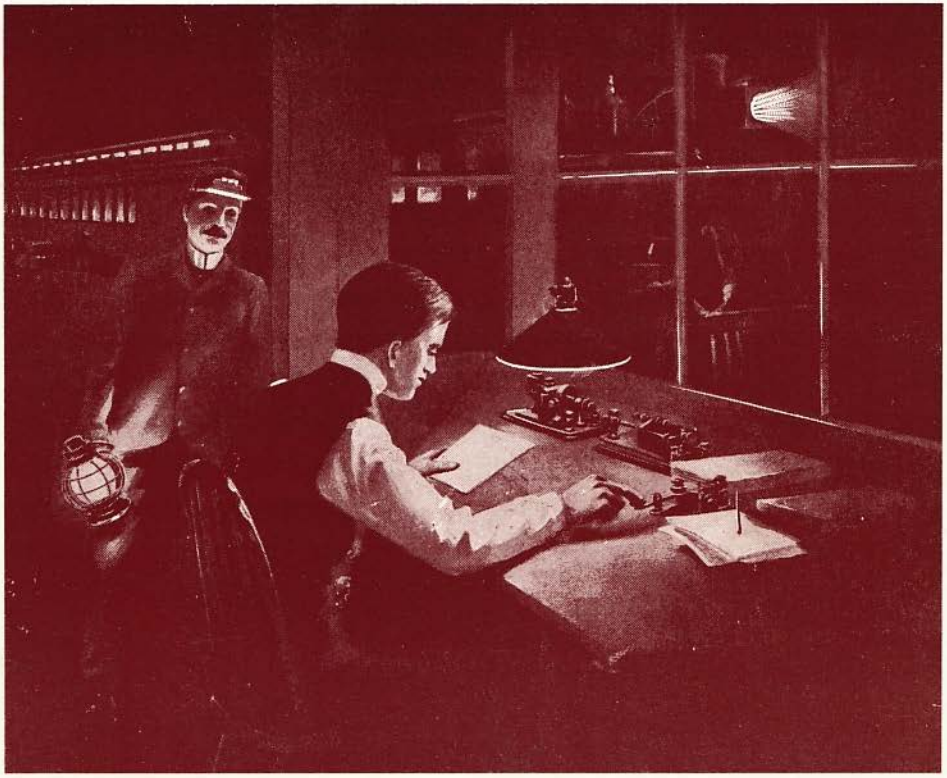
RAILROAD TELEGRAPHER'S HANDBOOK



by Tom French

RAILROAD

TELEGRAPHER'S

HANDBOOK

by

TOM FRENCH

MAYNARD
MASSACHUSETTS
U.S.A.

RAILROAD

TELEGRAPHER'S

HANDBOOK

by Tom French

American Morse Series

Cover: From the cover of
The Railroad Telegrapher, O.R.T., July 1904

6 7 8 9 0

ARTIFAX BOOKS
P.O. Box 88
Maynard MA 01754

foreword

It started with collecting telegraph keys. Like other hobbies that lead the enthusiast into related byways, this led me to find, investigate and appreciate other telegraph instruments. Sounders and relays soon found their way onto my shelf.

These instruments, and especially the ones with railroad markings (a main line relay stamped NYRS; a sounder marked E & NARR) led to an investigation of their uses, and thence to a study of those areas of knowledge and expertise required by the man who used these instruments: the railroad telegrapher.

There have been many interesting and useful books published over the past century which would be of interest to today's aficionado of railroad telegraphy; some are referenced at the end of this book. While they may be available at a good library, hobbyists should have a text they can use and refer to at will. And using a book often means folding pages, marking passages, and inserting marginalia—all practices frowned on by librarians.

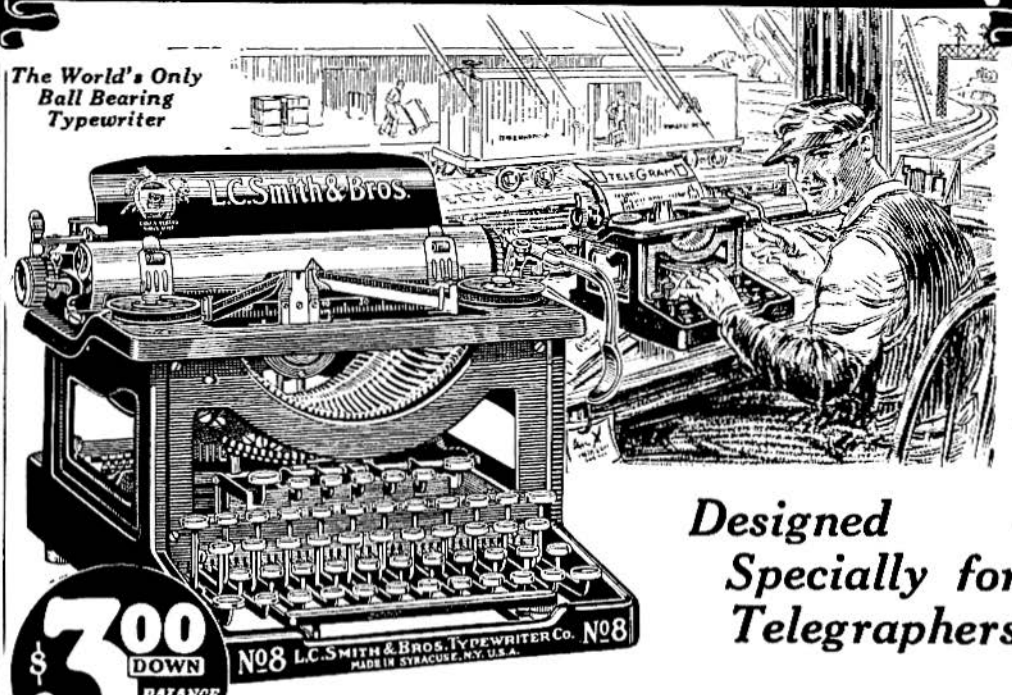
But the old books can be difficult to find. And although they may not be individually expensive, a collection in which the appropriate information can be found can add up.

Hence this book. In addition to the rules, regulations and knowledge required of the old-time railroad telegrapher, I have included notes on how it really worked in practice, and comments on those practices from today's perspective.

This book would not have been possible without information generously provided by former railroad telegraph operator and dispatcher Warren Vance of Mesa, Arizona, or without the critical and knowledgeable reviews of the manuscript by former AT&T 'phone man John (Ace) Holman, Jr, of Malvern, Pennsylvania, a telegraph circuits maven, and by former operator/dispatcher Wes Burnham of East Thetford, Vermont, a rules expert. Each of these gentlemen is a member of the Morse Telegraph Club, making their contributions in advice, information and constructive criticism particularly relevant. They have my thanks, and you have my caveat that any errors in this book may be attributed to me alone.

"You Should *Try* This Mill!"

The World's Only Ball Bearing Typewriter



$3.00 DOWN
BALANCE EASY TERMS

Designed Specially for Telegraphers

Yours for 10 Days FREE!

Try this special Telegraphers' Model 10 days. Then you'll know why it's the favorite "mill" of thousands of speedy operators. Its world famous BALL BEARINGS make it the **easiest running and longest wearing** of typewriters.

All the Features Most Desired by Telegraphers

With this "mill" you can have a Western Union Special Keyboard or a wide carriage or both **without extra charge.** It has all the 1927 operating attachments and carries a FIVE-YEAR GUARANTEE. It is 100% perfect—renewed—and in perfect adjustment. Never has a lower price been offered on this machine. It is the greatest typewriter bargain ever offered on easy terms.

Our prices are always the lowest. We are the world's largest dealers in L. C. Smith typewriters. Send now for this "mill" and there will be NO EXTRA CHARGE for special keyboard or wide carriage. State in coupon whether you wish standard with carriage or 14-inch—telegraphers' special shiftless single case or regular Plea type. State if you wish figures or lower case or on shift. By mailing in this coupon you receive Tools, Waterproof Cover, Instructions and a Complete Course in Touch Typewriting absolutely free. Send for this machine today. If you don't find it the greatest machine you ever used and the biggest bargain ever offered you, return it at our expense.

Free Valuable Equipment

$40 SAVED by Using this Coupon

SMITH TYPEWRITER SALES CORP.
109-360 E. Grand Ave., Chicago, Ill.

Ship me the L. C. Smith Typewriter, F. O. B. Chicago. I will deposit $3.00 with the express agent on arrival subject to 10 days' trial. If I keep it, I will send you $5.00 a month until the $66.70 balance of the special $69.70 price is paid. The title to remain in you until then. It is understood that I have 10 days in which to examine and try the typewriter. If I choose not to keep it, I will repack and return it to the express agent, who is instructed to return my $3.00. You are to give your standard 5-year guarantee.

Name .....

Address ..... Employed by .....

You Don't Send a Cent Until After a 10-DAY TRIAL

Mailing this coupon brings you the typewriter for a 10-day trial, yet puts you under no obligation to keep it. If you do decide to keep it, send us only $3—then just $5 a month until our special price of $69.70 is paid (cash price, $65.20). You'll want to keep it—it's the "mill" you've been looking for.

CONTENTS

The ads reproduced in this book are from The Railroad Telegrapher *published by the Order of Railroad Telegraphers. Those not identified as to date are from various issues from the first decade of this century.*

Smith typewriter ad (opposite) dates from 1927.

introduction

As the train steams toward the way station, the engineer looks down the track. He sees the order board drop twice. Slowing to 30 mph, he approaches the station. He watches as the operator steps out onto the platform, hoop in hand. The engineer shifts slightly, and extends his arm out the side window....

That, brothers, is a vision of days long past. It is a glimpse of the final step in the creation, receipt and delivery of a train order, that all-important slip of flimsy that directed the flow of traffic and maintained order on the rails.

Those days are gone now, and following all too fast are the men whose memories keep that past alive. The day is approaching when the order hoop will be an antique-shop relic, its purpose forgotten; when American Morse, with its "beautiful tones arising out of the beat of a sounder tuned to Prince Albert," will be heard only in the dreams of a dwindling few.

Holding that bleak prospect at bay are those who learn the past, and preserve it for the future. Some collect old landline telegraph instruments; others study Morse code, and use it to communicate with like-minded friends. This book is dedicated to those hobbyists, and to those who study the history and practices of the railroad telegrapher.

Return with me now to the days of steam and sounders, when trains and telegraphy went together like an iron wheel on a rail. We'll go back to no specific year, nor to any particular railroad. Procedures and signals varied from time to time, and from line to line. But the things we'll find in these pages were used at some distant time, on one railroad or another. Our purpose isn't to document the practice of an individual line, but to re-create a past so that one day we, too, may dream.

All abo-o-o-a-ard....

1. SOME DEFINITIONS

Before travelling to the old depot and sitting down at the order desk, there are a few things we've got to learn. The code and the rules, sure. But there are more basic things you might be expected to know; for example, what a train is. You laugh? Well, think over your answer, and then read this: An engine displaying markers is a train.

What's that? A single engine can be a train? Sure can be, Sonny, if it's displaying markers. Well, perhaps you knew that. But let's, for the edification of our beginning students, run through some of the other definitions. These are only slightly simplified; operation under the rules is assumed, which includes the proper display of markers and signals.

A **train**, to extend our previous example, is an engine, or more than one engine coupled, with or without cars, displaying markers. A **section** is one of two or more trains running on the same schedule. A **regular train** is a train authorized by a time-table. An **extra train** is a train not authorized by a time-table schedule.

A **time-table** is the authority for the movement of regular trains; it contains the schedule of trains. A **station** is a place designated in the time-table by name.

A **main track** extends through yards and between stations, upon which trains are operated by time-table or train order, or both. Main tracks may be **single track**, on which trains are run in both directions, or **double track**, on one of which the current of traffic is specified to be in a certain direction, and on the other in the opposite direction. When there are **three or more tracks**, the current of traffic may be specified to be in either direction on any track.

A **yard** is a system of tracks within defined limits provided for the making up of trains, storing of cars, and other purposes, over which movements not authorized by time-table or train order may be made.

Train orders permit and direct the movement of extra trains, and change and control the movements of regular trains. They may do this by affecting the **superiority** of trains. Superiority is discussed in its own chapter, and train orders are discussed at length throughout this book.

2. GENERAL RULES

Like regular trains that run according to a time-table, the operation of a railroad is based on predictability. The movement of trains, the actions of employees, the forms of train orders—all are, or should be, predictable. The bedrock purpose of knowing what must be done, and how, and when, is safety.

The safe operation of all rail lines is assured by conformance to rules. There are rules for the movement of trains, and for the use of signals. There are rules for engineers, and for flagmen. Rules governing, or relevant to, the work of the telegraph operator are covered in later chapters. In addition to those particular rules, there are certain rules—the General Rules—which all employees are expected to know and abide by.

These are the twelve basic rules as they appeared years ago which were used in one form or another by all railroads. They were based on the general rules adopted by the Association of American Railroads, which themselves were based on regulations previously made by individual companies.

Rule G was the undoing of thousands of railroad men, especially boomers. The objection of the railroads was not to liquor itself, but to the threat to safety caused by its use.

A. Employes whose duties are prescribed by these rules must provide themselves with a copy.

Employes whose duties are in any way affected by the time-table must have a copy of the current time-table with them while on duty.

B. Employes must be conversant with and obey the rules and special instructions. If in doubt as to their meaning, they must apply to proper authority for an explanation.

C. Employes must pass the required examinations.

D. Persons employed in any service on trains are subject to the rules and special instructions.

E. Employes must render every assistance in their power in carrying out the rules and special instructions and must report to the proper official any violation thereof.

F. Accidents, failure in the supply of water or fuel, defects in track, bridges, signals, or any unusual condition which may affect the movement of trains must be promptly reported by quickest available means of communication to the proper authority.

G. The use of intoxicants or narcotics is forbidden.

H. The use of tobacco by employes while on duty in or about passenger stations, or on passenger cars, is prohibited.

J. Employes on duty must wear the prescribed badge and uniform and be neat in appearance.

K. To avoid annoyance to the public, employes and others authorized to transact business at stations or on or about trains must be courteous, orderly and quiet.

L. In case of danger to the Company's property, employes must unite to protect it.

M. Employes must exercise care to avoid injury to themselves or others. They must observe the condition of equipment and the tools which they use in performing their duties, and when found defective will, if practicable, put them in safe condition, reporting defects to the proper authority.

They must inform themselves as to the location of structures or obstructions where clearances are impaired.

They must expect trains to move at any time, on any track, in either direction.

They must not stand on the track in front of an approaching engine or car for the purpose of boarding it.

observation

In addition to Rule G (which still survives), there's another way an "employe" can get in trouble even today: "assuming the position." Look like you're asleep, or overly relaxed, and you're out.

3. SUPERIORITY OF TRAINS

Whenever there appears to be a conflict in the flow of traffic between two trains, it is resolved by superiority. That is, one of the trains is always superior, and has precedence over the other. A train may be superior to another by right, by direction or by class.

Climbing the ladder of precedence, we start at the bottom with a train of superior class, which is given precedence by timetable.

1954: If you knew Morse, a job was waiting.

When there is a conflict between trains of the same class, direction determines superiority. Notice that superiority of direction comes into play on single tracks only, since trains going in opposing directions on double tracks present no conflict. A train of superior direction is one given precedence in the direction specified by time-table.

Finally, right is superior to direction or class. A train of superior right is one given precedence by train order.

4. RULES FOR TELEGRAPH OPERATORS

The rules given here are taken from similar rules applicable to telegraph operators since the turn of the century. They have been used, in various forms and numberings, by most lines.

1. Telegraph operators will report to, and receive their instructions from, the chief train dispatcher. They will also comply with the instructions of the superintendent of telegraph and the station agent.

2. Operators must be constantly on duty during the hours assigned to 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 report to the 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.

3. Offices will be in charge of the day operator. Operators at day and night offices must not leave the office until relieved.

They will notify relieving operators of the position of trains, of all orders to be delivered, and any unfinished business.

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

Before leaving, a card must be placed in the window, which can be read from the outside, showing where the operator may be found.

4. They must be conversant with the rules for movement by train orders, know that required signals are properly displayed, and see that all orders received are promptly delivered.

5. Operators handling commercial business must conform to the rules and regulations of the telegraph company.

This company has contracted to receive, transmit and deliver the commercial business of the Western Union Telegraph Company at its offices, and operators must handle this business in accordance with the rules and regulations.

Reports of commercial business handled must reach the office of the superintendent of telegraph not later than the sixth day of each month.

6. They must not permit unauthorized persons in their office. Students may be allowed when authorized by the superintendent.

7. They must not receive messages to be transmitted free, unless signed by, or addressed to, an officer, agent, or other employee 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 addressed, nor to make their contents the subject of conversation or remark.

8. They must have sufficient knowledge of their instruments, apparatus and wires leading into their office, and their manipulation to ensure proper service.

They must keep instruments and appliances clean and in good order, but must not take them apart or change their arrangement.

They must, on closing office, cut out all telegraph instruments.

9. In all cases of interruption of circuits, they must assist with test switches or cords to ground, open or patch circuits as necessary to locate the difficulty when requested to do so by the wire chief, and remain in the office until the trouble is located.

Other use of the ground wire is forbidden, except when ordered, or when the circuit is interrupted and then only to report important business.

10. If the circuit is open more than two minutes, they must determine the direction in which the wire is open, and report the same to the wire chief or chief train dispatcher.

11. They must not contend for circuit, nor use profane or indecent language on the wire.

If an operator is writing and is broken by other than a "21" or "55" message, the operator who is writing will respond "8" and close his key. If the request is not complied with, he will keep his key closed until he can proceed without interruption, and report the case in writing.

12. They must regulate speed of transmitting to suit the ability of the receiving operator. Under ordinary circumstances, the sending operator will be held responsible for errors.

13. Operators must familiarize themselves with the duties of station agent and pass required examinations before they can be advanced to the position of agent.

observations

Knowing how to manipulate (adjust) the instruments to work smoothly and operate properly doesn't mean you should do it. Sometimes you have to know when to leave well enough alone. Wes Burnham cautions us on "the unwritten rule" of telegraphers: When filling in as an extra man in any office, you never change the adjustment of the Morse keys. (That is, unless you want to rile the regular man!)

5. COMMERCIAL MESSAGE HANDLING

Operator's rule number 5 shows that the railroad telegraph operator had many more duties than simply receiving, recording and delivering train orders. One of his added responsibilities was that of handling Western Union or Postal Telegraph commercial messages. This didn't apply to all operators, but many were burdened with this extra work.

And more work didn't always mean more pay. After the Civil War, operators received 20% on telegrams. This later dropped to 10%. At the turn of the century they were receiving nothing from Western Union, although Postal paid 10%, at least to telegraphers who were agents on the Illinois Central and the Yazoo & Mississippi Valley systems.

It was a bone of much contention among operators. They despised having to handle telegrams without compensation, especially since it might mean several daily walks into town to deliver them.

(Deliver them? You shouldn't be surprised. What did you think they did with a telegram once they received it? This was additional incentive for operators to take students, who they could use as errand boys. But we'll discuss the students later.)

By 1904, the hue and cry in the ORT (the Order of Railroad Telegraphers, a union organization) was for a 10% commission on commercial messages. But those receiving this commission knew it was hardly compensation to an operator who had to listen for the sounder 12 hours a day, 31 days a month and find that his monthly commission was five cents.

That example was surely a slow office; at this time, the average WU telegram cost 25¢ to send. But many messages were "paid there" so the operator collected nothing. To account for this, some of them claimed a minimum of $4 or $5 per month (in addition to their average monthly wage of about $50) was also warranted.

The situation was resolved within the next half-century as the commercial offices were located outside of the stations, manned by their own operators. The telegraph lines were extended to these in-town offices, and the railroad operators could finally concentrate on railroad business.

6. TELEGRAPH INSTRUMENTS

Before looking at the code used by land-line telegraphers, it will be instructive to understand the instruments on which the code is sent and received. They are the key, the sounder, the relay, and the typewriter, or mill.

We won't cover the mill, except to observe that being a proficient typist couldn't hurt an operator's chances of being hired. Messages (train orders) may be written on the forms in pencil, but your writing must be neat and legible.

On to the key. This is the instrument with which the operator sends messages. The keys illustrated in the 1904 Manhattan ad on the next page are a leg key (on left) and a legless key (on right). The legless key is screwed to the table, and the wires are connected to the terminals at the back of the key.

As for the leg keys, the legs are bolts that passed through holes in the table-top. The legs serve both to fasten the key to the table and as the electrical terminals, the wires being connected to them from below.

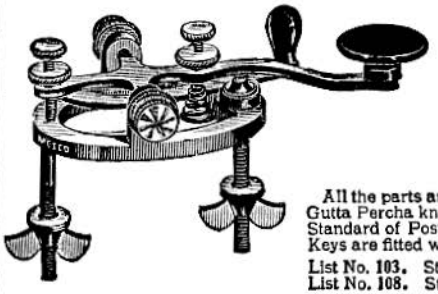
To the right of the operating lever and knob on either key is the circuit closer, sometimes referred to as a shorting switch. This must always be kept closed, to close the circuit, when not transmitting. Otherwise, the line would be open and the operator would not be able to hear an incoming message. In fact, the open line would be unusable by any station.

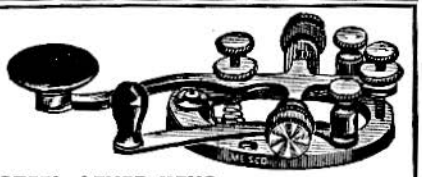
The sounder is a simple electromagnetic instrument. Its armature is attracted whenever a dot or dash (short or long current pulse) is received in its magnets. This causes its lever to be pulled downward, and hit the lower stop. An interruption of the current releases the armature, and the lever hits the upper stop under the force of its spring.

The sounders offered in the ad are local sounders. They are of low resistance and generally intended for use in local battery circuits. We'll investigate this in more detail in a later chapter.

Placing the sounder in a resonator permits you to hear it easier. The one shown is very similar to the Bunnell "Mascot" portable resonator. Another type, the swing-arm resonator, uses a jointed arm which permits

FROM MANUFACTURER TO YOU

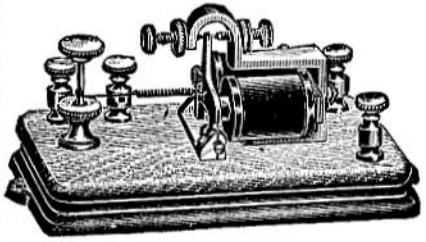




STEEL LEVER KEYS.

All the parts are finely finished. They have Nickel-plated levers, Gutta Percha knobs, and Brasswork highly polished. They are the Standard of Postal and Western Union Telegraph Companies. All Keys are fitted with our improved adjustment spring holder.

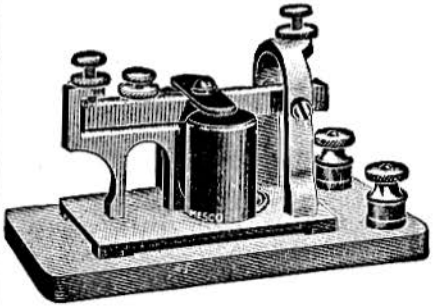
List No. 103. Steel Lever Key with legs.....net price, $0.75.
List No. 108. Steel Lever Key legless.....net price, .81.
By mail, 11c. additional.



STANDARD PONY RELAY.

Mounted on Polished Mahogany Base, with Metallic Surbase.

List No. 115. 20 ohms.....net price, $1.40.
List No. 116. 50 ohms.....net price, 1.45.
By mail, 50c. extra.



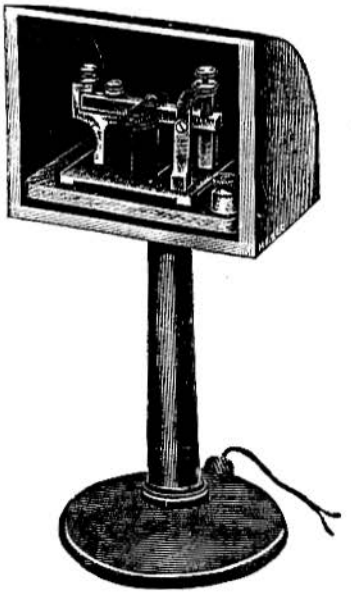
IMPROVED GIANT SOUNDER.

Either Aluminum or Brass Lever Furnished.

Proportions scientifically correct. One cell of Crow-foot Battery will operate it, producing a sound louder and clearer than any other sounder with two cells of battery. Thousands of these sounders are in use by the Postal and Western Union Telegraph Co's.

List No. 111. Wound 6 ohms.....net price, $1.40.
List No. 113. Wound 20 ohms.....net price, 1.45.
By mail, 25c. extra.

"PERFECT" PORTABLE RESONATOR



This is the best low-priced Resonator made. The base is broad and heavy, and is enameled black and striped with gold. Box is well made of nicely polished hardwood, and finished natural. Conducting Cords pass through the base and hollow standard.

List No.		Price
654	Complete with Sounder and 6 ft. Cord,	$3.00
655	Resonator and Base only.....	1.35

MANHATTAN ELECTRICAL SUPPLY CO.

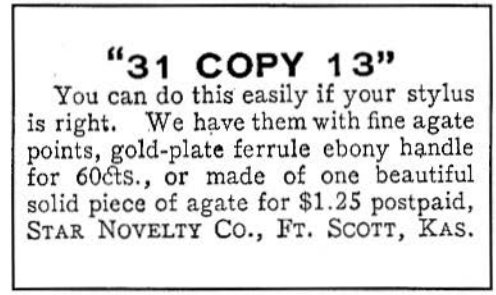
32 Cortlandt St., 39 Dey St., NEW YORK. Factories: JERSEY CITY. 186 and 188 Fifth Ave., CHICAGO.

the resonator to be moved, so that it may be positioned closer to you. If you worked in a busy station, a small tobacco tin wedged between the resonator and the stop standard of the sounder would make the tone of your sounder more identifiable, as well as make it heard over the sound of an approaching train. Prince Albert is said to work well.

Finally, the relay is used to allow a local battery to operate the sounder. The relay is more sensitive, and therefore requires less electromotive force from the wire, than the sounder. So the wire is allowed to operate the relay coils, and the relay contacts are used to operate the sounder. Later, we'll take a look at how these instruments are arranged in typical circuits.

observations

John Holman calls our attention to the stylus, which was preferred by many operators in lieu of the pencil or mill to copy orders. Since the carbon used between TOs was double-sided, the message appeared on the back of the top copy, and could easily be read through the thin paper used for the forms. The 1904 ad shown here, from the ORT publication *The Railroad Telegrapher*, touted a fancy stylus capable of making 13 copies. (Bear down hard, just in case.)



Old Morse sounders and keys are common and rather inexpensive. They can often be found at amateur radio hamfests or flea markets held by antique radio collectors. Combination sets consisting of a key and sounder on a common wooden base (the cheaper ones were called practice sets) are sometimes easier to find than the individual instruments. Prices (1991) generally range from $5 to $35 for the instruments mass-produced by Bunnell, Manhattan Electric Supply Co. (MESCO) and Signal Electric Manufacturing Co. (Menominee).

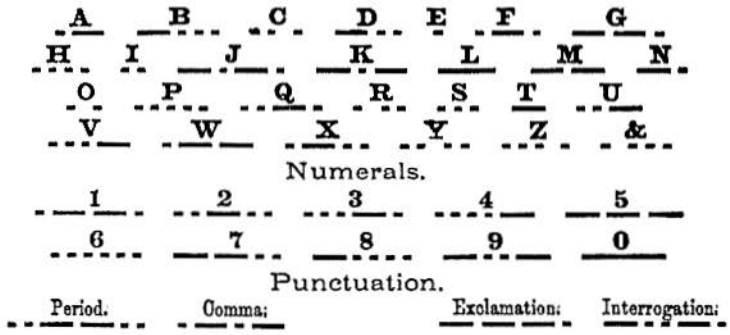
7. THE MORSE CODE

The American Morse Code was and still is the code used in North America for landline telegraphy. Its sound is that of a sounder lever hitting its stops. The downward stroke produces a different tone than that which is produced on the upward return stroke: a quick *clickclack* for a dot, and *click, clack* for a dash.

Since the current in the wire is either on or off, the signals making up the code are elementary. They are the dot, the dash, and the long dash. These code elements are separated by variable intervals, or spaces. Here are the lengths of the code elements and spaces:

A **dot** is one unit long.
A **short dash** is three units long.
A **long dash** is six units long.
The space between the elements of a letter is one unit.
The space within the "spaced letters" is two units.
The space between the letters of a word is three units.
The space between two words is six units.

(Some sources give shorter times for the dashes and longer spaces. While this may not trouble the expert, the beginner should avoid it.)



In learning the code, the help of an experienced operator will be invaluable. From the start, the letters should be sent quickly, with long

spaces between. As the student progresses, the spaces between letters may be shortened.

In sending, keep in mind that it will be easy to learn to send fast only after you have learned to send well. The habit should be acquired of making short, firm dashes, instead of light, quick dots. Make the space between dashes as short as possible, consistent with releasing the key lever fully.

Notice that the spaced letters are composed only of dots and spaces. When learning, they may be remembered as "C or Y and Z." That is, they are C, O, R, Y, &, Z.

Don't make T too long and L too short. As for L and the cipher 0, when the long dash occurs alone or among letters, it is L; when found with figures it is 0 (zero). You will find that this does not cause confusion.

observations

A railroad telegraph operator cannot, under the rules, take a student without permission. In the early part of this century, an operator would usually charge each student a fee of $10 per month. An operator taking five or six students could double his earnings.

This resulted in some telegraphers running "ham factories," promising to teach the student in three months. Experienced operators considered this impossible; in any case, the student stood a good chance of not learning very quickly as long as the operator could collect his $10 each month.

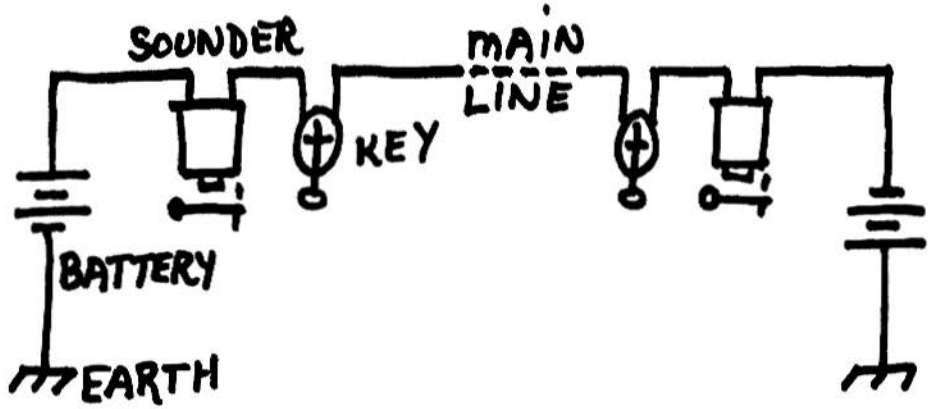
Having a student also provided other benefits to the operator. I've already mentioned his utility as an errand boy. He also could be used to wake the operator when his station call was heard.

Many operators frowned on these practices, refused to take students, and tried to persuade others to do the same. Although they called the taking of students degrading, the principle motivation of some ORT members in the early 1900s seems to have been to protect their own interests; if the pool of experienced operators could be limited, their chances of gaining higher wages would increase.

8. TELEGRAPH CIRCUITS

You will recall the earlier admonition that the circuit closer of the key be kept closed when not in use. That's because the basic circuit used in the United States is the closed circuit system (in contrast to the European open circuit system). In our system of landline telegraphy, current flows continuously in the main line. An elementary telegraph circuit is shown below.

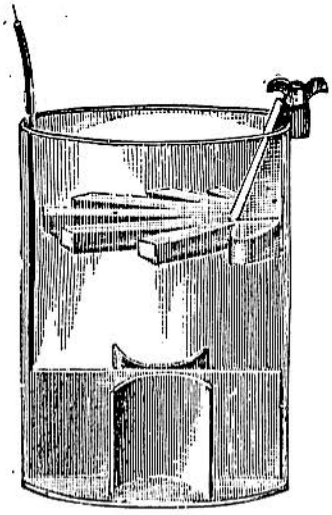
By opening his key (that is, his circuit closer), either operator may send to the other. Since all instruments on the line are in series, he may monitor his sending on his own sounder, and be sure that the far station is receiving.



But, you may wonder, doesn't this closed circuit system weaken the battery when both keys are closed? It would, were it not for the type of battery employed. In this circuit, the current need not be large, but it must be constant. The gravity battery is ideal for this purpose. One type, the bluestone battery (page 21, top), is composed of a glass jar, with a copper on the bottom (the positive pole) and a zinc at the top (the negative pole).

From the shape of the zinc, this is often called a crowfoot battery. The jar is filled with water, and sulfate of copper (blue vitriol, or bluestone) is dropped in. The battery will develop full strength in about

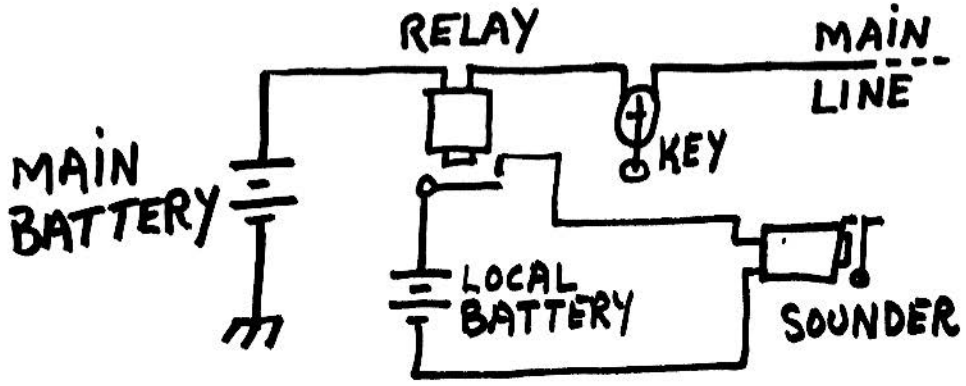
two days. This time may be reduced considerably by short-circuiting the battery terminals.



Since the instruments are in series, the batteries may be placed at one station only. When there are many stations on a line, batteries are often placed at each end of the line (the terminal stations).

The elementary circuit may be used on short lines with a main line sounder, but on longer lines a relay is added as in the next figure. The sensitive relay eliminates the need for more batteries in the main circuit, although a local battery is needed for the sounder.

The circuit with relay performs adequately up to about 300 miles. Beyond that, it is necessary to break up the main line into segments capable of being powered by a reasonable number of batteries. This requires the use of a repeater to transfer the signals from one segment to the other. The simplest form of a repeater is the relay shown in the circuit below, which transfers the current impulses in its coils to the sounder by means of its contacts and the local battery. But a main line repeater must operate in both directions, something a single relay cannot do.



Many repeaters used complex instruments to accomplish their purpose. The Toye circuit used instruments called transmitters, which were sounders having tongue contact breakers. The Milliken circuit used even more complex three-coil instruments. In the late 19th century it seemed that everyone with a smattering of telegraphic knowledge was designing "improved" repeater circuits and instruments.

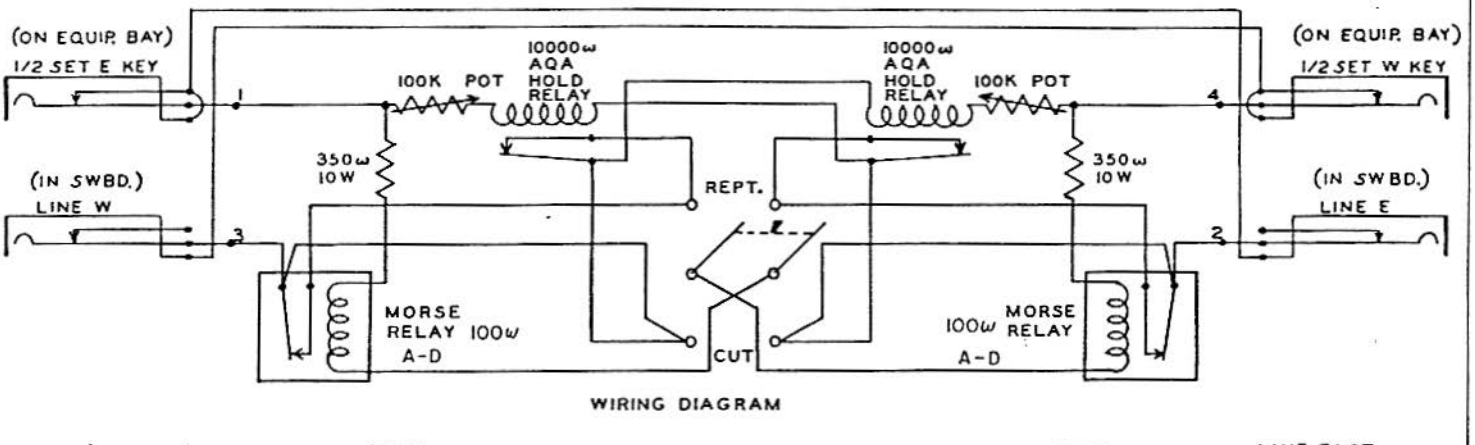
In 1954, the Atchison, Topeka and Santa Fe Railroad installed a simple circuit (shown opposite) at Prescott, Arizona. It uses only relays with single-pole contacts; two of these are standard Morse relays.

With the switch shown in the wiring diagram in the *cut* position, each line (E and W, "in swbd.") simply works through a Morse relay and resistor to the battery ("on equip. bay"). Each line is properly terminated, but will not repeat into the other. In this situation, the station behaves as a terminal station for each line.

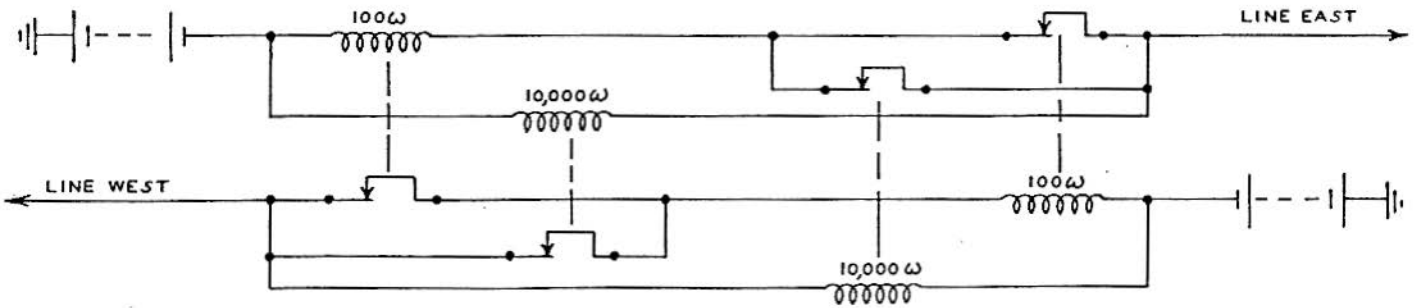
With the switch in the *rept* position, the circuit reduces to the simplified schematic shown at the bottom (the switch, resistors and potentiometers are eliminated for clarity). With both East and West keys closed, all of the relays are energized and the four sets of contacts are closed, as shown. Now if East opens his key to send, both relay coils in that line of the repeater de-energize, opening their respective contacts in the West line of the repeater.

The opening of the contacts in the West line opens the circuit to the West low-resistance Morse relay. This causes its contacts in the East line to open, but this has no effect since they are parallelled by the (still closed) holding relay contacts. That is the purpose of the holding relay in the West side of the circuit: to maintain circuit continuity through its contacts to the East Morse relay. And although the holding relay coil is still in the West circuit, its high-resistance coil looks like an open circuit to any Morse instruments down the West line.

In summary, this repeater has operated as follows: East opened his key, which opened the West line. The holding relay coil in the West line remains energized, and its contacts in the East line permit East to key his Morse relay. Thus, the East line "repeats" into the West line. Operation in the opposite direction is similar.



WIRING DIAGRAM



SCHEMATIC

ADJUST AQA HOLD RELAY CURRENT BETWEEN 1&2 MA. USING 100K HOLD POT. WITH OTHER LINE OPEN

SANTA FE
SINGLE LINE REPEATER
MORSE & AQA RELAYS

4-10-59

A. T. & S. F. RY. CO.

ENG. BY J.A.P. APPROVED J.A.P.

TRACED BY ERH DATE ~~9-2-54~~

CHECKED BY J.R.W. S C O. 2672-S

9. LAND LINES AND STATION CALLS

A short branch line might have but one telegraph wire strung between stations. The instruments in each station's office could be either of the simple arrangements shown in chapter 8. But most systems are more complex than this. We'll cover an actual station set-up in chapter 11. Before we get to that, we'll look at the lines connecting the stations.

The map on the facing page shows all of the stations of the New Mexico Division of the Santa Fe line circa 1950. A few of these stations were busy terminals; most were small way (or "country") stations. Some were nothing but a siding for meeting trains, and had no office at all.

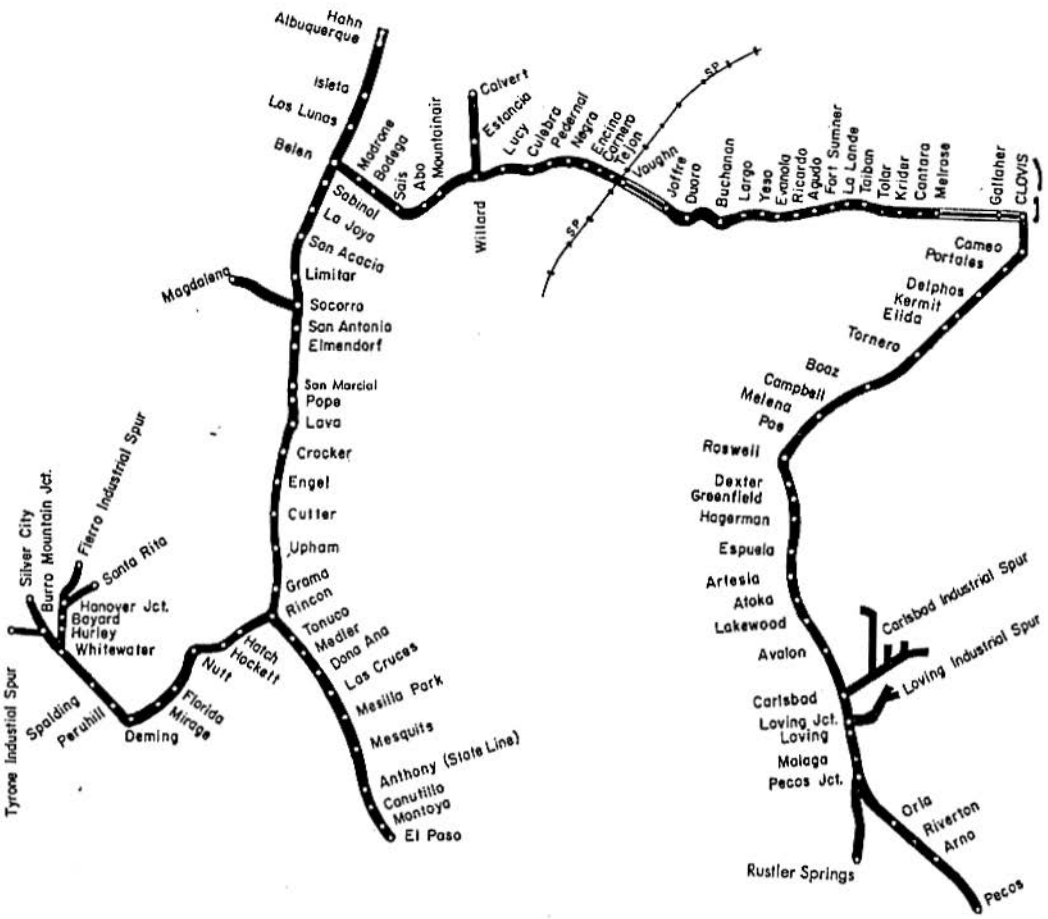
The telegraph lines along the system were identified by numbers. Number 10 wire ran from the branch at Magdelena to Socorro, then North to Albuquerque and East to Clovis. 11 wire ran East from Belen to Clovis. Two wires, 3 and 5, ran between El Paso and Albuquerque.

Stations were connected to some or all of the lines passing them, depending on how busy they were. Belen, a terminal station, was connected to all four intersecting lines. A small "country station" like Yeso was connected to 10 wire, but not to 11 wire. Although three lines intersected Socorro (3, 5 and 10), it connected to just two of them.

This set-up gave the dispatcher access to his stations, and for some stations a choice of wire. If one wire was busy, he could use the other. Sometimes one wire would make the sounder sound more "alive" than the other wire, so that one would be favored.

Here is a list of the call letters (or "office calls") of some of the stations of the New Mexico Division.

AO	El Paso	GN	Engel	NO	Encino
AQ	Albuqr	HX	Hatch	RN	Rincon
BX	Belen	MG	Magdelena	SO	Socorro
CF	Yeso	MN	Mountainair	VN	Vaughn
CS	Clovis	MQ	Mesquite	WI	Willard
CU	Las Cruces	MR	Melrose		
FS	Ft Sumner	NA	Las Lunas		



NEW MEXICO DIVISION

Atchison, Topeka and Santa Fe: 1950

10. THE SELECTOR SYSTEM

In chapter 5 I mentioned that the Western Union offices were eventually located away from the railroad stations. They had their own office calls; those which connected to the New Mexico Division (Santa Fe) wires were AY for Albuquerque and EP for El Paso, for example. But these office calls weren't used in raising the commercial operators. Instead, selector systems were installed at the telegraph offices.

A typical selector system was the Gill selector, in which a series of dashes transmitted on the wire operated the selector mechanism to "unlock" the local office circuit. The office signal was a usually a five-figure combination such as 31421. Because the selector mechanism was constantly activated by Morse signals on the wire, it first had to be cleared by sending a number of dashes (six was sufficient) preparatory to sending the actual combination. Then, if the correct sequence was sent, the system would light a lamp or operate a buzzer in the commercial office and return a series of dashes on the wire. This answering signal told the sending operator he had contacted the office. Breaking the line momentarily terminated the answer signal.

The selector combination was not sent in Morse. Instead, only dashes were sent, with the number of dashes corresponding to the digit. The last dash for each digit was usually made longer then the others. For example, a "3" would be sent as two short dashes and one long dash.

Selector systems weren't limited to commercial offices. One was installed in 1938 in the passenger station at Huntington, West Virginia, by the Chesapeake and Ohio Telegraph Department. The selector system saved time and manpower at both ends. The sending operator could go about other work while he waited for an available operator to answer his call, and the operators at the receiving office could finish current business before answering the call. The process should be familiar to us today; it was the telegraphic version of being put on hold.

Ad opposite shows new style bug introduced in 1923.

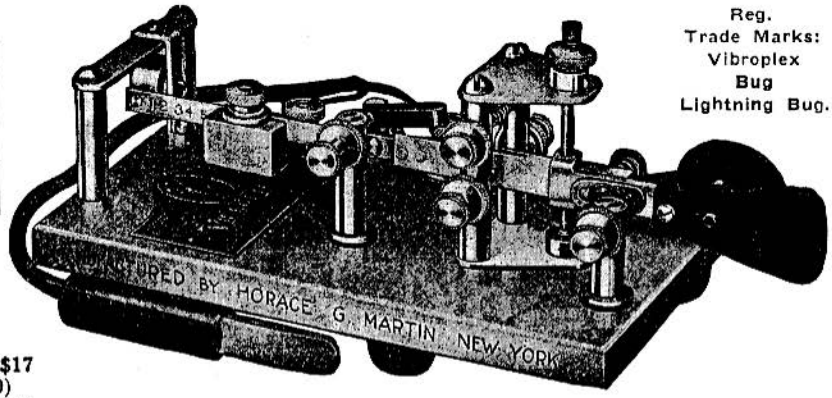
A five minute sending test with

[Single Lever Martin]

The Great New VIBROPLEX No. 6

will show you why it has so quickly won representative telegraphers everywhere

10 Great *New* Features



Reg. Trade Marks: Vibroplex Bug Lightning Bug.

Japanned Base . . $17
(In Canada, $22.50)
Nickel-Plated Base, $19

Get this Great New Vibroplex No. 6 that users say is the smoothest and easiest-working bug made. Learn why it makes sending under the most trying conditions **easier, better and safer.**

Not necessary to change the adjustment when shifting from one wire to another. Properly adjusted—it carries perfectly on any workable wire. Sends the kind of Morse operators like to copy, and its ease of control is amazing.

With constantly changing wire conditions, the operators' biggest problem is how to get his stuff through with as little trouble and effort as possible.

The Great New Vibroplex No. 6 was designed specifically to meet that problem. Tests made by users under existing wire conditions prove this bug to be **SUPERIOR** to any other sending machine in 5 important ways:

1. **Smoother Action.**
2. **Easier Adjustment.**
3. **Stronger Signals.**
4. **Greater Carrying Power.**
5. **Easier Manipulation.**

Test **The Great New Vibroplex No. 6** on the 5 points listed above. Learn why it has so quickly won telegraphers in every branch of the service. **ORDER TO-DAY.** Prompt shipment. Liberal allowance on old Vibroplex.

UNDERWOODS REBUILT...ALL CAP

Guaranteed

Write like NEW, look like NEW, and do the same good work as NEW machines.

$40

With two-color and back spacer attachments,

$50

IMPROVED SINGLE LEVER VIBROPLEX
Equipped with Simplified Trunnion Lever and Extra Large Contact Points. (Heavy Base).
Japanned Base $17
Nickel-Plated $19

No. 4 (FAMOUS BLUE RACER)
Equipped with Simplified Trunnion Lever and Extra Large Contact Points. Small Base.
Japanned Base $17
Nickel-Plated $19

CARRYING CASE
Morocco finished, Plush lined.
With lock and key..... $3

LATEST EDITION PHILLIPS' CODE
Accurate and complete to date..... $1.25

VIBROPLEX DEALERS
C. C. Dahl, 600 Railway Exchange Bldg., Seattle, Wash.
G. J. McCrum, 242 St. John St., Portland, Maine.
J. G. Duran, Iturbide 1510, P. O. Box 17, Laredo, Texas.
Standard Typewriter Co., 606A Centre St., Calgary, Alta, Canada.

Remit by Money Order or Registered Mail

THE VIBROPLEX CO., Inc., 825 Broadway, New York

Phones: Stuyvesant 4828, 4829, 6094

J. E. Albright, President, Member O. R. T. Grand Div'n, Cert. 395

11. INSIDE THE STATION

From the definitions in Chapter 1, we recall that a "station" is just a place named in the timetable. If there is a depot at that place, there will be an agent to handle passenger ticket and freight transfer matters, and a telegraph operator to OS trains, receive train orders and, perhaps, handle commercial telegrams. If it is a small office, the agent will handle most of the jobs, including telegraphy. In that case, he is an agent-operator.

The telegraph bay is the trackside window location of the operator's worktable. With this arrangement, the operator can observe rail traffic and see approaching trains. An early operating table for a way station would have held few instruments. A key and main-line sounder, perhaps. At most, a relay, key and sounder, with the local battery on a shelf.

In larger stations, the operator will handle only telegraph messages, usually train orders. In these stations, he needs no view of the rails; in fact, he may not be able to see a window from his table. His instruments are the same; however, if he works in a station into which several wires drop, there may be three or four main-line sounders on his table.

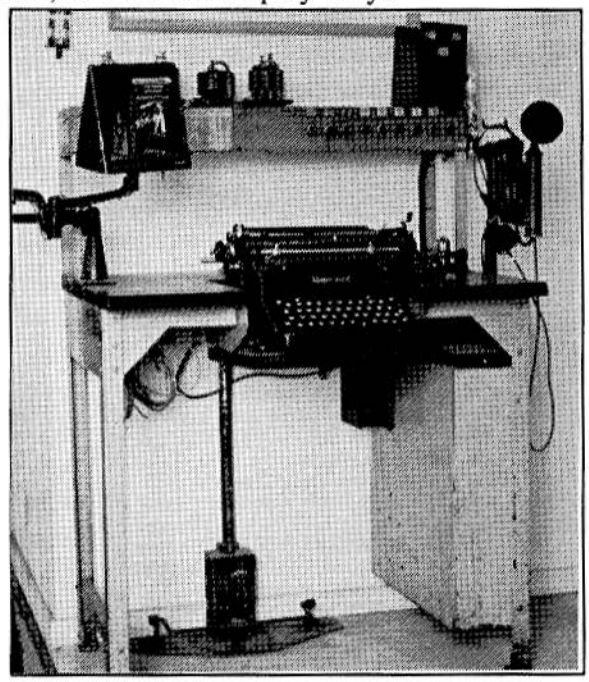
Whether the office is large or small, the telegraph lines don't simply come in and run directly to the instruments. The wire (or wires) are connected to what is variously called a cut-out, pegboard or switchboard. This device might be mounted on the interior wall of the station adjacent to the drop from the pole outside.

The operator's instruments (or, where there are several calling sounders, the cordless jacks to which these instruments are wired) also run to the switchboard. The final connections are made by inserting brass pegs into the switchboard, and removing a peg (the "cut-out") which shorts the drop wires.

There are other styles—the springjack switchboard is one—and older devices—the cut-out switch, which shorts the single line dropped into a way station. But the peg switchboard was flexible and ubiquitous.

From the switchboard, the lines might run to an order table such as that shown opposite. This is a photograph of an order table from the Belen, New Mexico, terminal station (A.T. & S.F.) as used in the early

1950s. The instrument shelf holds four main-line sounders (Western Union no. 15B, 120 ohms, was specified, although others of similar resistance were occasionally substituted when a quick fix was required). The swing-arm resonator holds a local sounder (no. 1B, 400 ohms, for 110 volt battery; see p. 31). The small box on the right of the instrument shelf, a Fahnestock no. 1-F switchboard, is there for display only.



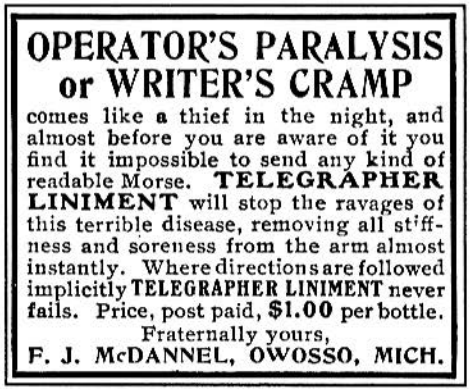
The mill sits front and center; behind it are the Morse relay (no. 4B, 150 ohms), the hand key and a Vibroplex semiautomatic key (also called a "bug"). A telephone with extensible arm is attached to the right side of the table; a no. 3C foot switch under the table operates the telephone. Per specification, the table top and typewriter drop are made of asbestos-ebony.

As we saw earlier, there are four lines coming through Belen. When the operator hears his station's call letters (BX) on any sounder, he inserts a cordless plug into the corresponding jack on the panel attached to the shelf. This transfers the line from that sounder to the local sounder in the resonator. The other main-line sounders continue to operate as usual.

The Morse plug/jack system is a cordless system. The plug looks like a standard headphone plug, but it is one piece of brass. (Indeed, a monaural headphone plug could be used, with the tip wired to the sleeve.) A typical three-line circuit (A.T. & S.F., 1948) is shown on page 31.

Initially, each line connects to its own sounder. Inserting the plug into one of the jacks disconnects the West side of the line from the sounder and connects it, from the plug tip through the jack frame, to one side of the local Morse relay. At the same time, a jack contact connects the East side of the line to the key (and, through the closed key, to the other side of the Morse relay). The reason the operator connects a line to his local line is twofold. The first is for easier copy; he may move the resonator close to his ear as he types the message. Second, this places his key in the line; he can answer questions, confirm receipt of a message, and break the sending operator to ask for repeats.

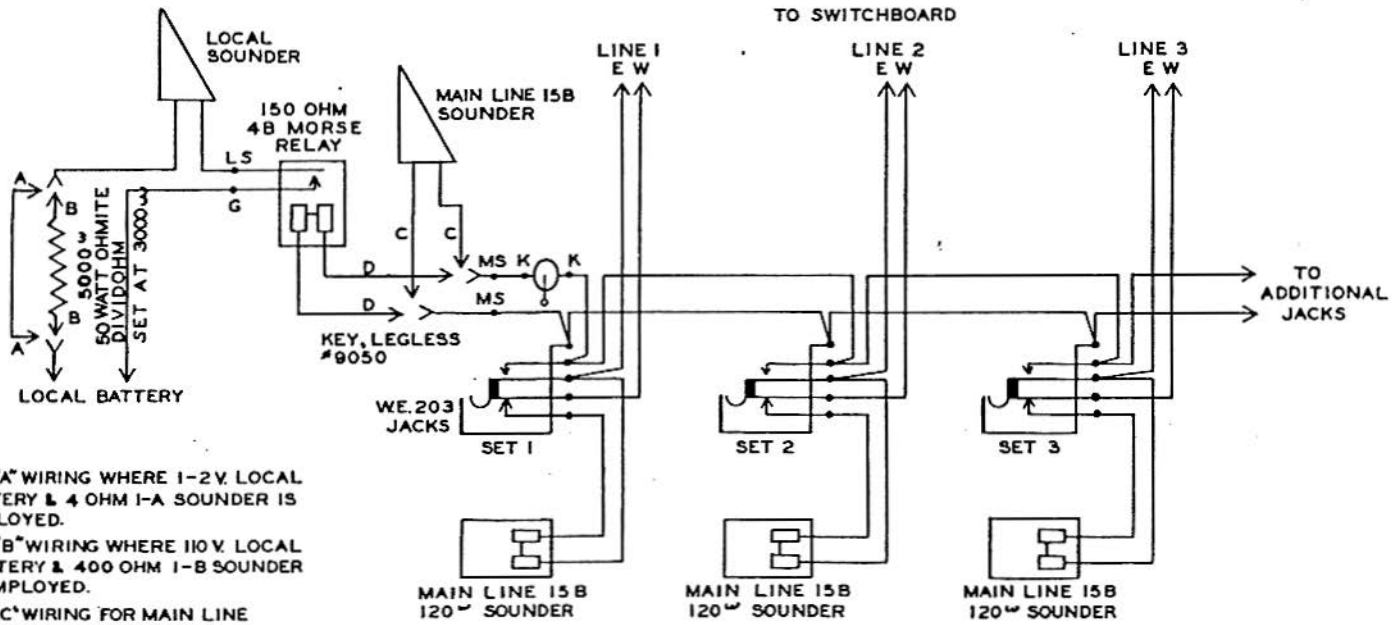
observations



An experienced operator at a small station at the turn of the century might have found himself performing the "four duties" of station agent, telegraph operator, express agent and mail carrier. Since his duties as operator might require the handling of Western Union telegrams he would, in effect, work for four different concerns and collect only one monthly paycheck from the railroad.

quiz

By this point in the book, you've picked up some knowledge about the railroad telegrapher. From Wes Burnham comes this question to see if you've been paying attention: "When making three copies of a train order, how many sheets of carbon paper do you use?" If you need it, one or two hints appear on pages 15 and 17. Don't cheat; think it over before turning to the answer on page 51.



NOTE:

USE "A" WIRING WHERE 1-2 V. LOCAL BATTERY & 4 OHM 1-A SOUNDER IS EMPLOYED.

USE "B" WIRING WHERE 110 V. LOCAL BATTERY & 400 OHM 1-B SOUNDER IS EMPLOYED.

USE "C" WIRING FOR MAIN LINE SOUNDER IN RESONATOR.

USE "D" WIRING FOR MORSE RELAY & LOCAL SOUNDER OPERATION.

TYPICAL MORSE CORDLESS JACK CIRCUIT

A. T. & S. F. RY. CO.	
ENG. BY S.60	APPROVED JAP
TRACED BY VAW	DATE 12-6-48
CHECKED BY GAG	S. C. O. 2302-S

12. THE TRAIN ORDER: RULES

The essential principle for the movements of every train is predictability, so that back-ups will be avoided and collisions prevented. The movement of trains according to a time-table is predictable, but it may be necessary to alter the schedule to accommodate changed track conditions or traffic. And extra trains don't appear in the time-table.

It is the train order that authorizes and directs these non-scheduled movements. TOs are brief messages, normally addressed to the conductor and engineer of a train, directing a movement or schedule change, or advising of changed conditions or speed restrictions.

Like the twelve General Rules, the rules for handling train orders have been codified and adopted by all major lines. What follows are the important rules which were common to most lines relating to train orders; they are numbered according to the standard practice.

Some rules or parts of rules, more relevant to train-order signals or delivery, are left to those chapters. Other rules, not relevant to the telegraph operator's practice (for example, the rule that an engineer on receiving an order must show it to the fireman) are omitted.

There are two basic types of train orders. A "31" order requires the train to stop; the persons addressed will then pick up their orders at the operator's office. The train need not stop to receive a "19" order; just how such an order is delivered will be seen in the chapter on delivery. These numbers also refer to the blank on which they are recorded.

rules for train orders

201. For movements not provided for by time-table, train orders will be issued by authority and over the signature of the superintendent and only contain information or instructions essential to such movements.

They must be brief and clear; in the prescribed forms when applicable; and without erasure, alteration or interlineation.

202. Each train order must be given in the same words to all employees or trains addressed.

203. Train orders must be numbered consecutively each day, beginning at midnight.

204. 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 engineer. A copy for each person addressed must be supplied by the operator.

205. Each order must be written in full in a book provided for the purpose in the office of the train dispatcher; and with it recorded the time and signals showing when and from what offices the order and responses were transmitted.

206. Regular trains will be designated by number as "NO 10," and sections as "SECOND 10." Extras will be designated by engine number and direction as "EXTRA 796 EAST."

Even hours as "10 A.M." must not be used in stating time of day in train orders.

In transmitting and repeating orders, time must be stated in figures and duplicated in words.

207. To transmit an order, the signal "31" or the signal "19" followed by the direction must be given to each office addressed, and the number of copies stated, if more or less than three—thus, "31 WEST COPY 5," or "19 EAST COPY 2."

208. An order to be sent to two or more offices must be transmitted simultaneously to as many as practicable. When not sent simultaneously to all, the order must first be sent to the superior train.

A train order restricting the movement of a train must not be issued for it at the point where such movement is restricted if it can be avoided. When so sent, the fact will be stated in the order, and the train will be brought to a stop before delivery is made.

209. Operators receiving train orders must write or typewrite them in manifold during transmission.

210. Operators receiving a "31" order must repeat it back at once, in the succession in which their several offices have been addressed, and then write the time of repetition on the order. Each operator must observe whether the others repeat correctly.

SAVE YOUR STEPS

It's Cheaper and Quicker to Talk when you can get Complete Telephones for

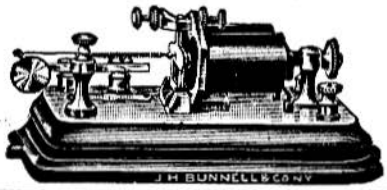
Per Pair **$5.00** Per Pair

SEND FOR CIRCULAR AND TERMS.

Operators can make Money selling these Telephones.

Our Latest Improved No. 1 Model Relay

WE recognize no competitor in the line of TELEGRAPH INSTRUMENTS. Our make is acknowledged the best—they may cost a little more than cheap imitations, but are worth much more where quality or service is a consideration. It pays to get the best. The finest ever made.



J. H. BUNNELL & CO.,

Manufacturers, Importers and Dealers in Telegraph, Telephone, Railway and Electric Lighting Supplies, Instruments, Batteries, Insulated Wires and Line Equipment.

MAIN OFFICE, 20 Park Place, P. O. Box 1286.

FACTORY, 5 to 15 Sullivan Street.

NEW YORK.

Bunnell was a large manufacturer and supplier of telegraph and electrical equipment. Relay shown in early twentieth-century ad above is a main-line relay with "spectacle" style frame.

The persons addressed must read the order to the operator and then sign it, and the operator will send their signatures to the train dispatcher. The response "COMPLETE" and the time will then be given to the operator.

Each operator receiving this response will then write on each copy the word "COMPLETE," the time, and his last name in full, and deliver a copy to each person addressed. When delivery to an engineer will take the operator from the immediate vicinity of his office, it may be signed for and delivered by the conductor. The engineer will read the order to the conductor before proceeding.

211. Operators receiving a "19" order must repeat it back at once, in the succession in which their several offices have been addressed, and then write the time of repetition on the order. Each operator must observe whether the others repeat correctly.

When the order has been repeated correctly, the response "COMPLETE" and the time will be given.

Each operator receiving this response will then write on each copy the word "COMPLETE," the time, and his last name in full, and must then effect delivery of the order to the persons addressed.

211(A). Clearance Form A must be filled out by the operator before clearing a train, showing thereon the total number of train orders and the number of each train order, if any, addressed to a train. He will repeat from the Form to the train dispatcher the information shown thereon. If the operator has correctly repeated, the dispatcher will respond by giving "OK" and the time, which the operator will endorse on the Form.

The Form must be delivered together with all orders to each person addressed.

212. When so directed by the train dispatcher, an order may be acknowledged before repeating by the operator responding "(number of train order) TO (train number) X" with the operator's initials and office signal. The operator must then write on the order his initials and the time.

213. "COMPLETE" must not be given to an order for delivery to an inferior train until the order has been repeated or the "X" response sent by the operator who receives the order for the superior train.

214. When an order has been repeated or the "X" response sent, 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.

217. 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 "C & E _____ AT _____ CARE OF _____", and forwarded and delivered by the conductor or other person in whose care it is addressed.

When form 31 is used, "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 engineer addressed, and a copy upon which he will take their signatures. This copy he must deliver to the first operator accessible, who must transmit the signatures to the dispatcher.

For orders so delivered to a train, the superiority of which is thereby restricted, "COMPLETE" must not be given to the order for an inferior train until the dispatcher has received the signatures.

218. When a train is designated in an order by its schedule number alone, as "NO 5", all sections of that schedule are included, and each must have copies delivered to it.

219. An operator must not repeat or give the "X" response to an order for a train which has been cleared or of which the engine has passed his train order signal until he has obtained the signatures of the conductor and engineer.

220. Orders once in effect continue so until fulfilled, superseded or annulled. Any part of an order specifying a particular movement may be either superseded or annulled.

221. A train-order signal must be provided at each train-order office, except at stations where all trains are required to stop.

222. Operators must promptly record, and report to the dispatcher, the time of arrival and departure of all trains and the direction of extra trains.

They must observe trains and report at once to the dispatcher if the proper signals are not displayed.

223. The following abbreviations may be used:

Such office and other signals as are arranged for by the superintendent.

C & E - for Conductor and Engineer

X - Train will be held until train order is made "COMPLETE"

COM - for Complete

NO - for Number

ENG - for Engine

SEC - for Section

JCT - for Junction

OPR - for Operator

CONDR - for Conductor

ENGR - for Engineer

MPH - for Miles per Hour

OK - for Correct

31 or 19 - to clear the line for train orders, and for operators to ask for train orders.

226. A train order office must not be closed until permission is obtained from train dispatcher. Signals must be arranged to indicate "no train orders."

notes

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

Rule 206 in referring to "even hours" means hours stated without minutes; the rule book for at least one line seems to misunderstand "even" as meaning the opposite of odd.

Rule 209, "in manifold" means to make the number of carbon copies required.

Rule 217. Some lines provide that orders restricting superiority may not be sent in this manner.

13. THE DISPATCHER

As mentioned in Chapter 1, train orders originate with the dispatcher. He has control over all of the traffic on a certain portion of the railroad. An extensive line may have several dispatchers. While all of them would have their offices at division headquarters, each of them has exclusive jurisdiction over a particular segment of the line.

Take a look at the map of the New Mexico Division of the Santa Fe line on page 25. In the mid-1950s there were three dispatchers on each shift at Clovis. On was responsible for the line from Clovis to Vaughn, another controlled Vaughn to Belen, and the third dispatcher had the branch lines and all the rest. Although in the 1950s CTC was used on the main lines, the branches were controlled by train order; at an earlier time this was true of the entire line.

Let's say the dispatcher has an order to be delivered to the C&E of a train at a particular station. First, he'd call the operator at that station by sending the station's office call, usually three times, followed by his own. The operator would acknowledge by sending "II" and his station call. Then the dispatcher might send something like this:

31 EAST COPY 2 NO 7 TO C&E NO 4.
NO 4 WAIT AT WILSON UNTIL FOUR FORTY FIVE
445 PM FOR EXTRA 5300 WEST. PRM

Note that the entire message consists of the preface (rule 207), the TO number (Rule 203), the address (Rule 204), the body of the order itself, and the superintendent's initials (Rule 201). Also note conformance to Rule 206 in designating the train and stating time.

As required by Rule 205, the dispatcher must record every order he sent "in a book provided for the purpose." As the receiving operator repeated it back, the dispatcher underlined each word to ensure it was received correctly and, if it was, sent COMPLETE (Rules 210, 211).

In a busy office, the dispatcher might not have the time to write the order in his book and then send it. The solution was the "copy operator" who would listen to the Morse as the dispatcher sent it and copy the TO into the book. As soon as the dispatcher signed the order off, the copy

operator would slide the book to him so the dispatcher could check the repeat. When that TO was made COMPLETE, the dispatcher would slide the book back to the copy operator and send the call for the next TO.

observations

This comment, made on the day of the short-lived rail strike in April 1991 by a spokesman for Amtrak (whose employees did not participate in the strike), illustrates the importance of the dispatcher: "We lease the lines of other railroads to run over. But if they don't have dispatchers to dispatch our trains, we can't operate."

Six dispatcher's offices, including that of the New Mexico Division, were consolidated at Albuquerque in 1990. There will soon be ten dispatchers on each shift, handling the Santa Fe from Needles, California, to Denver, Colorado, and to Amarillo and Sweetwater in Texas. As Warren Vance, a former dispatcher for the line, observes, "That's a lot of railroad for one office to keep up with."

CTC means a Centralized Traffic Control System, which is comprised of automatic signals and interlocking. Using this system, the dispatcher routes trains by means of the CTC machine, which electrically operates the switches and signals to the desired position.

14. TRAIN ORDER FORMS

The primary meaning of train order "form" means the form of the wording used in the order; a secondary meaning is the form of blank on which the order is recorded upon reception. In this chapter we'll look at the wording standards, leaving some typical TOs for later. As with the other rules, forms of train orders were codified, and the usual letter designation is followed below. The standardized forms have many examples; not every form or example is illustrated here.

TOs originate with the dispatcher and end with (usually) the C&E, who must act on them. Thus the need for standardization of format, to avoid confusion. More than one form may be used in the same TO; indeed, that may be necessary to avoid confusion.

While it may not be necessary for the operator in a large station to know the train movement procedures to be followed under an order, he should be aware of the consequences of an order. This is particularly true for the agent-operator.

The parenthetical letter S or D denotes the form is for single or for two or more tracks, respectively. Forms without either letter apply to one or more tracks.

FORM A (S): Fixing meeting points for opposing trains.

NO 1 MEET NO 2 AT PRESCOTT.
NO 2 AND SECOND 4 MEET NO 1 AND NO 3 AT ERIE.
NO 9 TAKE SIDING MEET NO 16 AT MARLBORO AND NO 158 AT ARON.

Trains receiving these orders will run with respect to each other to the designated points and there meet in the manner prescribed by the rules.

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

EXTRA 594 WEST PASS NO 1 AT HOMER.

Both trains will run according to rule to the designated point and there arrange for the rear train to pass promptly. The train to be passed will take siding.

When an inferior train receives and order to pass a superior train, authority is conferred to run ahead of the train passed from the designated point.

EXTRA 594 EAST RUN AHEAD OF NO 6 STOW TO LARSON.

FORM C (S): Giving right over an opposing train.

NO 1 HAS RIGHT OVER NO 2 BARLOW TO MEREDITH.

If the second-named train reaches the point last named before the other arrives, it may proceed, keeping clear of the schedule of the opposing train as required by rule.

EXTRA 37 EAST HAS RIGHT OVER NO 3 ACTON TO STOW.

The regular train must not go beyond the point last named until the extra train has arrived, unless authorized by train order to do so.

If the trains meet at either of the designated points, the first-named train must take the siding, unless the order otherwise prescribes.

FORM D: Giving right over another train in the same direction.

NO 1 HAS RIGHT OVER NO 3 WALTHAM TO SOMERVILLE.

The second-named train must clear the time of the first-named train between the designated points as required by rule.

FORM E: Time orders.

NO 1 RUN 50 FIFTY MINS LATE NEWTON TO CAMBRIDGE.

This makes the scheduled time of the train named, between the stations designated, as much later as stated in the order, and any other train receiving the order is required to run with respect to this later time, as before required to run with respect to the regular schedule time. The time in the order should be such as can easily be added to the schedule time.

NO 2 WAIT AT ASHBY UNTIL 950 NINE FIFTY AM
WINSLOW 1020 TEN TWENTY AM
BILLERICA 1045 TEN FORTY FIVE AM.

The train named must not pass the designated point until the time given. Other trains receiving the order must run with respect to the time specified at the designated points or any intermediate station where schedule time is earlier than the time specified in the order, as before required to run with respect to the schedule time of the train named.

The station names must be written in column formation.

FORM E (S): Time orders.

NO 1 WAIT AT ECHOLS JUNCTION UNTIL 840 EIGHT FORTY AM FOR NO 2.

The train first named must not pass the designated point before the time given, unless the other train has arrived. The train last named is required to run with respect to the time specified, at the designated point or any intermediate station where schedule time is earlier than the time specified in the order, as before required to run with respect to the schedule time of the train first named.

FORM F: For sections.

ENG 20 DISPLAY SIGNALS AND RUN AS FIRST 1 BOSTON TO ACTON.

To be used when the number of the engine for which signals are displayed is unknown, and is to be followed by the next form, both being single-order examples.

ENG 25 RUN AS SECOND 1 BOSTON TO ACTON.

ENGS 20 AND 99 RUN AS FIRST AND SECOND 1 STOW TO HUDSON.

Each section affected by these orders must have copies, and must arrange signals accordingly.

FORM G: Extra trains.

ENG 99 RUN EXTRA WATERTOWN JCT TO WEST CONCORD.

ENG 37 RUN PASSENGER EXTRA QUINCY TO NEWTON.

FORM H (D): Work extra.

ENG 292 WORKS EXTRA ON EASTWARD TRACK 645 SIX FORTY FIVE AM UNTIL 545 FIVE FORTY FIVE PM BETWEEN CONCORD AND ACTON.

The example "on eastward track" is for a double track location.

FORM J: Holding order.

HOLD NO 2.

HOLD EASTWARD TRAINS.

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

NO 2 MAY GO.

These orders will be addressed to the operator, and will be delivered to conductors and engineers of all trains affected.

FORM K: Annulling a schedule or a section.

NO 1 DUE TO LEAVE BEKMAN FEB 29 IS ANNULLED BEKMAN TO WATTS.

SECOND 5 DUE TO LEAVE CARSON FEB 29 IS ANNULLED CARSON TO STOW.

The schedule or section annulled becomes void between the points named and cannot be restored.

This form must not be combined with other forms of train orders.

FORM L: Annulling an order.

ORDER NO 10 IS ANNULLED.

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 which has been annulled must not be reissued under its original number.

FORM M: Annulling part of an order.

THAT PART OF ORDER NO 10 READING NO 1 MEET NO 2 AT WORCESTER IS ANNULLED.

Form M will be used only when that part of the order not annulled is clear in its wording.

FORM P: Superseding an order or part of an order.

NO 1 MEET NO 2 AT LITTLETON INSTEAD OF ACTON.

This order is given by adding to prescribed forms, the words "instead of ___."

An order which has been superseded must not be reissued under its original number.

15. TRAIN ORDER EXAMPLES

This chapter discusses a few TOs issued on the Santa Fe line on May 31, 1940, together with the clearance card for the orders. These were issued at Vaughn, 130 miles west of Clovis (see map on page 25), to the C&E of Extra 5001 East. The TOs and clearance card were received and signed by the operator at Vaughn, Roy Moots, who later became a dispatcher at Clovis. The dispatcher was John Collins, who is identified by the operator writing his initials (JCC) on the clearance card. The superintendent at Clovis (JEL on the TOs) was Jack Lester.

The clearance card (page 46) lists the six TOs to be delivered to the C&E; it also operated as permission for the train to proceed from the point of issuance. Just as a TO would be made COMPLETE upon proper repetition by the telegraph operator, so the clearance card was made OK by the operator repeating the information to the dispatcher.

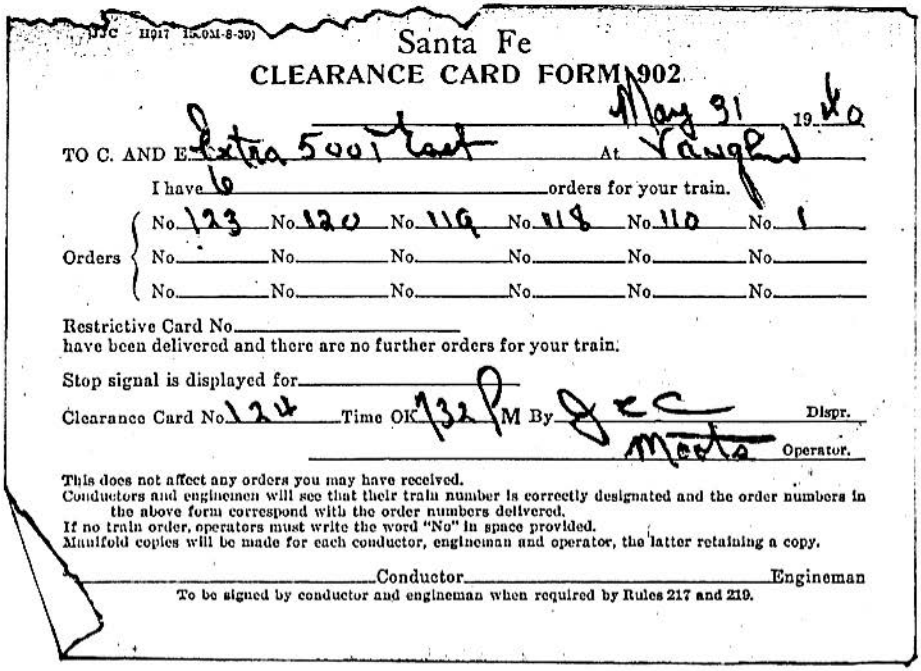
Order 120 read as follows: NO 120 TO C&E EASTWARD EXTRAS. EASTWARD EXTRAS FOLLOWING EXTRA 5001 EAST BETWEEN VAUGHN AND YESO WAIT AT VAUGHN UNTIL TEN THIRTY 1030 PM. JEL.

With a copy of this TO, extra 5001 east knows that no other eastward extras would follow them between Vaughn and Yeso before 1030PM. This would relieve the flagman on the caboose from having to provide flag protection to the rear in case they stopped—that is, up until 1030PM. Otherwise, every time they stopped, the flagman would have to take flagging equipment (red flags, fusees, torpedoes) and go back and flag against following trains to prevent being struck in the rear.

Order 119 read : NO 119 TO C&E EXTRA 5001 EAST. ENG 5001 RUN EXTRA VAUGHN TO CLOVIS. JEL.

This is the authorization for engine 5001 to run from Vaughn to Clovis. Without it, 5001 couldn't even foul the main track, much less run to Clovis.

Order 118 (page 47) is what was commonly called a "right of track order." The dispatcher had extra 5001 moving east and extra 3820 moving west (this is a single track railroad). He could have given them a train



Santa Fe

CLEARANCE CARD FORM 902

May 91 19 ko

TO C. AND E. Extra 5001 East At Yaugh

I have 6 orders for your train.

Orders
No. 123 No. 120 No. 116 No. 118 No. 110 No. 1
No. No. No. No. No. No.
No. No. No. No. No. No.

Restrictive Card No.
have been delivered and there are no further orders for your train.

Stop signal is displayed for

Clearance Card No. 124 Time OK 132 P M By Dispr.

Operator.

This does not affect any orders you may have received.
Conductors and enginemen will see that their train number is correctly designated and the order numbers in the above form correspond with the order numbers delivered.
If no train order, operators must write the word "No" in space provided.
Manifold copies will be made for each conductor, engineman and operator, the latter retaining a copy.

Conductor Engineman

To be signed by conductor and engineman when required by Rules 217 and 219.

order to meet at a certain station—a "meet order"—but in this case he either didn't want to delay extra 5001 east or he wasn't sure just what time extra 3820 west would be at any given location. Maybe extra 3820 west had work to do en route making it hard to figure where the meet should be set up. So what this order does is allow 5001 to continue moving, but being sure not to pass any one of the stations mentioned before the times shown. The 3820 would have a copy of this order also, and knows that the 5001 has right over him and he must keep out of his way. 3820 will keep moving west, getting in the clear at some station, going as far as he can against the times. For example, if he can make Ricardo and be in the clear no later than 955PM he might go there. If he could go farther, he would. In other words, he would go to the farthest station he could make, just being sure to be there and in the clear by the time shown for that station.

Orders 1, 110 and 123 mentioned on the Clearance were speed limits, or "slow orders" as they were called.

Santa Fe

Form 933 Standard

TRAIN ORDER NO. 118 MAY 31 19 40

To C & E EXTRA 5001 EAST

At VAUGHN X Opr. M.

THIS MARGIN NOT TO BE WRITTEN UPON

EXTRA 5001 EAST HAS RIGHT OVER EXTRA 3820 WEST
VAUGHN TO MELROSE BUT WAIT AT
YESO UNTIL NINE THIRTY FIVE 935 PM
EVANOLA NINE FORTY FIVE 945 PM
RICARDO NINE FIFTY FIVE 955 PM
AGUDO TEN NAUGHT FIVE 1005 PM
FOR EXTRA 3820 WEST

J E L

THIS MARGIN NOT TO BE WRITTEN UPON

Made [illegible] time 907 P M. Mooto Opr.

16. THE TRAIN ORDER: SIGNALS

Once the operator has received a train order, he must deliver it. As we've seen, an order is usually addressed to the conductor and engineer of a particular train. That train will arrive at the operator's station, but the station may not be a stop on the train's schedule. Without signals, the train would speed by the station.

Of course, many stations are terminal stations at which all trains must stop. The conductor, and perhaps also the engineer, will report to the order table to pick up the clearance for their train, and to sign for any train orders. Referring again to the map on page 25, Clovis, Belen, Albuquerque and El Paso were terminals where the crews went on duty, so the conductor would report to the office and pick up the orders from the telegraph operator in person.

The stations we are concerned with in this chapter are the way stations, or any station at which a train does not normally stop. Rule 221 requires a train-order signal at such stations.

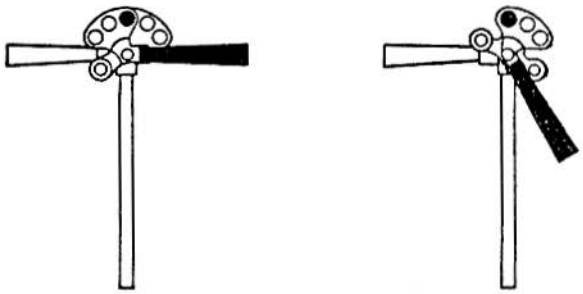
A train-order signal, often called an "order board," lets the engineer of an incoming train know whether there are orders waiting for him at the station. It also tells him whether he must stop to pick them up, or if he can receive them "on the fly."

The simplest form of train-order signal is indeed a "board" about two feet square, painted white. When draped with a yellow flag ("slow board"), orders will be picked up without stopping; how this is done is covered in chapter 18. On a red flag ("red board"), the train must stop to receive orders. When white is showing, there are no orders and the train may continue on its way.

The flag-draped board is rarely used outside of yards. Most order boards are fixed signals, operated by pulling a lever or chain or throwing a switch in the station. The kind of signal used, and the way they are displayed, varies among lines as does train order Rule 221 which, in addition to what is stated in this book, will go on to require certain procedures of the operator and engineer.

In general, indications of signals are conveyed by the position of semaphore blades, position and color of lights, flashing of lights and combination of a color and flashing of light. The figure shows a typical semaphore; the arm to the right is the one that governs. Since the "right-hand side" is the engineer's side of the cab, the signal is located to give him a good view as he approaches.

Such a signal is always kept in the stop position except when it is cleared for an approaching train. While some lines (the C&O, for example) use a three-position signal, we will discuss the two-position semaphore procedure.



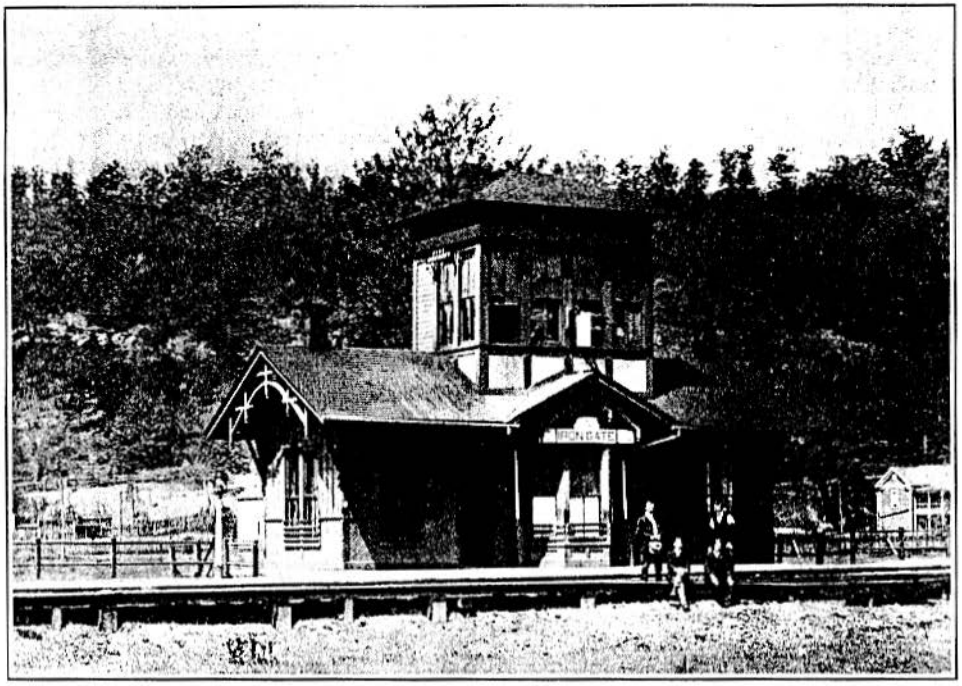
Stop **Proceed**

If the operator holds no orders for the approaching train, he will clear the board—but only after the train has reached a point from which the signal can be seen. This avoids the situation of a semaphore stuck in the clear position; the engineer can see the arm drop. The operator will restore the signal to stop after the rear of the train has passed.

In the previous situation, if the engineer first sees the signal in the proceed position he must stop. It is an indication that something is not right. Perhaps the signal is broken, or the operator failed to follow proper procedure. Whatever the problem, the rules, based on safety, require that the engineer bring the train to a stop.

If the operator holds 31 (stop to receive) orders, he will leave the arm in its normal or stop position. The train cannot leave the station until the engineer has received the orders and a clearance card.

Finally, if the operator holds 19 orders which are to be delivered to the train on the fly, he will drop the arm twice and return it to the stop position. Seeing this, the engineer will reduce his speed to thirty miles per hour or less. This results in delivery on-the-fly, and sometimes a long walk for the operator or an embarrassed engineer who juggled the circle.



C & O Railway System, Iron Gate, Virginia

This turn of the century photograph shows the Iron Gate station with its complement of telegraphers posing outside. Operators Alvis, Showalter, Davis and Johnson were all members of the Order of Railroad Telegraphers, and obviously proud of it.

As with all unions through the years, wages and hours were the concerns of the ORT then. But some didn't want Sundays off, for fear of losing pay. Others were concerned that cutting back the ten or twelve-hour day would also reduce their paycheck. And while some argued for a seventy-five dollar a month wage, others merely wanted a four-dollar-per-month guarantee for handling telegrams. History and progress resolved their concerns forever.

17. A VERY YOUNG OPERATOR

In the early years of this century children were often required, by financial circumstances, to leave school at a young age and help support the family. Most of the work available to them were menial jobs—delivery boys, stock clerks and the like. Some, after suitable training, became telegraph operators for the railroads. But although an earlier age limit of 18 years was not at this time widely observed or enforced, it was unlikely that a child not yet in his teens could obtain such a position.

The railroad held a fascination for many youngsters. One of them was John Collins. John's uncle was the agent/operator at a C&O country station in Kentucky, and young John stayed with him frequently. By the age of seven, he had started to learn Morse and operating procedures.

When he was about ten or twelve years old he was awakened one night by a knocking at the door. It was the conductor of a C&O train, who explained that there had been a wreck up the line. The station was closed, so the conductor walked to the operator's house.

John's uncle was away that evening, so John went with the conductor to the station. They opened it, and John called the dispatcher on the wire to report the wreck.

Answer to quiz on page 30.

Page 15 mentions the pencil and mill; page 17 mentions the double-sided carbon, and that you can read through the blank. So the answer is: One.

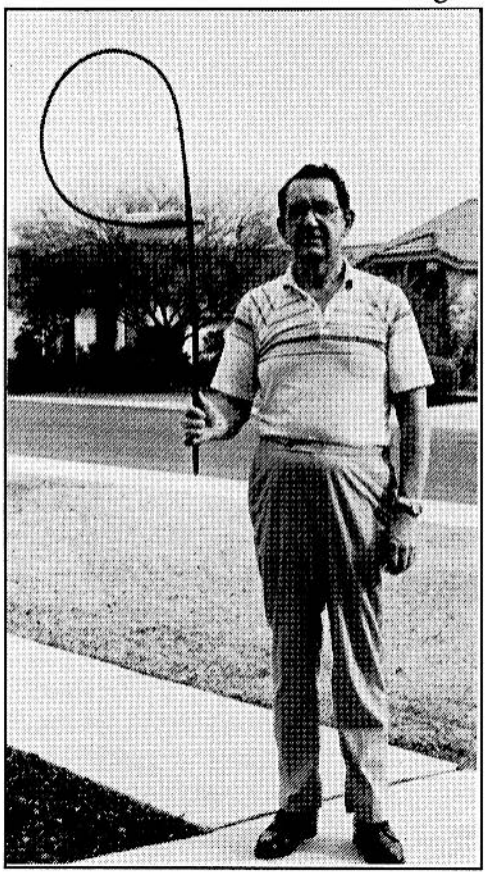
Place the carbon under the second blank, and use your mill or pencil on the top one. The impression is on the top of the first and third copies, and on the back of the second (which can be read through).

The dispatcher asked John if he knew how to copy train orders. John answered that he did, and the dispatcher had him copy several orders. Thanks to John's interest in railroading and his uncle's training, the dispatcher was able to get a wrecker moving to the scene.

Later, John Collins would serve in World War One as a telegrapher in France and, after the war, as an operator with the AT&SF in New Mexico. This is the same John Collins whose initials appear on the clearance card on page 46.

18. THE TRAIN ORDER: DELIVERY

In the usual case of delivery at a terminal or train-order office, the train is stopped and the conductor and engineer go into the station and pick up their orders from the operator. More often, the conductor picks up the orders for himself and for the engineer.



The more interesting case is that of delivery on the fly. If the train is not required to stop to receive its orders, the operator in the olden days would gather the orders together with the train clearance form, fold them up, and clip them to an "order hoop." The hoop is nothing more than a stick of wood, the upper portion of which is bent back to itself. A wire clip is affixed to the joint. The photograph shows a hoop held by Warren Vance (MTC/PX).

The operator would prepare two hoops, one with a long handle for the engineer's orders, and another with a shorter handle for the conductor's orders. He would then stand on the station platform (being on the "right hand side") where he'd hold the hoops up as the train approaches.

The engineer, high up in the cab, would crook his arm out the side. If all went well, he'd catch the hoop on his arm, unclip the orders, and drop the hoop. Some engineers were so adept at this that the hoop would fall practically at the operator's feet. Others might take their time

or be slowed by age—or have a bone to pick with the operator—and the hoop would be tossed from the cab a quarter-mile up the track. The operator, of course, had to retrieve it.

The conductor, at the caboose, went through the same motions as the engineer to obtain his copy of the orders. If either missed the hoop, or "juggled the circle" as it was called, neither would be pleased as the train would have to be brought to a stop to retrieve the orders.

The hoop was eventually replaced with a forked order-holder. This device was held in a socket on the platform. The orders were tied to a loop of string which was then placed on the fork. A hook on the train caught the orders.

The fork was always at the right height, the engineer was never embarrassed, and the operator had no hoop to retrieve. As with many aspects of railroading, the system had gained in efficiency, but lost the romance and thrill of the earlier method.

Great Northern operators at Swan River (Minnesota) station, 1904.

19. TELEGRAPH NUMERALS

Numbers are commonly used as abbreviations for questions or short messages. Two of these, 19 and 31, have already been seen in the chapter on train order rules. Many others, used on both commercial and railroad lines, exist. The more useful and common signals are listed here.

1.	Wait a minute.
2.	Very important.
3.	What is the correct time?
4.	Where shall I repeat from?
5.	Have you anything for me?
6.	I have something for you; are you ready?
8.	Close your key; you are breaking.
9.	Wire test. (Has precedence over 25 and 55.)
10.	Low.
12.	The circuit is yours.
13.	Do you understand?
14.	What is the weather?
15.	Have you any orders?
17.	Daily weather report.
18.	What is the matter?
21.	This message has precedence over all others on Division Wires. On through wires, this has precedence over 9, 25 and 55 business.
22.	I am 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. Has precedence over ordinary and 55 business.
28.	Did you get my writing?
29.	This message is private, and must be delivered in a sealed envelope.

33.	Answer is paid.
39.	This dispatch has precedence over all other business on through wires. (Used only for messages from the President, Vice-President, General Manager and General Superintendent of the railroad.)
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 are you at the key?

In commercial services, some numbers had other meanings, and other numbers were also used. Here are a few of those.

6.	I am ready.
7.	Are you ready?
12.	Do you understand?
13.	I understand.
25.	Busy.
30.	The end.

20. RAILROAD SLANG

Every profession has its own "slanguage," words and phrases which are humorous, derogatory or merely shorthand for the people, tools and everyday tasks of the trade; those who worked on the rust were no different. Such words, once coined, spread rapidly during the boom years of the late 1800's. But the passing of the boomer after the turn of the century, and the growth of the home guard, slowed the spread of some slang and resulted in other words known only locally.

A full listing of the slang of the railroad worker would be impossible in these pages. This list is limited to some terms which might be of interest to the telegrapher.

BIG E: Engineer, from the large initial on membership buttons of the Brotherhood of Locomotive Engineers.

BIG O: Conductor, from the first initial of the Order of Railway Conductors. Also, The Brains, Captain, Conducer, or Dinger.

BOARD: A fixed signal regulating rail traffic, such as slow board, order board, clear board (clear tracks) or red board (stop). Not to be confused with Extra Board (see).

BOOMER: A drifting worker who goes from one railroad job to another, following the boom camps. Not tramps, but workers in demand because of their experience. The opposite of Home Guard (see).

BRASS HAT: Railroad official.

BRASS POUNDER: Telegraph operator. A heavy-fisted operator was also demeaned as a "pounder".

BUCK THE BOARD: Working the Extra Board (see).

BUG: Semiautomatic telegraph key (a bug's key, from the earlier meaning of an incompetent operator), or trainman's light (bug torch).

BUNCH OF THIEVES: Relief crew. Also, Wrecking Crew.

CARD: Union or Brotherhood membership credentials.

CIRCUS: Railroad.

COMPANY BIBLE: Book of rules.

COUNT THE TIES: Reduce speed.

CUT THE BOARD: To lay off the most recently hired men on the Extra Board (see).

DETAINER: Train dispatcher; also, Delayer.

EXTRA BOARD: A list of men not in regular service, called to work as needed. Also Spare Board, Slow Board or Starvation List.

FIST: Telegrapher operator's handwriting, characterized by its legibility. The modern reference is to the quality of an operator's sending.

FLIMSY: Train order. Forms were issued on tissue paper to facilitate making carbon copies.

HAM: A student, or a poor telegrapher.

HIGH IRON: Main line track (laid with heavier rail than branches).

HOME GUARD: Employee who stays with one railroad; the opposite of Boomer.

HOMESTEADER: A Boomer who gets married and settles down.

INDIAN VALLEY LINE: A mythical railroad where there are always good jobs waiting.

JUGGLE THE CIRCLE: To miss a train-order hoop.

LETTERS: Service certificate given to man who is laid off or discharged. Applicants for jobs are usually asked to present Letters proving previous employment.

LIGHTNING SLINGER: Telegraph operator.

NON: Telegrapher's term for Operator who doesn't belong to the O.R.T.

O.R.T.: Telegrapher's union, Order of Railroad Telegraphers.

OS: Train report ("on sheet"), to report a train by to dispatcher. Although an important duty of the operator, it was used derogatorily to mean a station where little more than OS work occurred.

PIE-CARD: Meal ticket.

RAIL: A railroad employee.

RUST: Railroad.

SLING MORSE: To work as a telegrapher.

STRING: A telegraph wire; or, several cars coupled together.

UNDER THE TABLE: Situation of telegrapher to whom messages are being sent faster than he can copy.

WISE GUY: Station agent.

REFERENCES and BIBLIOGRAPHY

Many sources were drawn on in researching and writing this book. Some are acknowledged in the text; others are specifically acknowledged below. In addition, some of the more useful books from which material or general background was gathered are listed for the reader who wishes to seek them out for further study and enjoyment.

Introduction. Quote: *Letter* from Ted McElroy (1901-1963), world champion telegrapher, to J.M., 2/19/58. Courtesy Sy Saslow WB2MEW.

Chapter 5. *The Railroad Telegrapher* (ORT), 1904: July p. 918; October p. 1289; November p. 1414.

Chapter 7. Re ham factories: *The Railroad Telegrapher* (ORT), July 1904, p. 922.

Chapter 10. *Pocket Edition of Diagrams and Complete Information for Telegraph Engineers and Students*, Jones (Willis H.), 1915. New York: Telegraph and Telephone Age. *Dots and Dashes*, July-Aug-Sept 1990 issue, p. 2. Morse Telegraph Club.

Chapters 15 and 17. The Santa Fe train order examples, and the story on John Collins, were provided by Warren Vance.

Chapter 20. *Railroad Avenue*, Hubbard (Freeman H.), 1945. New York: McGraw-Hill Book Company.

Rules and Regulations of the Transportation Department, Southern Pacific Company (Pacific Lines), Feb. 15, 1943.

Rules for the Government of the Operating Department, Boston and Maine Railroad, April 25, 1948.

Rules of the Operating Department, New York Central System, October 28, 1956.

Modern Practice of the Electric Telegraph, Pope (Frank L.), 1886. New York: Van Nostrand.

Telegraphy Self-Taught, Edison (Theo. A.), 1902. Chicago: Frederick J. Drake & Co.

Twentieth Century Manual of Railway Commercial and Wireless Telegraphy, Meyer (Frederic L.), 1914. Chicago: Rand McNally & Co.

the Morse Telegraph Club

If railroad telegraphy interests you, I'd be remiss in not tipping you off to the Morse Telegraph Club. The MTC keeps the spirit of Morse and the memories of the railroad telegraphers alive with its quarterly publication, *Dots and Dashes*.

For more information, write to the club at 1101 Maplewood Drive, Normal IL 61761.

ABOUT THE AUTHOR

Hm-m-m, that's me. Well, at the risk of being pretentious, here goes: I've been interested in telegraphy since earning my Amateur Radio License in 1956 (then, WN1IMQ—now, W1IMQ). Almost all of my radio operating is on CW (International Morse, of course). And although I'm proud to say I'm a ham, I'm not sure I want to be called one by a railfan.

I've been researching the history of telegraphy for several years now, and have gradually accumulated a small collection of telegraph instruments and reference materials. Most of these instruments are keys, and to impose some limits on my collecting, I try to concentrate on Vibroplex and McElroy bugs and U.S. military keys. But the most interesting part of my collection is the books and magazines that provide the information about who made the telegraph instruments and how they were used. I've tried to share some of that in these pages.

I'm a member of the American Radio Relay League, the Antique Wireless Association, the Morse Telegraph Club and the New England Antique Radio Club. My wife, Carla, and I live in Massachusetts. We have two grown sons; one lives in Arizona and the other in Florida. We like to travel and, as you might guess, we spend as much time in the southeast and southwest as possible during the winter.

If you have any comments on this book, questions on the contents, or suggestions for another, feel free to write (c/o Artifax Books). Please enclose a SASE if you'd like a response to questions.

Two sounds that evoke the image of railroading as it used to be are the whistle of the steam engine and the click of the telegraph sounder. This book won't help you with the steam whistle, but it does show you how the railroad telegraph systems worked—and how the men behind the telegraph instruments made it work.

The **railroad telegrapher's handbook** covers all of those subjects the operator had to know, and the duties he performed so that the railroad would run smoothly and efficiently. You'll learn about the instruments and the Morse code, how train orders are used, worded and delivered, the working rules for railroad employees and the special rules for telegraph operators...and more.

Whether you're a railfan, model railroader or telegraph buff, the **railroad telegrapher's handbook** will broaden your knowledge of your hobby and expand the limits of your interests.

American Morse Series

Artifax Books 9.95