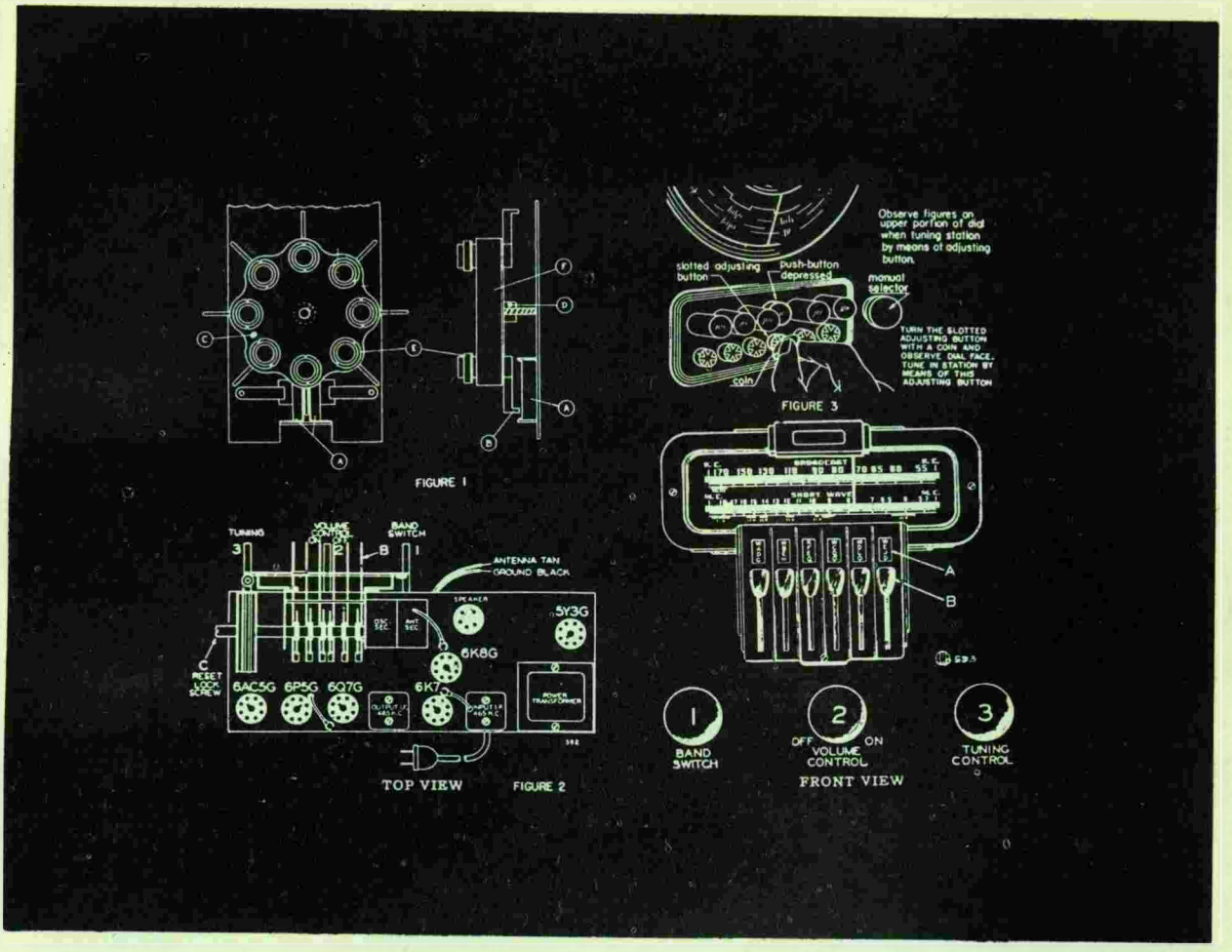

LESSON
42 RA

AUTOMATIC TUNING SYSTEMS

RADIO-TELEVISION TRAINING SCHOOL, INC.
ESTABLISHED 1922
LOS ANGELES

RADIO-TELEVISION TRAINING SCHOOL, INC.

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AUTOMATIC TUNING SYSTEMS

Automatic tuning as employed in modern radio receivers is merely another forward step to meet the desires of the general public for greater convenience and comfort. Whereas in earlydays the average radio listener was contented to manipulate three or more tuning dials and as many rheostats and other controls, the development of the single dial receiver with only a volume and tone control, greatly simplified the efforts that had to be expended while tuning in desired stations. But still there was the stooping and the squinting necessary while these few controls were being manipulated.

TYPES OF AUTOMATIC TUNING SYSTEMS

All automatic tuning systems employ some form of preselected tuning, that is, a preliminary setting or adjustment is first made of the receiver tuning mechanism for each automatic control position, and every time a given lever or button is later operated, this preliminary setting is reestablished.

The various automatic tuning systems used in presentday receivers can be grouped into four general classes according to the operating principles employed in them. The first consists of the manually operated mechanical tuners. Included in these are the telephone dial type mechanisms and those employing a system of levers and cams for rotating the tuning condenser into the several pre-determined positions. The second class is composed of the automatic push-button tuners employing pre-calibrated trimmer condensers. This system is frequently also referred to as the tuned circuit substitution type. Here a series of inter-locked push-button station selectors are arranged so that pressing any one button shunts a pre-calibrated trimmer condenser across the tuning coil in place of the regular variable condenser.

The third group often referred to as the permeability tuned type also uses

a push-button station selector, but here each button cuts into the circuit a pre-tuned coil. In these coils a movable iron plunger is used to vary the inductance of the coils, so that the tuned circuits consist of a coil of variable inductance shunted by a fixed condenser. The advantage of this system of tuning is that the coils can be made very compact and with high operating efficiency. Also, the calibration retains its settings well and does not readily drift in frequency.

The fourth group of automatic tuners comprises the electric motor operated mechanisms. In these the condenser gang is rotated by a small electric motor that in turn is controlled by a series of interlocked push-buttons. Pushing in a button closes the motor circuit and causes it to turn the condenser to a pre-determined position. At this point the circuit is opened, the motor comes to rest, and the receiver is tuned to the station frequency for which the tuning system was pre-set.

Each of these automatic tuning systems is taken up in detail in the following sections, and the applications of each are illustrated in a number of late commercial receivers. Every type of automatic tuner is considered, so that a thorough knowledge of automatic tuning should be acquired from a careful study of these pages.

TYPES OF MANUALLY OPERATED SYSTEMS

In the manually operated automatic tuning systems the main tuning condenser is rotated and brought into position for a number of pre-determined station settings through the mechanical effort of the person tuning the receiver. Two types of such mechanical systems are in common use: in one a telephone like dial is used with a series of holes around the outer edge according to the number of stations that are to be tuned in, while in the other a group of levers

or keys are employed that are moved downward and through a system of cams and sprockets rotate the condenser gang into corresponding pre-arranged positionsies s

Although the various dial-operated mechanical tuners differ somewhat in design and construction as well as the station selecting adjustments, they all operate pretty much on the same general principles. Around the edge of the dial are a series of push-buttons, each of which has an attached plunger. These plungers are usuallyserrated and slide freely in a series of grooves in the dial plate. They can thus move in and out but not turn, unless the locking device is released for station setting adjustments. At the end of the plunger is a projecting pin that engages the stopping or locking-in mechanism.

The dial plate in turn is geared to the condenser shaft, the gear ratio being such that the dial can be turned through nearly 360 degrees for a complete movement of the condenser rotor. As the dial is turned into position, the inner projecting pin on the button which is pressed in meets the stopping device or slides into a latch gate. This arrests the turning motion, and the receiver is tuned to the particular station for which this condenser setting was pre-arranged.

In some receivers the arresting pin is off center so that the station setting can be adjusted more accurately by turning the plunger. This is accomplished by releasing the holding screw or lock nut and thereby relieving the spring action that holds the button in place. The plunger is then pushed in, turned into the proper position, returned to its normal sstting, and the lock nut reset so that the plunger is held in place by the usual spring action. It is very important that these lock nuts or holding screws by drawn up tight so that they cannot let go and disturb the dial setting.

In the lever type of mechanical tuner a series of levers are provided on

the front panel of the receiver. These levers operate a system of cams that in turn rotate the tuning condenser by means of suitable sprockets attached to the condenser shaft. These operating levers must be moved downward through a greater distance than merely pressing a button, but they are very positive in their action and the system has proved very satisfactory.

Although these various forms of manually operated automatic tuners were at first used to a great extent by numerous set manufacturers, many of them have been replaced by other automatic systems, especially the trimmer substitution type and the permeability tuned systems, which will be explained later on. These latter systems are much lower in cost in that they involve simpler mechanical construction and fewer moving parts. Also, the electric tuning systems are probably more accurate and stable in operation. Many of the early mechanical tuners were very subject to wear and shift in calibration, and required frequent readjustment and service attention. Some mechanical tuners, however, have proved very satisfactory, and are being used, and will continue to be used, in various modified forms in future sets.

Many receivers equipped with these manually operated automatic tuners also employ a muting switch for silencing the audio amplifier while the dial is being operated. This muting switch is generally mounted directly on the dial mechanism, and is tripped when any one of the station selector buttons is pushed in. As soon as the dial is in position and the button is released, the switch opens and the amplifier becomes operative again.

THE GENERAL ELECTRIC MODELS G-50 AND G-55

The General Electric Models G-50 and G-55 are 5-tube A.C. operated receivers employing a conventional superheterodyne circuit. A composite 6A7 oscillator

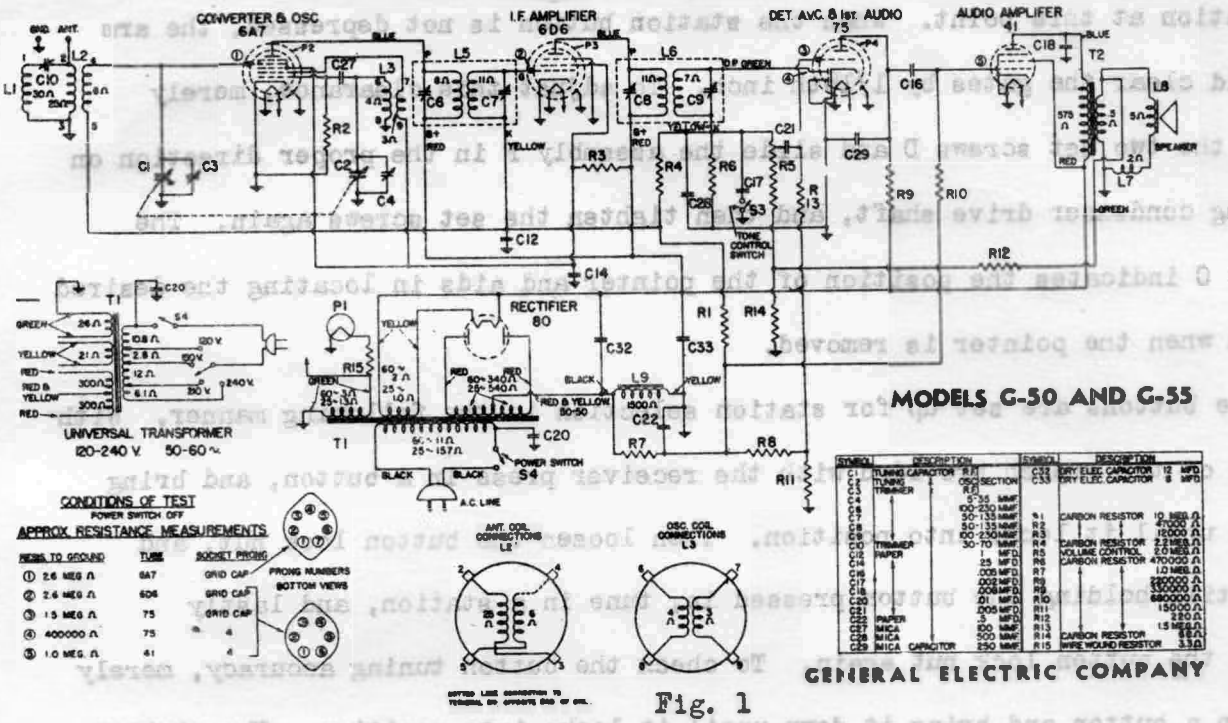


Fig. 1

and converter feeds into a type 6D6 I.F. amplifier peaked at 465 kc. In the 2nd detector stage a type 75 tube functions as demodulator and 1st audio amplifier and also provides the necessary A.V.C. potential. A type 41 pentode is used in the output stage.

An interesting feature of the circuit system is the degenerative audio feedback employed. A portion of the signal from the secondary of the output transformer is returned through resistor R-12 into the grid circuit of the type 75 triode. Although this feedback cuts down the available output somewhat, it greatly stabilizes the audio amplifier and improves the tone quality, in that it suppresses a good bit of the distortion, hum, and noise ordinarily developed in the audio system. Resistors R-12 and R-14 act as a voltage divider and determine the percentage of the output signal voltage that is fed back.

The dial mechanism used in the Touch Tuning system on the General Electric Models G-50 and G-55 is illustrated in Fig. 1. By pressing in a station button and rotating it to the lower part of the assembly, the button arm Bengages

between the two gates A which allow the set to be mechanically tuned to a pre-set station at this point. When the station button is not depressed, the arm B should clear the gates by 1/16th inch. To adjust this clearance, merely loosen the two set screws D and slide the assembly F in the proper direction on the gang condenser drive shaft, and then tighten the set screws again. The red dot C indicates the position of the pointer and aids in locating the desired station when the pointer is removed.

The buttons are set up for station selection in the following manner. With the aid of the wrench provided with the receiver press in a button, and bring it down until it locks into position. Then loosen the button lock nut, and while still holding the button pressed in, tune in a station, and lastly tighten the button lock nut again. To check the button tuning accuracy, merely press in a button and bring it down until it locks into position. The station should be tuned in correctly. The buttons as numbered tune through the following range of frequencies.

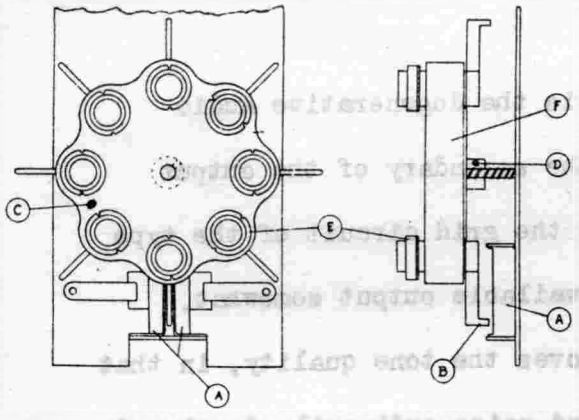


FIGURE 1

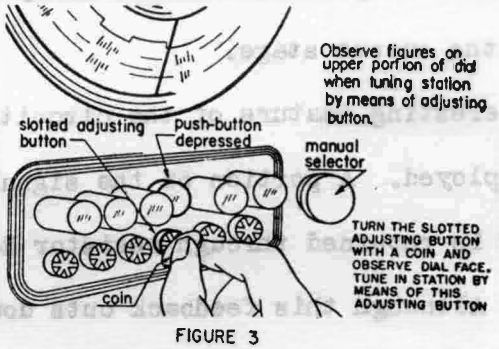
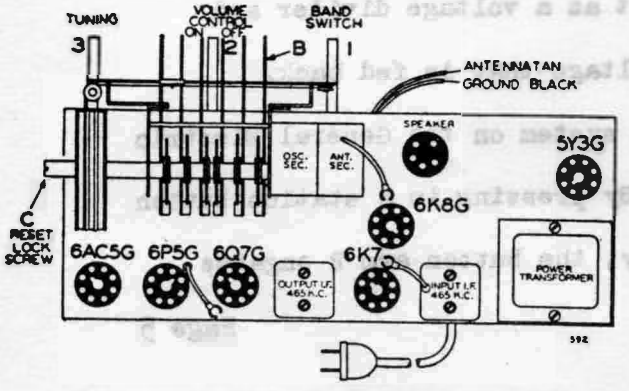
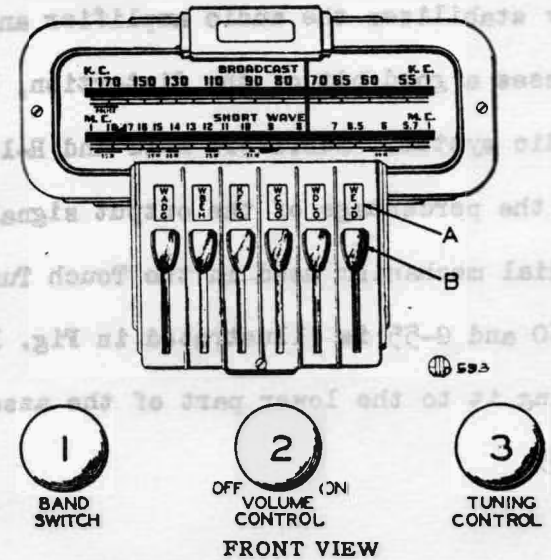


FIGURE 3



TOP VIEW FIGURE 2



FRONT VIEW

Button No.	1	540-590	Kilocycles
	2	570-670	"
	3	630-780	"
	4	710-940	"
	5	830-1150	"
	6	1020-1400	"
	7	1220-1700	"
	8	1580-1800	"

BELMONT RADIO CORPORATION--CHASSIS NO. 665

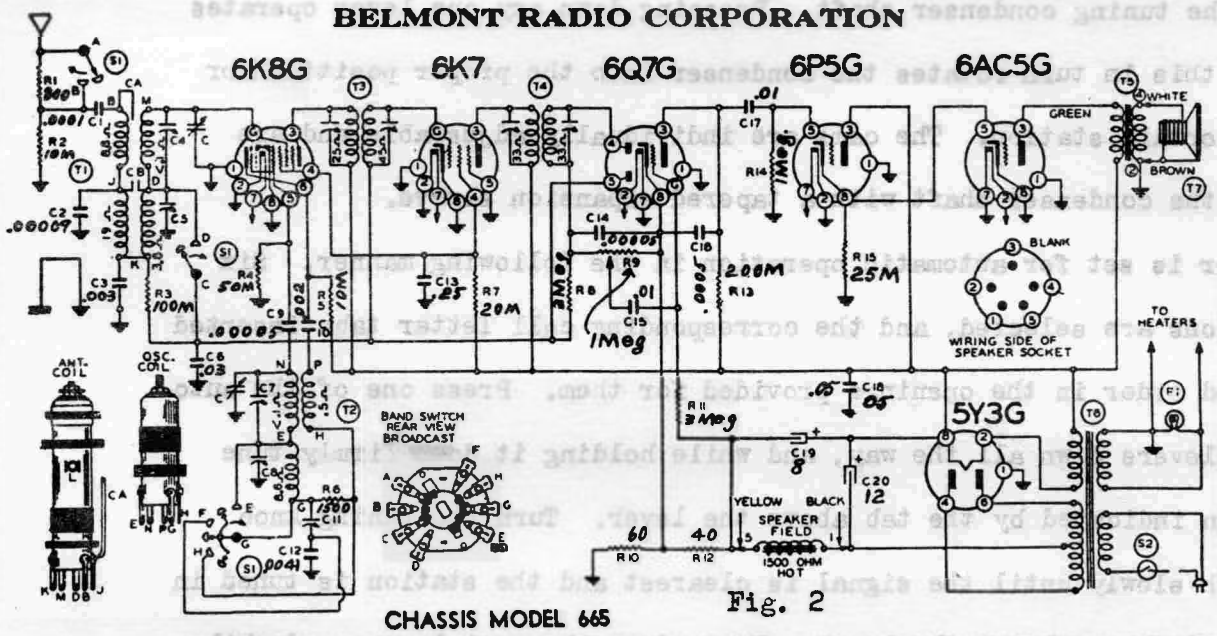


Fig. 2

The Belmont No. 665 Chassis incorporates an A.C. operated 2-band superheterodyne system with a 6K8G composite oscillator and converter feeding into a 6K7 I.F. amplifier peaked at 465 kc. In the 2nd detector a 6Q7G tube functions as demodulator and audio amplifier and also provides the necessary A.V.C. Potential.

The 6P5G tube is electrically similar to the type 76, except that it has an octal base. It operates here as a driver for the 6AC5G, which is a positive grid ClassA power amplifier triode similar to the output section of the type 6B5 direct coupled power amplifier. This combination of tubes, the 6P5G and

the 6AC5G, comprises a low cost method of increasing the number of tubes in the set and at the same time improving the quality and performance.

The automatic tuner employed in the Belmont Model 665 radio receiver, as well as in a number of other of their models, is illustrated in Fig. 2. Directly below the calibrated dial are six projecting levers for tuning in as many different stations. These levers connect with a series of cams that operate directly on the tuning condenser shaft. Pressing down any one lever operates the cam, and this in turn rotates the condenser into the proper position for tuning in a certain station. The cams are individually adjustable and are tightened to the condenser shaft with a tapered expansion sleeve.

The tuner is set for automatic operation in the following manner. Six desired stations are selected, and the corresponding call letter tabs inserted in any desired order in the openings provided for them. Press one of the automatic tuning levers down all the way, and while holding it down firmly tune in the station indicated by the tab above the lever. Turn the tuning knob back and forth slowly until the signal is clearest and the station is tuned in accurately, and then release the lever. Press down the next lever, and while holding it firmly tune in the station called for on this tab, and release the lever. In a similar way adjust the remaining levers until a station has been tuned in on each.

With all six levers arranged, turn the tuning control knob to the right (clockwise) as far as it will go. Remove the metal button from the right side of the cabinet, and with a screw driver tighten the reset locking adjustment screw. It is very important that this locking screw is absolutely tight or the cams will slip on the condenser shaft.

This reset lock screw is loose when the set is shipped from the factory.

If it is desired to change one or several of the selected stations, loosen the reset screw four or five turns, adjust the levers for the new stations desired, and tighten the reset lock screw again. If the dial mechanism works hard when a lever is being set for a station, it is due to the lock screw being too tight. The reset lock screw must always be tightened well after station adjustments have been completed.

EMERSON RADIO AND PHONOGRAPH CORPORATION, MODELS BQ-225 AND BQ-228

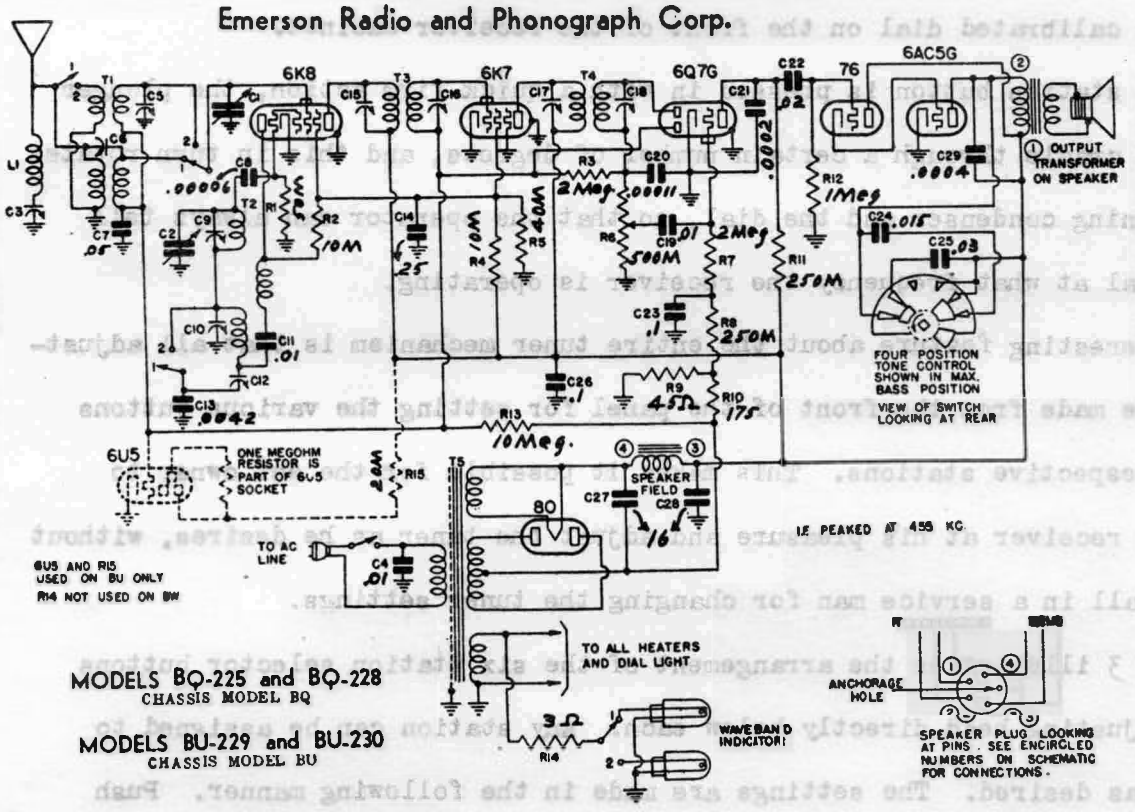


Fig. 3

The Emerson Model BQ chassis is built around a conventional 2-band superheterodyne circuit system, except that in the audio amplifier a not so common tube complement is used. Following the triode section of the 6Q7G tube, which functions as the 1st audio stage, is a type 76 tube that serves as driver for a 6AC5G tube. The latter two tubes are really equivalent to a type 6B5 direct coupled power amplifier, the 76 tube serving as the input section and the 6AC5G

as the output section. This arrangement increases the number of tubes in the set and also improves the quality of the output. The Emerson BU chassis is similar to the BQ except that it has an additional type 6U5 tuning indicator tube.

The instamatic Tuner employed in these Emerson receivers is another form of manually operated mechanical tuner. This tuner is equipped with six station buttons each of which moves a plunger that in turn operates on or rotates a half-cylinder cradle. This cradle is geared to the gang tuning condenser and also to the calibrated dial on the front of the receiver cabinet.

When a station button is pressed in with a quick firm action, the plunger rotates the cradle through a certain number of degrees, and this in turn rotates both the tuning condenser and the dial, so that the operator can always tell from the dial at what frequency the receiver is operating.

An interesting feature about the entire tuner mechanism is that all adjustments can be made from the front of the panel for setting the various buttons for their respective stations. This makes it possible for the set owner to operate the receiver at his pleasure and adjust the tuner as he desires, without having to call in a service man for changing the tuner settings.

Figure 3 illustrates the arrangement of the six station selector buttons with the adjusting head directly below each. Any station can be assigned to any button as desired. The settings are made in the following manner. Push in the manual selector knob and tune in the desired station with it until the mark on the dial face corresponding to the frequency of the station appears at the black indicator line on the conical escutcheon window. Then push in the button intended for this station with a firm action.

To fix the adjustments for this button, use a small coin such as a penny

or a dime and insert it in one of the slots in the head directly below the button pressed in. Turn this adjusting head until the mark on the dial face corresponding to the frequency of the station again appears at the black indicator line. After the station is heard, tune it in carefully by turning the adjusting head back and forth slowly. It is very important, however, that the last turning motion of the adjusting head be in a counter-clockwise direction as is indicated in Fig. 3. The remaining buttons are adjusted one at a time in a similar manner.

AUTOMATIC TUNING AND AUTOMATIC FREQUENCY CONTROL

Automatic frequency control (A.F.C.) is a system used in some of the early automatically tuned receivers by virtue of which the receiver circuit inherently adjusts itself to the exact frequency of the incoming station signal even though the tuning mechanism may be set several kilocycles off resonance. The action is purely electrical in nature and does not involve any mechanical manipulation or adjustment of the tuning apparatus.

Such automatic frequency control played a very important part in the first receivers equipped with automatic tuning, for since the tuning apparatus was still somewhat crude, exact resonance settings were not always obtained and A.F.C. action was required to help establish them. But as the automatic tuning methods were improved and greater accuracy obtained both in the operating mechanisms as well as in the values of the component parts, the need for automatic frequency control was no longer there. Also, automatic frequency control systems are in themselves rather involved and require quite accurate adjustment to function properly. This made their application rather costly and greatly increased the complexity of the receiver.

Consequently automatic frequency control is not used very extensively any more and is found in only a few of the more costly receivers. In some sets the

need for automatic frequency control is overcome by broadening the tuning. For example, a receiver is designed with two degrees of selectivity--it tunes very sharp with manual tuning, but when automatic tuning is cut in, the circuit is changed somewhat and the tuning curve broadened out, so that such accurate settings are not required. Receivers using such circuit arrangements are shown later on.

SEMI-FIXED TRIMMERS REPLACE THE TUNING CONDENSER

In the trimmer substitution systems of automatic tuning a series of pre-calibrated trimmers are used in place of the regular tuning condenser. A push-button tuner is also used, arranged so that pressing in any button shunts the corresponding trimmer across the circuit which is to be tuned. The main advantage of th.. system is that tuning is practically instantaneous since no time is consumed while the various circuit components adjust themselves. The instant the button closes the circuit, resonance is established, and the receiver responds to that frequency.

As many as eight and ten stations can frequently be selected and cut in by this method, depending upon the number of push-buttons provided in the automatic tuner. In addition most sets also have a manual tuning system by which the main tuning condenser is rotated with a knob located on the front panel of the receiver. Means must then also be provided for shifting from automatic to manual tuning or vice versa. On some sets this is done by means of an additional push-button provided in the automatic tuner, and on others by means of an extra position on the range selector switch. Special switching arrangements are also used in some sets as will be shown later on.

The successive trimmers used in an automatic tuner are of various sizes so that each will tune through a certain frequency range. Usually four or five

trimmers are required to cover the customary range from 550 to 1750 kc. A given station must therefore always be assigned to a push-button that controls a trimmer tuning over the range within which the station frequency lies. Adjacent trimmers always overlap sufficiently that practically any selection of stations can be accommodated, for after all, automatic tuning is intended chiefly for local and nearby stations, and the frequency assignments are such that a group of stations in a given community will never be crowded within a narrow band of frequencies. When such station assignments are made to a series of buttons in an automatic tuner, the manufacturer's service instructions should always be consulted so that the frequency ranges will be selected correctly and the various adjustments made in the proper order, etc.

TWO AND THREE-BANK TRIMMERS

Although the majority of push-button tuners employ only two banks of trimmers for tuning the antenna and oscillator in a superheterodyne receiver, three banks of trimmers can also be used if it is necessary to tune a preliminary R.F. stage ahead of the 1st detector. A 2-bank trimmer is used in place of a 2-gang condenser, and each trimmer corresponds to a particular setting of the condenser. Similarly, a 3-bank trimmer corresponds to a 3-gang condenser. Trimmer substitution systems are also used in tuned radio frequency circuits. In fact, a number of small tuned radio frequency sets employ only a push-button tuner with two banks of trimmers and no variable condenser at all.

The successive trimmer condensers in a given bank are always arranged so that one side of each is connected to a common bus wire, and the other side is connected to its respective push-button switch. Some circuits are arranged so that the push-button switches are in the high potential or grid side of the tuned circuit with the common side of the trimmers grounded, while in others

the common side of the trimmers is in the grid line and the open side of the switches are grounded. The former method is more generally used in that it permits of a simpler switching system from manual to automatic tuning and back.

In some superheterodyne circuits the selectivity of the intermediate amplifier is broadened when operation is shifted from manual to automatic tuning. Such a circuit shift is then made by means of an extra operation of the change-over switch. For better selectivity on manual tuning looser coupling is employed in the I.F. transformers, while for automatic tuning closer coupling is arranged so that the tuning curve becomes broader. Such broader tuning eliminates the need for automatic frequency control in that it makes suitable allowances for off-resonance settings of the tuner.

HOWARD MODEL 240 RECEIVER

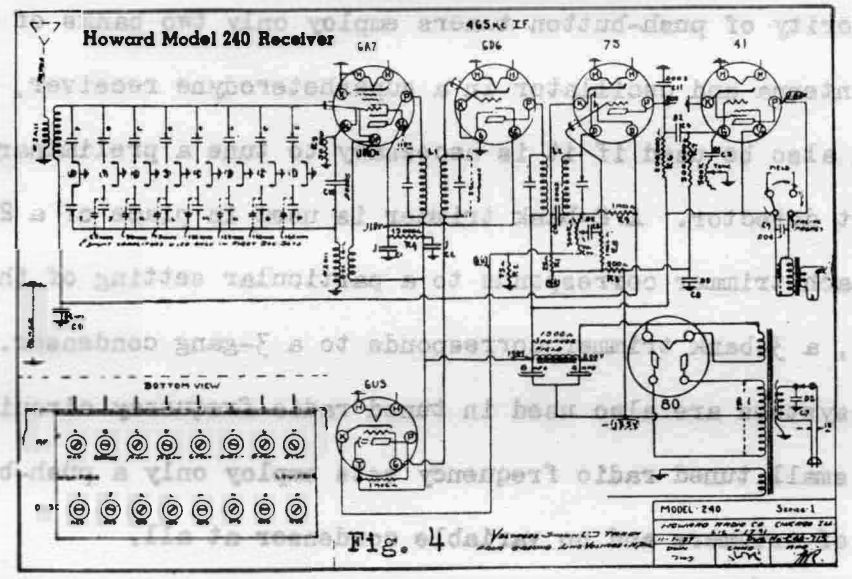


Fig. 4

The Howard Radio Company Model 240 Receiver is a 6-tube superheterodyne that employs only a push-button station selector and has no variable tuning condenser. Eight buttons are provided, making it possible to tune in eight different stations.

The tuner has two banks of trimmers, one bank for the 1st detector input

and the other for the oscillator circuit. The common side of the 1st bank of trimmers is connected into the high potential or grid line of the detector input, and the open switch sides to ground, while the common side of the second bank is connected into the oscillator grid circuit with the open switch sides to ground also. No changeover or transfer switch is needed since there is no variable-tuning condenser.

Button (1) at the right is at the low-frequency end and tunes from 550 to 860 kc. Buttons (2), (3) and (4) tune from 600 to 900 kc., buttons (5) and (6) from 800 to 1200 kc., button (7) from 1000 to 1500 kc., and button (8) at the extreme left from 1150 to 1750 kc. Ample flexibility is thus provided in the frequency ranges so that practically any desired group of stations can be accommodated.

To assign a station to a button the following procedure is observed. First select a button that tunes over the frequency range within which the desired station frequency lies and press the button in. Next adjust the oscillator trimmer (the lower adjustment at the rear that carries the same number as the button pressed in) until the desired station is heard best. Thirdly, vary the upper adjustment of the same number until the electric eye shows maximum deflection. Lastly, reset the red adjustment for further eye deflection. The station call letter tab should also be inserted in the top of the button. Other stations are assigned in a similar manner.

SENTINEL-ERLA MODEL 107AE

The Sentinel-Erla Model 107AE is a 2-band superheterodyne receiver employing a 6-tube conventional circuit arrangement that includes a type 6G5 electric tuning indicator. It is equipped for both manual and automatic push-button tuning however covering only the broadcast band. A 2-position selector switch

is used for shifting manual tuning from the broadcast to the short-wave band.

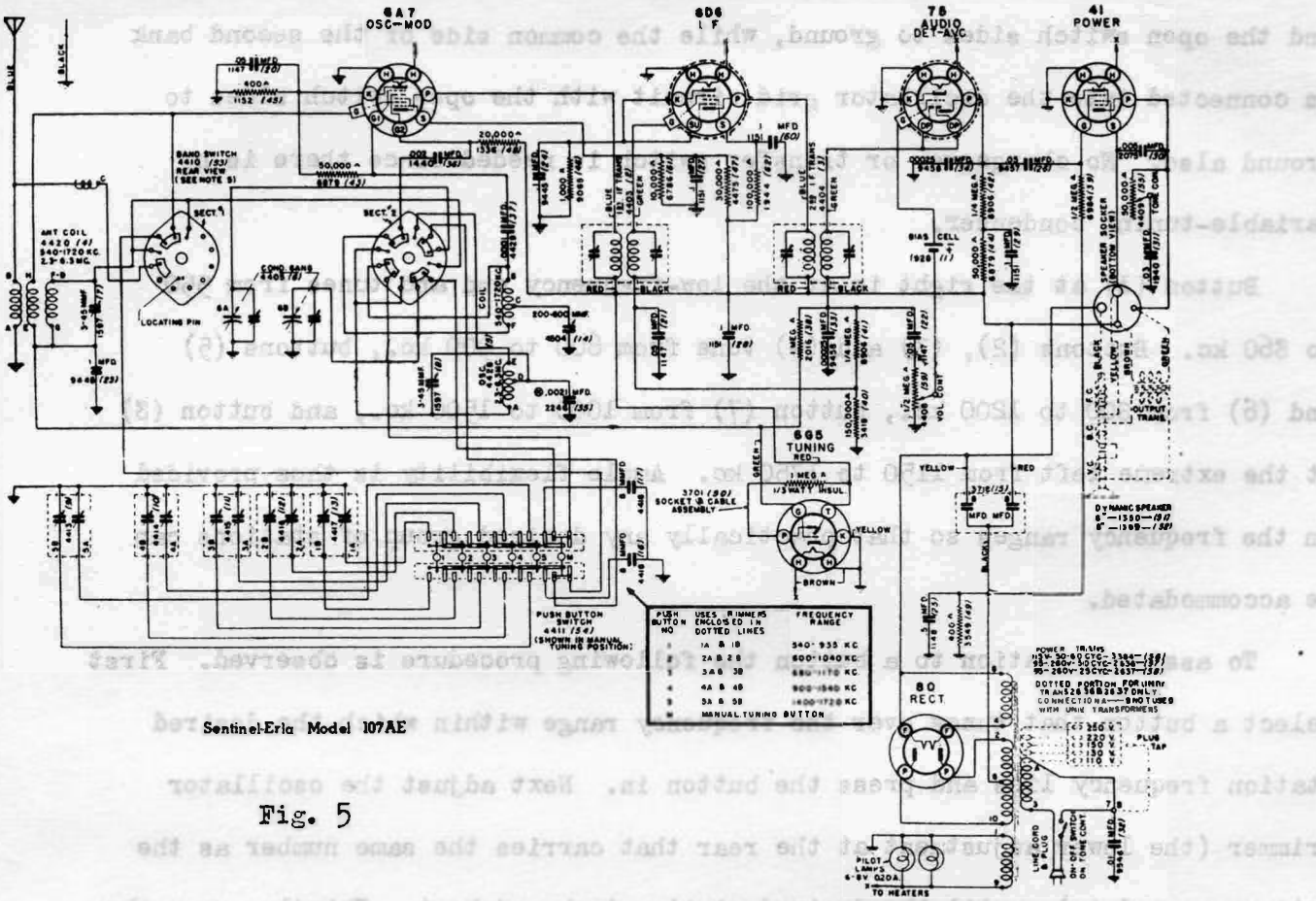


Fig. 5

The automatic tuner is equipped with six push-buttons, five automatic station selecting buttons and one button for shifting from automatic to manual tuning. For manual tuning this button must be "in." If any one of the five station selecting buttons is pushed in, this manual button is released and the receiver is instantly tuned to the station for which this button was pre-tuned. Either one of the five automatic tuning buttons must be in, or the manual button must be in, otherwise no station can be heard.

When the band switch is in the broadcast position and the automatic tuner

is set for manual tuning, the grid of the 6A7 tube, the upper end of the broadcast coil H, and the stator of the condenser gang are connected in parallel. The connection to the condenser stator is completed through the lower contact of the manual button. When this button is out, the line to the stator is open, and the receiver is set for automatic tuning.

As is illustrated in the diagram, two banks of trimmers are used, one for tuning the detector input and the other for tuning the oscillator circuit. The open switch sides of the trimmer circuits are connected into the high-potential grid line, and the common terminals of both banks of trimmers are grounded. Button No. 1 tunes from 540 to 935 kc., button No. 2 from 600 to 1040 kc., button No. 3 from 680 to 1170 kc., button No. 4 from 900 to 1540 kc., and button No. 5 from 1400 to 1720. The wide overlapping permits flexible selection of stations. Stations to be available on the automatic tuner must be assigned to buttons that tune over the frequency within which the desired station frequency lies.

The manufacturer recommends the following procedure in adjusting the trimmer condensers. Turn band selector switch to the broadcast position and press in the manual button M on the automatic tuner. With the manual tuning knob carefully tune in the selected station whose frequency lies between 540 and 935 kc., and then press in button No. 1 which operates over this frequency. The station may sound distorted or even entirely disappear, but this is because the trimmers are not set right. With an insulated screw driver carefully adjust trimmer 1A (the oscillator trimmer) and then 1B (the detector trimmer) until the signal is loudest and the tuning eye shows minimum deflection. Switch back to manual tuning and observe if the response of the receiver is the same. In a like manner assign button No. 2 by adjusting trimmers 2A and 2B, etc.

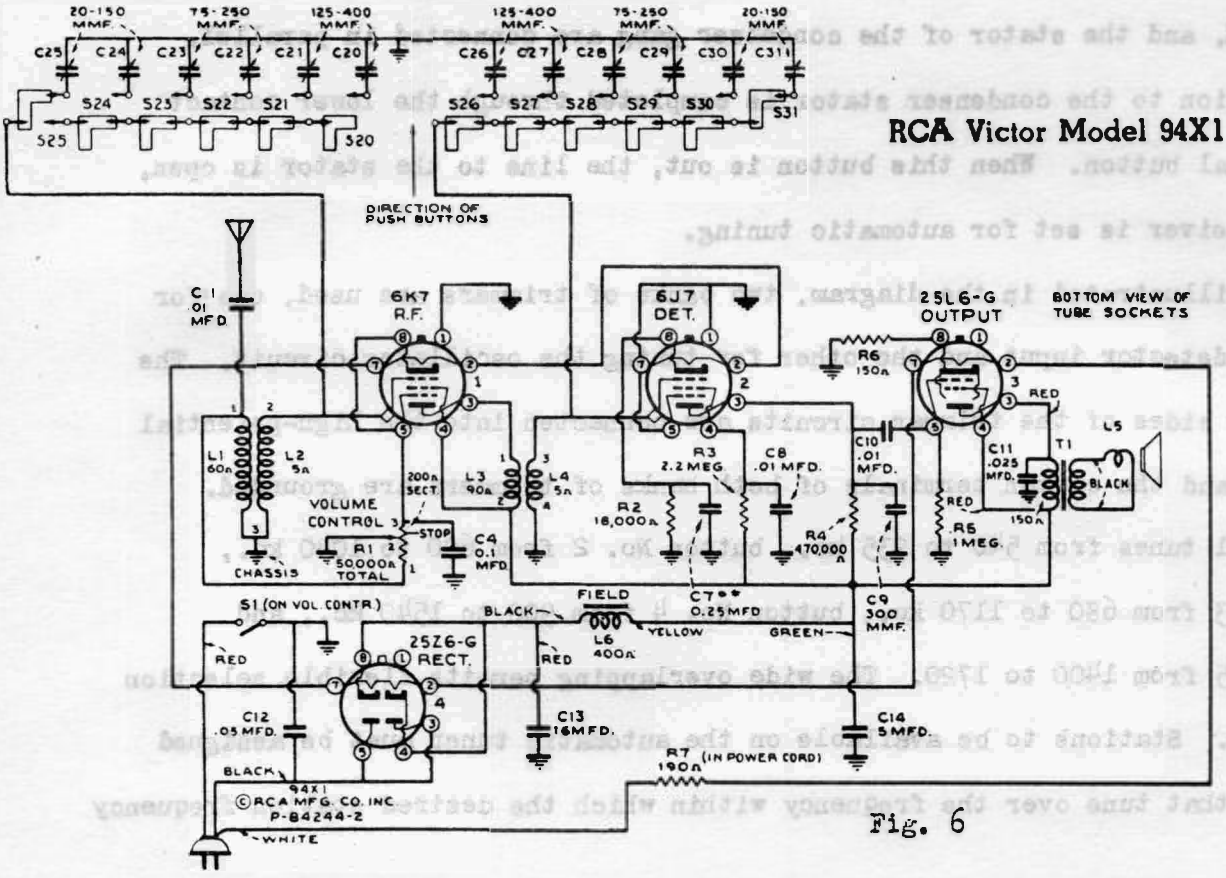


Fig. 6

The RCA Victor Model 94X1 is a small 4-tube AC-DC tuned radio frequency receiver that is designed only for automatic push-button tuning and has no automatic operated tuning mechanism. Six station selecting buttons are provided, permitting six different stations to be tuned in. The only other control on the receiver is the volume control, to which is also attached the power switch.

Two banks of trimmers are employed, one for the antenna coupler and the other for the radio-frequency stage. In each bank the open sides of the switches are connected into the high-potential grid lines, and the common sides of the trimmers are grounded. Switches S-20 and S-26 are operated by button No. 1, and switches S-21 and S-27 by button No. 2. These both tune over a range

of 540 to 900 kc. Switches S-22 and S-28 are operated by button No. 3, and S-23 and S-29 by button No. 4. These tune from 680 to 1200 kc. Switches S-24 and S-30 are operated by button No. 5, and S-25 and S-31 by button No. 6, these two tuning from 850 to 1500 kc.

Stations are assigned to their respective buttons and the necessary adjustments made in the following manner. Select the station having the lowest frequency and assign it to button No. 1, providing of course that its frequency does not exceed 900 kc. The manufacturer recommends the use of a calibrated signal generator for adjusting the trimmers. Connect the high side of the generator through a 60-mmfd. condenser to the end of the antenna wire, and the low side through a 0.1 mfd. condenser to the chassis.

Tune the generator to the station frequency and adjust the output attenuator for a strong output. Also have the receiver volume control full on. Then with an insulated screw driver adjust trimmers C-20 and C-26 until the strongest signal is heard, at the same time reducing the output of the generator so that a sharp peak is secured. Lastly, disconnect the generator and make any necessary final adjustment during the actual reception of the station.

The next station is then assigned to button No. 2 and trimmers C-21 and C-27 are adjusted in a similar manner, assuming the station frequency lies in the 540 to 900 kc. range. The remaining buttons are then adjusted and the receiver is ready to be put into operation.

FADA MODEL 368 RADIO RECEIVER

The Fada Model 368 is a 2-band 5-tube AC-DC operated superheterodyne receiver that is equipped for manual tuning and with an automatic dial-operated station selector. Shifting from short-wave to broadcast tuning, as well as changing over from manual to automatic tuning, is done with the aid of a 3-position

selector switch. In the 1st position (extreme counter-clockwise) the receiver is set for manual tuning on the short-wave band, in the 2nd position for manual tuning on the broadcast band, and in the 3rd position for automatic tuning on the broadcast band. In the circuit diagram this band switch is shown in the 2nd position, manual tuning on the broadcast band. No extra change-over switch is thus needed.

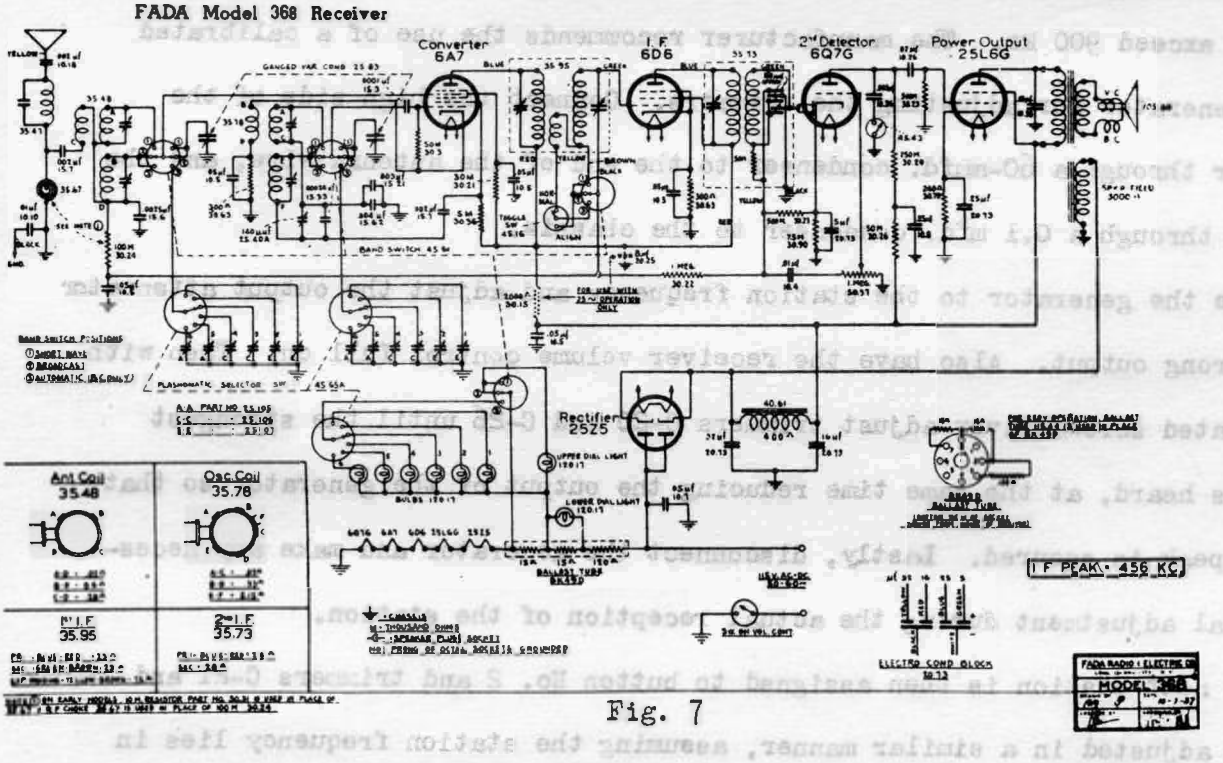


Fig. 7

Automatic tuning is of the pre-calibrated trimmer substitution type, but a rotary dial mechanism is used in place of the usual push-button tuner. Two banks of trimmers are used, one for tuning the detector input and the other for tuning the oscillator. The rotary station selector switch has three decks, one deck for the detector tuning trimmer bank, the second deck for the oscillator bank, and the third for cutting in a special pilot light for each station setting. There are six station positions on the rotary switch so that six

different stations can be tuned in automatically.

The method of assigning stations and adjusting the trimmer condensors is similar to the procedure outlined previously for other receivers employing pre-calibrated trimmers and need not be repeated at this time. It must be remembered, however, that in every case the oscillator trimmers are always the first to be adjusted and then the detector trimmers.

SERVICING AUTOMATICALLY TUNED RECEIVERS

Automatically tuned receivers are subject to the same general ills and service troubles that manually tuned sets are, and in addition they have the automatic tuning mechanisms as further sources of trouble. When balancing and aligning adjustments are necessary, these should be made with the receiver controls set for manual tuning. Also, the manufacturer's instructions should always be consulted for any special observations that may be necessary.

If a receiver functions satisfactorily on manual tuning but fails to do so on automatic tuning, it is evident that the trouble must lie in the automatic tuner. No reception may be due to a broken lead from some section of the push-button tuner, or a broken switch contact. The trimmer condensers may be shorted or the capacity of the trimmer may be too large or too small for the station assigned. If the reception is poor or distorted, it is generally due to improper adjustments in the trimmer condensers. It might also be that one or several spring contacts are corroded or dirty and that as a result excessive resistance is introduced into the circuit.

If the selectivity is poor, or unwanted stations are heard in the background, this can often be corrected by reducing the antenna input with a small series condenser or by connecting a wave trap in series with the antenna lead-in. Sometimes such poor selectivity can be improved by realigning the I.F. transformers

and peaking them more sharply.

The following suggestions should be carefully observed to obtain best results when station assignments and trimmer adjustments are being made. Always allow a set to heat up for at least twenty or thirty minutes before any adjustments are attempted, so that all parts are at their normal operating temperature. Make all adjustments with careful thought and deliberation, for it is sometimes very difficult to undue a careless mistake. Turn the adjustments slowly and watch the tuning indicator for optimum position. Never try to extend any adjustments beyond their assigned frequency range. Check and double-check the trimmer adjustment number against the button numbers to avoid any confusion.

The trimmers should never be adjusted very loosely or too tightly, for in either position they do not function to best advantage. Therefore, a station should always be assigned to such a button that the station frequency falls well within the minimum and maximum range of the trimmers. The same station might also fall within the overlapping range of the next higher or next lower button, but then the trimmers would have to be all the way out or in, and that would not be so good. In a superheterodyne always adjust the oscillator trimmer first and then the detector trimmer and check back on the oscillator trimmer.