

COLLINS SIGNAL

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THIS is the first issue of a little bulletin which the Collins Radio Company will publish periodically and mail to all of its friends who have requested the Collins general catalogue. The COLLINS SIGNAL will serve principally as a supplement to the general catalogue and will keep it up to date. The format is such that it can be inserted in the binder furnished with the catalogue. In this way it will be possible to describe the equipment a little more fully and discuss in detail certain subjects which prove to be of general interest. However, we also propose to include newsy bits which will acquaint you with the radio activities of many of your friends and our friends. May we suggest that you write to us whenever something unusual or interesting occurs within the sphere of your activity. We will welcome suggestions as to what additional material should be included.



A Recent Collins Installation

The first installation of the 20B was made at W9BHT, the station of Mr. W. P. Ingersoll at Canton, Illinois. Mr. Ingersoll is an old-time amateur. Before installing the 20B, he had built several record making transmitters which had won him a WAC certificate and a host of friends throughout the country. Mr. Ingersoll's desire to have a station which would be the "last word" in appearance and performance led to the creation of the 20B. W9BHT now operates on 3905 kc and 14224 kc and "Bill's" voice has become familiar to amateurs and short wave listeners all over the globe.

The Collins Type 20B

The 20B Transmitter is a continuation into the higher powered field of the series of standard Collins Transmitters. It is capable of a fully modulated carrier output of 750 watts which is perhaps the highest power that can economically be obtained when using air-cooled tubes. The 20B is designed primarily as a broadcast transmitter although it has found application for amateur use where it was desired to obtain the maximum possible modulated output with the limitation of one kilowatt input which is placed upon amateur transmitters. It is a broadcast transmitter which may be used by an amateur to fulfill his dream of an outfit with which he can sit down and talk, by means of either code or voice, with almost any station in any part of the world which it is possible to hear. Although the cost of a transmitter of this size is higher than many amateurs will care to pay in view of the excellent results that can be obtained with lower powered transmitters, a technical description is set out at length with the thought that it will be of general interest.

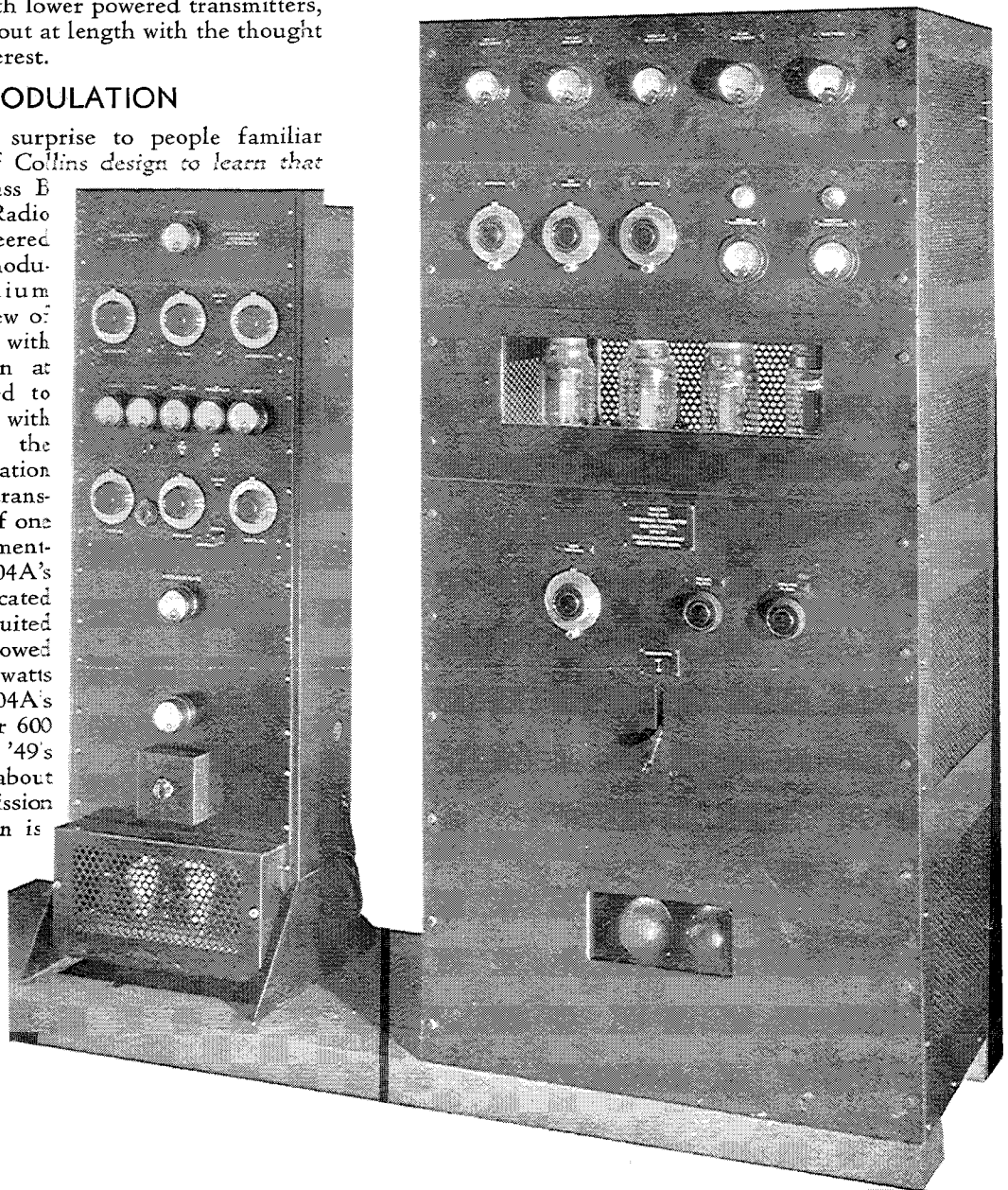
CLASS B MODULATION

It will, perhaps, not be a surprise to people familiar with the general features of Collins design to learn that this transmitter employs class B modulation. The Collins Radio Company has virtually pioneered the application of class B modulation to low and medium powered transmitters. In view of the excellent results obtained with this method of modulation at lower power, it was decided to carry on extensive tests with larger tubes to determine the suitability of class B modulation at high level for use with transmitters having plate inputs of one kilowatt or higher. Experimental load curves were run on '04A's and '49's. These curves indicated that these tubes were well suited to class B circuits and showed that an audio power of 500 watts could be obtained with the '04A's and a power of slightly over 600 watts could be obtained with '49's using a plate potential of about 2500 volts. Filament emission rather than plate dissipation is the limiting factor in obtaining maximum output from existing radio tubes including these two types.

Although the 20B is constructed in a manner adapted to high power components, its appearance harmonizes well with rack-mounted excitation and speech units.

The load curves indicated that a relatively small amount of power would be required for driving the grids of the modulators and measurements showed that UX 250's could be used for this purpose. However, in order to obtain the least possible distortion and to avoid working close to the limitations of any part of the circuit, it was decided to employ 845's as class A drivers with a class B input transformer having a high step-down ratio. The 845 driver stage is located in the transmitter proper and obtains its power supply from the transmitter power circuits. The audio frequency input to the transmitter is approximately at plus 8db.

The class B modulation transformer is a standard Collins 795 oil insulated type.



A High Power Radiophone Transmitter

Power Supply

When the 20B Transmitter is operated at 750 watts output, the load on the 2500 volt power supply varies from 1.3 kilowatts at zero modulation to 2.6 kilowatts with 100% modulation. This fluctuation in load imposes severe requirements on the design of the main power supply as to regulation and maintenance of low ripple values over fluctuating load conditions. Because of the difficulty in obtaining polyphase power circuits in many locations, it was necessary to design a power supply for operation on single phase current. Of course, mercury vapor type rectifiers were employed because of their economy and their low voltage drop. The type 575 rectifier tubes are used. A special high voltage transformer having a nominal rating of 4.4 KVA is used in connection with two special filter reactors having a relatively high value inductance and very low D. C. resistance. A 2-section filter circuit is employed with choke input

and a high value of output capacity to accomplish good transmission of the bass frequencies. The percentage of ripple is very low so that the amount of carrier noise is less than common among broadcast stations. The regulation of power supply is good (approximately 5%) over the range of load values which obtains during modulation.

The Radio Frequency Circuits

Two '04A's in push-pull are used in the final modulated stage. By careful design of the radio frequency circuits, it is possible to operate the transmitter with excellent stability and efficiency on frequencies as high as 15 mc. Very careful attention has been paid to insulation, reduction of stray RF fields, and the avoidance of high circulating currents. Insulation is chiefly Isolantite. A split stator variable capacitance is used in the plate tank circuit which has several unusual features of construction including Mycalex insulation and an effective air gap

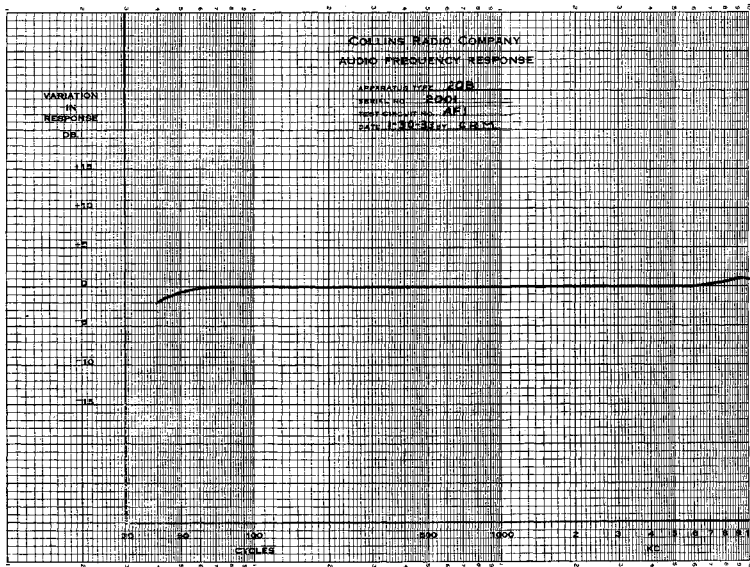
spacing of approximately 0.6 inch. This condenser has a relatively low maximum capacity and it is used alone only on the highest frequencies. As the frequency is reduced, low loss fixed condensers are cut into the tank circuit. The tank circuit is maintained at quite low C on all frequencies to obtain maximum efficiency. Standard Collins "E" series inductances are used in both the plate and grid tank circuits. The output of the transmitter is designed for a 2-wire transmission line having a characteristic impedance of from 400 to 600 ohms. Low pass filters can be provided for insertion in this transmission line when a large attenuation of harmonics is required. Parasitic suppressors are used in the grid circuits of the 204A's making their operation entirely stable on all frequencies.

Frequency Control and Excitation

No buffer stages are included in the 20B unit itself. The Collins 150A Transmitter is used for crystal control and excitation and is coupled to the grid circuit of the '04A's by a short 2-wire transmission line. If precision frequency control is required, an additional relay rack is provided for this equipment. This type of construction permits the 20B Transmitter to be added to an existing 100-watt unit.

Provisions for Changing Frequency

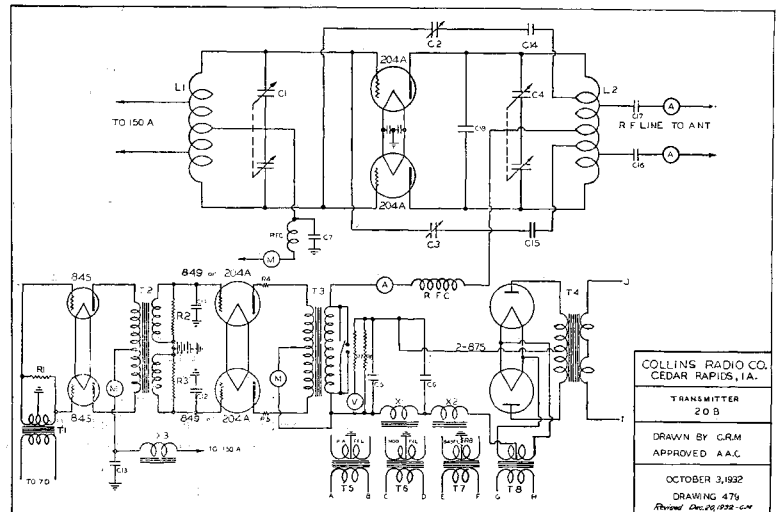
Changing the frequency of the transmitter is accomplished by varying both the inductance and the capacity in the final tank circuit. Standard plug-in inductances are used and various values of fixed capacity are cut in or out by bus connections. Exact tuning of the final tank circuit is accomplished by means of the variable condenser. Plug-in inductances are also used in the grid circuits and in the preceding buffer stages. All of the tuning controls are provided with a new type of dial lock and a complete tuning chart is furnished which makes it possible to place the transmitter on any predetermined frequency within a few seconds by inserting the proper inductances, setting the dials to the correct position, and locking them in place.



The overall audio response curve (above) was measured from transmitter input to antenna. RF modulation voltages at the various frequencies were measured on cathode-ray oscillograph in order to avoid introducing errors by the use of a linear rectifier.



Safety devices and control circuits are not shown in the circuit diagram (right). Following usual Collins practice, the D. C. Plate current to the modulated stage is carried through the modulation transformer windings.



Provisions for Varying Output

It is frequently desirable to operate a transmitter at various output powers. In certain broadcast installations a transmitter is required to operate at a power of 500 or 750 watts during daytime and 250 watts at night. In high frequency work, it is frequently possible to reduce the power of the transmitter when transmission conditions are favorable. A reduction of power is a fairly simple matter in a radio telegraph transmitter but in a radiophone transmitter it is often difficult to maintain the proper load relations between the various circuits when the output is varied unless special consideration is given to this problem. This difficulty is particularly true in transmitters employing low level modulation. The 20B Transmitter is normally supplied for operation at a single output power, namely, 600 watts. However, auxiliary equipment can be supplied on special order making it possible to vary its power between any values from 250 to 750 watts by means of a single control. This is accomplished by the use of a special auto-transformer in the primary circuit in the high voltage power supply. A rotary contactor adjusts the plate voltage to give the required power output. The plate voltage to the modulators and the modulated amplifier is varied simultaneously with the grid bias to the modulators. This makes the simplest possible means of varying the power output and exactly the correct load resistance is placed on the modulators at all outputs. When only two definite power outputs are required, provision can be made for shifting from one power to another by means of a single set of pushbuttons which may be located remotely. The change is accomplished instantaneously and the carrier is not taken off the air.

Constructional Features

The 20B unit is built on a steel frame which is assembled by welding in a special jig giving unusual strength and accuracy to the mechanical construction and avoiding the use of unsightly gussets. The front panels are of heavy aluminum and bakelite and the sides and rear are enclosed with perforated grilles. Maple spars are used to carry Isolantite insulators used in the high voltage circuits. The power tubes and the rectifiers are visible from the front of the transmitter through plate glass windows. All direct current and low frequency wiring is accomplished by a single cable. Radio frequency circuits are connected by copper piping with lug fittings. The interior of the transmitter is very neat and attractive in appearance.

Safety Devices

In order to protect fully the various parts of the transmitter and to afford complete safety to the operators, a number of safety devices have been incorporated in the construction. Safety switches are used on the rear door of the transmitter so that it is impossible to gain access to any of the high voltage circuits with power on. The front panel of the transmitter is entirely "dead front" and all dials and other metal parts on the front panel are grounded. The meters are protected by means of grounded shields (not shown in the photograph).

IMPORTANT!

New Collins Developments

The next issue of this Bulletin will describe in detail two NEW Collins Transmitters. In cost and size they are a marked contrast to the 20B described in this issue, yet many amateurs will obtain as much enjoyment from these new outfits as they would from more elaborate and more expensive transmitters. The new jobs are the 32A and the 32B, each having an output of 20 to 25 watts. The 32A is a CW transmitter, priced at \$85.00, and the 32B is its Radiophone companion, priced at \$125.00. Both models are 3-stage crystal controlled. Full class B modulation is employed in the 32B. Full details will be given.



Our Factory and Laboratory Now Located in New Modern Quarters

The offices, laboratory and plant of the Collins Radio Company are now located on the ground floor of the Metropolitan Building, 2920 First Avenue, N. E., Cedar Rapids, Iowa. The Metropolitan Building is directly on the U. S. Highway No. 161 and can easily be found by out-of-town visitors. The telephone number is 2-0016. Anyone having difficulty finding his way around town can call that number for directions. A considerable number of amateurs and radiomen have stopped in Cedar Rapids to see us in the past, and we are always delighted to have our friends, new and old, drop in for a chat.

It is felt that our improved facilities will be helpful in our constant efforts to better the quality of our products. Inventory of all standard items has been increased so that immediate shipment can be made to customers who want to get their new equipment in operation without a minute's delay.

Isolating condensers are provided in the transmission line connections, and static charges are drained off the antenna through bleeder resistances. Possibly the most important features from the standpoint of proper operation of the transmitter and tube life is a delicately adjusted overload switch which removes the plate voltage whenever the transmitter is seriously over-modulated or the radio frequency tubes draw an unusual amount of current due to damage to the antenna or for some other reason. An additional safety relay is provided which removes the audio frequency excitation to the modulators whenever the plate current to the modulated stage falls below normal, thus preventing the modulators from operating without their proper load. All parts of the circuit are designed with a wide margin of safety so that the failure of any part during continuous operation is a remote possibility.

Control Devices

All power conduits to the 20B and the 150A excitation unit, as well as any auxiliary apparatus which may be used, are brought to a single junction box. This box contains line switches, primary fuses and also a full set of relays for control of the circuits. The time delay relay insures the closing of the various circuits in the proper

sequence. Provision is made for turning the transmitter on and off from any position. A neat pushbutton box is furnished with the transmitter which has master control as well as buttons for turning on the various parts of the transmitter individually.

Audio Frequency Fidelity

Every effort has been made to achieve the greatest possible audio fidelity in the 20B Transmitter. It is not possible in this brief description to describe the various methods used to this end but it is significant to point out that the overall frequency response of the 20B Transmitter is flat within 2db from 40 to 12,000 cycles. The wave shape distortion is extremely low. Very careful measurements of the audio performance of this transmitter have been made. One important feature from the operator's standpoint is the ease with which it can be adjusted for proper modulation. It is much simpler to obtain excellent quality with a high level class B modulated transmitter of this type than it is to properly adjust a low level modulated transmitter.

(Note: Unlike other Collins Transmitters which are carried in stock for immediate delivery, the 20B is custom built for each user. Delivery can ordinarily be made within thirty days upon receipt of order. Prices on request.)