing compound from the top of cell, taking care not to break carbon, and pour the solution down into the interior, allowing it to sink in, and keep up the process until the contents are saturated with the fluid.

1589. **Power of Two Cycle Motor.** L. W., St. Louis, Mo., asks: I wish to know if the gasoline motor described in the January number is strong enough to run the generator described by Stanley Curtis in the same issue? Ans.—The power of the engine described is barely ¼ h.p., therefore it is not powerful enough to run the dynamo mentioned. An engine of 1 or better 2 h.p. would be more suitable if the machine is to do practical work. See article by Mr. Curtis in this issue.

1590. **Transformer.** H. M., Portland, Ore., sends us a sample of sheet iron punchings which were evidently intended to be used as the core for a ring armature. He has 64 such pieces and wishes to know if he can use them as the core of a small step-down transformer. Ans.—Certainly you may use the punchings for this purpose but the capacity of the transformer will be small on account of the small size of the core. The iron is .014 in. thick, therefore the core when built up will be about .9 in. high. Insulate the punchings by dipping them in varnish and bind them together with tape. For the primary wind on 1,000 turns of No. 26 d.c.c., and over this wrap a layer of tape. For the secondary use 100 turns No. 16 d.c.c. and bring out taps from every tenth turn. This will give you any voltage from 1 to 10. The device may be used for ringing bells or lighting just a few small tungsten lamps. The primary will heat up and burn out if it is required to carry more than .25 ampere for more than a few minutes at a time.

1591. **Spark Coils in Series.** L. N., Johnson City, Tenn., asks: (1) If he can get an 18 in. spark by using three sets of battery and three 6 in. induction coils. (2) The necessary articles for a 1,000 mile receiving and sending station. (3) Can we refer him to some books which will tell him how to construct such a set? Ans.—(1) Three coils may be connected with their secondaries in series and the spark length increased to approximately three times the length of one of the coils. The primaries should all be connected in series and a single independent interrupter should be included in the circuit. The enormous voltage induced, however, would be likely to break down the insulation unless the coils were built to stand it. In such a connection, the primaries and secondaries must be "poled" correctly, particularly if the coils are placed side by side. This may be determined by a test or by tracing the direction of the windings. (2) Our magazine contains a very complete series of articles by Mr. Guilford on such a receiving set in the February, March, April and May, 1910, issues. We will supply these on receipt of ten cents each. (3) Twining's "Wireless Telegraphy and High Frequency Electricity" covers the subject in a simple and thorough manner. We will be pleased to supply you with a copy for $1.50.

1592. **Storage Battery Charging.** R. H. D., Guilford, Conn., asks: (1) Would the transformer described in the January issue be a practical means of charging storage batteries for ignition and auto lighting purposes? (2)

Could the rectifier described in Mr. Stanleigh's article be used on large motors of 2 or 3 h.p.? Ans.—(1) Yes, the transformer in connection with the rectifier would do the work. (2) The rectifier is not practicable for such heavy work as this.

1593. **Six-Inch Induction Coil.** H. M., Natick, Mass., asks: (1) Would not the vacuum method described in his communication to us be a better method to pursue in building the 6 in. coil described in Mr. Stanleigh's articles than to merely boil the sections in paraffin? (2) Is enameled wire better than single silk for secondary, and should the enameled be wound dry or be run through paraffin? (3) If micanite tube were used instead of paper and fiber, what would be the requisite thickness of walls? Ans.—(1) Mr. Stanleigh states in his article that the vacuum method is far superior to the one suggested, but that it is scarcely within the scope of the average amateur builder. Your suggestion is good, but we think you will have some difficulty in securing an air-tight joint where the rod which supports the sections, passes through the top of container. It is worth trying at any rate. (2) Enameled wire is far better than silk-covered as the same number of ampere turns can be placed in about one-half the space. This brings the wire nearer to the core. It is difficult to handle, especially in the very fine sizes, as it is sometimes hard-drawn wire and kinks are difficult to avoid. In winding, rewind wire on another spool with very little tension so as to form a loose winding. Immerse this spool in hot wax for an hour. Do not wind until cold. Run wire on former over flame. This method carries more wax on the wire than any other. The method of winding dry and immersing afterwards has the drawback that the wire is too tight in the section and trouble is likely to be experienced later on account of contraction and expansion. If wire is wound with little tension and a layer of paper inserted frequently, the method is very satisfactory. (3) A micanite tube should be from $\frac{3}{16}$ to $\frac{1}{4}$ in. thick, depending upon amount of wax insulation between inside turns of section and tube.

1594. **Engine Power.** W. M., Oxford, Mass., asks: (1) How to find the h.p. of a gasoline engine? (2) What is the scheme of the compressed-air-tank water supply for country houses? (3) What will be the available capacity of a 30 gal. tank pumped to a pressure of 80 lbs.? Ans.—(1) The only accurate way is to apply a Prony brake, measure the speed, get the torque in foot pounds, and then apply the simple formula that the h.p. equals 6.28 times the revolutions per minute times the torque, divided by 33,000. A fair method is to drive a dynamo with the engine, and from the electrical output, with a guess at the efficiency of the generator, to estimate the approximate power delivered to it by the engine. (2) It would be well for you to address the Lunt-Moss Company, of Boston. In general, you should put the tank in a place where there is no danger of freezing, and should have a safety valve on the tank, and a relief valve on pump, so that when desired pressure is reached, the engine will run almost idly. (3) About the most practicable variations are between one-third full and two-thirds full. Your tank is pretty small for satisfactory operation. 200 gal. capacity would allow none too great leeway in pumping.

1595. **Wiring.** R. W. B., Lawrence, Kan., asks: (1) What book is on the market that gives more complete directions for wiring a large building than Cushing's Manual? (2) What should be the winding for the 20-light dynamo described in Trevert's "How to Make Dynamo Electric Machinery," if a 16-tooth armature is used in place of the smooth core? Slots are $\frac{3}{8}$ x $\frac{5}{8}$ in., and 110 volts are desired, speed being 2,000 revolutions. A compound field winding is desired, full load voltage being 115. Ans.—(1) The Correspondence Schools publish excellent books on the subject. Also, you can often get trade publications, as from the Condit Electric Co., of Boston, or of the Factory Mutual Fire Insurance Co., office being in same city. (2) There is no danger of getting the teeth too slender—the more so the better. They do not heat, though they will induce heat in solid pole pieces. Insulate the slots with at least two thicknesses of varnished cambric, such as "empire cloth." Wind five turns per layer, and four layers for each half of the winding, of No. 16 d.c.c. wire. If you are familiar with armature winding, and can adapt it for 32 commutator segments, instead of 16, the operation will be much better. About 25 lbs. of No. 21 s.c.c. wire for the shunt portion, with very thin paper between layers, and 8 lbs. of No. 9 wire for series portion, one-half these amounts being placed on each spool. We might call your attention to one error in the design of this machine. The two bolts that hold the structure together should not extend into the base, for there they would short-circuit considerable of the field magnetism. Attach the pole pieces to the hollow brass blocks by means of short internal bolts, and similarly attach the blocks to the base by bolts put up from beneath. The long bolts can then extend merely through the top block, the round cores and terminate in the upper portions of the pole pieces.

1596. **Induction Motor.** J. R. E., Christianburg, Va., refers to the machine about which we gave an answer (No. 1210) in the January, 1910, number, and states that he has finished the motor, that he puts 165 turns of No. 21 wire on each spool, and that the machine runs with a very vigorous torque The stator keeps properly cool, but in five minutes the rotor gets very hot. He used only the natural oxide, or rust, that was on the punchings. What is the cause of so much heat? Ans.—We are glad that you have met with success in the construction of the stator. That is usually the more difficult part. You did not state what sort or size of end connections for the rotor rods you used, and it may be that they are insufficient in cross-section, or are imperfectly connected. If you have slotted the ends of rods, the cuts should be at least ½ in. deep, and a ring of sheet copper ⅝ in. to ¾ in. wide and 3/64 in. thick should be thoroughly soldered in, dipping the entire ends in a pot of melted solder. The current that may pass through these end connections readily reaches several hundred amperes. If you have used copper discs similar to many regular makes, they should be 1/16 in. thick, and two at each end used in place of one. They should be the same in other dimensions as the iron discs; let them be 1/16 in. or ⅛ in. apart, to improve the character of the soldering. Unless you use asphaltum varnish on the iron sheets or separate them with tissue paper, there will be considerable heat from eddy currents.

1597. **Small Dynamo.** G. C., Upper Sandusky, O., sends a sketch of a machine that he proposes to build out of home-made materials. Eight slender bundles of iron wire are wound with copper coils and attached, parallel to the shaft, to a central wooden hub. Four iron wire field cores are provided by bending the ends at right angles, so as to come close to the ends of the revolving member. He asks if the design is practicable? Ans.—For direct currents, we should say, no. If, however, you use eight field members, and terminate the armature winding in two rings, you will get a simple alternator. In that case, the field must be separately excited. It would be well for you to look up, in some older books, the original construction adopted by Gramme for his ring armatures. You can follow his methods, and get a fairly good working machine. Still, sheet iron, with or without slots, can be readily procured for small dynamos at reasonable prices, and we doubt if you can do better than to get it. Its use will greatly economize the amount of field wire required.

1598. **Lighting Plant.** To P.W. B., New York, N.Y. In a large office building the electrical equipment is ordinarily with direct current machinery, on the simple two-wire system. Sometimes there is a storage battery adjunct, but more often there would be a "breakdown" connection with the city lighting company. Incandescent lamps would comprise the principal part of the load, but arc lamps would be of the multiple sort, and connected to the same circuits. Electric elevators might be used, but operated from separate engines and dynamos. A host of small motors, for most miscellaneous purposes, would be found. The only way that might be open to you to secure employment in such a place might be to advertise your wishes in some of the electrical papers. Your name and address could be kept as secret as you please.

1599. **Toy Motor.** R. C. G., Onaway, Mich., sends a sketch of a motor with armature 1¼ in. long, 1¾ in. in diam., having 8 round holes, each ⅜ in. in diam., and adapted for a 4 segment commutator. Field magnet is of the Edison type, but made of sheet iron, winding space being ½ x 1¼ in., and 1 5/16 in. long. What series winding should be used to give a speed of 2,000 revolutions, with current from 5 or 6 dry cells? Ans.—No. 21 on armature and No. 18 on field will be fairly good and convenient to wind, but we doubt if you can get the proposed speed without using twice as many cells. It would have been better to have 8 commutator segments.

1600. **Sounder.** G. M. S., Griswald, Ia., asks: (1) What is the winding on such an instrument for 4 ohms? (2) Where can permanent magnets or the steel for them be obtained? Ans.—(1) 10 layers of No. 24 s.c.c. wire on each core; 47 turns per layer; 940 turns in all. (2) From Hermann Boker & Co., 101 Duane St., New York, but this firm has also offices in Chicago, Boston and Montreal.

1601. **Induction Coil.** J. E. M., Chicago, Ill., asks: For directions for making such a one as is used for telephones. Ans.—For the "magneto" system the standard construction was as follows: the core is a bundle, 4 in. long and 9/16 in. diam., of No. 24 B. & S. gauge Swedish iron wire; a tube of thin fiber holds these wires together, and square fiber heads are glued on. The winding consists first of two layers of No. 20 single silk-covered wire, amounting to about 200 turns. This serves as the primary. Just inside the head through which the wires are led out, two No. 34 silk-covered wires are soldered, this being merely a device to secure a reliable fastening, and to economize the number of terminals to be cared for in the hook-switch arrangements. Several layers of varnished cambric are then wound on over the primary, and 1,400 of these double wires wound on, the result being nearly the same as if a single No. 31 wire was used. Resistance of primary is about .38 ohm, and of secondary about 75 ohms. For the common battery system the primary coil is wound with finer wire, having 1,700 turns, and a resistance of 17 ohms, while the other,—it is really a matter of dispute which is the primary and which the secondary,—has 1,400 turns but only 30 ohms resistance.

1602. **Woodworking.** J. B., Baltimore, Md., asks: Please let me know as soon as possible through your valuable magazine the name of the wood used in the manufacture of buggy and wagon tops. Also wood used for making chairs. Also explain how it is shaped and formed. Ans.—Straight-grained hickory, ash or other fibrous and tough wood. To bend, the wood is steamed or placed in boiling water, until pliable and bent around nails driven in the floor, being allowed to cool and dry in this position, when the bend will be permanent. For small pieces, two hours in a wash boiler of boiling water will be sufficient.

1603. **Fire Underwriters' Code.** W. L. R., Mitchell, Ill., asks: What is the address of the Board of Fire Underwriters having jurisdiction in my territory and do they publish a National Electric Code, and what is the price of same? Ans.—The board of underwriters controlling your district may be reached by addressing Board of Fire Underwriters, 207 E. Ohio St., Chicago, Ill. They will furnish a pamphlet on rules and regulations.

## TRADE NOTES

The Manhattan Electrical Supply Co. have recently issued a circular describing their Signal Horn, which is suitable for use on auto or boat. The tone is said to be high-pitched and clear, which features give it great carrying power. The construction is strong and durable, and the horn is built to stand hard usage. The descriptive circulars will be sent to any reader upon request.

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We are in receipt of catalog E from the Carlyle Johnson Machine Co., Manchester, Conn., which describes the Johnson Friction Clutch. The catalog calls attention to the numerous valuable features embodied in this clutch. A glance at the half-tone illustrations in the attractive booklet offers convincing evidence of the simple, rugged construction. One striking feature is the small number of parts used and the entire absence of bolts, nuts, links, etc. All working parts are encased, thereby being kept free from dust and dirt. The exterior of the case is smooth and round and there are no projections which are so often a source of danger. The tension is quickly adjusted with one screw. These clutches are made both single and double and are especially adapted for driving high speed machinery, such as is used for woodworking and manual training equipments. The company will be glad to send a copy of their catalog to any interested reader on request.

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We take pleasure in calling our readers' attention to the excellent line of electrical instruments offered by the Mohawk Electric Co., Albany, N.Y. This line includes bell-ringing transformers, rectifying sets for charging storage batteries from alternating current circuits, hot-wire ammeters and voltmeters and current-saving devices for moving-picture arcs. The importance of the hot-wire meter in connection with wireless sets has been fully brought out in our Wireless Department in recent issues, and present or prospective owners of stations of either high or low power will do well to investigate the merit of the Mohawk Company's instruments One distinct advantage of the hot-wire meter lies in the fact that its readings are equally accurate on either direct or alternating currents and the readings are totally unaffected by the near-by presence of magnetic fields which would cause great inaccuracy in the type of instrument whose action is dependent upon electro-magnetism.

Among the current-saving devices manufactured by this company, the "Transarc" is most efficient. The advantages of the step-down transformer in the field of motion-picture projection are recognized by leading managers in theatres where alternating current is employed. The "Transarc" is built to meet the exacting demands of such service, and it will save many times its cost in the course of a year. A choke-coil, listing at a lower price than the transformer, is sold by this company, and, while it does not show the efficiency of the "Transarc," still it is many times better than a rheostat would be under similar circumstances. The various descriptive circulars will be sent to interested readers on request.

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We are in receipt of advices from the Foos Gas Engine Co., Springfield, Ohio, to the effect that on March 22d they shipped to the U.S. Government two Foos engines for use in operating one of the dams in the river improvement work near Wheeling.

These engines are designed along the lines of their heavy duty Vertical Multiple Cylinder type, consisting of three cylinders each of 100 h.p. capacity.

They are part of the order received from the U.S. Government and turned out by the Foos Factory for the above purpose and will be installed at Dam No. 8.

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Emmelmann Brothers Manufacturing Company, Indianapolis, Indiana, have sent us a copy of their "Catalog C," describing their gasoline soldering iron and blow torch. The results attained in the invention of this tool are the culmination of many years of experience, and with its use, the old-fashioned fire pot and soldering iron are done away with. The tool has entirely contained within itself all the elements of heating unexposed to cooling draft or blast of wind, and it requires no pump platinum coil or other appliances in its operation. Cost of operation is said to be very small with a high degree of heat. The Company will be pleased to send catalog and price list to those who are interested.

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## BOOK REVIEWS

*The Wireless Operators' Pocket Book of Information and Diagrams.* By Leon W. Bishop. Lynn, Bubier Publishing Company, 1911. Price: cloth, $1.00; leatherette, $1.25; leather, $1.50.

The purpose of this little manual is to satisfy the desires of the wireless operator and of those experimenters who have already some knowledge of wireless phenomena, and who wish for a practical book more suited to their needs than the many elementary ones which deal mostly with the construction of simple apparatus or the elaborate technical and mathematical treatise which presuppose a technical education to understand them. Although some acquaintance with wireless apparatus is expected, it has been the author's intention to give enough of the theory of the circuits and of each piece of apparatus so that anyone interested may understand it and its workings. The book contains 150 illustrations of apparatus and circuits, and besides the full descriptions of complete modern transmitting and receiving sets, it gives cuts, abbreviations, message forms, and a call book of all American stations, both government and commercial. A chapter on wireless telephony is included and a glossary of wireless terms. On the whole it is a very interesting pocket book for every one interested in the subject.

## BOOKS

I.C.S. AND A.S.C. SETS and odd volumes of books on engineering, wireless, mechanics, shop-work, etc., new and second hand. Few I. C. S. scholarships for sale. Bargain. GEORGE F. WILLIAMS, Box 408, New Orleans, La.

## MISCELLANEOUS

MOTORCYCLES, New and Second Hand; MOTORS, Castings and Accessories. Our Attachable Motor Outfit converts any bicycle into a motorcycle at small cost. Write for catalog and bargain list. SHAW MFG CO., Dept. 32, Galesburg, Kan. (7)

AUTOMOBILE for sale. Locomobile Steam Runabout. A bargain for someone. Price, $35.00. F. L. NIXON, Malta, Ohio. (s)

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WANTED—Second-hand spectacle lens measure. Geneva or Reisner make preferred. State make and price. Address, J. A. S., 3619 California Ave., Allegheny, Pa. (s)

C. L. PARKER, Patent Attorney, Ex-examiner, patent office, 952 G St., Washington, D.C. Inventor's handbook "Protecting, Exploiting and Selling Inventions" sent free upon equest. (4)

FOR SALE—Moving Picture Film, 1 cent per foot. H. DAVIS, Watertown, Wis.

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Wireless Telegraphy and Telephony Popularly Explained.......................... 1.08

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Principles of Electric Wave Telegraphy. A comprehensive digest of wireless telegraphy in all of its branches. One of the most complete and practical books ever published on this subject.......................... 6.60
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Wireless Telegraphy and Telephony, enlarged and reprinted............................ 1.14

**HARRISON, NEWTON, E.E.**
Making Wireless Outfits.—A concise and simple explanation on the construction and use of simple and inexpensive wireless equipments, for sending and receiving up to 100 miles, giving full details and drawings of apparatus, diagrams of circuits and tables. 12 mo. cloth, 50 cents; in paper covers...................................... .25
Wireless Telephone Construction.—How to make and use an inexpensive equipment. cloth, 50 cents; paper,.................. .25

**TWINING, H. LaV., A.B.**
Wireless Telegraphy and High Frequency Electricity.—A most complete manual containing detailed information for the construction of transformers of from 100 watts to 5 kilowatt capacity; wireless telegraph and high frequency apparatus, with chapters on their theory and operation. 1909... 1.50

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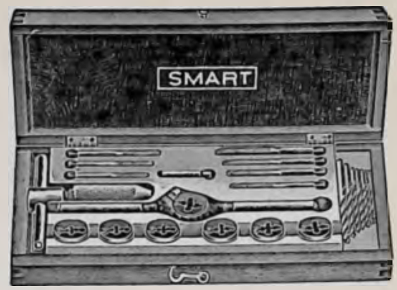


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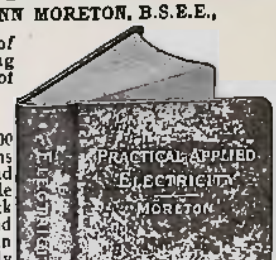


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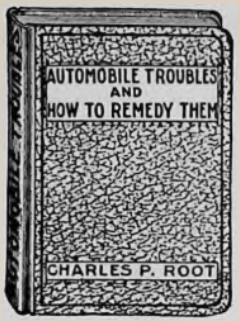


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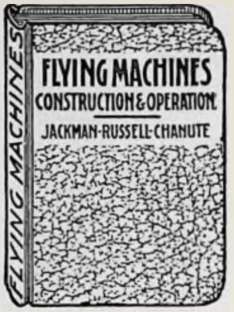


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