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AMECO

CODE COURSE

PREPARATION FOR
AMATEUR AND COMMERCIAL
CODE EXAMINATIONS

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CHAPTER 1

INTRODUCTION

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WHY IS CODE USED?

It is a relatively simple matter for anyone to broadcast a message using radio-telephony (speech); the only requirement is that the individual sending the message should speak into a microphone that is connected to a transmitter. At the receiving end, the procedure is just as simple; the individual desiring to understand the transmitted message needs only to tune his receiver to the broadcasting station and listen to the spoken words as they are reproduced by the receiver.

The transmission of messages by code however, requires special skill on the part of both the sender and the receiver. The obvious question that then arises is: "Why use code transmission at all, if voice transmission is so much simpler?" This question can best be answered by these four important reasons:

1. Radio communications by code requires less elaborate, less costly, and less bulky equipment than does radiotelephone communication.
2. Code transmission will penetrate radio and atmospheric interference more readily than will 'phone transmission. Code transmission will usually be intelligently received under conditions that render radiotelephone transmission and reception impossible; the spoken word, with its inflections, intonations and tremendous variety of sounds is infinitely more complex than is the single, piercing note of a radiotelegraph signal.
3. The radiotelegraph code constitutes an invaluable method of sending secret messages and "security" information with a greater amount of safety.
4. A transmitted code signal requires much less frequency space than does the broad radiotelephone signal. This is especially important in the crowded amateur and commercial bands.

WHY LEARN THE MORSE CODE?

Before proceeding to learn the code, it is best to clarify the reasons for learning it, and to realize why a knowledge of the code can be of importance.

An individual's knowledge of code can be of great benefit to the community during times of emergency. During wartime, the Armed Services call upon thousands of experienced code operators to perform special duty. During peacetime disasters, such as floods, hurricanes and fires, a knowledge of code can be utilized to help save lives and property. In the past, amateur radio operators on countless occasions have been instrumental in such work, often providing the only means of communication between the stricken areas and the outside world. Many a ship's distress signal was first heard by private people who had learned the code. For these reasons, the competent code operator is a valuable, respected member of his community.

The International Code provides a means of obtaining interesting, valuable careers in communications. Many highly important positions require a knowledge of code. For example, radio-operators in the maritime service send and receive coded messages. Code operators are required in trans-oceanic and trans-continental radio stations, as well as in countless smaller local communication networks. Due to the vital importance of these services, an individual must be duly licensed by the Federal Communications Commission in order to hold a position as a code operator. Government licenses for radiotelegraph and amateur radio operators are only issued to those individuals who successfully pass an examination in sending and receiving code as well as a written examination covering radio theory.

CODE REQUIREMENTS FOR GOVERNMENT LICENSES

In order to pass the Amateur Operator's code examination for the Novice or Technician class license, the applicant must be able to send and receive International Morse Code at the rate of 5 words per minute. The General class of Amateur license requires a code speed of 13 words per minute. The prospective holder of an Amateur Extra class license must be competent in the code at a speed of 20 words per minute. The code requirement for the Commercial second class radio-telegraph license is a sending and

receiving speed of 16 words per minute. For a First Class commercial license, the rate of sending and receiving is 25 words per minute.

The text of the Commercial operators' exam is composed of coded groups of letters and punctuation marks, whereas the text of the Amateur exam is composed of various English words interspersed with numbers and selected punctuation marks. An average word is considered to be one of 5 letters. Numbers and punctuation marks count as 2 letters. The exam is of 5 minute's duration, and one minute of perfect copy is necessary to successfully meet the requirements. In other words, an applicant for the General class license must copy 13 consecutive words without an error, in order to pass the examination. The one minute ruling applies to all federal code examinations, commercial as well as amateur.

WHAT IS THE MORSE CODE?

The Morse code consists of letters, as does any spoken language. The code letters consist of sounds of short and long duration which are called dots and dashes. These sounds are usually high pitched tones of about 500 cycles, or approximately the sound of C above middle C on the piano. The long sound (dash) is three times as long in duration as is the short sound (dot). Each letter of the alphabetic, each number and each punctuation mark is composed of a different combination of these long and short sounds.

There are two different systems of code in use today. By far the more important is the International Morse Code. The other system is the American Morse Code which today is used solely by a few of our railroads. The majority of our services use the international code for purposes of radio communication. Since we are primarily interested in code for the purpose of radiocommunication, we shall study the International Morse Code, sometimes referred to as The Radiotelegraph Code.

LEARNING THE CODE

Many beginners frequently ask the question - "How long will it take me to learn how to send and receive 13 words per minute?" There is no stock formula, since the answer to this question varies greatly with the individual; the rate of learning depends solely on the student. An average stu-

dent requires approximately 120 half-hour sessions of concentrated practice (a total of 60 hours) to become thoroughly proficient in code at a rate of 13 words per minute. Proficiency at a speed of 15 words per minute requires an average of 160 half-hour lessons, or a total of 80 hours of practice.

If you intend to take the General Class amateur radio operator's examination which requires a code speed of 13 words per minute, you should best become proficient at a speed of 15 w.p.m. Likewise, if you are preparing to take the Commercial Second-Class License examination, which requires a code speed of 16 words per minute, you should be thoroughly familiar with the code at a rate of 18 w.p.m. These additional two words per minute serve as security against the possibility of failing the examination as a result of a loss of code speed due to nervousness. Most people become somewhat nervous when they are taking the code examination, and their code proficiency becomes lowered as a result. The added 2 w.p.m. act as a safety precaution, should this happen to you too.

Another question that is often asked by code beginners is: "How do I know that I can learn the radio-telegraph code?" The answer to this question is much simpler. Generally speaking, there is no such thing as not being able to learn the code. With sufficient practice, and with the necessary will-power, anyone can learn the code. Of course, not everyone can become thoroughly proficient at advanced speeds of 35-45 words per minute, but every willing student can certainly learn to copy at speeds of 15-25 words per minute.

At this point, it is best to state that there is no magic method of learning the code. The most important element in learning the code is practice. One cannot learn Morse code by reading a book about the subject and expecting the ability to send and receive to be transmuted to him. Learning can be accomplished only by continual practice. A definite schedule of code practice sessions should be set up and maintained. These periods of practice should be arranged on a daily basis, and should be properly spaced and timed.

GENERAL RULES FOR CODE PRACTICE

In learning the Morse code, the student should try to adhere to the following essential general rules:

1. Never study code for more than an hour and a half a day. Spread the practice sessions apart as much as possible, since this will increase the rate of learning. For instance, it is better to schedule five one-hour lessons per week, rather than two two-and-one-half-hour lessons.
2. At no time should you practice until you become exhausted. For that matter, do not attempt to study if you are not "in the mood", or if you do not feel well, since such time would just be wasted. The law of diminishing returns sets in after a while, and rather than the time spent studying being of value, it becomes of no value what-so-ever, and may actually be detrimental.
3. Do not attempt to practice the code for more than 15 minutes in one sitting. Continuous copying should be limited to no more than this period. After you have been receiving code for 15 minutes, take a short break for relaxation, and then start to practice once again. Once refreshed, your ability to learn is far greater.
4. Go slowly! Do not attempt to learn the code at speeds of 10 to 13 words a minute in one week's time. It simply cannot be done. By attempting this feat you will only wear yourself out, become discouraged and develop such a distaste for code that it may cause you to discontinue your studies entirely. You must be patient with yourself, and realize that you must learn one thing thoroughly before proceeding to another. Do not worry about developing speed in the initial stages of study. Speed is acquired gradually; if you learn the code properly at the beginning, it will be easier for you to gain speed later on.
5. Follow the lessons carefully. There are no further short-cuts to learning code. If you follow the instructions in the various lessons carefully, you will be learning the Morse code by the fastest and most scientific method yet devised. These instructions have been formulated by the Ameco Publishing Corporation, utilizing years of teaching and operating experience on the part of its staff members.

6. While in the process of learning the code, a point will be reached when you feel that you are not progressing. This point is referred to as the "plateau of learning". It comes at various speed levels. For example, you may find that you have reached the rate of 10 words per minute, and for some unknown reason you cannot increase your code speed by a single word, or even letter. This is a common experience that most code students undergo. It is important to realize that this is only a temporary situation that lasts for a short period of time, and that you really have nothing to worry about. Do not become discouraged, and be sure to continue your regular practice sessions with interspersed breaks for relaxation as you were doing before. Before you know it, you will be over the plateau, and on your way to higher code speeds.

Well, so much for the general rules, and now for a final word before the course is actually started.

Ninety percent of the requirements for learning the code is a willingness to learn and to practice. "Natural" ability means relatively little when it comes to mastering the Morse code. If you are thoroughly determined to learn the code and set aside sufficient practice periods in which to study, you have a 100% guarantee that you will become a proficient operator (whether Amateur or Commercial) in a short period of time.

RULES FOR BEGINNERS

As a beginner in code, there are several errors that you might possibly make which would serve to hamper your progress. In order to avoid these basic mistakes while learning the code, the following rules should be observed:

1. Do not use the conventional words "dot" and "dash" to represent the code element sounds "dit" and "dah". For example, if you want to say "C" in code language, the proper method would be to say: "dah-dit-dah-dit", and not: dash-dot-dash-dot. The reason for this seemingly unimportant rule is that dit and dah sound more like the actual code signals than do dash and dot. In order to be a proficient code operator, you must learn to translate the code signals directly into letters. For example, when a radio operator hears the sound "dah-dit", he immediately translates these sounds into the letter "N". Were he to begin learning the

code incorrectly in terms of dots and dashes, he would first have to translate the code sounds into the dots and dashes, and then into letters. This would lower his code speed tremendously, since an extra process is included in the decoding. For example, the sounds dah-dit would first have to be translated into dash-dot, since only in this form could he distinguish them as representing the letter "N". This, obviously, is an indirect, and highly inefficient method of receiving.

2. Code should be learned by the correct aural method, and not by the incorrect, slower visual method. The visual method causes the receiving operator to mentally visualize the entire chart of Morse code characters in order to pick out the letter that corresponds to these sounds. This method too, is a slow, laborious process. It curtails and limits the speed that a beginner can hope to achieve. The correct aural method enables the operator to immediately associate the rhythm of the code sounds with the letters that they represent. For example, hearing the rhythm of the sounds dah-dit-dah-dit would immediately bring to mind the letter "C" and no other. This method does not require lengthy thought processes or translation on the part of the operator.

3. You will soon find that certain letters are more difficult to learn and to memorize than others. You should, therefore, spend more time studying these letters than the others, and should give more of your practice to reviewing them. Far too many beginners learn the easier letters well and are hardly familiar with the more difficult letters. The folly of such a procedure is obvious; the beginner is uneven in his ability and will probably remain in this predicament for some time.

4. Learn numbers and punctuation marks as you learn the alphabet. Although punctuation marks are less frequently used than are the letters, they are equally important. The code tests for both amateur and commercial licenses include punctuation marks and numbers. To be weak on these symbols is to risk failing the exam.

CHAPTER 2

THE CODE ALPHABET

LEARNING THE CODE ALPHABET

Now that the fundamentals of the study process are known, we can begin the actual study of Morse code. We will learn groups of letters individually.

Read the "dit-dah" sounds out loud. Keep repeating the sounds, and try to look at the chart as little as possible. Be sure to keep the pauses between the sounds of each letter uniform in length. By so doing, the letter will become associated in your mind with the combination of sounds.

Below is the first group. The line under the dah signifies that it should be accentuated. Notice that the dit is shortened, and referred to as "di" when it immediately proceeds another sound.

Group One

E - dit
 T - dah
 A - di-dah
 R - di-dah-dit
 L - di-dah-di-dit
 Period (.) di-dah-di-dah-di-dah

The first four letters in the above group are fairly easy ones; the L and period will require more practice. Remember to keep the dits short, and the dahs three times as long as the dits. The proper rhythm of the code, will be accomplished by maintaining the prescribed 3 to 1 relationship, as well as by keeping the proper spacing. Make sure that both the dits and the dahs are separated by the same time interval. This interval should be equivalent to the duration of the sound "dit". If this is not done, a group of code sounds which are supposed to represent one letter may be misunderstood to represent two, or even three different letters. For example, if you leave too big a spacing between the dah and the last dit of the letter "R", it will sound like di-dah---dit. This will then be interpreted as code sounds representing the two letters "A" and "E", rather than as the one letter "R" that was intended.

Do not proceed to this next group until you have completely mastered Group 1 to the extent that you know all of the letters and their correct rhythms by heart.

Group Two

I - di-dit
 U - di-di-dah
 F - di-di-dah-dit
 S - di-di-dit
 V - di-di-di-dah
 ? - di-di-dah-dah-di-dit*

* - This last symbol may also stand for request for repetition of a transmission not understood.

After you have memorized the second group, go back and review the first group. At this point, you should know both groups well. It will be a great help to you if you can have someone test you by reading the dit-dah language to you correctly. You can judge how well you know these two groups by how quickly you recognize the letters and punctuation marks from the rhythm of the dit-dah sounds.

Group Three

M - dah-dah
 G - dah-dah-dit
 Z - dah-dah-di-dit
 Q - dah-dah-di-dah
 O - dah-dah-dah
 comma . (,) - dah-dah-di-di-dah-dah

In group three, the letters become a bit more complicated. This is especially true of the Z and the Q which are easily confused with the F and L. Make sure, by constant practice, that you can differentiate between Z and F, and Q and L.

Group Four

K - dah-di-dah
 C - dah-di-dah-dit
 B - dah-di-di-dit
 D - dah-di-dit
 W - di-dah-dah
 colon (:) - dah-dah-dah-di-di-dit

Continue to review the material in the previous code-letter groups after you have mastered Group Four. An excellent method of giving yourself the practice needed in learning the code is to translate words that you may see on posters, signs and headlines into code sounds. This should be done in addition to, rather than instead of the regular sessions. Little time is lost this way, and it is a rather pleasant way to pass the time while walking along the street, or riding in a vehicle that has posters displayed in it.

Group Five

N - dah-dit
 Y - dah-di-dah-dah
 X - dah-di-di-dah
 P - di-dah-dah-dit
 J - di-dah-dah-dah
 H - di-di-di-dit
 semicolon (;) - dah-di-dah-di-dah-dit
 fraction bar - dah-di-di-dah-dit
 double dash or break - dah-di-di-di-dah

Most beginners confuse the H with the S. This will happen if you do not learn to recognize the difference in rhythm between the two letters. Here again, sufficient practice does the trick.

Group Six

1 - di-dah-dah-dah-dah
 2 - di-di-dah-dah-dah
 3 - di-di-di-dah-dah
 4 - di-di-di-di-dah
 5 - di-di-di-di-dit
 6 - dah-di-di-di-dit
 7 - dah-dah-di-di-dit
 8 - dah-dah-dah-di-dit
 9 - dah-dah-dah-dah-dit
 0 - dah-dah-dah-dah-dah
 error - di-di-di-di-di-di-di-dit
 wait - di-dah-di-di-dit
 hyphen - dah-di-di-di-di-dah
 parentheses* - dah-di-dah-dah-di-dah*
 end of telegram or message unit - di-dah-di-dah-dit
 end of entire transmission - di-di-di-dah-di-dah
 received message O. K. - di-dah-dit

invitation to transmit - dah-di-dah

* - Before and after words.

Group six contains numbers, punctuation marks, and special procedure signals. As you learn this group, think of the punctuation marks and procedure signals as individual units and memorize them as such. For example, the code symbol that signifies the end of a message in a transmission is to be memorized as di-dah-di-dah-dit, one complete unit.

You will notice that there is a definite pattern to the numbers. Each number contains five code elements. The number one has one dit and four dahs. Number two has two dits and three dahs, etc. This pattern should be an aid to memorizing the numbers. However, do not think of the numbers as consisting of so many dits and so many dahs. Learn to hear the rhythm of the combination of dits and dahs in a number so that when you receive dit-dit-dit-dah-dah, for example, you will immediately associate that particular rhythm with the number 3. The incorrect way to do it would be to first figure that there are 3 dits and 2 dahs; then to figure back that this stands for the number 3. The mental figuring required for the incorrect method will cause you to lose speed. Remember, the key to learning the numbers and symbols is to associate a number or symbol with the particular rhythm of all the dits and dahs as a combined sound unit.

After studying groups one through six, you will have completed all of the alphabet, the numbers, and the important punctuation marks. Do not go on to chapter 3 until you are absolutely sure that you have mastered all of the material contained in the code groups of chapter 2. When that material is completely familiar, and you feel that you know it thoroughly with an absolute minimum of hesitation during code practice, then you are ready to proceed to chapter 3.

CHAPTER 3

HOW TO SEND CODE

THE IMPORTANCE OF PROPER SENDING

The importance of learning how to send correctly is often underestimated, and consequently, many beginners do not devote the proper amount of attention to code sending. Some beginners are made to feel that learning how to send "comes naturally". This, of course, is an erroneous concept. It takes a great deal of patience, practice and skill before an individual can send properly.

There are many reasons for learning how to send with precision and accuracy. First of all, you will be examined by the Federal Communications Commission when you take the Amateur or Commercial Radio-telegraph examinations. The examiner listens carefully to your sending, and he will fail you if he finds that your sending is difficult to copy. A second reason for learning how to send properly is that as an Amateur operator, you will find it exceedingly difficult to make, or to keep contacts if your sending is poor. Other "ham" operators would just as soon not answer your calls as try to copy "sloppy" code. Atmospheric disturbances and crowded band conditions in themselves may often make copying difficult, and poor sending makes the task even harder. The vast majority of operators would much rather copy a slow sender than one who pushes himself, making errors, confusing symbols and sending erratically. Also, in order to hold a position as a commercial radio operator, you must be skillful to the degree of being able to send well enough for all other operators to be able to copy your sending easily. For these reasons you can therefore see that sending code is just as important as receiving it.

Now that the importance of proper sending has been realized, it is advisable that you follow the rules as detailed below very closely. They represent standard procedure, and by closely adhering to them, uncomfortable as they may seem at the very outset, keying fatigue will be greatly reduced, and proper key manipulation will be made much easier.

1) Sit fairly erect and comfortable at the code table. A table 30" high is ideal for this purpose.

2) Both your feet must be on the floor, and your shoulder line should be parallel to the table.

3) The key should be in line with your right shoulder and about 18" from the edge of the table. This will allow enough room for your elbow to rest on the table. Your forearm muscle will then carry the weight of your arm. The key should be mounted on the table or on a large board. Try to secure the key to a mounting or directly to the table itself, to insure stability. It is exceedingly difficult to key properly if the key is not secured to a heavier, stationary object. The pressure exerted during normal operation is all that it usually takes to cause the entire key to move about.

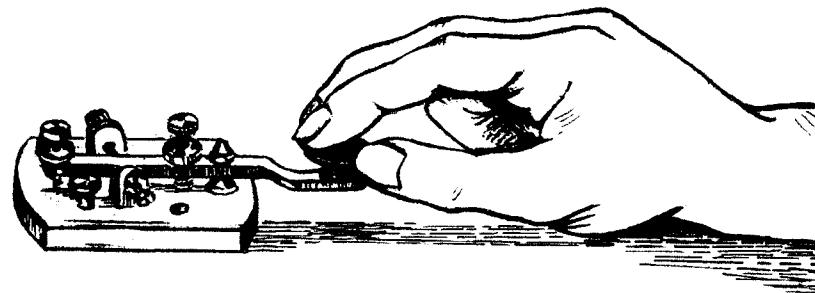


Fig. 1. How to Hold the Key

GRASPING THE KEY

How one grasps the key knob is a factor where we find a great deal of individual variation. Figure 1 shows the correct finger position for grasping the key knob. This position is used by all good telegraph operators. Study the picture carefully and try to duplicate the position shown with your own key. Your fingers should grasp the knob of the key as follows: Your thumb should press against the left edge of the knob. Your index finger, or first finger, should be slightly curved and should touch the top rear end of the knob. Your second finger should also be curved and be placed toward the rear right side of the knob, as shown in Figure 1. The two remaining fingers curve toward the palm and do not touch the key knob.

ADJUSTING THE KEY

After you become familiar with holding a key, the next thing for you to learn is the method of adjusting the key. See Figure 2 for the names of the various parts of the key. The steps in the adjustment of the key are as follows:

1) Adjust the two side screws so that the arm of the key is free to move up and down with ease and without any noticeable side play. Once this is done, tighten the two lock nuts on the side screws to secure their adjustment.

2) Adjust the space between the two contact points. This is done by adjusting the "space adjustment" screw at the rear of the key until the distance between the contact points in the "key-up" position is from 1/32 of an inch to 1/16 of an inch. When this adjustment is made, tighten the lock nut to secure the space adjustment. The exact spacing of the points will vary with the individual operator. As you become more experienced in code sending, you will choose the spacing that suits you best. You may find that as your code speed increases, you will slowly be decreasing the space in between the contacts, until they become very close together. This procedure, however, should not be rushed. As a general rule, the correct spacing is the comfortable spacing, and the comfortable spacing is the correct spacing.

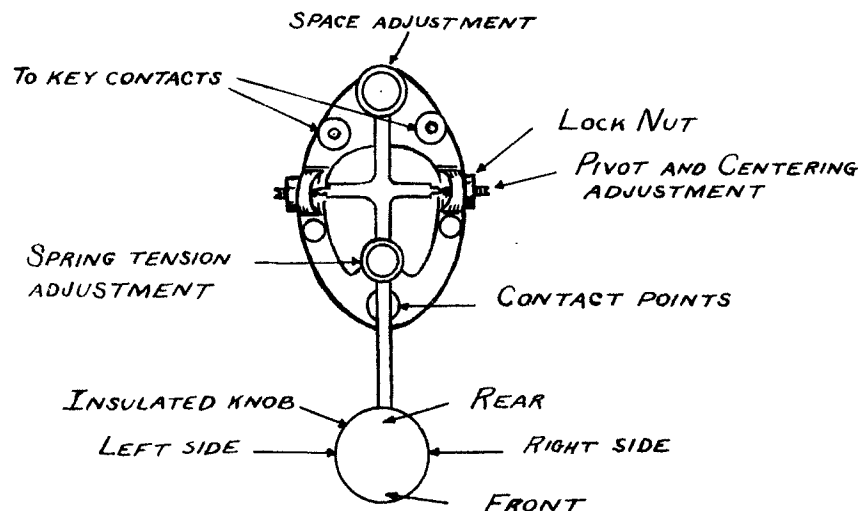


Fig. 2. A Telegraph Key

3) The final key adjustment is the tension of the spring. The spring tension should be so adjusted that the contact points separate as soon as pressure on the key knob is relaxed. At the same time, the spring tension should not be so strong that heavy pressure is required to close the key contacts. If the spring tension is too strong, the physical effort required to press the key arm will cause hand fatigue in a short time. Also, the sending will appear to be choppy. On the other hand, if the spring tension is not strong enough, the spacing of the sounds will be uneven and the dits will sound slurred.

SENDING DITS AND DAHS

Now that you know how to adjust and grasp the key, you are ready to send "dits" and "dahs". Connect the key to an audio oscillator or buzzer. (Detailed instructions for hooking up the key to a buzzer or audio oscillator will be found in the appendix.) Begin by sending a series of "dits". Try to time the dits by sending about three per second. Do not grasp the knob too tightly. Be sure to keep your fingers on the knob at all times. Send about five or six evenly spaced dits in a period of about two seconds. Bend by flexing your wrist. Do not attempt to send by working either your fingers or your arm. **KEEP YOUR WRIST FLEXIBLE AND ALLOW IT TO BOB UP AND DOWN DURING SENDING. IT IS YOUR WRIST THAT ALWAYS DOES THE WORK IN SENDING, NOT YOUR FINGERS OR ARM.**

GETTING THE "FEEL" OF THE KEY

In order to develop the feeling for the difference between the dits and dahs, as well as for the spacings, practice sending the following groups of dits and dahs:

4 dits, 4 dahs, 4 dits, 4 dahs, etc.
3 dits, 3 dahs, 3 dits, 3 dahs, etc.
2 dits, 2 dahs, 2 dits, 2 dahs, etc.
1 dit, 1 dah, 1 dit, 1 dah, etc.

Practice these code sounds until you have full control over the key. Be sure to keep all of the spaces equal in duration to a dit. Try to develop uniform sending; the dits being one third as long as the dahs, and the dahs being of constant length. This is the foundation of "clean" sending.

SENDING THE LETTERS OF THE ALPHABET, PUNCTUATION MARKS, AND NUMBERS

You are now ready to learn how to send the letters of the alphabet. The simplest letters to learn are the E (dit) and the T (dah). They require no practicing. The next letters that you must learn are the ones containing 2 elements. These are the A, I, M and N. Send each of these letters many times until you are familiar with their individual rhythms.

After you have mastered the two-element letters, you are ready to practice sending three - element letters. These are the D, G, K, O, R, S, U, and W. These letters require much more practice than the two-element letters. As you practice, be sure to keep the spaces between the elements equal. Beginners may run into the difficulty of having one letter sound like two other letters because of unequal spacing between the elements of the letter. If you do not keep the same space between the elements of a letter the following may happen: When practicing the letter D (dah-dit-dit) you may find yourself sending it as dah---dit-dit. Someone receiving your code would interpret what you had intended to be the letter D as the two letters T and I. Or, if the letter G (dah-dah-dit) is sent as dah-dah---dit, it would be interpreted as the two letters M and E. In order to prevent yourself from making these errors, you must become thoroughly familiar with the rhythm of all of the letters in the alphabet. At this stage in your practice sessions you should work slowly and carefully, and not worry about speed. Be sure to review the two-element letters after you have thoroughly studied three-element ones. You can now go ahead with the last group, the four-element letters. They are B, C, F, H, J, L, P, Q, V, X, Y, and Z. This is the most difficult group of all to learn to send. As with the other groups, it is extremely important that you keep the spacing between the elements equal. Most beginners let their C (dah-dit-dah-dit) sound like N and N, and their B (dah-dit-dit-dit) sound like T and S because they have not acquired the individual sending rhythms for the different letters. Extended practice is necessary to master the rhythm of the four element letters. When you know the four element group, go back once again over all the other letters of the alphabet. Concentrate on those letters which give you difficulty. Only when you are completely satisfied that you know how to send the letters, are you ready

to practice sending numbers and punctuation marks. Everything we have said about four element letters holds doubly true for numbers and punctuation marks because they contain five and six elements. Make sure that you can send the numbers and punctuation marks as well as you can send the letters. Do not forget that punctuation mark errors on the code examination can fail you just as easily as errors in the letters of the alphabet.

SENDING WHOLE WORDS

After you are sure that you have acquired the proper sending rhythm for each and every letter, number and punctuation mark, you are ready to practice sending whole words. Use the daily newspapers for your text material. Be sure that the text material contains numbers and punctuation marks.

You know that the spacing between the elements of a letter is equal to the duration of the code sound dit. Now, the spacing between the different letters of a word is equal in time to three dits. Thus, the space between letters that make up a word is three times as long in time as the spacing between the elements of a letter. Since you are now sending from text material, you must also know the proper spacing between words. The time interval between words is, on the average, equivalent to six dits. It may vary however, from five to seven dits, depending on the individual style of sending and the overall code speed. At first, it would be a good idea to have the space between words equal to seven dits.

A good code operator is one who can send accurately with a minimum of mistakes. At your stage of the game you will find that the only way to get into the habit of sending accurately is to send slowly. You must overcome a natural desire on your part to increase your speed. An early speed-up will only result in a decrease in sending accuracy. Do not worry about lack of speed at this point. The important thing to concentrate on is accuracy. As your accuracy in sending increases, you will find your speed increasing with it. When you can accurately send eight to ten words per minute, you are ready to start receiving practice. Your sending and receiving speed should increase at the same rate; do not neglect one for the other. As your receiving speed increases, continue with your sending practice. Your practice periods should consist of both sending and receiving exercises so that you can work both speeds up together.

Today there are a variety of semi-automatic and "automatic" keys on the market. These are designed for sending at rapid speeds. They do not magically make low-speed operators capable of sending at more rapid speeds; what they do is make it easier, and less tiring to send at the higher rates of speed. These types of keys are designed for highly experienced operators who are capable of sending well over 20 words per minute on the standard "hand key". It is unwise for you to even attempt using either an automatic, or semi-automatic key until you are able to send approximately 20 words per minute with precision and accuracy on a standard key. Once you become a thoroughly experienced "old-timer" on a standard key, you can learn the use of other types of keys in a few short lessons.

CHAPTER 4

THE CODE RECORDS

Each 45 RPM record that you received consists of two lessons, one on each side. The 33-1/3 RPM records contain five or six lessons per side. The Junior Code Course, containing ten lessons, takes you from start through 7.5 words per minute (wpm). The Advanced Code Course, containing twelve lessons, takes you from 8.5 wpm through 18 wpm. The Senior Code Course consists of the Junior and Advanced Code Courses. The Extra Code Course, containing ten lessons, is from 13 wpm to 22 wpm.

After you have read through the first three quarters of this book and have memorized the alphabet, numbers and punctuation marks, you are ready for the code records. Go through each of the following lessons in the order given. Pay particular attention to the sample F.C.C. type examinations. After you have copied the code information from a record, check it against the record contents which you will find below the discussion of each lesson.

LESSON 1 -- ALPHABET, SEND-RECEIVE. 3-1/2 W.P.M.

This lesson contains the alphabet, numbers, and the more common punctuation marks. Because the alphabet and numbers are in their regular order, there is no guessing as to which letter or number is about to be heard. This lesson is designed to teach you the correct code sounds and rhythm. You simply sit back and listen to the proper formation of each character.

Lesson 1 is also a sending lesson. There is sufficient time between characters to enable you to duplicate them immediately after you hear them. Set up your phonograph, key, and buzzer or oscillator. As soon as you hear a character, imitate, with your key, its sound and rhythm as closely as possible. You can start with the one and two element letters. Then you can go on to the more difficult ones. Before you are through with Lesson 1, you should be able to go through the entire side, repeating, with ease and accuracy, each character that you hear.

The Lesson 1 recording consists of the following:

ABCDEFGHIJKLMNOPQRSTUVWXYZ 1234567890.,
? Double Dash (Break) Fraction Bar
End of Message End of Entire Message

LESSON 2 -- MIXED LETTERS, NUMBERS, ETC. 4 W. P. M.

Lesson 2 is similar to Lesson 1 except that the letters and numbers are not in their regular order. They are all mixed up. This enables you to practice receiving. Go over this lesson until you have mastered the entire alphabet, numbers, and punctuation marks.

This lesson may also be used for sending practice in the same way that lesson 1 was used. There is plenty of time between the characters to repeat them.

The Lesson 2 recording consists of the following information:

R8GWK4MA9YLFSE5 RTB2CIPJ.1?TK3VME
ØC7NAQGD6VZF,XO

LESSON 3 -- 2 LETTER GROUPS. 4.5 W. P. M.

This lesson consists of 2 letter code groups. It is faster than Lesson 2. The difficult characters and the simple ones are mixed together. The numbers and punctuation marks are mixed in with the alphabet. Practice this lesson until you are quite sure of the material in it.

The Lesson 3 recording contains the following:

LR TF CI BA NF DE AZ DO YI GT VC NE PS JQ D.
IY 21 38 45 67 90 GK LJ MA B? UZ X, RW FD HL OA

LESSON 4 -- 5 LETTER CODE GROUPS. 5 W. P. M.

This lesson consists of 5 letter groups. It is given at 5 words per minute--the same speed as the F.C.C. Novice and Technician code examinations. There are no numbers or punctuation marks in this lesson because the F.C.C. 5 w.p.m. examination does not contain them. You may, however, be responsible for sending numbers and simple punctuation marks. When you copy code groups or words, leave spaces on your paper wherever spaces occur in the sending. This makes your work easy to check.

Lesson 4 recording consists of the following:

ERISU ARGFT KITAC NSOHI GYUDT VMKEN OBRTI
MAHFS SGANZ ROUIN TBARS LIOTW JUGEK CNDNX
PEKEQ

LESSON 5 -- 5 LETTER WORDS. 5 W. P. M.

Lesson 5 is a sample F.C.C.-type examination. It consists of the same type of material that you will receive on the Novice and Technician Code examinations. Five letter words make up the material on the record. The speed is 5 words per minute, the same as the F.C.C. examination. Study this lesson carefully: it is important to you if you intend to take the 5 words per minute examination.

Lesson 5 recording consists of the following:

SLAVE KEYED NIGHT PLAIN PARIS LEAST
TODAY HOTEL STEAM DONOR COURT AWAIT
CRASH BEING USUAL

LESSON 6 -- 3 LETTER GROUPS. 5.5 W. P. M.

Lesson 6 contains 3 letter code groups, 3 letter words, numbers and punctuation marks. It is at a slightly faster speed than Lesson 5. It is excellent practice since you do not know whether words or code groups are coming next.

Lesson 6 recording consists of the following:

NOS REP DEZ IRO HTU AYL UDA SIR VET AMO IDO
NRI NEC SEB FTG THE LOG SUM RIG 384 721 965
BR. H, U SC? EET

LESSON 7 -- 5 LETTER CODE GROUPS. 6 W. P. M.

This lesson is exactly the same as Lesson 4, except that the code speed is 6 words per minute. It provides excellent receiving practice before taking the 5 w.p.m. FCC Code examination.

You will notice that this lesson, as well as most of the others, are in code groups and not in English. This is because code groups are much more difficult to memorize than English words.

Lesson 7 recording consists of the following:

USADE ZPHRT EDHAS BELOS TIYEK AUHPI NMKXR
EYSGE DHTOM VEMOA LTFEI PDRSU THJEA GROEL
NHAKI SIFAC BTAEU NRSTI

LESSON 8 -- ENGLISH WORDS. 6.5 W.P.M.

This lesson consists of mixed English words and numbers. The words have anywhere from two to six letters in them. If you have learned Lesson 7 well, you shouldn't have any trouble with this lesson. English is easier to copy than code groups.

Lesson 8 recording consists of the following:

RANGE MEANS THE OF GRID WILL THERE AND
UNDER THEN CAN LOOP PICK ? METER FOR WITH
COIL PLACE SHOWN 4723 WEST 86TH STREET

LESSON 9 -- 4 LETTER CODE GROUPS. 7 W.P.M.

This lesson may sound more than a half word faster than Lesson 8. This is because you are going from simple English words to code groups containing difficult letters. If you can master this lesson, you will have no difficulty with the F.C.C. 5 w.p.m. code test. Whenever you intend to take a code examination, make sure that you can do at least 2 words per minute better than the speed requirements.

Lesson 9 recording consists of the following:

GNSZ DEEP FERI HTKS 2UJA MWEN IAEQ VNDR KDIO
UDTM VILM XVIE UFRA KTNQ ZEGT ?ADB SLHI OHTG
5KRM NSDU CFET MKDE EABU GY6V QWIN RE

LESSON 10 -- MIXED ENGLISH WORDS. 7.5 W.P.M.

Lesson 10 should be fairly simple after Lesson 9. It consists mainly of English words having from 2 to 9 characters. This is the last lesson in the Junior Group. It can be considered additional practice for the Novice and Technician Code examinations, which also contain English words.

Lesson 10 recording consists of the following:

FREQUENCY ANTENNA SYSTEM LOWER HALF MOBILE
28 DEGREES NORTH OF THE 35TH PARALLEL. A
SMALL TRIMMER ACROSS THE COIL ? CAPACITY
OF TUBE

LESSON 11 -- 4 LETTER CODE GROUPS. 8.7 W.P.M.

Lesson 11 is somewhat more difficult than the previous lessons. It contains a considerable amount of characters that generally give trouble to code learners. Go over this lesson as many times as necessary to master these difficult letters.

If you count the amount of characters per minute in this lesson and divide by 5, you will arrive at a code speed of slightly over 7 w.p.m. However, the number of characters per minute is not the only criterion by which we judge code speed. An important consideration is the type of characters used. Letters such as Q and J take a longer time to send than letters such as I and E. Therefore, since this lesson contains a larger percentage of the longer characters, its speed is higher than 7 w.p.m. Its actual speed by F.C.C. standards is 8.7 w.p.m.

Lesson 11 recording contains the following:

IADE JQCH LFPZ BEFN LPRY FYZS BDSH FLQX VUWE
LQCA LZGI RESA IH50 PDES S5TL JXQI CLFU WPJU
BFHQ JVIY LOZK FYPA EOWG ?MSZ ONW. ,UIT 2MOE

LESSON 12 -- MIXED ENGLISH. 9.5 W.P.M.

Lesson 12 contains mixed words, numerals and punctuation marks. After Lesson 11, this should be a simple lesson.

Lesson 12 recording contains the following:

RUGGED COMPLETE THE IOWA VOLT METER PANEL
PORTABLE FROM OVER TYPE. TWO AND SQUAR 7.3
MC. POWER STATION SET PEAK FLASH RANGE
MODEL 2456 WITH AUDIO PERCENT CIRCUIT

LESSON 13 -- 5 LETTER CODE GROUPS. 10 W.P.M.

Letters, numerals and punctuation marks are mixed together in groups of five. Once again, this lesson may seem more than 1/2 word per minute faster than the previous lesson. This is because you are going from words to code groups. In code groups, you never know what letter or number to expect.

Lesson 13 recording contains the following:

REBHT UORSE SEIRT YRNIA ARBIV NSFU3 CBVOI
TX8UE SRGO4 LTXEY TF7ED VZEEH .CTNG QPTEC
IPELD ALT9R KY,EM OUWEQ GTZOE B5GAD SIBWV
RDUNR AV2WH NRZHI FANSM MYECX NGLCQ

LESSON 14 -- MIXED ENGLISH WORDS. 11 W.P.M.

Common words and numerals make up Lesson 14. It should be simple to copy.

Lesson 14 recording contains the following:

SIMPLE GAS COAX CONVERT FURNACE LOW HEAT
FOR MAIL BANK PAID INTEREST EASILY SAVE
PRODUCT NEW CUSTOMERS 74 CENTS, QUALITY
BOTTOM PACKAGE FATHER NOON RECORD SIDE
CARTON PLAIN MILK ENGINE?

LESSON 15 -- 5 LETTER CODE GROUPS. 12.2 W.P.M.

Letters, numerals and punctuation marks are mixed together. In Lesson 15, quite a few of the more difficult characters are included. Stay with this lesson until you have mastered all the characters, including the more difficult letters.

Lesson 15 recording contains the following:

RISMJ KQYFG IRMUS GOLEH TGTFX LYTOC ITZEN
SBUTC CFOXU NSE?U HRBE, GSIHA XAP3O I4WAS
GERPT ELIC7 SRMZE NDCFG VWAQK ENOTU BJH.N
CIPAO W2DTY LGUXE BFLBC ?THW VSO,L QZETV
AYXWG BH9FB PQKRE

LESSON 16 -- MIXED ENGLISH. 13 W.P.M.

Lesson 16, as well as Lesson 17, was made to consist of English words in order to prepare you for the F.C.C. General Class Code examination. This examination consists of English words, numerals and simple punctuation marks. The speed is 13 words per minute. Lesson 16 is a typical General Class F.C.C.-type examination.

Lesson 16 recording contains the following:

SYMBOL DO CITY GREENWICH SHIELD BOTTOM
CHART NUMBER THE COURSE CONDITION PRICE
SPEAK VAGUE READING SECTION VACUUM HISTORY
CONVERT? COLOR CODE? BEAM POWER TUBE.

HIS LONGITUDE IS NORTHWEST MY ALTITUDE IS
268 FEET ABOVE SEA

LESSON 17 -- MIXED ENGLISH. 13.5 W.P.M.

Lesson 17 is another typical General Class F.C.C.-type examination. The speed of Lesson 17 is about 1/2 word per minute faster than the F.C.C. examination. As such, it represents excellent code practice for the exam.

Lesson 17 recording contains the following:

UNIT OF SHIELDING ON THE AIR COUPLED TO TWO
811S. ORIGINAL 600 OHM, OPEN WIRE A LOW PASS
FILTER SPURIOUS RADIATION CAN EASILY BE
ELIMINATED HIGH FREQUENCY PARASITICS
REDUCTION OF HARMONICS VERIFY MY SIGNAL?
CQ DE W5MOI TRAP CIRCUITS

LESSON 18 -- 5 LETTER CODE GROUPS. 14 W.P.M.

Lesson 18 contains mixed letters, numbers and punctuation marks in groups of five. There is no special emphasis on difficult letters.

Lesson 18 recording consists of the following:

VIBRA NAIRY TRIES ESROU TH2ER VEXTL EUTX8
G4ORS EOVCB 3UFSN DLEPI CETPQ GNT2C HEEZU
OE7FT DAGB5 GOZT6 QEWUO ME,YK R9TLA DB-MH
ETKSU YZB?O QCLGN XCEYM MSNAF IHZRN HW2VA
RNUDR VWBIS VWIT, GCBLF JSNLM BALRH ISYJE
GFYQK

LESSON 19 -- 5 LETTER CODE GROUPS. 15 W.P.M.

You should know this lesson well before taking the 13 word per minute F.C.C. examination. This lesson is 2 w.p.m. faster than the F.C.C. exam. If you can copy it, you will have no difficulty with the actual examination.

Lesson 19 is also intended to prepare you for the F.C.C. Second Class Radio-Telegraph Code examination, which is 16 words per minute. Lesson 19 is similar to this examination, except that it is one w.p.m. slower. Notice that the groups consist of 5 letters, except where a numeral or punctuation mark is involved. In these cases, the groups only have four actual characters because the numbers and punctuation marks count as two characters.

Lesson 19 recording contains the following:

UDEZR SAH8 BUSEO EK2H P4AU YINLE TODHE
THPAS NX?N GRESX FIEML R,IO CREGI THDYE
?NKM VTJAG AOLT D 4NEK IFTAC 9SAI M0AH D,RE
P?EH BAEUO NOSER 6NBI SFOIB DTJ5 2RAV ZIT4
RMG, ISURM PNSEM UGS2 BREON EBELS M3KQ
5OCT H?EN ZGBO TBERH ARNIY VZEEK FIM3 LST

LESSON 20 -- 5 LETTER CODE GROUPS. 16 W.P.M.

Lesson 20 is a sample F.C.C.-type code examination for the Second Class Telegraph license. It is similar in its makeup and speed to the actual F.C.C. exam.

Lesson 20 recording consists of the following:

DAOLT FOISB ?PEH JTD5 EPMSN VAR2 TZ4I ACIFT
WKX3 OTTNE COT5 LIMYT FTGTI EBSLE MR,G PDEEZ
ONERB 37G SKMCI SREDA ?EHN ROHTG DELEH 8YDN
S2GU E,DR JYTIR NET0 VLAHN AIS9 8YDN IN6B RO7T
CTUBS ETAYR 30I HELOG SUMRI ERH. NORSE UPA4
ZDEUR GK5A PAV6 HS8A ESUB LIEFM WITUK

LESSON 21 -- 5 LETTER CODE GROUPS. 17 W.P.M.

Lesson 21 is further practice for the Commercial Second Class Radiotelegraph Code examination. All the letters, numerals and punctuation marks are mixed together.

Lesson 21 recording contains the following:

DGATO F4WEJ IPKNR VE,UL LHIOW AUSNJ KDTEI
HMRQB RMHUS KEGLD HFEST COAOM 7FTNG EBH2Q
EEX3U V?LZA GSENF HEZNH RI8TU ESRUO CNOIT
URTSN 0DARB GNIKM BFXIA LHPZD VTCS3 YLGNE
W1OFJ KQPTA RU.TO 9OURS TIONC SNEZZ ?ENOT
ELYFH S,2VA UPQOT HIFEJ UWOTD 0ARKB BTFQC
CSVOR SGW6E

LESSON 22 -- 5 LETTER CODE GROUPS. 18 W.P.M.

You should be able to copy Lesson 22 well before making the 16 w.p.m. F.C.C. examination. This lesson contains the same type of material, only it is 2 w.p.m. faster than the actual code test.

Lesson 22 recording consists of the following:

KE2H YIMED ESGXR ZBNAT DTHOE HEF1 CNEMR 27W
ELYNI K4DM ROI, CEW? PTHAS GIREX TNKIO YES.
CNEMR IU8F BERIS FJ?I DEABQ UGEAV YEDTH TLHCI
RAVNS EQF5 MPEWS 4NEK Z6BO NFILS FDEEP EXSIW
RHTKS 2GUN TLHMI JEPAT TCHWI INYEL OIR? REXLG
IREVT 7VDM 48Z UITSO .NAH LOADT SBIOF ,HEP
5JTD PMSNE 2AVR 41ZT TFIAC TEONT