

# Breaking into the Amateur Game

## The Operator's Exam.

**T**HIS article, in continuation of the series on "Amateur Transmitting," deals with the Amateur Operators' Examination. Before a license to transmit is issued, the applicant must obtain a Government Amateur Operators' Certificate, which is given after the examination has been passed. This is the most important part of getting a station on the air, but there is nothing very difficult about it. For the average listener, with little or no knowledge of the Morse code, there is a certain amount of patience required for the passing of the examination. It usually takes a person with average spare time about two months to prepare for it, but it is an interesting, pleasant occupation, and, as already mentioned, will reveal to the listener another side of radio which before was but a meaningless jumble. Hence in any case it is well worth while to learn the code, for besides being used to a large extent by amateurs, it is the basis of communication between ship, shore and many commercial stations.

### Learning Morse.

**T**HE examination is divided into two sections—Morse and a written paper. The Morse part, in which candidates have the greater difficulty, will be dealt with first. In this a speed of ten words per minute, both sending and receiving, is required, each word being assumed to have five letters. This is a comparatively slow speed, but in the actual examination mistakes are not allowed, so it is safer to attain a speed of 13 or 14 words per minute before sitting. The test is given for about three or four minutes, the Morse being sent by a P. and T. officer through headphones, and in plain language, though numerals may be included. It must be copied down in pencil exactly as sent, while the sending required is simply a reversal of this process. Receiving Morse is generally considered by the beginner to be much harder than sending, but as we shall see later the standard of an operator is determined largely by his style of sending, or "fist." It is best, however, to break well into receiving before starting on sending.

Now the first step in learning the code (a diagram of which is shown), is to memorize the corresponding letters and symbols thoroughly. It is essential to do this by learning the symbols as they actually sound in practice—learn R as "dit-darr-dit," not "dot-dash-dot," and understand "dit-darr" as A, etc. This must be practised and the alphabet and figures mastered so that their sounds can be repeated quickly in order. Then have them asked in any order, until each can be given in the "dit-darr" fashion without any hesitation.

After this point it is only a matter of practice to gain speed in receiving, and a start may be made on sending. For this a key and buzzer with a small battery, must be procured. As the key may be used later on in a transmitter, it should be of sound construction, and its spring tension and contacts adjusted for easiest sending. The knob of the key should not be grasped, but just pressed firmly by the first and second

fingers with a wrist action. The fingers must not leave the knob, and the muscles should be loose for steady, regular sending. The difference between a good and a bad sender depends mainly on the even spacing of the dots, dashes, and letters. A dot is simply a tap of the key knob, while the length of the dash is equal to three dots, and the time between parts of the same letter equals one dot.

This spacing should be kept almost invariable, the speed of the morse being varied by the length of the spaces left between letters. The alphabet and numerals should be sounded on the buzzer at a slow even rate, but no speeding should be attempted until more practice has been had in receiving well-sent signals. A learner's "fist" will thus be considerably bettered.

It is a good plan for two persons to learn the code together, so that each may give the other this receiving practice. The morse should be sent slightly faster than it can be received, and the letters, not the dots and dashes, should be written down. Any amount of practice may be obtained by listening to amateurs on the 75-85 metre band, as special slow morse transmissions for beginners are given regularly. At other times a slow but even sender may be chosen to copy.

in legible writing at a little above this speed, no trouble should be had in passing the code examination, even though nervousness is experienced, as is often the case.

### The Written Examination.

**H**AVING dealt with the harder part of the examination, we now come to the second part, the written paper. The requirements here are not highly technical. All that is necessary is a knowledge of simple short-wave transmitters and receivers, elementary electrical principles, and the Government amateur radio regulations. Usually the paper consists of about 15 questions, divided into 4 on the regulations and 11 on the rest. Of these a choice of 10 is given, 3 on the regulations and 7 on the rest. The time allowed is 3 hours, and the pass standard required about 50 per cent. A great deal of information which is necessary for the examination is contained in the "Radio Listener's Guide," and if this has been read thoroughly, especially the glossary, the exam. will be much easier.

A candidate should be able to draw a circuit diagram of the complete transmitter, including the power supply he expects to use. This is a very frequent

ductive coupling feed-back from the plate to the grid, and those using capacitive coupling. The elementary theory of how the valve oscillates should thus be known. Further descriptions of transmitting circuits and parts will be given in the next article.

### Typical Questions.

**A** QUESTION often asked is how the power input to the valve would be measured. The input, which is measured in watts, is simply the voltage on the plate of the valve (corresponding to the voltage of the "B" battery in a receiver) multiplied by the current in amperes drawn by the plate. These would be measured by means of a voltmeter connected across the plate power supply, and a milliammeter in the positive lead to the plate. Thus, if the plate voltage is 200 and the current 20 milliamperes, the input would be (200 x .02) equal 4 watts. In practice, there is no necessity for these meters in a low-powered transmitter, however. The plate dissipation of the valve is the input it will radiate in the form of heat without overheating, while the efficiency of the valve is the amount of radio-frequency output given as a percentage of the input. Candidates may be asked for simple definitions such as these.

Another likely question is one on modulation, such as "Explain with a diagram the Heising method of modulation." In a Morse valve transmitter using pure direct current power supply, the continuous wave sent out is unmodulated, and is simply started and stopped by means of the Morse key. For telephony, however, this wave, now known as the carrier wave, is on the air continuously, and is modulated by voice or music. Thus, its amplitude, or the energy it contains, is varied in accordance with changes in sound waves in the form of variations in the current input or output of the transmitter.

The latter variations are reproduced in the receiver and converted back into sound waves. The commonest method of modulating is the Heising, or constant current, method. With this, besides the valve that generates the carrier wave, there is another one of equal size, the modulator valve, and the plates of these two are fed through an iron-core choke from a common power supply, as shown in Fig. 1. This choke keeps the total plate current and the voltage across both valves invariable. A microphone is connected through a transformer between the grid and filament of the modulator valve, and when spoken into varies the grid voltage of this valve at speech frequency, thus causing changes in the plate current. As the sum of the plate currents drawn by both valves is invariable, the current of the oscillator must become smaller as that of the modulator becomes greater, or greater as the modulator current becomes smaller, with corresponding variations in the input.

Thus as the speech varies the grid voltage and plate current of the modulator, the input to the oscillator is inversely varied, which correspondingly affects its output. Also, as explained, the carrier wave will thus be modulated by the speech. Heising and similar

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Even though the speed permits of only a letter here and there being written down at first, soon calls and short words will come, and later with practice the missing letters will disappear. Perseverance is the keynote in learning the code. Speed is bound to come with practice.

If now the learner returns to sending, he should have a good idea of spacing, and will probably realise the value of a decent "fist." He should aim at slow, well-spaced sending rather than fast, jerky sending, readability coming before speed. To obtain an idea of relative speeds, clock tests may be made with any 20 words of five letters each, and these sent in just two minutes, the speed being then ten words per minute. If the learner becomes accustomed to copying morse

question, and an easy one, as will be shown in the next article. The circuit of the transmitter is much simpler than that of the average receiver, while every amateur constructor is familiar with the two chief types of power supply—batteries and valve, or chemical rectified alternating current (R.A.C.). The parts used in a transmitter are much the same as those in a receiver, and their use and operation should be known, as such questions as "Explain the use of the radio-frequency choke, and the grid-leak, in a transmitter," are often asked.

In the majority of transmitters there is a single valve which is simply an oscillator. Also, as with regenerative receivers, there are two general types of transmitting circuits—those using in-