

THE SELF-TAUGHT  
CONCRETE MANUAL  
OF CONSTRUCTION

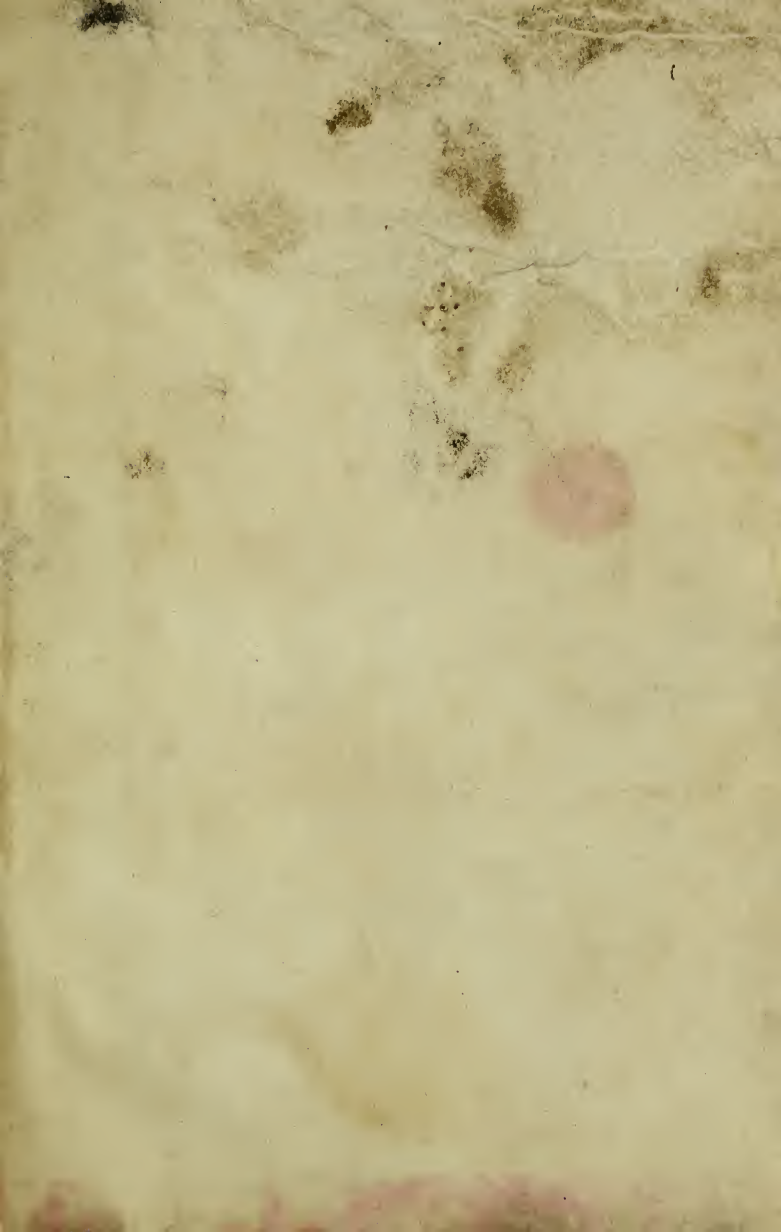


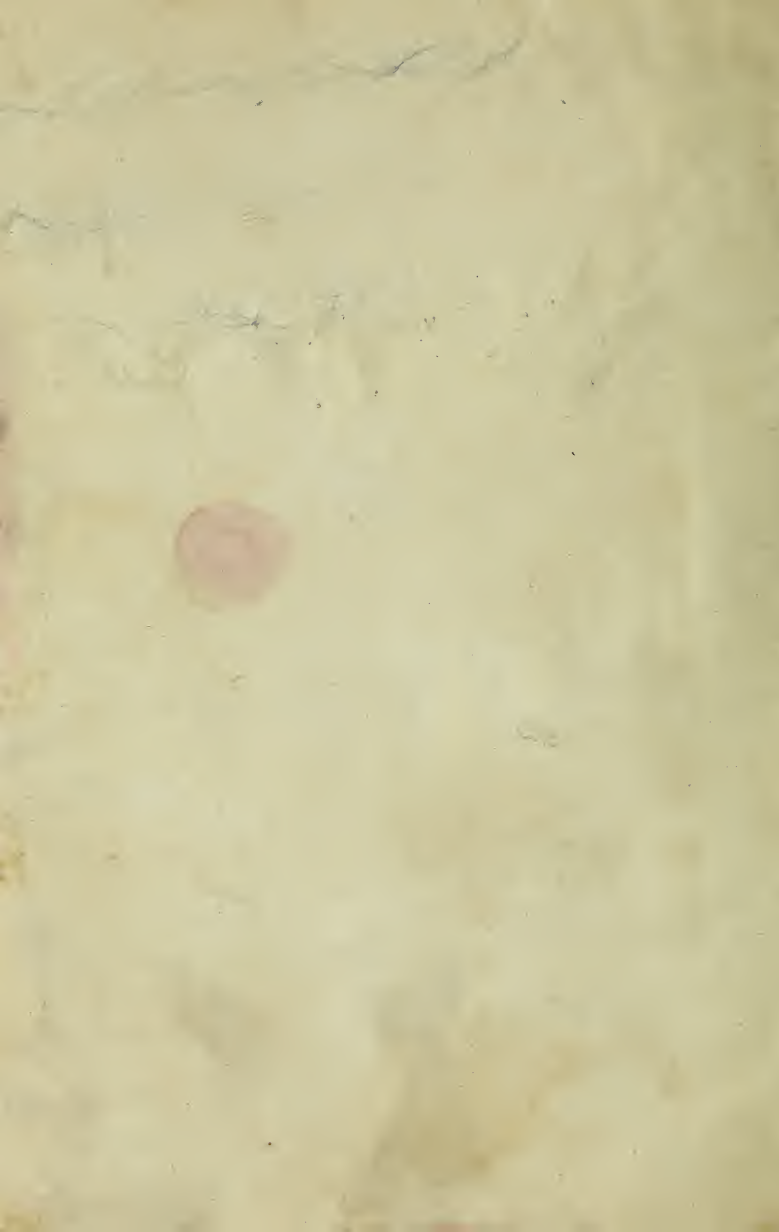
EDISON

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# Telegraphy

## Self-Taught

A COMPLETE MANUAL OF INSTRUCTION,  
CONTAINING CHAPTERS AND LESSONS ON  
TELEGRAPHY IN ALL ITS BRANCHES. IN-  
CLUDING EASY EXPERIMENTS IN ELECTRIC-  
ITY AND MAGNETISM WHICH OPERATORS  
SHOULD KNOW.

BY  
THEO. A. EDISON, M. A.

ILLUSTRATED



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# CONTENTS

Abbreviations .....	135
Alphabet .....	55
Alphabetical Lessons .....	55
Battery .....	39
Block Signals .....	113
Commercial Messages .....	81
Dash Letters .....	55
Dash, with Dots, in Succession.....	56
Decimals .....	62
Dot and Space Letters.....	55
Dot Letters .....	55
Dots and Dashes in Combinations.....	55
Dots, with Dash, in Succession.....	56
Duties of Line-Repair Men.....	112
Electricity and Magnetism.....	9
Explanations and Directions .....	51
Fractions .....	65
How to Count the Words in a Message.....	104
Instruction .....	103
Key .....	44
Letters and Numbers Mixed.....	58
Magnetism .....	16
Morse Code .....	49
Numbers .....	59
Numerals .....	56
Office Calls .....	81

18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200

Option Months .....	150
Order of Transmission.....	82
Position and Movement.....	53
Private Lines .....	29
Provision, Grain and Stock Abbreviations....	151
Punctuation Marks .....	57
Railroad Rules for Telegraph Operators.....	107
Relay . . .:.....	48
Rules for the Movement of Trains by Tele- graphic Orders .....	116
Sentences . . . . .	75
Sounder . . . . .	46
Student, The .....	102
Telegraph Numerals .....	50
Telegraph Instruments .....	21
Telegraph, The .....	7
Train Order Forms.....	123
Words .....	67



# INTRODUCTION

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In this little book will be found everything that is necessary to the study of telegraphy. Though telegraphy is essentially a matter of practice, it has been the aim of the author to present to those who aspire to master the art of telegraphy a book treating the subject in as concise and clear a manner as possible, without eliminating anything that is important, and without putting in things that are detrimental, and which would have a tendency to confuse.

The book contains unsurpassed essays on electricity, illustrating in a simple manner how it is adapted to the different instruments, and its functions as applied to the telegraph. Cuts of instruments used and explanations will enable the learner to easily acquire a practical knowledge that will be of great use in meeting any emergency.

After the beginner has set up his instruments and mastered the first ten or twelve lessons, he should get a partner-student, and they should work together. This is the only practical way that will enable them to become efficient operators. Criticism should be given and taken in a kindly spirit. The few points about numbers, decimals and fractions should be committed to memory. Also how to count the words in a message, abbreviations—in fact, there is nothing in the book which the student

should not learn and always keep in mind. When they have practiced receiving and sending words, sentences, etc., until they can easily and accurately receive and transmit, they should commence on the messages.

Accuracy, not speed, is the first requirement. The student should sacrifice any desire for speed until his accuracy is beyond dispute. The failure of a few unsuccessful students is due to the fact that they did not give proper attention to the first few lessons. Had they mastered these, failure to become efficient operators would have been impossible.

May, 1902.

THEO. A. EDISON.

# Telegraphy Self-Taught

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## THE TELEGRAPH.

The word "telegraph" means literally "to write afar off." That is, one man can speak to another though thousands of miles intervene. He can send his thoughts over deserts, through forests, over mountains and under oceans. But in order to do this he must harness an unseen *force* called *electricity*. What this unseen force is no man knows; but he does know to a certain extent what it is capable of; and, accordingly, he uses it to the best of his knowledge and ability.

Electricity is thus defined in Webster's International Dictionary :

Electricity means a power in nature, a manifestation of energy, exhibiting itself when in disturbed equilibrium or in activity by a circuit movement, the fact of direction in which involves *polarity*, or opposition of properties in opposite directions; also, by attraction for many substances, by a law involving *attraction* between surfaces of unlike polarity, and *repulsion* between those of like; by exhibiting accumulated polar tension when the circuit is broken; and by producing heat, light, concussion, and often chemical changes when the circuit passes between the poles or through any imperfectly conducting substance or space. It is generally brought

into action by any disturbance of molecular equilibrium, whether from a chemical, physical or mechanical cause.

Electricity is manifested under the following different forms: (a) Statical electricity, called also frictional or common electricity, electricity in the condition of a stationary charge, in which the disturbance is produced by friction, as of glass, amber, etc., or by induction. (b) Dynamical electricity, called also voltaic electricity, electricity in motion, or as a current produced by chemical decomposition, as by means of a voltaic battery, or by mechanical action, as by dynamo-electric machines. (c) Thermo-electricity, in which the disturbing cause is heat (attended possibly with some chemical action). It is developed by uniting two pieces of unlike metals in a bar, and then heating the bar unequally. (d) Atmospheric electricity, any condition of electrical disturbance in the atmosphere or clouds, due to some or all of the above mentioned causes. (e) Magnetic electricity, electricity developed by the action of magnets. (f) Positive electricity, the electricity that appears at the positive pole or anode of a battery, or that is produced by friction of glass, called also *vitreous electricity*. (g) *Negative* electricity, the electricity that appears at the negative pole or cathode, or is produced by the friction of resinous substances, called also *resinous electricity*. (h) Organic electricity, that which is developed in organic structures, either animal or vegetable, the phrase *animal electricity* being much more common.

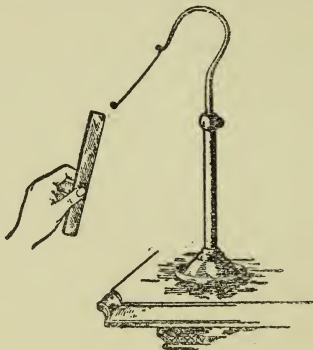
## SOME EASY EXPERIMENTS IN ELECTRICITY AND MAGNETISM WHICH ALL OPERATORS SHOULD KNOW.

The first knowledge of electricity came from the fact that when amber was rubbed it attracted light particles. This was discovered by the Greeks, and they called the amber electron. You may prove this by taking a piece of sealing-wax, or of resin, or a glass rod, and by rubbing it upon a piece of flannel or silk, it will be found to have acquired a property which it did not previously possess: namely, the power of attracting to itself such light bodies as dust, or bits of paper, etc. Although a large number of substances possess this property, amber and jet were the only two in which its existence had been recognized by the ancients, or even down to so late a date as the time of Queen Elizabeth. About the year 1600, Dr. Gilbert of Colchester discovered by experiment that not only amber and jet, but a very large number of substances, such as diamond, sapphire, rock-crystal, glass, sulphur, sealing-wax, resin, etc., which he styled *electrics*, possess the same property. Ever since his time the name electricity has been employed to denote the agency at work in producing these phenomena.

A good way to observe the attracting force is to employ a small ball of elder pith, or of cork, hung by a fine thread from a support, as shown in Fig. 1.

A dry warm glass tube, excited by rubbing it briskly with a silk handkerchief, will attract the pith ball strongly, showing that it is highly electrified.

Immediately when touching the glass tube the pith ball acquires an electric charge and is at once repelled by the tube. Should the ball be approached by a piece of resin previously rubbed with silk it will be attracted. This shows that the electricity produced by rubbing resin with silk is



*Fig. 1.*

of a different character than that which is produced by rubbing glass with silk.

This experiment shows that there are two kinds of electricity, viz: Positive electricity and Negative electricity. In rubbing one body with another, both bodies become charged with electricity of an opposite character; that is to say, if a piece of glass is rubbed with a piece of wool or silk, if the wool or silk receives the positive charge the glass will receive the negative charge.

Opposite conditions of electricity attract one another, and although electricity cannot flow through glass it can act across it by induction. For example: placing a plate of glass between two pith balls, one being electrified positively, the other negatively, will not interfere with their attracting or repelling one another, although the electric charges cannot pass through the glass. On this principle was invented the Leyden jar, and other condensers. The Leyden jar was accidentally discovered by Musschenbroek, and his pupil Cuneus, in the town of Leyden, from which it derives its name. It usually consists of a glass jar on which is pasted two coatings of tin-foil, one on the inside, and one on the outside, the coating covering the jar three-fourths of its length. Electric connection is made by a chain, or a flexible wire hanging into the jar from a brass rod, which may be supported by a wooden cover to the jar, to which the rod is fixed. A brass knob is attached to the top of the rod. To charge the jar, it is necessary to hold or connect this knob to the prime conductor of an electrical machine; the outer coating being either held in the hand, or connected to the earth by a wire. The jar can be easily charged in a few minutes in this way, and if made of good glass, kept dry and free from dirt will retain its charge for many hours. The jar may be discharged by holding it in one hand by the outer coating and touching the brass knob by the other hand. The person so doing will see a bright spark pass be-

tween the knob and the hand, making a sharp report, and at the same time giving the person a convulsive shock.

A very simple Leyden jar can be made in the following manner, and was the original experiment of Musschenbroek and his pupil: Take a glass bottle, fill it two-thirds full of water, make a hole through the cork and push through it a long nail, so that it hangs low into the water, when the cork is in the bottle. This jar can be charged like the modern Leyden jar, and in the same way, the water acting as the inner coating and the hand as the outer. When the jar is charged, it can be discharged by holding it in one hand and touching the top of the nail with the other. Thin glass has a greater capacity as an accumulator than thick glass, but if the glass should be too thin, the jar will be liable to be destroyed by the spark of a powerful charge actually piercing it. A powerful battery may be made of Leyden jars by connecting a number of them together by thin inner coatings; then also uniting their outer coatings. Care should however be taken in discharging this battery of Leyden jars, by using a pair of discharging tongs, as a shock from such a battery might prove fatal. The discharging tongs is an arrangement consisting of a brass rod with two brass knobs, and insulated from the hand by a glass handle. The electric discharge we see during a thunder shower is the same kind of so-called electricity.

Electricity is often found in belts, running pul-



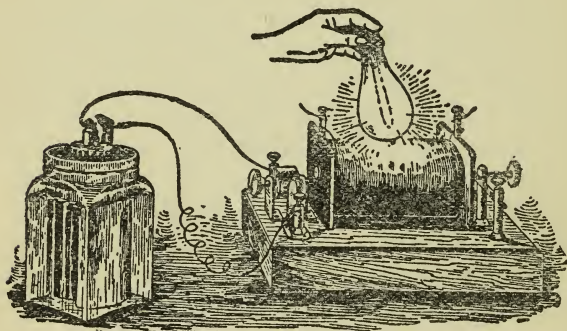
leys and shafting in factories. Placing your finger, or hand, or what is better, holding a piece of copper near a large belt which is running shafting, you will hear a cracking sound and sometimes receive a perceptible shock. The writer has seen enough electricity collected on wires from large belts to light coal gas. This experiment is more successful in cold weather. Quite a quantity of frictional electricity is developed in cylinder printing presses when moving at full speed, which electrifies the paper so that the sheets will stick together quite firmly, and should you pull them apart the same crackling sound spoken of in regard to the belt is heard, and the person separating them will sometimes receive quite a shock.

Electricity can also be obtained by joining two dissimilar metals by soldering, and then heating their points of contact. The same result may be obtained by lowering the temperature at the point of contact. For example, the metals joined, may be copper and iron or bismuth and antimony. There are a number of other metals which if joined together in the same way here described will produce Thermo-Electricity.

A very pretty experiment showing "molecular bombardment" and the "aurora" may be made by rubbing an incandescent lamp on the clothing, or on paper, leather, sheet rubber or tin foil, when the bulb will become filled with light; if you stop it grows dark. If touched with the finger, the filament and the interior will be a bright glow, lasting

from one to three seconds; if touched again it is repeated, by drumming or drawing the finger slowly over the glass the light is quite continuous. If rubbed on a newspaper in an absolutely dark room, the larger letters can be read at a distance of two to three inches. Fan the bulb with sheet rubber eight or ten inches away, but do not touch the glass, it will light the same quite bright if the fanning is very rapid.

Most of the miniature lamps will give the light, but not all. The Edison, 16 c. p., 20 and 22 volts will; but the 110-volt store lamps will not.



*Fig. 2*

It is evidently charged through the glass, as the glow will occur if the metal parts are enveloped in rubber. Everything used should of course be dry. It seems to be an electrophorous effect, the discharging only exhausting a section at a time. The best effect is obtained by rubbing with a dry newspaper. If a wire from the terminal of the secondary

coil of a  $\frac{1}{2}$ -inch spark Ruhmkorf induction coil be placed against the glass of the lamp it will glow very brightly. By placing the hand against the glass of the lamp it glows more brightly. The lamp will also glow if brought within a half inch of the coil without any wire being connected with it. See Fig. 2.

## MAGNETISM.

The discovery of magnetism has never been decided. It is claimed to have been discovered by the Greeks and it is also asserted that the Chinese knew of the compass at a much earlier date, yet to the Greeks we owe the name of this science. About the year 1600, Dr. Gilbert, first physician to Queen Elizabeth of England, published his work, "De Magnète" and showed among many other things that magnetic attraction was only peculiar to a few bodies, while electricity was universal.

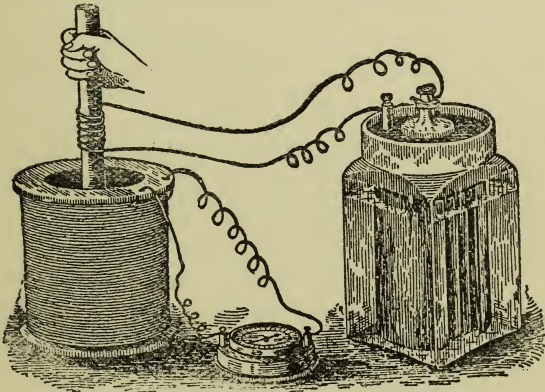
Every magnet is supposed to have what are termed lines of force running around it and through it, or to possess what is termed a magnetic field. The same may be said of a helix carrying an electric current. A very simple experiment to illustrate this theory is to lay a piece of paper or glass over a bar magnet, and then to sprinkle iron filings over the paper or glass. The iron filings will be found to have arranged themselves into lines.

These lines show the lines of force around the magnet. Each particle of the iron filings becomes a separate magnet by induction so long as it remains in the magnetic field.

The filings should be very small and light, and should be sifted through a very fine sieve. You should also tap the paper lightly when sprinkling the filings.

We see by this experiment that the space around

a magnet is pervaded with this unseen force, or lines of force, as they are termed. An electro-magnet is a magnet which is only magnetic when a current of electricity is passing through its coils and is generally made of a core of soft iron with a number of turns of insulated wire wound around it. This magnet has the lines of force like the permanent magnet. Faraday showed that if the lines of force of a magnet were broken by plunging or revolving another magnet within its fields, that the current of electricity was produced in the wire of the second magnet. See Fig. 3.



*Fig. 3.*

This is called induction, and it is the fundamental principle of the dynamo.

Should you take a common compass, hold above it and parallel to its needle, a wire carrying a current of electricity, the needle will instantly turn aside.

When the current is flowing along the wire above the needle from North to South, the North pole of the needle will turn towards the East. If the current should be flowing from South to North, the needle will be deflected Westward. If you hold the wire below the needle the motions will be the reverse. Thus you see by this experiment the first principle of the electric motor.

Magnetism like electricity may be communicated from one body to another, and as in the case of hardened steel, it will be found to remain in the article so magnetized, after the magnetic body has been removed. In other words the second body becomes a magnet like the first. This is also accomplished without any apparent decrease of strength in the first magnet. Steel and nickel seem to retain their magnetism, while iron more easily and strongly magnetized loses its magnetism almost immediately after the magnetic influence has been removed.

Another strange thing about magnetism is that it can be communicated from one body to another through layers of glass, paper or wood, placed between the magnet and body to be magnetized, and that the intervening medium is directly concerned in this transmission of magnetic force, and that medium is "ether," which surrounds all molecules of matter.

Magnetism may be obtained from the earth, as the earth itself is a great magnet. A very simple experiment is to take a steel bar, place it in the

magnetic meridian, with the north end dipping down, and while it is in this position strike it a number of hard blows with a wooden mallet, after which it will be found to have become magnetized.

Although Faraday showed by the aid of very powerful magnets that almost every substance was susceptible to magnetic influence, generally speaking, some bodies are not magnetic. Such is the case with copper, bismuth and antimony. These are called diamagnetic bodies; while such bodies as iron, steel and nickel are highly efficient in magnetic power. Every magnet has what is termed a North and South pole, which can be seen by observation of the compass. A very simple experiment to illustrate this principle, is to take a small common steel sewing needle, and after having magnetized it by bringing it in contact with the poles of a permanent, or an electro-magnet, float it in a glass of water when it will be seen to take a north and south position. To float the needle it will be necessary to lay it on a thin piece of tissue paper and carefully place both paper and needle on top of the water; the paper will soon absorb water enough to sink to the bottom of the tumbler, leaving the needle floating on the surface. It is supposed that should you divide a bar magnet into the smallest molecules possible, each molecule would be a separate magnet, endowed with a North and a South pole. This may be illustrated by dividing a small bar magnet or by magnetizing a darning or knitting needle, and breaking it into small pieces, when each piece will be found to have become a separate magnet.

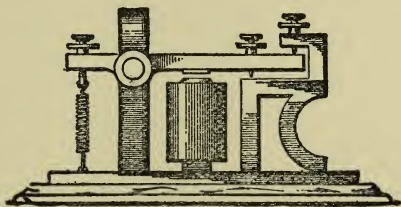
There are various ways of magnetizing bodies. Should you bring a bar of steel to a red heat and let it cool in the magnetic meridian (that is the bar should lie in a north and south position) it will become magnetized. The most powerful magnets are made by winding insulated copper wire around the steel to be magnetized, and then sending through the coils a strong current of electricity. You may partially or wholly destroy the magnetism in a steel magnet by rough usage, as by hitting it, or knocking it about. It will also lose its magnetism on heating being heated to redness.



## HOW TO MAKE A TELEGRAPH INSTRUMENT.

The most satisfactory way the author knows for an amateur to make a telegraph instrument is to saw wood, or apply himself to any other remunerative form of labor until he has made enough money and then buy himself one.

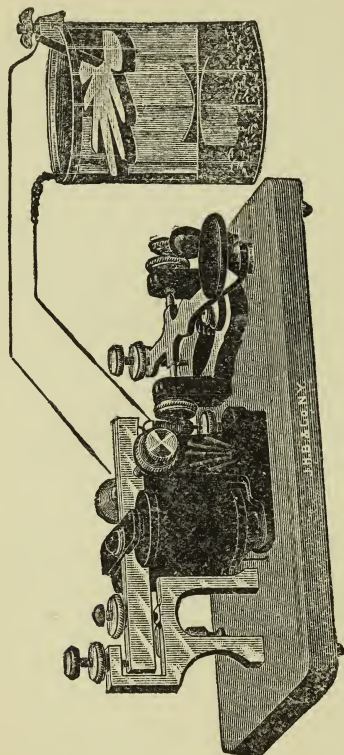
A cheap or poorly made instrument is a constant source of annoyance, and even the better kind



TELEGRAPH SOUNDER

will occasionally take freaks. There exists, however, a class of people who take a much greater pleasure in anything home-made, and which they understand from beginning to end, than in the store article, even if the latter does look and work better, and it is to this class that I address myself, repeating my warning that they cannot expect to have a very pleasant time operating a home-made instrument. This instrument is one that cannot be "simplified" to any great extent without sacrificing its good qualities, so the form described will follow very closely that in general use at present.

The cores of the magnets are to be made of  $\frac{3}{8}$  inch round wrought iron—Norway iron preferably, on account of its great purity and softness. Cut



The Morse Learners' Outfit.

two pieces  $1\frac{1}{2}$  inches long and tap one end of each for a  $\frac{1}{8}$  inch machine screw. Fit over each end of them a washer made of fiber of ebonite 1 inch in external diameter and  $\frac{1}{8}$  inch thick—they must

fit tightly. Insulate the cores between the washers and bore a 1-16 inch hole in one washer on each spool to take out the beginning wire and then put the spools in a lathe and wind them full of No. 24 insulated wire, according to the directions given in previous articles. It is customary to slip over the spool when winding is finished a casing of ebonite both as a protection to the wire and to improve the appearance, but it is not essential.

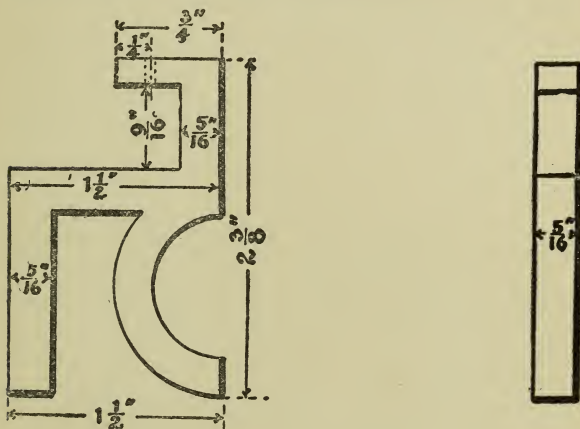


Fig. 1.

The yoke is also soft iron  $\frac{3}{8}$  of an inch wide,  $\frac{3}{16}$  of an inch thick and  $1\frac{1}{2}$  inches long. Drill a  $\frac{1}{8}$  inch hole in each end,  $1\frac{1}{4}$  inches distant from each other and one in the middle tapped for a  $\frac{3}{16}$  inch screw. Screw the spools you have wound to the yoke making a U-shaped electro-magnet. This magnet stands on a base made of  $\frac{1}{4}$  inch sheet

brass,  $2\frac{1}{4}$  inches wide and 5 inches long. Drill a 3-16 inch hole through the base  $2\frac{1}{4}$  inches from one end and midway between the sides; this hole is for the purpose of screwing the magnet to the base. Cut a strip of  $\frac{1}{8}$  inch sheet brass 5-16 of an inch wide and  $10\frac{1}{8}$  long; bend it into a U-shape, making the curved portion a semi-circle of 2 inches diameter; at 2 inches from each end drill and tap a hole for a  $\frac{1}{2}$  inch screw.

Now file a groove in the edges of the two sides of the base plate, 5-16 of an inch in width, and  $\frac{1}{8}$  of an inch deep, the edge of the groove to be 1 3-32 inches from the end of the plate the magnet is nearest. The legs of the U-piece fit with this groove and are to be secured to the base with 8-32 machine screws.

The anvil had best be cast from brass, making a pattern for the same from Fig. 1. The bottoms of the legs of the anvil are to be tapped for 8-32 machine screws, and holes drilled in the brass base through which to pass the screws from underneath and secure the anvil. The straight leg should be 3 inches from the end of the base, and toward the magnet, as shown in the drawing of the completed instrument. The hole in the short arm is  $\frac{1}{4}$  of an inch from the end, and is drilled and tapped for a  $\frac{1}{8}$  inch screw.

Another brass piece which should be cast from brass, should be made in accordance with Fig. 2. The holes Y and Z are to be drilled and tapped for a  $\frac{1}{8}$  inch screw, and X-drilled with a No. 30 drill.

Through the hole in the little downward projection of this piece is to be driven a piece of No. 14 Stubbs' steel wire, pointed at each end, and well hardened.

A soft armature of the shape and dimensions shown in C, Fig. 2, is screwed on the upper side of the brass casting, to the hole Y. Four thumb screws and check nuts will be required, and may be made by following the dimensions given at B, Fig. 2. Two of the thumb screws should have their ends slightly countersunk or drilled with a very fine drill, to form bearings for the pointed ends of the Stubbs' steel pivot. Two more screws and nuts are needed: the screw to be made from

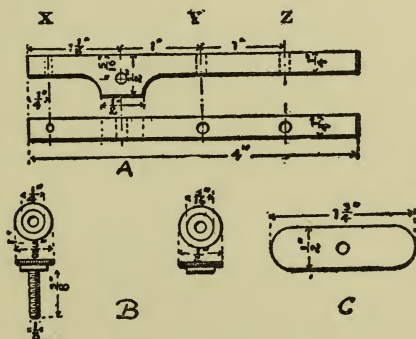


Fig. 2.

$\frac{1}{8}$  inch brass wire, 1 inch long, and threaded the entire length, and the nut to fit this thread. Through one end of this screw drill a small hole. At  $\frac{3}{8}$  of an inch from the end of the base plate, and directly under the projecting end of the arma-

ture carrier, back of the pivot, solder a small hook. Make a closed spring out of No. 22 spring brass wire. We are now ready to put things together.

In the first place, the brass base-plate should be mounted on a neat wooden base, a little larger than the brass plate, and on the wooden base place two binding posts. Screw the magnet to the base-plate, if you have wound both cores in the same directions and have screwed them to the yoke so that both starting ends are together, connect the two inside wires together and the remaining ends to the binding posts, or, in other words, see that the wires are connected in such a way that if the magnet were bent out straight, the current will pass around the bar in one direction throughout its whole length. Screw the anvil to the base plate and put in the adjusting screws and nuts as shown in the general drawing.

Place the armature in position and adjust it so that it moves easily on the pivot point by means of the adjusting screws in the sides of the U shaped piece. Put the nuts on the piece of threaded wire you made and slip it into the hole in the end of the armature. The end with the hole in it should be down, and into the hole hook one end of the spring you wound, and cut off the other end so that it will reach the hook beneath with a little stretching, and hook it there. The tension on the spring can then be regulated by the nuts on top, and should be such that the armature will be pulled against the top when freed.

Adjust the screws in the anvil so that the armature will have  $\frac{1}{8}$  of an inch play between them, and at its lowest point the soft iron piece will be 1-32 of an inch from the ends of the magnet, and your sounder will be ready for work; that is to say, whenever you put a current through the coils the armature will draw down and make a click, and when the current is taken off, will fly up and make another.

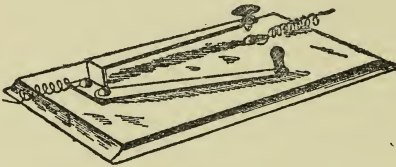
The place in which the instrument is set makes a good deal of difference in the sound. A sounding board of some sort is necessary if it is desired to have the instrument make much noise. A good table answers for this very well and often the instrument is placed upon a plate of glass or has a bell or curved piece of tin attached to the anvil for the purpose of increasing the volume of sound.

To break and make the circuit and thus work the instrument, we must have a key which can be made from a piece of spring brass, as shown in Fig. 3.

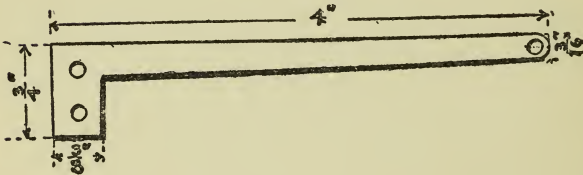
Cut and bend the brass in the shape shown, and screw a wooden or ebonite button to it. The screw head on the under side is to be filed off a little flat and another screw placed beneath, so that its head may be touched by the other when it is pressed down. The wires are to be connected to the strip and screw head as shown, though of course this is to be done underneath the board on which they are mounted, so that the wires will not be seen. The circuit must be kept closed except when a message

is being sent, so that another strip of brass is to be screwed to the first, so it will move freely and will close the circuit when swung against the lower contact. A suitable handle is to be made for this.

The contacts of the key are apt to become fouled by the dirt and sparking on breaking the circuit,



TELEGRAPH KEY.



*Fig. 3.*

and must be occasionally cleaned. The fouling from the last cause can be obviated somewhat by soldering small pieces of platinum to the contacts as it does not oxydize as readily as most other metals.



## PRIVATE LINES.

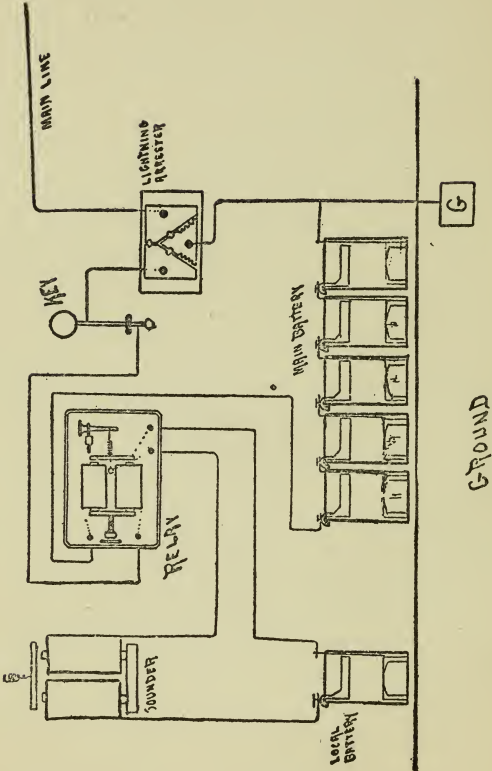
In the construction of short lines, No. 12 galvanized wire is chiefly used, being of light weight and cheapest for the purpose, and measures thirty ohms resistance to the mile.

Only one wire is necessary to the construction of a line, the earth being used for the return circuit.

Great care should be taken to have the earth connections perfect. Instruments on the same line must always be of the same resistance. Whatever other difference there may be in the instrument, they should be all alike in resistance.

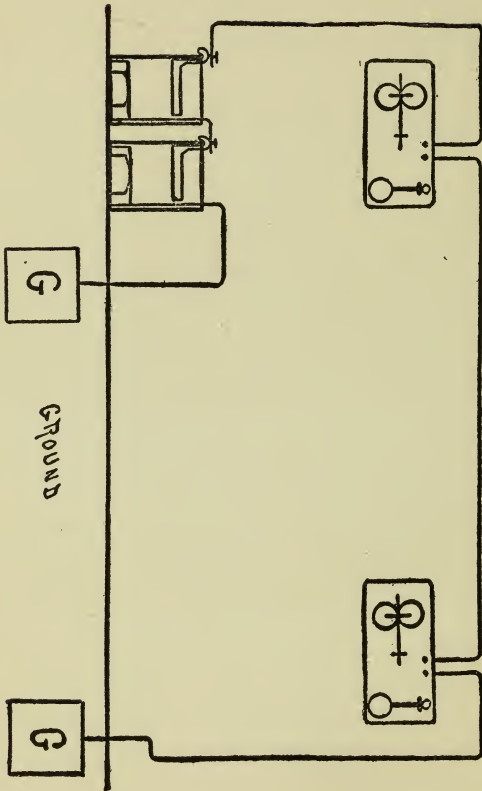
For lines between one and twelve miles in length, the instruments are required to have their magnets wound with finer wire than those used on currents of less than one mile. Such instruments are designated as being of "20 ohms resistance."

In ordering instrument give the length of line and the number of instruments to be used on it.



### TO CONNECT TWO INSTRUMENTS WITH A SHORT LINE.

Connect the wire from the copper pole with your ground wire and the wire from the zinc pole to the binding post on the instrument. Connect the line wire to the opposite binding post at the other end of the line and attach the wire to one binding post. Then run a wire to the ground from the opposite post. If part of the battery is used at each end of the line always be careful to have the zinc and copper poles of the battery towards each other.



## PRIVATE LINE WITH SEVERAL STATIONS IN CONNECTION.

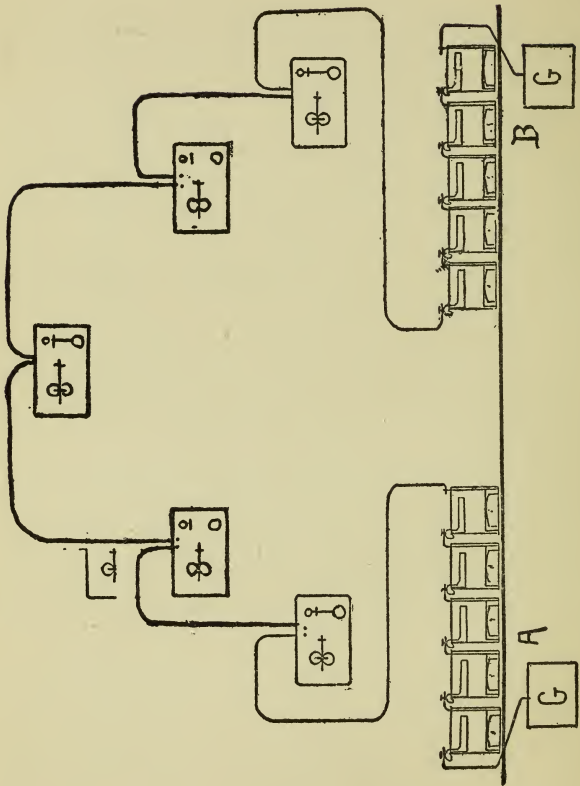
Connect wires, instruments and batteries on such a line as shown in the diagram, placing the batteries at each end of the line.

Battery at A has its zinc pole connected to the earth and its copper to the line. Necessarily, therefore, the other battery at B presents its zinc pole to the line and its copper to the earth. Were both batteries connected with the same pole to the line, they would neutralize each other, and no current would be produced.

The line is connected from the battery to the first instrument and on the next in such a way that the current is made to pass through every instrument on the route.

It is necessary when two or more offices are connected on a line that every key be kept closed by having the circuit closer shut, except only when sending communications. If any one key on the entire line is left open all communication is stopped.

In running an out-door wire between points at any distance apart, it should be insulated by means of glass or rubber insulators from contact with the buildings, trees or posts, so as to prevent the escape of the current into any object it might come in contact with and thus reach the ground before going through the instruments. To make a joint or splice in wire, scrape the ends of the wires to be joined



with a knife or file until they are clean then twist them tightly together with the aid of a pair of plyers.

Wires for use inside of buildings should be of copper and insulated with cotton or gutta-percha. They should be fastened with staples and care taken not to break the insulation.

Main lines of telegraph are arranged in the same manner. With wires of many miles in length, main batteries containing a large number of cells are placed at the end stations and the return made by means of the ground wire and each office connected to the line in the same manner described. Tapping a wire is done by simply cutting a wire and connecting the instrument with the two ends. Whatever passes over the wire can then easily be read.

## THE RELAY.

The Relay is a main line instrument. It is simply an armature hung in front of two spool magnets in such a way as to be susceptible to rapid vibrations. These vibrations are unlike those of the key, which are made by hand with the assistance of a spring. The vibrations of the Relay are automatic and are caused by the applications of two forces, in one direction by the constant pull of the spring or mechanical force, in the other by the intermitted application of magnetic force generated in an electro-magnet. The object of this vibration is to open and close an electrical circuit called the local circuit.

There are four binding posts in the base of the Relay. Two of them form the terminals of the wires of the electro-magnet and answer for the attachment of wires leading to the main line; the other two are connected with the local contact points and serve to accommodate the wires leading to the sounder and local battery.

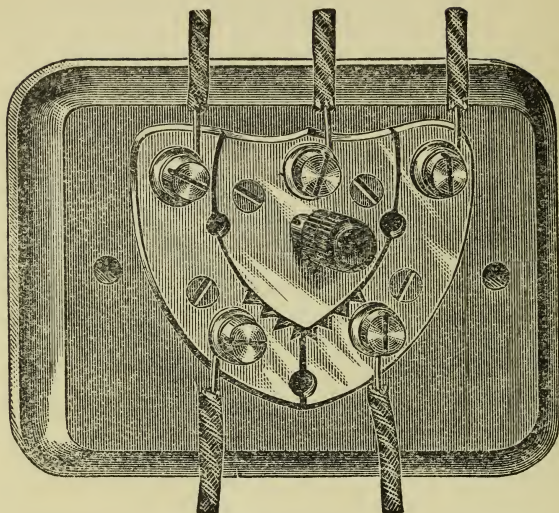
By simply opening and closing a key on the same circuit with itself, no matter how near to or how far from the Relay it may be, magnetism is generated in the electro magnet and discharged therefrom intermittently, and the two forces above referred to are so proportioned to one another and the armature that where there is no magnetism present the spring is strong enough to pull the armature away from the electro magnet. The spring,



however, must be so regulated as to be weak enough to be overcome by the power of the magnetism when the current is let into the magnets and permit the armature to be pulled up against the end of the spools.

When the current comes over the main wire weakened from traveling a long distance it passes into the Relay. The armature of the Relay is so delicately hung as to be moved by the slightest current and the current, punctuated into dots and dashes, passes through the Relay and then to the sounder, which, aided by a local battery, gives the message from the main line clear and distinct.

The above cut shows the best method of connecting the Lightning Arrester and Relay on a grounded circuit consisting of only two stations.

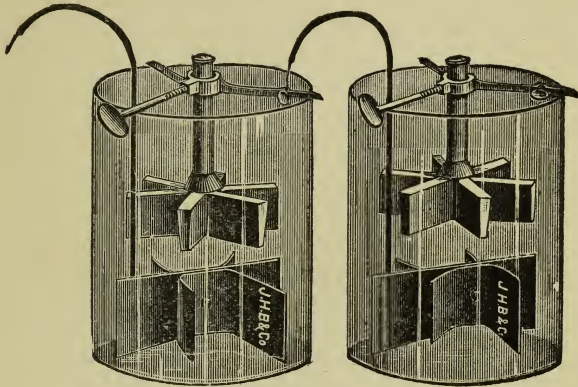


### LIGHTNING ARRESTERS.

As lightning is frequently attracted to out-door lines and thereby enters the office, sometimes damaging the instruments, or even setting fire to curtains or other inflammable materials about the instrument table, a simple and cheap instrument called the "Lightning Arrester and Cut Out" is used for the purpose of intercepting and carrying to the earth such discharge of lightning as would be liable to cause damage. This apparatus is entirely effective, and is a safeguard against lightning.

## THE BATTERY.

The *gravity* battery is the one most commonly used for telegraphic purposes. It consists of a glass jar, a zinc, and a copper. The copper is known as



BATTERY.

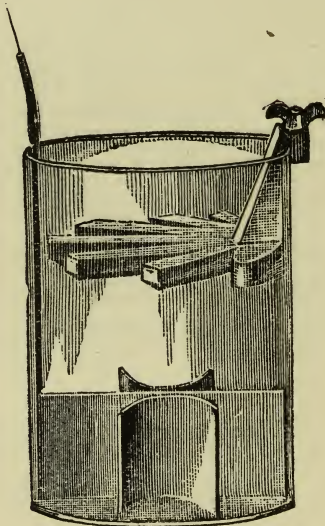
the *positive* pole of the battery, and the zinc is the *negative*.

The battery is put in operation according to the following directions :

Spread the leaves of the copper out, and place on the bottom of the jar, so that it rests level as possible, with its wire passing up alongside of jar, as shown in the cut. Then fill the jar with water within two inches of the top, and drop in about three-quarters of a pound of blue vitriol. See that the lumps lie evenly around and on the copper.

Next suspend the zinc in the jar so that the water will cover it, as shown in the cut; and the battery is all ready for operation, although its full strength will not be developed for about two days.

To hasten the development of its strength, connect the copper with the zinc by fastening the wire into the clamp screw of the zinc, and leave it so for



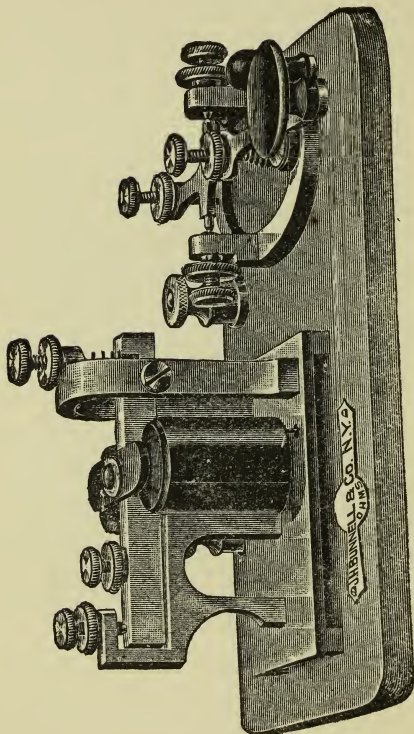
about twelve or fourteen hours. This places the battery on a short circuit, which matures its strength in a little time. After its strength has been sufficiently developed, the circuit should be opened in order to save its strength from being too quickly exhausted.

The battery should not be kept in a place where

there is a liability of its freezing, for, if frozen, the current is apt to be suspended. But it should be kept in as warm a place as can be conveniently found, as heat adds strength to the battery.

To replace the loss by evaporation, water should be from time to time added to that in the jar. The battery is fully charged and in full working order when a blue color can be observed in the liquid rising to within an inch of the lower surface of the suspended zinc. If the color rises higher than this it is an indication that too much sulphate of copper is being used, and no more should be added until the blue has receded to the copper. This latter state always indicates that more sulphate of copper is required. There is an increase in the quantity of the sulphate of zinc in solution in the upper part of jar as long as the battery continues in action. A hydrometer is used for the purpose of testing the strength of the solution. When the specific gravity is thirty degrees, or more, a portion of the top of the liquid should be scooped out and replaced with fresh water. On the other hand, when it is less than fifteen degrees, the sulphate of zinc solution should be strengthened.

It is necessary to thoroughly clean the battery once in from three to four months, on account of the vitriol becoming decomposed and the zinc dissolving. Carefully take out the zinc and copper; pour the clean liquid into a separate jar, leaving behind the sediment which has gathered on the bottom of the jar. Then wash jar thoroughly and pour



COMBINATION KEY.

back the clean liquid; take the copper and zinc and clean them by scraping with the blade of a knife. Replace copper and zinc in jar, add enough water to cover zinc, and place in a few lumps of vitriol. The battery will then be in good condition again, and requires no further attention, excepting when necessary to add sulphate of copper, or to clean it. The power of the battery depends on the position in which the zinc is placed with reference to the copper. To strengthen the power, lower the zinc to within about an inch of the copper, taking care not to allow a contact between the two. To decrease the power, thereby lengthening the life of the battery, raise the zinc farther away from the copper.

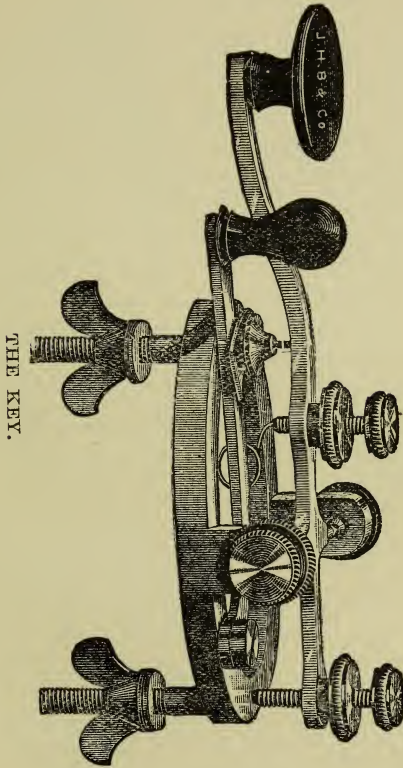
When joining together any number of cells, the positive pole of the first cell must be connected with the negative pole of the second cell; the positive of the second with the negative of the third; the positive of the third with the negative of the fourth; and so on throughout the whole series. The idea is never to connect like poles, though it does not matter which pole we begin with. This law holds good in joining batteries hundreds of miles apart, as well as those that stand side by side.

### THE KEY.

The key should be firmly screwed to the table. The armature lever should be adjusted so that it works freely with a movement of about one-sixteenth of an inch. The spring which draws the armature lever upward should only be set at a sufficient tension to raise the lever when no current is passing through the magnets. If drawn too tightly the armature will not respond to the magnets. A little practice will enable the student to judge best for himself how to regulate the screws of the key in order that its play may suit his hand, though it is well to remember that the adjustment should be loose enough in order that all force may be brought to bear on the platina points.

The platina points of the key should be kept perfectly clean so that perfect contacts can be made. The battery will be kept in good condition if the circuit-closer of the key is left open about half the time when the instrument is not in use.



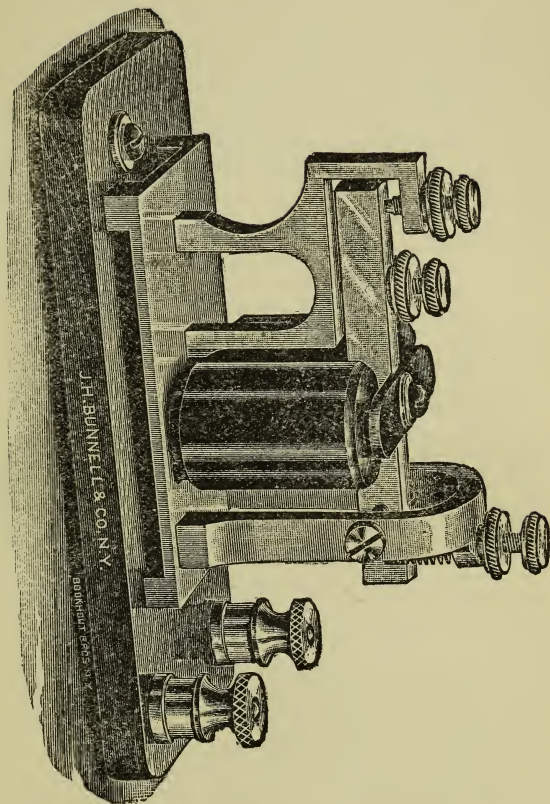


THE KEY.

### THE SOUNDER.

The sounder is regulated by two adjustable screws. One limits the reverse movement, and the other governs the movement toward the magnets. The play of the lever should be about two thicknesses of ordinary paper.

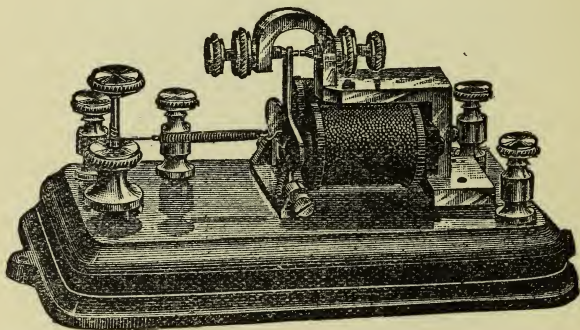
The sounder is connected with the local circuit only. Its connections are attached to the poles of the battery and the relay.



THE SOUNDER.

## THE RELAY.

The relay is used chiefly for resistance. It is connected with both the main line and local circuits. The armature has a platina point on both sides, and stands perpendicularly upright; the platina point to the right sets against a similar point on the set-screw above the magnets when the circuit is closed. The platina point to the left should set against the



THE RELAY.

point of non-conducting material on the set-screw to the left when the circuit is open.

The play of the armature between the two set-screws should be about two-sixteenths of an inch. The adjustable screw at the right of the relay is used to adjust the magnets in their relation to the lever on the armature.

## THE EARTH AS A CONDUCTOR.

A circuit is made by connecting the outgoing poles of a battery at one end of a line with the opposite pole at the other end.

To save the construction of a return wire on every circuit, most telegraph companies make great practical use of the earth as a conductor in order to complete the circuit. That the earth is really one vast conductor is shown when one pole of a battery is connected with the earth, and if the wire from the opposite pole is also connected with the earth the current will flow as readily as though the circuit had been made complete by the use of a return wire.

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## THE MORSE CODE.

The Morse code of signals as applied to the telegraph is used exclusively in the United States. It is made up of dots and dashes.

In the study of telegraphy the first thing the student should learn is to thoroughly memorize the alphabet, so that each character can be called to mind instantaneously; thus, A, dot and a dash; B, dash and three dots; C, two dots, space, dot; D, dash, two dots, etc.

## THE ALPHABET.

A	B	C	D	E	F	G
H	I	J	K	L	M	N
O	P	Q	R	S	T	U
V	W	X	Y	Z	&	

## NUMERALS.

1	2	3	4	5
6	7	8	9	0

## PUNCTUATION MARKS, ETC.

Period.	Comma.	Colon.
Question mark.	Semi-colon.	Interrogation.
Paragraph.	Parenthesis.	Dollars.
	Exclamation.	
Quotation.	Brackets.	Hyphen.
Dash.	Apostrophe.	Under-line.
Colon-quotation.		Capital letter.

## EXPLANATIONS AND DIRECTIONS.

In the alphabet a short closure of the key (an instantaneous downward stroke of the key) represents a dot, and a prolonged closure (holding) the key down as long as it would take to make three dots, represents a dash. A space is represented by a pause or rest between two closures of the key.

The dots and dashes are produced by a downward movement (closing the key), while the breaks and spaces are produced by the upward movement (opening the key).

It is essential that there be an unmistakable difference between dots and dashes and spaces, so when making dots and dashes in succession, put them compactly together, in order that intervals may not be mistaken for spaces.

A long dash, as used in the letter "l", or the numeral "cipher," is made by holding down the key as long as is required to make six dots, although a cipher is frequently made by holding down the key as long as is required to make seven dots.

Breaks are the intervals between dots or dashes in the same letter. A space in letters should be made by holding down the key as long as is required to make a dot or a break.

The space between words occupies the time required for three dots and breaks. The dots and dashes should follow each other as closely as possible in letters that do not contain spaces.

To obtain a perfect style in sending, the student should be careful to form space letters correctly.

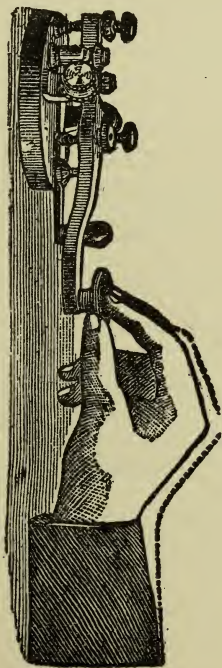
By constant practice and strict observation in the beginning he will have no difficulty or trouble in perfecting a style that will be speedy and perfect.

---



## POSITION AND MOVEMENT.

Sit erect in an easy and natural position, facing the key. Place the first and second fingers on the top of the key-button, with the thumb under the edge. Curve the first and second fingers, so as to form a quarter section of a circle. Partially close the third and fourth fingers, and keep them about a quarter of an inch above the table. Rest the arm on the table a little below the elbow. Let the grasp upon the key be firm, but not too rigid, and



never take the fingers from the key, nor the elbow from the table, while transmitting.

The motion should be perfectly free and natural—directly up and down, without any side pressure. The wrist, hands and fingers should be kept flexible, and should all move in the same direction simultaneously.

Learn the movement by making dots at the rate of one every second, then two, three, four and five, until the speed of about 350 per minute is attained. In the same way begin with dashes, and gradually increase until 115 per minute can be made with clearness and regularity.

When dots and dashes have been mastered, take up the following exercises in their order, always remembering that in letters of more than one character, the dots and dashes, unless spaced, must follow each other closely:

## EXERCISE NO. 1.

Dot Letters.

E	I	S	H	P	6
-	--	---	----	-----	-----

## EXERCISE NO. 2.

Dot and Space Letters.

See that the spaces are uniform, and are in the proper place.

o	c	r	y	z	&
-	--	---	----	-----	-----

## EXERCISE NO. 3.

Dash Letters.

Be careful about the proportion of the short and long dashes.

t	l	m	5	0
—	——	———	————	—————

## EXERCISE NO. 4.

Dots, with Dash, in Succession.

See that they follow each other as closely as possible.

a	u	v	4
—	---	-----	-----

## EXERCISE NO. 5.

Dash, with Dots, in Succession.

n	d	b	8
---	---	---	---

## EXERCISE NO. 6.

Dots and Dashes in Combinations.

F	G	J	K	Q
---	---	---	---	---
W	X	1	2	3
---	---	---	---	---
7	9	Period.		
---	---	---		

## EXERCISE NO. 7.

Numerals.

1	2	3	4	5
---	---	---	---	---
6	7	8	9	0
---	---	---	---	---

## EXERCISE NO. 8.

## The Alphabet.

a	b	c	d	e	f
-----	-----	-----	-----	-----	-----
g	h	i	j	k	
-----	-----	-----	-----	-----	-----
l	m	n	o	p	q
-----	-----	-----	-----	-----	-----
r	s	t	u	v	
-----	-----	-----	-----	-----	-----
w	x	y	z	&	
-----	-----	-----	-----	-----	-----

## EXERCISE NO. 9.

## Punctuation Marks, Etc.

Period.	Comma.	Colon.
-----	-----	-----
Quotation.	Semi-colon.	Interrogation.
-----	-----	-----
Paragraph.	Parenthesis.	Dollars.
-----	-----	-----
Exclamation.	Quotation.	Brackets.
-----	-----	-----
Hyphen.	Dash.	Apostrophe.
-----	-----	-----
Under-line.	Colon-dash.	Capital Letter.
-----	-----	-----



## EXERCISE NO. 11.

Numbers.

A short space is usually made between every three figures in large numbers:

1,000.

-----

1,506.

-----

1,500.

-----

2,450.

-----

14,000.

-----

18,328.

-----

18,907.

-----

258,900.

-----

999,999.

-----

8,488,300.

-----

-----

12,400,000.

150,488,000.

1,150,464,525.

50,424.

90, 108.

150,644.

16,241.

24,900.

100,000.

1,000,000.



1,000,000,000.

444,222.

5,555,332.

66,999.

1,201.

42,325.

168,245.

1,246,658.

10,249.

## EXERCISE NO. 12.

Decimals.

The decimal point is transmitted by spelling out the word "dot."

4.8.

-----

4.28.

-----

10.1.

-----

44.7777.

-----  
-----

19.00001.

-----

215.01.

-----

\$1.20.

-----

\$184.27½.

-----  
-----

\$999.26¾.

-----  
-----

.20.

---

.0000 $\frac{1}{8}$ .

---

\$28.61 2-3.

---

---

1,000.000000.

---

5.12.

---

.000.

---

425.1.

---

2.02.

---

288.0001.

---

---

1,000.01.

---

15.10.

---

25.13.

-----

488.00001.

-----

25.00.

-----

13.10.

-----

14.01.

-----

15.001.

-----

16.0001.

-----

17.00001.

-----

18.000001.

-----

1,000.01.

-----

900.001.

-----

800.0003.

-----

700.000002.

-----

## EXERCISE NO. 13.

Fractions.

In fractions a dot represents the dividing line.

2-3.

-----

 $\frac{5}{8}$ .

-----

3-5.

-----

4-5.

-----

8-9.

-----

13-14.

-----

 $\frac{3}{4}$ .

-----

4-8.

-----

11-12.

-----

9-12.

-----

6-7.

-----

16-17.

---

2-10.

---

4-32.

---

100-200.

---

1-14.

---

3-21.

---

2-17.

---

4-14.

---

5-15.

---

6-16.

---

7-17.

---

8-18.

---

9-19.

---

10-20.

---

## EXERCISE NO. 14.

Words.

After the student has written the words in this exercise repeatedly, he may arrange series himself for practice; but he must always bear in mind that it is only by constant repetition that he can thoroughly familiarize himself with the words:

And.

- - - - -

Terminate.

- - - - -

Ramify.

- - - - -

Quotation.

- - - - -

Practice.

- - - - -

Opinion.

- - - - -

Nominate.

- - - - -

Maintain.

- - - - -

Limited.

- - - - -

Knowledge.

-----

Inmate.

-----

Judgment.

-----

Chair.

-----

Desire.

-----

Exchange.

-----

Family.

-----

German.

-----

Humane.

-----

Aluminum.

-----

Exposition.

-----

Cataract.

-----

Construction.

-----

-----



Magnificent.

-----  
-----

Majesty.

-----

Tremendous.

-----  
-----

Extraordinary.

-----  
-----

Terminal.

-----

Restoring.

-----

Gradually.

-----  
-----

Marvelous.

-----  
-----

Hydraulic.

-----  
-----

Generators.

-----

Transmit.

-----

Predominate.

-----  
-----

Apparatus.

-----  
-----

Structure.

-----

Parallel.

-----

Kingdom.

-----

Authorize.

-----

International.

-----  
-----

Manipulated.

-----  
-----

Perpendicularly.

-----  
-----

Diagram.

-----

Respectively.

-----  
-----

Characters.

-----  
-----

Exclamation.

-----  
-----

Invariably.

-----  
-----

Attainment.

-----

Suggestions.

-----  
-----

Accuracy.

-----

Position.

-----

Numerals.

-----

Milwaukee.

-----  
-----

American.

-----

Union.

-----

Pacific.

.....

Merchandise.

-----  
.....

Manhattan.

-----

Birmingham.

-----  
.....

Mutual.

-----

Prominent.

.....

National.

-----

Drummond.

-----  
.....

Semaphore.

.....

Richmond.

-----

Beacon.

-----

Canopy.

-----

Arbitration.

-----  
-----

Monopolize.

-----  
-----

Harland.

-----

Rural.

-----

Garrison.

-----

Discrimination.

-----  
-----

Entertainment.

-----  
-----

Colonial.

-----

Sovereign.

-----

Barn.

-----

Elocution.

-----

Mechanical.

-----  
-----

Manipulated.

-----  
-----

Continental.

-----  
-----

Magnets.

-----

Armature.

-----

Electrical.

-----

Vulcanize.

-----  
-----

Standard.

-----

## EXERCISE NO. 15.

## Sentences.

After familiarizing himself with the following sentences, the beginner may take such other as he chooses, for practice ; but he must always be careful to write one correctly before commencing with another :

How are you ?

-----  
 -----

Are you going home ?

-----  
 -----

Will be home tomorrow.

-----  
 -----  
 -----

John is sick.

-----  
 -----

It rained to-day.

-----  
 -----

When are you coming ?

-----  
 -----  
 -----

Yes, you may come.

-----  
 -----

Ask him.

Ere the dawn of another glorious day.

It is not likely.

What makes you think so?

Why not?

Is that so?

Snow to-morrow.

Four houses wrecked.

The savings bank was looted.



Beautiful as a lovely dream.

From far away.

Dead in his prime.

Far from the life he loved.

Tell him he must not do it.

Send four hundred.

About Tuesday.

Original copy.

Two may come.

Order is too large.

-----  
 ..      -----      ..      -----      ..      -----

Cut it down.

-----  
 -----

See that you do it.

-----  
 -----

Bear it in mind.

-----  
 -----

Balmy are the days.

-----  
 -----

Wheat received.

-----  
 -----

Cargo is on wheels.

-----  
 -----

Please state terms.

-----  
 -----

Can't you come down a little?

-----  
 -----  
 -----

Give another price.

-----  
-----  
-----

Send in bid.

-----

Goods were in bad order.

-----  
-----  
-----

Will ship today.

-----  
-----

It is due.

-----

Fair weather.

-----  
-----

I cannot do it.

-----  
-----

The train was late.

-----  
-----

Are you positive?

-----  
-----

I am positive.

-----  
-----

It is a thing of beauty.

-----  
-----  
-----

It was well done.

-----  
-----

## COMMERCIAL MESSAGES.

Great care should be exercised in both receiving and transmitting commercial telegrams, for they are the medium through which the public transact their business. Mistakes are easily made and the outcome of some will likely involve the telegraph company in costly litigation.

In sending a message the date is always prefixed by "from." The word "to" always precedes the address. The address comprises the name and place of the person to whom the message is addressed. The check, sending operator's letters, and the number precedes the date.

The check tells whether the message is paid, free or collect.

The "from," "to" and "sig." are never copied by the receiving operator.

When an operator is through receiving a message he must always sign "O. K."

The message has not been properly received and must be repeated if no O.K. is received.

When the receiver finds he is not getting the message correctly, he breaks and tells the sender to "G. A." (go ahead) the last word received.

When the sender discovers that he has made a wrong letter, he stops, makes six or more dots, says "msk." (mistake), and commences again with the last word made correctly.

The operator should see that he has the number of words called for by the check, after receiv-

ing a message. If they do not agree, he should compare with sender until error is found. This is done by commencing at the period and writing the first letter in each word until the missing portion is found.

---

### ORDER OF TRANSMISSION.

The operator will always observe the following order of transmission:

1. Number of message.
2. Office call.
3. Operator's personal signal.
4. Check of message.
5. Place from and date.
6. Address.
7. Body and signature.

















## EXERCISE NO. 23.

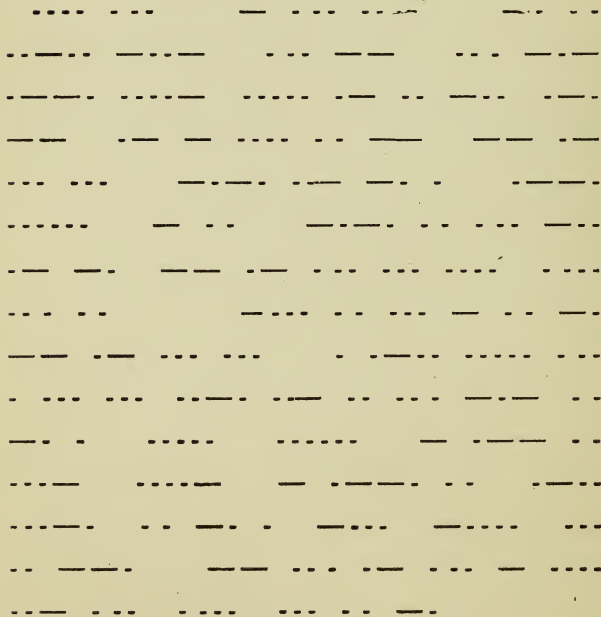
Hr. Tru. No. 29. Rm. Ck. 14. Paid.

From Athol, Mass., June 16.

To Jordon Marsh & Co., Boston, Mass.

Express quick one P 6, two V four, two X three,  
one B eight.

(Sig.) McARTHUR & SON.















EXERCISE NO. 29.

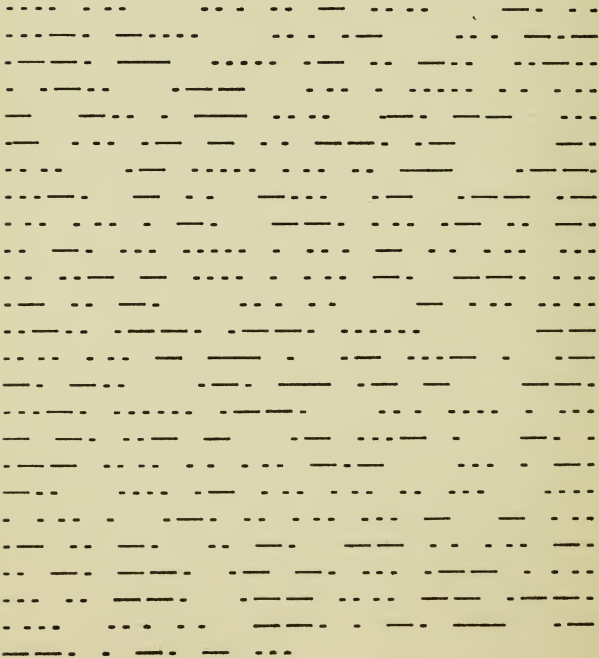
Hr. City. No. 38. Ca. Ck. 10. Paid. 2 Ex.  
W. Report Dely.

From Saratoga, N. Y., April 12.

To B. A. Warren, Grain Inspector, Southern Grain  
Co. Try 2116 Myrtle Ave., and Flat G, 361  
Chestnut Ave., New York.

Send Harris here. First train in morning. An-  
swer.

(Sig.) WYMAN & Co., General Agents.





## EXERCISE NO. 31.

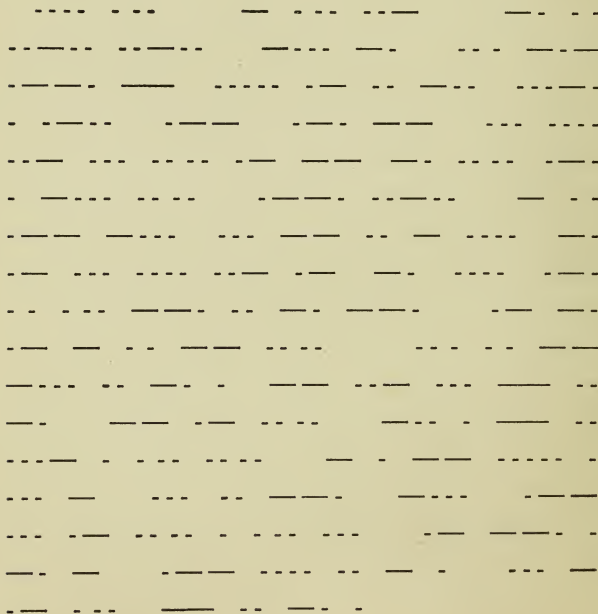
Hr. Tru. No. 22. Bn. Ck. 10. Paid. 3. Ex. W.

From Shusham, N. Y., Feb. 12.

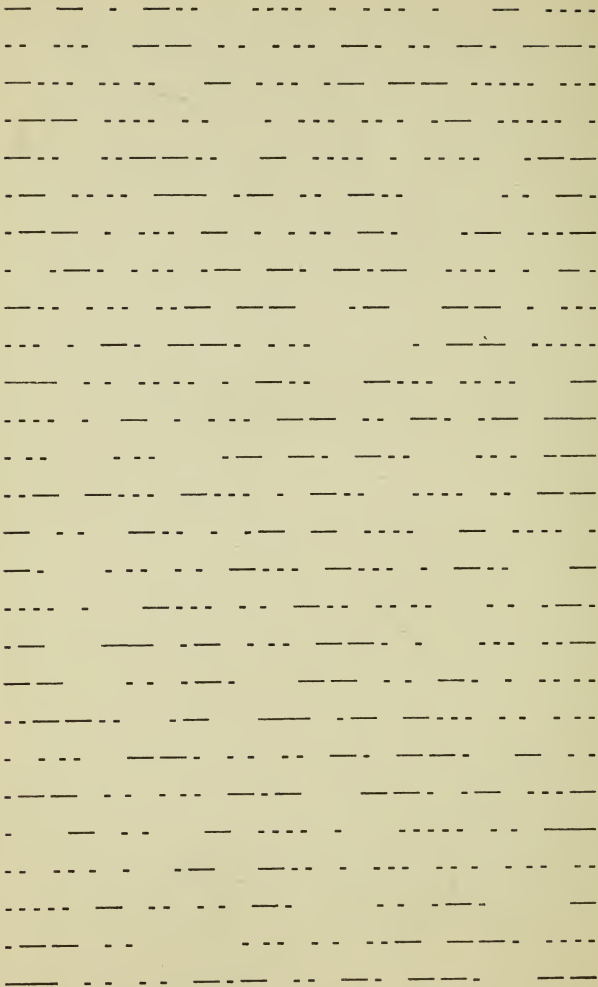
To W. B. Smith, Nashua, N. H.

Forging anatomy combine. Muslin May delivery tempest.

(Sig.) B. W. SAYERS,  
Agent White Star Line.











## THE STUDENT.

Three things only are required by the student who aspires to be a telegraph operator. They are study, perseverance and common sense. A common school education is all that is needed in the way of learning.

First he should familiarize himself with the principles involved in the production of the current, and the application of the current to the telegraph. After he has done this, and has set his instruments in position, he is then ready for the first lesson.

It is not hard to learn telegraphy. The alphabet is easily mastered, and, in a nut-shell, the rest consists of practice. But the student should not stop after he has secured his position. He should learn the mechanism of his instruments—how they are put together, and what each piece is for—and indulge in the principles of the science as applied to the more complicated apparatus of the telegraph.

Once a telegraph operator, not always an operator, should ever be in his mind. Use the profession as a stepping stone for something higher. Learn the work thoroughly, once and for all. There are thousands of operators who are always learning something they should have mastered before ever being hired. These are those who say that the profession is over-crowded, and that there is no promotion for the ordinary operator. That is all wrong. Look at the successful railroad and

business men. Thousands of them began life as an operator on a small salary. Through the accuracy and quickness of mind that operators' duties developed in them they have risen to the top. Their success will be your success, if you don't idle the precious minutes away, but apply yourself to your work as diligently and faithfully as you can.

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#### OFFICE CALLS.

Every telegraph office has a call which consists of not more than two letters. The call for Chicago is Ch., Duluth, D. If Chicago desires to communicate with Duluth, he repeats Duluth's call until answered. He will also sign his own office call at short intervals when calling an office, and will sign it when answering calls.

## HOW TO COUNT THE WORDS IN A MESSAGE.

In a prepaid message the following words will be counted:

Extra words in an address.

Words, figures and letters in the body of a message.

Figures, decimal points and letters will be counted separately, each as one word.

The affixes st., d., nd., rd., and th., will be counted each as one word.

Abbreviations of weights and measures, and the names of territories, states, cities, town and villages will be counted as written in full. Also initial letters and surnames of persons.

In a collect message, and in the check, such words as "delivery charges guaranteed," "deliver and report charges," "report delivery," "repeat back," should be counted and charged for.

The word "collect" will be counted, but not charged.

Compound words and proper combinations of dictionary words will be counted and charged for as given in the list following:

A. M.....	1 word
Alright.....	2 words
Assistant General Freight Agent.....	4 words
Bill-lading.....	1 word
Cwt .....	1 word
Can't or Cannot.....	1 word

COD.....	1 word
Cook County.....	2 words
C. I. F.....	1 word
C. A. F.....	1 word
Delivery charges guaranteed.....	3 words
Dist. of Columbia.....	1 word
East Chicago.....	1 word
East St. Louis.....	1 word
East St. Paul.....	1 word
F. O. B.....	1 word
Foreman.....	1 word
General Freight Agent.....	3 words
Harrett, M. D.....	2 words
Highland Park.....	2 words
La Salle.....	1 word
Lbs.....	1 word
Long Island Sound.....	1 word
McDonald.....	1 word
New York.....	1 word
New York State.....	2 words
No. 487 21st St.....	8 words
O'Shannon.....	1 word
O. K.....	1 word
Per cent.....	1 word
Prepaid.....	1 word
Rhode Island.....	1 word
Someone.....	2 words
St. Paul.....	1 word
South Chicago.....	1 word
South Carolina.....	1 word
South Carolina State.....	2 words

Swartz, A. B., M. D.....	3 words
Somehow.....	2 words
Something.....	2 words
Somewhere.....	2 words
Twenty millions.....	2 words
West Albany.....	1 word
Wilson, Sr.....	2 words
Wilson, Jr.....	2 words
3.25.....	4 words
44.82.....	5 words
376.22.....	6 words
4,208,629.....	7 words
4th.....	2 words
33rd.....	3 words

## RAILROAD RULES FOR TELEGRAPH OPERATORS.

All telegraph operators report to, and receive their instructions from, the Superintendent of Telegraphs and Signals. They will obey the orders of the chief operator on their respective divisions. They will also observe the instructions of station agents, where the same does not interfere with their duties as operators.

They are required to be constantly on duty during the hours assigned them, and must not leave their offices to go to meals, deliver messages, or for any purpose that will take them out of hearing over five minutes, without permission, and will always report promptly to the train-dispatcher upon their return. They must not leave their office while a train is at the station, unless required to do so by business connected with the train.

Offices will be in charge of the day operator, and when two or more are employed one must be always on duty. Day and night operators must not leave their posts until relieved by each other, and they will instruct the one going on duty in regard to the position of trains and any unfinished business.

At offices where a day operator only is employed, the operator must not close his office for the night until he has received "Good night" from the train-dispatcher's office.

Day operators will report on each Sunday morn-

ing, and night operators will report on each Sunday evening, and if not needed will be excused.

They must be courteous in their intercourse with one another, and with all persons transacting business at their offices. Improper or profane language will not be permitted over the wires.

They must not take students, or leave their offices in charge of other operators, without permission.

They must not permit persons (whether employes of the company or not) to frequent their offices.

All messages sent and received must be dated, timed, and have written on them the initials of the operators who sent or received them. When messages from General or Division Officers are left for transmission, the original will be sent by train to the sender at his office, and a copy with all time notations kept for the office file.

The original or a copy of all messages sent, and copies of all messages received, that can not be delivered directly or promptly, must be preserved for reference. If a message received cannot be delivered within a reasonable time, the party or the office sending the message must be notified why.

They must not receive messages to be transmitted free, unless signed by, or addressed to, an officer, agent, or other employe entitled to the use of the wire. They must consider all messages strictly confidential, and will not permit them to be read by any persons except those to whom they are ad-



dressed, nor to make their contents the subject of conversation or remark.

If the circuit is broken for an unusual length of time, they must test the wires and report on which side of the office the break is. If they receive reliable information as to the location of a break, and cannot reach the Division Train-Dispatcher promptly, they will direct section foreman to make temporary repairs.

Contention for circuit will not be permitted. Should the circuit be interrupted while an operator is writing, he will stop immediately to ascertain the cause; if it be another operator breaking, unless the one breaks says "21" (this dispatch must have preference over all other business on division wires), or "55" (this dispatch is of great importance), the operator who is writing will say "8" (close your key, you are breaking others), and close his key; if the request is not complied with, he will keep his key closed until he can proceed without interruption, and then report the case in writing.

The ground wire must never be used except when the wire is interrupted, and then only long enough to report, or to transact important business. Operators will be held to a strict accountability for violations of this rule.

Operators must make themselves familiar with their switch and spring boards, so that they can connect wires, as directed by the testing operator, correctly and promptly. Always be sure that the

testing operator has finished his directions before commencing to connect wires or removing ground-wire. When directed to "open circuit" say "now" and make a slight pause before actually opening the circuit. Never connect wires *vice versa* unless directed to do so by the testing operator, and always keep an instrument on the wire on which instructions are being given until communication is opened.

The telegraph must not be used for the transmission of communications which may be sent by train without detriment of or to the company's interests. Operators will enclose copies of messages passing through their offices that evidently infringe on this rule to the Superintendent of Telegraph.

They must keep a full set of signals in good order, and always ready for immediate use, and use them strictly in accordance with the rules.

They must keep a register of all trains passing their offices, and the reports from such other offices as may be required, on the blank furnished for this purpose. This report must show the arriving as well as the leaving time of all trains, and the color of the signals, if any were carried. Operators at offices equipped with semaphore signals must also note the signal given each train.

When reporting the time of trains operators will also name the station block signal given to the trains. When a train remains two minutes or longer at a station the arriving as well as the leaving time

will be given. When a passenger train is delayed over five minutes, or a freight train is delayed over fifteen minutes, the reason for the detention must be entered on the register and reported with the time.

Arriving time of a train is the time at which the engine reaches the station or siding, but it must not be reported until the markers of the train have been seen. Departing time will be reported when the rear of the train, with markers attached, passes the office.

Operators must give particular attention to the adjustment of their relays when trains are behind time, and be ready to receive Special Orders. When holding a train for orders they must signal it in person, and not depend upon anyone else to do so.

They must observe the rear of all trains passing their offices, and if markers or red lights are not displayed, report it at once to the Division Superintendent.

On a single track and at junctions, when signals for a following section are taken off a train at a station, the operator must immediately display red signals, and hold all trains not having the right of road until the train for which the signals were displayed has arrived.

Operators will require conductors, or others, reporting accidents to use the blanks for that purpose, and see that all the necessary information is included and written plainly.

## DUTIES OF LINE REPAIR MEN.

Line repair men located at points along the road will in the absence of the Superintendent of Telegraph report every morning to the train dispatcher of the division, and advise him as to their movements for the day, and will obey his instructions as to repairs necessary to keep the lines working.

They must see that the poles are kept in proper position, the wires connected, insulated, and clear of all obstructions, and make all necessary repairs. When assistance is required they will call upon the section foreman on their respective track sections. Section foremen must not be taken off their sections except in cases of emergency.

They must pass over the road frequently, and closely observe the condition of the line; examine the connections at the offices, and inquire of the operators as to the working of the lines.

They must always be provided with a full set of tools, and be ready to respond immediately to any orders they may receive.

They must supply the operators and section foreman with wire and insulators, and instruct them in regard to splicing the wire and making other repairs.

## BLOCK SIGNALS.

Block signals are erected at nearly all principal stations on railroads in the United States. They consist of single-armed semaphore signals for each main track, and are operated by levers from the block station.

A red light at night, and a red semaphore blade extended in a horizontal position by day, is a signal for trains to stop.

A white light at night, and a red semaphore blade lowered to a hanging or nearly vertical position by day, is a signal for trains to proceed.

The normal position of these signals will be to indicate danger, and to hold all trains. When there are no orders for the approaching train, and the operator has a report of the preceding train having passed the next block station, the signal to proceed must be given promptly, and without causing delay to the approaching train, and should be given when the train whistles for the station, or when the engineer first sights the signal.

If, on the arrival of a train at a block station, the preceding train has not been reported clear by the next block station, the train must be held until ten minutes after the departure of the preceding train, unless in the meantime it is reported clear. Trains must not be reported clear unless they are off main track, or have passed one hundred yards beyond the block semaphore signal. If at the expiration of ten minutes the preceding train is not reported clear, the operator will then give the

conductor of the train held a written clearance notice showing the time at which the preceding train left, and the signature of the conductor must be taken on a copy of this notice to be retained by the operator. This clearance the conductor will deliver to the engineer before the train starts. The train so held will not start until the semaphore has been changed to safety. A train with a clearance entering a block, as provided for in this rule, will be held responsible in case of an accident caused by overtaking the preceding train.

The time for holding trains (ten minutes) may be increased at the discretion of the dispatcher in foggy or stormy weather. Operators must notify the dispatcher promptly in case of fog, blinding snow storms, or bad weather.

Operators must report promptly to the next block station in the rear, and also to the next block station ahead, the time of trains passing their stations. These reports have preference over the reports to the Division Superintendent's office.

If no markers are displayed on the rear of a train, the operator at the next block station must be notified to stop the train, notify the conductor, and ascertain whether he has all the cars in his train. The block station in the rear must be notified that the track is blocked, until it is ascertained that the conductor has all of his train.

The block stations which are open day and night, and those which are open only during the day, will be indicated on the time tables. The Division Superintendents will issue notice from time to time

showing between what hours day block stations will be opened and closed, and conductors and engineers must have copies of such notices.

When operators have special orders for trains they will display a red signal at the place designated for this purpose, in addition to the semaphore signal. This position will be located by the Division Superintendent, and must not be changed except by his order. On double track, these red signals for special orders will govern the trains moving on the track on which the signal is shown, placed on the right hand, or engineer's, side of the track on which the train to be held is moving.

At block stations which are not equipped with semaphore signals the operator will, when instructed by the Division Superintendent, carry out these rules, using a red flag by day and a red light by night, instead of the semaphore signals.

When a passenger train is stopped by the operator's red signal where it receives or discharges passengers, the train may run to the proper position at the platform, but must not leave the station until the signal is withdrawn. All other trains must stop before passing the signal.

## RULES FOR THE MOVEMENT OF TRAINS BY TELEGRAPHIC ORDERS.

Special orders, directing movements of trains varying from or additional to the time table, are issued by the authority and over the signature of the Division Superintendent. They are not issued for movements that are provided for by rule or time table. They must not contain information or instructions not essentially a part of them.

They must be brief and clear, and the prescribed forms must be used when applicable; and there must be no erasures, alterations or interlineations.

Each order, when practicable, must be given in the same words to all persons or trains directly affected by it, so that each shall have a duplicate of what is given to the others. Preferably an order should include but one specified movement.

Orders will be numbered consecutively for each day as issued, beginning with No. 1 at midnight.

Orders must be addressed to those who are to execute them, naming the place at which each is to receive his copy. Those for a train must be addressed to the conductor and engineman, and also to a person acting as pilot. A copy for each person addressed must be supplied by the operator.

Each order must be written in full in a book provided for the purpose at the Division Superintendent's office; and with it must be recorded the names of trainmen and others who have signed for the order; the time and signals, showing when and



from what offices the order and responses were transmitted; and the train dispatcher's initials. These records must be made at once on the original copy, and not afterward, from memory or memoranda.

The terms "superior right" and "inferior right" in these rules refer to the rights of trains under the time table and train rules, and not to rights under special orders.

When an order is to be transmitted the signal "31" meaning "Train Order," will be given to each office addressed, followed by the word "copy" and a figure indicating the number of copies to be made, if more or less than three—thus, "31 copy 5."

An order to be sent to two or more offices must be transmitted simultaneously to as many as practicable. The several addresses must be in the order of superiority of rights of trains, and each office will take only its proper address. When not sent simultaneously to all, the order must be sent first for the train having the superior right of track.

Operators receiving orders must write them out in manifold during transmission and make the requisite number of copies at one writing, or trace others from one of the copies first made.

When an order has been transmitted, preceded by the signal "31," operators receiving it must (unless otherwise directed) repeat it back at once from the manifold copy, and in the succession in which their several offices have been addressed.

Each operator repeating must observe whether the others repeat correctly. After the order has been repeated correctly by the operators required at the time to repeat it, the response "O. K." authorized by the train dispatcher will be sent simultaneously to as many as practicable, naming each office. Each operator must write this on the order with the time, and then reply "i i O. K." with his individual and office signal.

Those to whom the order is addressed, except enginemen, must then sign their names to the copy of the order to be retained by the operator, and he will send their signatures to the Division Superintendent. The response "complete," with the Division Superintendent's initials, will then be given, when authorized by the train dispatcher. Each operator receiving this response will then write on each copy the word "complete," the time, and his last name in full; and will then deliver a copy to each person included in the address, except enginemen, and each must read his copy aloud to the operator. The copy for each engineman must be delivered to him personally by the conductor, and the engineman must read it aloud and understand it before acting upon it.

For an order preceded by the signal "31," "complete" must not be given to the order for delivery to a train of inferior right until "O. K." has been given to and acknowledged by the operator who receives the order for the train of superior right. Whenever practicable, the signature of the con-

ductor of the train of superior right must be taken to the order and "complete" given before the train of inferior right is allowed to act on it.

After "O. K." has been given and acknowledged, and before "complete" has been given the order must be treated as a holding order for the train addressed, but must not be otherwise acted on until "complete" has been given.

If the line fails before an office has received and acknowledged "O. K." to an order preceded by the signal "31," the order at that office is of no effect, and must be there treated as if it had not been sent.

The order, the "O.K." and the "complete" must each in transmitting be preceded by "31," as the case may be, and the number of the order, thus, "31, No. 10." In transmitting the signature of a conductor it must be preceded by "31," the number of the order, and the train number, thus, "31, No. 10, Train No. 5." After each transmission and response the sending operator must give his individual and office signal.

The operator who receives and delivers an order must preserve the lowest copy. On this must appear the signatures of those who sign the order, and on it he must record the time when he receives it, the responses, the time when they are received, his own name, the date, and the train number, for which places are provided in the blanks.

Train orders used by conductors and engineers must be sent by them daily to the Division Superintendent.

Enginemen will place their orders in the clip before them until executed.

For orders delivered at the Division Superintendent's office the requirements as to record and delivery will be the same as at other points.

Orders to persons in charge of work requiring the use of tracks in yards or at other points, authorizing such use when trains are late, must be delivered in the same way as to conductors of trains.

An order to be delivered to a train at a point not a telegraph station, or while the office is closed, must be addressed to "A. and E., No. — at —, care of —," and forwarded and delivered by the conductor or other person in whose care it is addressed. "Complete" will be given upon the signature of the person by whom the order is to be delivered, who must be supplied with copies for the conductor and engineman addressed, and a copy upon which he shall take their signatures. This copy he must deliver to the first operator accessible, who must preserve it, and at once advise the train dispatcher of its having been received.

Orders so delivered to a train must be compared by those receiving them with the copy held by the person delivering and acted on as if "complete" had been given in the ordinary way.

Orders must not be sent in the manner herein provided, to trains the rights of which are thereby restricted.

When a train is named in an order, all its sections are included unless particular sections are

specified, and each section included must have copies addressed and delivered to it.

Meeting orders must not be sent for delivery to the trains at the meeting points if it can be avoided. When it can not be avoided, special precautions must be taken by the train dispatchers and operators to insure safety.

There should be, if possible, at least one telegraph office between those points at which opposing trains are to receive meeting orders.

Orders should not be sent an unnecessarily long time before delivery, or to points unnecessarily distant from where they are to be executed. No orders (except those affecting the train at that point), should be delivered to a freight train at a station where it has much work, until after the work is done.

A train, or any section of a train, must be governed strictly by the terms of orders addressed to it, and must not assume rights not conferred by such orders. In all other respects it must be governed by the Train Rules and Time Table.

Orders once in effect continue so until fulfilled, superseded or annulled. Orders held by or issued for a regular train which has lost its rights, are annulled and other trains will be governed accordingly.

A fixed signal must be used at each train-order office which shall display red when trains are stopped for orders. On double track train dispatchers will indicate to operators when giving

the signal "31" which track the signal is to be displayed on.

When an operator receives the signal "31," he must immediately display red, and then reply "signal set." The signal must not be changed until the object for which it is displayed is accomplished.

While red is displayed, all trains must come to a full stop, and any train thus stopped must not proceed without receiving an order addressed to such train, or a clearance card on a specified form stating over the operator's signature that he has no orders for it. Operators must be prepared with other signals to use promptly if the fixed signal should fail to work properly.

When a semaphore is used, the arm means red when horizontal and white when in an inclined position.

Operators will promptly record and report to the Division Superintendent the time of departure of all trains and the direction in which extra trains are moving. They will record the time of arrival of trains and report it when so directed.

Regular trains will be designated in orders by their schedule numbers, as No. 10 including all the sections of No. 10, unless particular sections are designated. First section No. 10 (meaning the first train), second section No. 10, third section No. 10, etc., adding engine numbers if desired; extra trains by engine numbers as "Extra 158," and all other numbers by figures. The direction of the movement of extras will be added when necessary, as "East" or "West." Time will be stated in figures and words.

## TRAIN ORDER FORMS.

Form A.—Fixing meeting point for opposing trains.

— and — will meet at —.

## EXAMPLES.

No. 1 and 2 will meet at Preston.

No. 3 and 2d No. 4 will meet at Erie.

No. 5 and Extra 94 will meet at Horning.

Extra 24 West and Extra 23 East will meet at Cornell.

Trains receiving this order will, with respect to each other, run to the designated points, and having arrived there will pass in the manner provided by the rules.

Form B.—Authorizing a train to run ahead of or pass another train running in the same direction.

(1.) — will pass — at —.

(2.) — will run ahead of —, from — to —.

## EXAMPLES.

(1.)—No. 5 will pass No. 3 at Homer.

(2.)—No. 4 will run ahead of No. 2 from Hegterton to Lindsay.

When under this order a train is to pass another, both trains will run according to rule to the designated point and there arrange for the rear train to pass promptly.

Form D.—Giving all regular trains the right of track over a given train.

All regular trains have right of track against — between — and —.

#### EXAMPLE.

All regular trains have right of track against No. 9 between Newberry and Kingston.

This order gives to any regular train of inferior right receiving it, the right of track over the train named in the order, and the latter must clear the schedule times of all regular trains, the same as if it were an extra.

Form E.—Time orders.

- (1.) — will run — late from — to —.
- (2.) — will wait at — until — for —.

#### EXAMPLES.

(1.) No. 1 will run 20 minutes late from Highland to Kingston.

(2.) No. 1 will wait at West Park until 10 a. m. for No. 2.

Form (1) makes the schedule time of the train named, between the points mentioned, as much later as the time stated in the order, and any other train receiving the order is required to run with respect to this later time, the same as before required to run with respect to the regular schedule time. This time in the order should be such as can be easily added to the schedule time.



Under Form (2) the train of superior right must not pass the designated point before the time given unless the other train has arrived. The train of inferior right is required to run with respect to the time specified, the same as before required to run with respect to the regular schedule time of the train of superior right.

Form F.—For sections of regular trains.  
 — will carry signals — to — for —.

#### EXAMPLES.

No. 1 will carry signals Catskill to Coxsackie for Engine 85.

2nd No. 1 will carry signals Coeyman's Junction to Albany for Engine 90.

This may be modified as follows:

Engines 50, 55 and 60 will run as 1st, 2d and 3d sections of No. 1 Coeyman's Junction to Albany.

For annulling a section:

Engine 88 is annulled as second section of No. 1 from Coeyman's Junction to Albany.

If there are other sections following add:

Following sections will change numbers accordingly.

The character of train for which signals are carried may be stated. Each section affected by the order must have copies, and must arrange signals accordingly.

Form G.—For arranging a schedule for a special train.

(1.) Engine — will run as special — train, leaving — on — on the following schedule, and will have the right of track over all trains:

Leave \_\_\_\_\_

\_\_\_\_\_

Arrive \_\_\_\_\_

#### EXAMPLE.

(1.) Engine 79 will run as special passenger train, leaving Rotterdam Junction on Monday, January 24, on the following schedule, and will have the right of track over all trains.

Leave Rotterdam Junction 11:30 p. m.

Pattersonville 12:25 a. m.

Amsterdam 1:47 a. m.

Arrive Fort Hunter 2:22 a. m.

#### EXAMPLE.

Example (1) may be varied by specifying particular trains over which the special shall or shall not have right of track must clear its time as many minutes as such train is required to clear the schedule time of a first-class train.

(2.) Engine — will run as special — train, leaving — on — with the rights of a — class train, —, on the following schedule, which is a supplement to time table No. —.

Leave \_\_\_\_\_

\_\_\_\_\_

Arrive \_\_\_\_\_

## EXAMPLE.

(2.) Engine 74 will run as a special passenger train, leaving Frankfort, Monday, January 12th, with rights of a first-class train West, on the following schedule, which is a supplement to time table No. 10.

Leave Frankfort 10:00 a. m.

Harbor 10:30 a. m., passing No. 14.

East Utica 11:00 a. m., meeting No. 4.

Arrive at Utica 11:30 a. m.

Example (2) creates a regular train and the specified meeting and passing points are to be regarded as if designated in the same manner as on the time table. Such trains will be governed by all rules which affect regular trains.

Form H.—Extra trains.

— will run extra from — to —.

## EXAMPLE.

(a.) Engine 99 will run extra from Canastota to Syracuse.

A train receiving an order to run extra is not required to guard against opposing extras, unless directed by order to do so, but must keep clear of all regular trains as required by rule.

A "Work Train" is an extra, for which the above form will be used for a direct run in one direction. The authority to occupy a specified portion of a track, as an extra while working, will be given in the following form:

(b.) Engine 282 will work as an extra from 7 a. m. until 6 p. m. between Syracuse and Amboy.

The working limits should be as short as practicable, to be changed as the progress of the work may require.

The above may be combined, thus:

(c.) Engine 282 will run extra from Syracuse to Amboy and work as an extra from 7 a. m. until 6 p. m. between Syracuse and Weedsport.

When an order has been given to "work" between designated points, no other extra must be authorized to run over that part of the track without provision for passing the work train.

When it is anticipated that a work train may be where it cannot be reached for meeting or passing orders, it may be directed to report for orders at a given time and place, or an order may be given that it shall clear the track for a designated extra, in the following form:

(d.) Work Train 282 will keep clear of Extra 222, East, between Weedsport and Memphis after 2:10 p. m.

In this case, Extra 222 must not pass either of the points named before 2:10 p. m., at which time the work train must be out of way between those points.

When the movement of an extra train over the working limits cannot be anticipated by these or other orders to the work train, an order must be given to such extra to protect itself against the work train, in the following form:

(e.) Extra 76 will protect itself against Work Train Extra 95 between Lyons and Newport.

This may be added to the order to run extra.

A work train when met or overtaken by an extra must allow it to pass without unnecessary detention.

When the conditions are such that it may be considered desirable to require that work trains shall at all times protect themselves while on working limits, this may be done under the following arrangements. To example (b) add the following words:

(f.) Protecting itself against all trains.

A train receiving this order must, whether standing or moving, protect itself within the working limits (and in both directions on single track) against all trains.

When an extra receives orders to run over working limits it must be advised that the work train is within those limits by adding to example (a) the words:

(g.) Engine 282 is working as an extra between Syracuse and Amboy.

A train receiving this order must run expecting to find the work train within the limits named.

Form J.—Holding order.

Hold —— at ——.

### EXAMPLE.

- (1.) Hold No. 2 at Weedsport.
- (2.) Hold all trains at Weedsport.

As any order for which "O. K." has been given and acknowledged operates as a holding order for the train to which it is addressed, this form will only be used in special cases, to hold trains until orders can be given for some other emergency. The reason for holding may be added, as "for orders."

This order is not to be used for holding a train, while orders are given to other trains against it, which are not at the same time given to it in duplicate. It must be respected by conductors and enginemen of trains thereby directed to be held as if addressed to them. Conductors when informed of the order must sign for it, and their signatures must be sent and "complete" obtained.

When a train has been so held it must not go until the order to hold is annulled, or an order is given in the form:

"—— may go."

This must be addressed to the person or persons to whom the order to hold was addressed and must be delivered in the same manner.

Form K.—Annulling a schedule train.  
— of — is annulled.

## EXAMPLES.

- 1.) No. 1 of February 29th is annulled.
- (2.) No. 3 due to leave Weehawken Saturday, February 9th, is annulled.

Adding “from Weehawken” or “between Cornwall and Coeyman’s Junction,” when appropriate.

This order takes away all rights of the train annulled and authorizes any train or person receiving it to use the track as if the train annulled were not on the time table.

If a train is annulled to a point named, its rights beyond that point remain unaffected.

The train dispatcher may direct any operator to omit repeating back an order annulling a train until he has occasion to deliver it.

When a train has been annulled it must not again be restored under its original number by special order.

Form L.—Annuling or superseding an order.

“Order No. —— is annulled.”

This will be numbered, transmitted and signed for as other orders.

If an order which is to be annulled has not been delivered to a train, the annulling order will be addressed to the operator, who will destroy all copies of the order annulled but his own, and write on that:

Annulled by order No. ——.

An order superseding another may be given, adding “this supersedes order No. ——,” or adding “instead of ——.”

#### EXAMPLE.

No. 1 and No. 2 will meet at Clarence instead of at Akron.

An order which includes more than one specified movement must not be superseded.

An order that has been annulled or superseded must not be again restored by special order under its original number.

In the address of an order annulling or superseding another order, the train first named must be that to which rights were given by the order annulled or superseded, and when the order is not transmitted simultaneously to all concerned, it must be sent to the point at which that train is to receive it and the required response first given, before the order is sent for other trains.



## TELEGRAPH NUMERALS.

1. Wait a minute.
2. Very important.
3. Give me the correct time.
4. Where shall I repeat from?
5. Have you any business for me?
6. I have business; are you ready?
8. Close your key; you are breaking.
9. Wire tests—has preference over 25 and 55.
10. Low.
12. The circuit is yours.
13. Understand?
14. What is the weather?
15. Have you any orders?
17. Daily weather report.
18. What is the matter?
19. Train order.
21. This must have preference over all other business on Division Wires. On Through Wires this will have preference over signals 9, 25, 55.
22. Busy on other wire.
23. All copy.
24. Repeat back.
25. Time reports to General Superintendent's office of passenger trains. (Used on Through Wires). Preference of circuit over ordinary and "55" business.
28. Did you get my writing?
29. This is private, and must be delivered in sealed envelope.

33. Answer is paid.

39. This dispatch must have preference over all other business on Through Wires, and will be used only by the President, Vice-President, General Manager and General Superintendent.

44. Answer quick by telegraph.

55. This message is of great importance.

73. Accept my compliments.

77. I have a message for you.

92. Deliver.

92d. Delivered.

134. Who is at the key?

## ABBREVIATIONS.

Abbreviations, or contractions, are generally made by leaving out the vowels, though some are entirely arbitrary, while others are spelled phonetically; and in clauses and phrases of oft-repeated "railroad" words, the first letters of the words are substituted instead.

There are also a few simple sentences which are so often used that figures have been substituted as symbols.

The following list of abbreviations is quite complete, and the student should commit them to memory and practice with the key until he can instantly recall to mind the abbreviation of any word, as they are important, and tend to materially lessen the operator's work.

## A

Abandoned .....	abnded.
Abbreviation .....	abbn.
About .....	abt.
Acknowledge .....	x.
Account .....	acct.
Account sales .....	a. s.
Action .....	actn.
Address .....	ads.
Afternoon .....	P. M.
Agent .....	agt.
All right .....	O. K.
Always .....	alwas.
Amount .....	amt.

And others .....	<i>et al.</i>
Annulled .....	annld.
Another .....	ahr.
Answer .....	ans.
Any .....	ay.
April ..	Apr.
Are .....	r.
Are you.....	R. U.
Arrival .....	avl.
Arrive .....	av.
Ascertain .....	ascrtn.
Assist .....	asst.
Assistant General Freight Agent.....	A G F A.
Assistant General Passenger Agent.....	A G P A.
At .....	a.
Attention .....	attn.
Attorney .....	atty.
Barrell .....	bbl.
August ..	Aug.
Avenue. ....	Ave.

## B

Back ..	bk.
Baggage ..	bage
Balance ..	bal.
Barrel ..	bbl.
Battery ..	bat.
Be ..	b.
Become. ....	becm.
Been ..	bn.
Before ..	b4.
Better ..	btr.

Between . . . . .	.btwn.
Bill-lading . . . . .	B L.
Black . . . . .	.blk.
Blanks . . . . .	.blnx.
Block . . . . .	.blk.
Board . . . . .	.bd.
Body . . . . .	.bdy.
Book . . . . .	.buk.
Bought . . . . .	.bot.
Boulevard . . . . .	.blvd.
Bound . . . . .	.bnd.
Break. . . . .	.bk.
Brakeman . . . . .	.brkmn.
Building . . . . .	.bldg.
Bushel . . . . .	.bu.
Business . . . . .	.biz.
But . . . . .	.bt.
By . . . . .	.bi.

## C

Can . . . . .	.cn.
Cancel former order . . . . .	.cfo.
Cannot . . . . .	.cnt.
Care of . . . . .	.c o.
Cashier . . . . .	.cashr.
Cent . . . . .	.ct.
Cents . . . . .	.cxs.
Charge . . . . .	.chg.
Charges . . . . .	.chgs.
Check . . . . .	.ck.
Chief . . . . .	.chf.
Circuit . . . . .	.ckt.

Clear . . . . .	clr.
Coal and water . . . . .	C & W.
Collect . . . . .	col.
Collection on delivery . . . . .	c o d
Combination . . . . .	combn.
Come . . . . .	cm.
Coming . . . . .	cmg.
Commercial . . . . .	coml.
Commercial news department . . . . .	end.
Commission . . . . .	comsn.
Company . . . . .	co.
Conductor . . . . .	condr.
Conductor and engineer . . . . .	C & E.
Connection . . . . .	conn.
Copy . . . . .	cy.
Correct . . . . .	O K
Correction . . . . .	corn.
Cost, insurance and freight . . . . .	c i f.
Could . . . . .	cld.
Creditor . . . . .	cr.
Crossing . . . . .	xng.

## D

Day . . . . .	da.
Day press rate . . . . .	d p r
Day's date . . . . .	d d.
Day's sight . . . . .	d s.
Dead head . . . . .	d h
Debtor . . . . .	dr.
December . . . . .	Dec.
Decrease . . . . .	dec.
Democrat . . . . .	dem.

Difference . . . . .	dif.
Dinner . . . . .	dinr.
Disregard former service . . . . .	d f s.
District. . . . .	dist.
Division . . . . .	divn.
Don't . . . . .	dnt.
Delivery . . . . .	dely.
Delivery charges guaranteed. . . . .	dely chgs gtd.
Depart . . . . .	d.
Despatcher . . . . .	despr.
Destroy . . . . .	bust
Did . . . . .	dd
Double deck . . . . .	d d.
Doubt. . . . .	dbt.
Down . . . . .	dwn.
Dozen . . . . .	doz.
Draft . . . . .	dft.
Duplicate . . . . .	dup.

## E

East . . . . .	e.
Election . . . . .	elect.
Empty . . . . .	mt.
Engine . . . . .	eng.
Engineer . . . . .	enr.
Enough. . . . .	enuf.
Errors excepted. . . . .	e e.
Errors and omissions excepted . . . . .	e & o e.
Every . . . . .	evy.
Excursion . . . . .	excn.
Excuse . . . . .	ex.
Express . . . . .	ex.
Extra . . . . .	exa.

## F

Favor . . . . .	fvr.
February . . . . .	Feb.
Few. . . . .	fu.
For. . . . .	r.
Foreign. . . . .	forgn.
Foreman . . . . .	4man.
Forward . . . . .	fwd.
Free . . . . .	d h
Free of general average . . . . .	F G A.
Free of particular average . . . . .	F P A.
Free on board . . . . .	f o b.
Freight . . . . .	frt.
From . . . . .	fm.

## G.

General Baggage Agent . . . . .	G B A.
General Freight Agent . . . . .	G F A.
General Passenger Agent . . . . .	G P A.
Get . . . . .	gt.
Give better address. . . . .	g b a.
Give some address . . . . .	g s a.
Go ahead . . . . .	g a.
Go ahead arrival . . . . .	g a a.
Go ahead departure . . . . .	g a d.
Going . . . . .	gng.
Gone . . . . .	gn.
Good . . . . .	gd.
Good afternoon . . . . .	p m.
Good evening . . . . .	g e.
Good morning. . . . .	g m.
Good night . . . . .	g n.



Gossips . . . . .	guff.
Got . . . . .	gt.
Government . . . . .	govt.
Grain. . . . .	grn.
Great . . . . .	grt.
Ground . . . . .	gnd.
Ground wire . . . . .	g w.
Guaranteed . . . . .	gtd.
Guess. . . . .	gs.

## H

Half . . . . .	hf.
Has . . . . .	hs.
Have . . . . .	hv.
Here . . . . .	hr.
High . . . . .	hi.
Hogshead . . . . .	hhd.
How . . . . .	hw.
How is. . . . .	hws
Hundred . . . . .	hnd.
Hundred weight . . . . .	cwt.

## I

Immediately . . . . .	immy.
Important. . . . .	imp.
Increase . . . . .	inc.
Instrument . . . . .	inst.
Invoice . . . . .	inv.

## J

January . . . . .	Jan.
Junction . . . . .	junc.
Junior . . . . .	jr.

## K

Knew . . . . .	nu.
Know . . . . .	no.
Knows . . . . .	nos.

## L

Last month . . . . .	u i x.
Laugh . . . . .	ha ha.
Learn . . . . .	lrn.
Leave . . . . .	lv.
Letter . . . . .	ltr.
Light . . . . .	lite.
Limited . . . . .	ltd.
Loads . . . . .	lds.
Local . . . . .	loc.
Look . . . . .	luk.
Loop . . . . .	lup.

## M

Made . . . . .	md.
Main . . . . .	mn.
Majority . . . . .	maj.
Make . . . . .	mk.
Manager . . . . .	mgr.
Manifold . . . . .	mfld.
Manifest . . . . .	mfst.
Manufacturer . . . . .	mfr.
Manufacturing . . . . .	mfg.
Many . . . . .	mny.
March . . . . .	Mar.
Marked . . . . .	mkd.
Market . . . . .	mkt.

Matter . . . . .	mtr.
May . . . . .	Ma.
Merchandise . . . . .	mdse.
Message . . . . .	msg.
Messenger . . . . .	msgr.
Might . . . . .	mite.
Mile . . . . .	mi.
Million . . . . .	myn.
Minute . . . . .	min.
Mistake . . . . .	msk.
Mistaken . . . . .	mskn.
Misses . . . . .	mrs.
Mister . . . . .	mr.
Months . . . . .	mos.
Months' date . . . . .	m d.
Months' sight . . . . .	m s.
More . . . . .	mo.
Morning . . . . .	a m.
Much . . . . .	mch.

## N

Namely . . . . .	viz.
Near . . . . .	nr.
Necessary . . . . .	necy.
Never . . . . .	nvr.
New . . . . .	nu.
Next month . . . . .	prox.
Night . . . . .	nite.
Night press rate . . . . .	n p r.
No more . . . . .	n m.
None between . . . . .	n b.
North . . . . .	n.

No such number	.....n s n.
Not	.....nt.
Nothing	.....ntg.
November	.....Nov.
Now	.....nw.
Number	.....no.
Numbers	.....nos.

## O

Obedient	.....obt.
O'clock	.....k.
October	.....Oct.
Of	.....o.
Office	.....ofs.
One hundred	.....1 hn
One thousand	.....1 tnd.
On time	.....o t.
Opening	.....opg.
Operator	.....opr.
Opinion	.....opn.
Order	.....ord.
Other	.....otr.
Our	.....r.
Out	.....ot.
Owner's risk	.....o r.

## P

Package	.....pkg.
Paid	.....pd.
Pair	.....pr.
Passenger	.....pasgr.
Pay	.....pa.

Payment . . . . .	payt.
Pecks . . . . .	pks.
Peoples . . . . .	peo.
Pint . . . . .	pt.
Per centum . . . . .	o o.
Per mill . . . . .	o o o.
Place for a seal . . . . .	l s.
Please . . . . .	pls.
Post office . . . . .	p o.
Pound . . . . .	lb.
Precinct . . . . .	pret.
Preferred . . . . .	pdf.
Present month . . . . .	inst.
President . . . . .	prest.
Principal . . . . .	prin.
Prohibition . . . . .	pro.

## Q

Quart . . . . .	qt.
Quarter . . . . .	qr.
Quarterly . . . . .	quar.
Question . . . . .	qn.
Quick . . . . .	qk.
Quotation . . . . .	qtn.

## R

Railroad . . . . .	r r.
Railway . . . . .	ry.
Ready . . . . .	rdy.
Rebate . . . . .	reb.
Receipts . . . . .	rects.
Received . . . . .	recd.

Receiving . . . . .	recg.
Reclining . . . . .	recg.
Refrigerator . . . . .	refr.
Release . . . . .	rel.
Relay . . . . .	rela.
Relief . . . . .	rf.
Repeat . . . . .	rept.
Report . . . . .	rpt.
Report delivery charges . . . . .	rept dely chgs.
Republican . . . . .	repn.
Right . . . . .	rite.
Round . . . . .	rnd.

## S

Said . . . . .	sd.
Same . . . . .	sm.
Say . . . . .	sa.
Second . . . . .	sec.
Section . . . . .	secn.
See . . . . .	c.
See former order . . . . .	s f o.
See former service . . . . .	s f s.
Seen . . . . .	en.
See your service . . . . .	s y s.
Sending . . . . .	sendg.
September . . . . .	Sept.
Service . . . . .	svc.
Several . . . . .	svl.
Should . . . . .	shld.
Siding . . . . .	sdg.
Sight . . . . .	site.
Sign . . . . .	sine.

Signature . . . . .	sig.
Signed . . . . .	sined.
Single deck . . . . .	s d.
Sir . . . . .	sr.
Slow . . . . .	slo.
Somehow . . . . .	smhw.
Some . . . . .	sm.
Some one . . . . .	sm l.
Something . . . . .	smtg.
Somewhat . . . . .	smwt.
Somewhere . . . . .	smwr.
Soon . . . . .	sun.
South . . . . .	s.
Speak . . . . .	spk.
Special . . . . .	spl.
Special delivery guaranteed . . . . .	spl dely gtd.
Station . . . . .	sta.
Stay . . . . .	sta.
Stock . . . . .	stk.
Stop for breakfast . . . . .	s f b.
Stop for dinner . . . . .	s f d.
Stop for night . . . . .	s f n.
Stop for tea . . . . .	s f t.
Straight . . . . .	strate.
Street . . . . .	st.
Superintendent . . . . .	supt.
Supper . . . . .	supr.
Suppose . . . . .	spose.
Switch . . . . .	sw.
System . . . . .	sys.

## T

Take . . . . .	tk.
Talk . . . . .	tlk.
Tariff . . . . .	tff.
Telegraph . . . . .	tel.
Telephone . . . . .	phone.
Thanks . . . . .	tnx.
That . . . . .	tt.
That is . . . . .	i e.
The . . . . .	t.
Their . . . . .	tr.
Them . . . . .	em.
Then . . . . .	tn.
There . . . . .	tr.
They . . . . .	ty.
Thing . . . . .	tng.
Think . . . . .	tnk.
This . . . . .	ts.
This morning . . . . .	a m.
Though . . . . .	tho.
Thought . . . . .	thot.
Thousand . . . . .	tnd.
Through . . . . .	thru.
Tierce . . . . .	te.
Today . . . . .	toda.
Together . . . . .	togtr.
Tomorrow . . . . .	tomw.
Tonight . . . . .	tonite.
Took . . . . .	tuk.
Track . . . . .	trk.
Train . . . . .	trn.
Transfer . . . . .	tfr.



Travelling Passenger Agent .....	T P A.
Trouble .. .	tbl.
Try .....	tri.

## U.

Unchanged . . . . .	unchd.
Undelivered . . . . .	undeld.

## V.

Versus . . . . .	vs.
Very . . . . .	vy.

## W

Was . . . . .	ws.
Water . . . . .	wtr.
Way . . . . .	wa.
Way-bill .. . . .	w b.
Weather . . . . .	wtr.
Weight . . . . .	wt.
West . . . . .	w.
Wharf . . . . .	whf.
What . . . . .	wt.
When .. . . .	wn.
Where . . . . .	wr.
While . . . . .	wile.
Why . . . . .	wi.
Who .....	wo.
Will . . . . .	wi.
With .. . . .	wi.
Word .....	wd.
Work . . . . .	wk.
Worked . . . . .	wkd.
Would .. . . .	wld.

Write . . . . .rite.  
 Wrote . . . . .rote.

## Y.

Yard . . . . .yd.  
 Yards . . . . .yds.  
 Year . . . . .yr.  
 Years . . . . .yrs.  
 Yes . . . . .es.  
 Yes sir . . . . .esr.  
 Yesterday . . . . .esterda.  
 Yet . . . . .et.  
 You . . . . .u.  
 Young . . . . .ung.  
 Your . . . . .ur.

## OPTION MONTHS.

F—January.  
 G—February.  
 H—March  
 J—April.  
 K—May.  
 M—June.  
 N—July.  
 Q—August.  
 U—September.  
 V—October.  
 X—November.  
 Z—December.

## PROVISION, GRAIN AND STOCK ABBREVIATIONS.

In the transmission of quotations of stocks, grain and provisions, a special list of symbols is used:

AE—Adams Express.

ACL—American Coal.

ACO—American Cotton Oil Co.

AD—American District Telegraph Co.

AM—American Express.

MX—American Malting Co.

AMS—American Spirits Mfg. Co.

ASW—American Steel & Wire Co.

Sug—American Sugar Refining Co.

AC—American Telegraph & Cable Co.

AMT—American Tobacco Co.

A—Atchison Topeka & Santa Fe R. R.

BO—Baltimore & Ohio R. R.

BSW—Baltimore & Ohio Southwestern Ry.

BG—Bay State Gas.

BL—Boston & New York Air Line R. R.

BE—Brooklyn Elevated R. R.

BRT—Brooklyn Rapid Transit Co.

BU—Brooklyn Union Gas Co.

BC—Burlington, Cedar Rapids & Northern R. R.

CA—Canadian Pacific Ry.

CP—Central Pacific R. R.

JC—Central R. R. of New Jersey.

CO—Chesapeake & Ohio Ry.

CEI—Chicago & Eastern Illinois R. R.

GW—Chicago Great Western Ry.

- NW—Chicago & Northwestern R. R.  
Q—Chicago, Burlington & Quincy R. R.  
CGL—Chicago Gas Light & Coke Co.  
CI—Chicago, Indianapolis & Louisville R. R.  
ST—Chicago, Milwaukee & St. Paul R. R.  
RI—Chicago, Rock Island & Pacific Ry.  
CM—Chicago, St. Paul, Minneapolis & Omaha  
R. R.  
CHD—Cincinnati, Hamilton & Dayton R. R.  
CIN—Cincinnati, Indianapolis, St. Louis & Chi-  
cago R. R.  
CC—Cleveland, Cincinnati, Chicago & St. Louis  
R. R.  
CLW—Cleveland, Lorain & Wheeling Ry.  
CFI—Colorado Fuel & Iron Co.  
CM—Colorado Midland.  
Gas—Consolidated Gas Co.  
CGC—Consumer's Gas Co., of Chicago.  
C—Corn.  
DH—Delaware & Hudson Canal Co.  
DL—Delaware, Lackawanna & Western R. R.  
D—Denver & Rio Grande R. R.  
DI—Duluth & Iron Range R. R.  
DS—Duluth, South Shore & Atlantic Ry.  
EJ—Elgin, Joliet & Eastern Ry.  
E&P—Erie & Pittsburg R. R.  
E—Erie R. R.  
FS—Federal Steel Co.  
FX—Federal Steel Co.—Pfd.  
GE—General Electric Co.  
KG—Kansas City, Pittsburg & Gulf R. R.  
EW—Lake Erie & Western R. R.

- LS—Lake Shore & Michigan Southern R. R.  
L—Lard.  
L&N—Louisville & Nashville R. R.  
Man—Manhattan Ry. Consolidated.  
MR—Metropolitan Street Ry.  
MXC—Mexican Central Ry.  
MC—Michigan Central R. R.  
MST—Minneapolis & St. Louis R. R.  
MK&T—Missouri, Kansas & Texas R. R.  
M&B—Mobile & Birmingham R. R.  
MO—Mobile & Ohio R. R.  
MU—Mutual Union Telegraph Co.  
BIS—National Biscuit Co.  
AB—New York Air Brake Co.  
Cen—New York Central & Hudson River R. R.  
N&W—Norfolk & Western Ry.  
NP—Northern Pacific Ry.  
NWT—Northwestern Tel. Co.  
O—Oats.  
O&M—Ohio & Mississippi Ry.  
OS—Ohio Southern R. R.  
PM—Pacific Mail Steamship Co.  
PA—Pennsylvania R. R.  
PO—People's Gas Light & Coke Co.  
PD—Peoria, Decatur & Evansville R. R.  
RG—Philadelphia & Reading R. R.  
PW—Pittsburg & Western R. R.  
PST—Pittsburg, Cincinnati, Chicago & St. Louis  
Ry.  
FW—Pittsburg, Ft. Wayne & Chicago R. R.  
P—Pork.  
PTC—Postal Telegraph-Cable Co.  
PU—Pullman Palace Car Co.  
RGS—Rio Grande Southern R. R.  
RGW—Rio Grande Western Ry.  
SR—Short Ribs.  
SP—Southern Pacific Ry. Co.  
SR—Southern Ry.

- TCI—Tennessee, Coal, Iron & R. R. Co.
- TPC—Texas & Pacific Coal Co.
- Tex—Texas & Pacific Ry.
- TC—Texas Central R. R.
- TLT—Texas Pacific Land Trust.
- TY—Toledo & Ohio Central Ry.
- TPW—Toledo, Peoria & Western Ry.
- KC—Toledo, St. Louis & Kansas City R. R.
- UP—Union Pacific R. R.
- UX—United States Express.
- RW—United States Rubber Co.
- WA—Wabash R. R.
- WF—Wells-Fargo Express.
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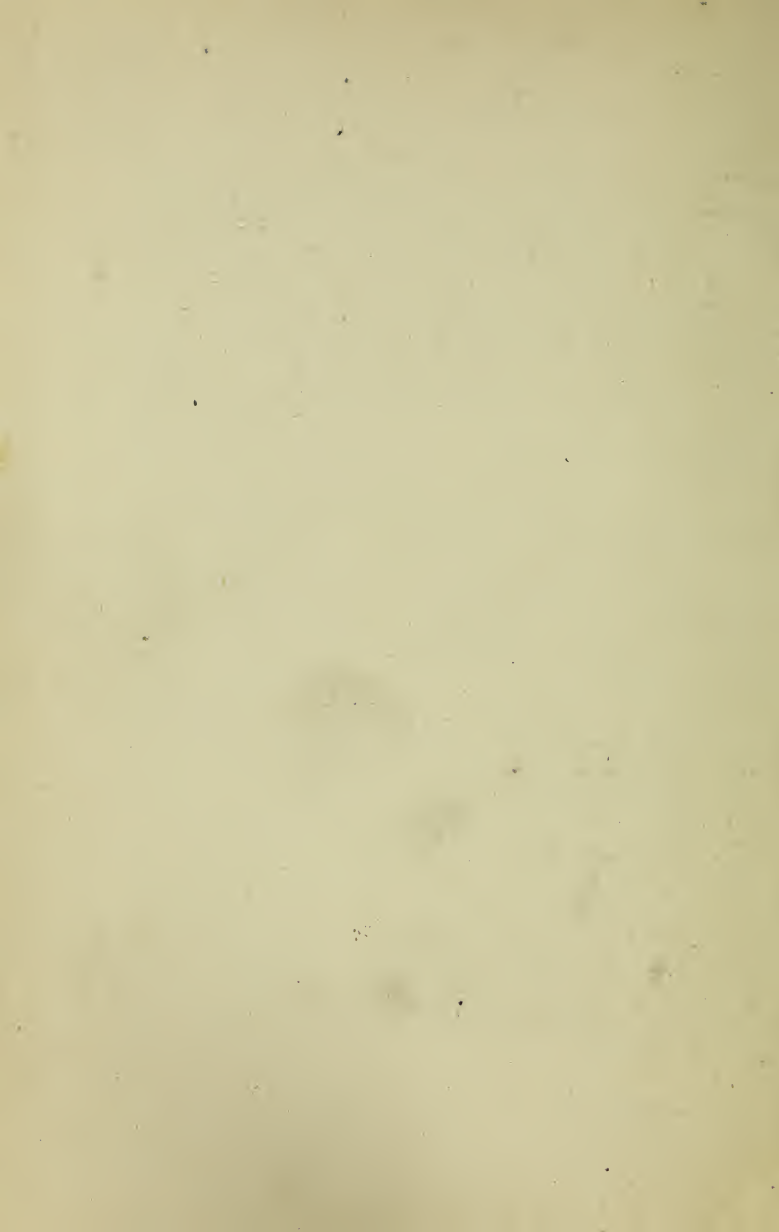
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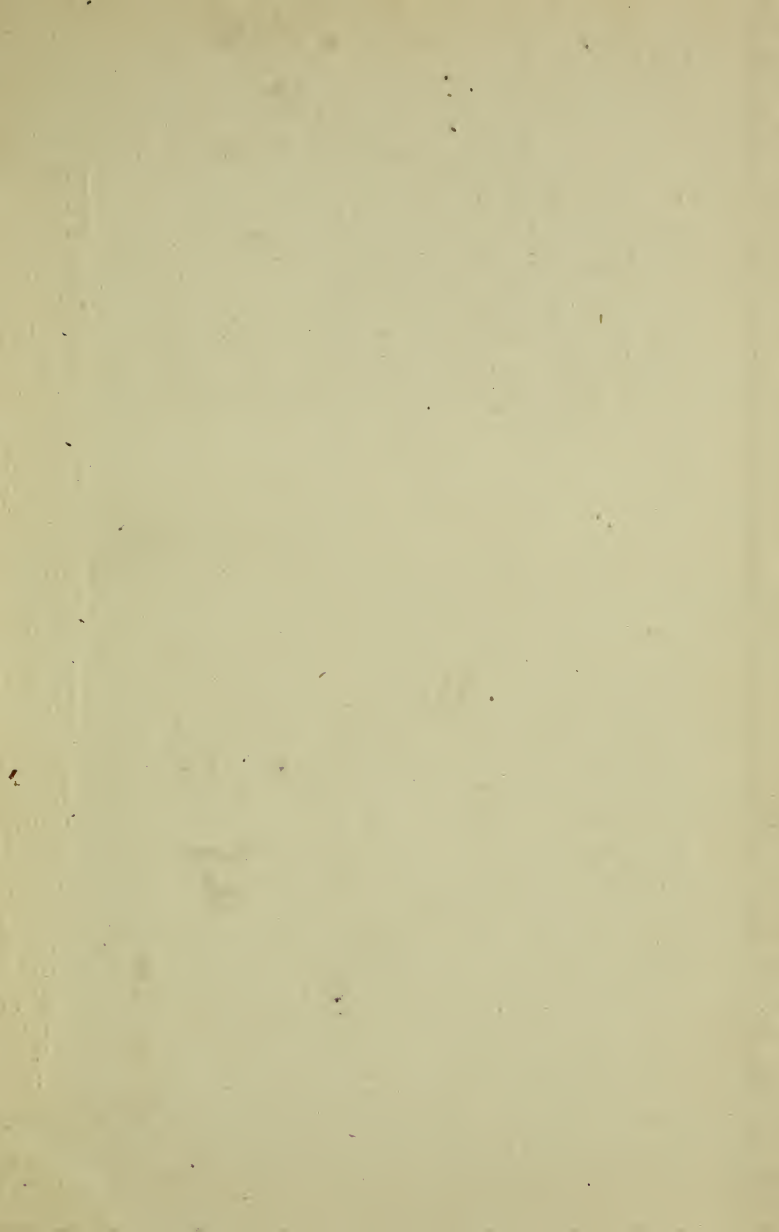
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