

Fig. 20. WLS control room.

SPEECH INPUT SYSTEMS

A Thorough Discussion of the Practical and Theoretical Aspects of Various Systems

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PART II

The purpose of the second part of this paper is to describe in some detail layouts for typical broadcasting stations using the system of switching that has been described in Part I.

First, a small size station installation is described and the features that are found to be most useful are outlined. Next is shown the medium size, and finally the larger stations, and those stations

which do considerable network switching.

The diagrams shown are reproductions of the block diagrams prepared by the RCA Engineering Department for radio stations considering studio equipment. Perhaps they are familiar to most readers, but if they have never been seen before, the following explanations will indicate what each piece of equipment does.

Fig. 16 shows the installation

of Radio Station WGTC, located at Greenville, North Carolina.

This station's system covers equipment for two studios and one outgoing line. In the upper left corner, enclosed within the dotted lines, is the block diagram of an RCA 76-B consolette. This consolette is a self-contained speech input system consisting of four pre-amplifiers, a program amplifier, a monitor amplifier and associated mixers and switches.

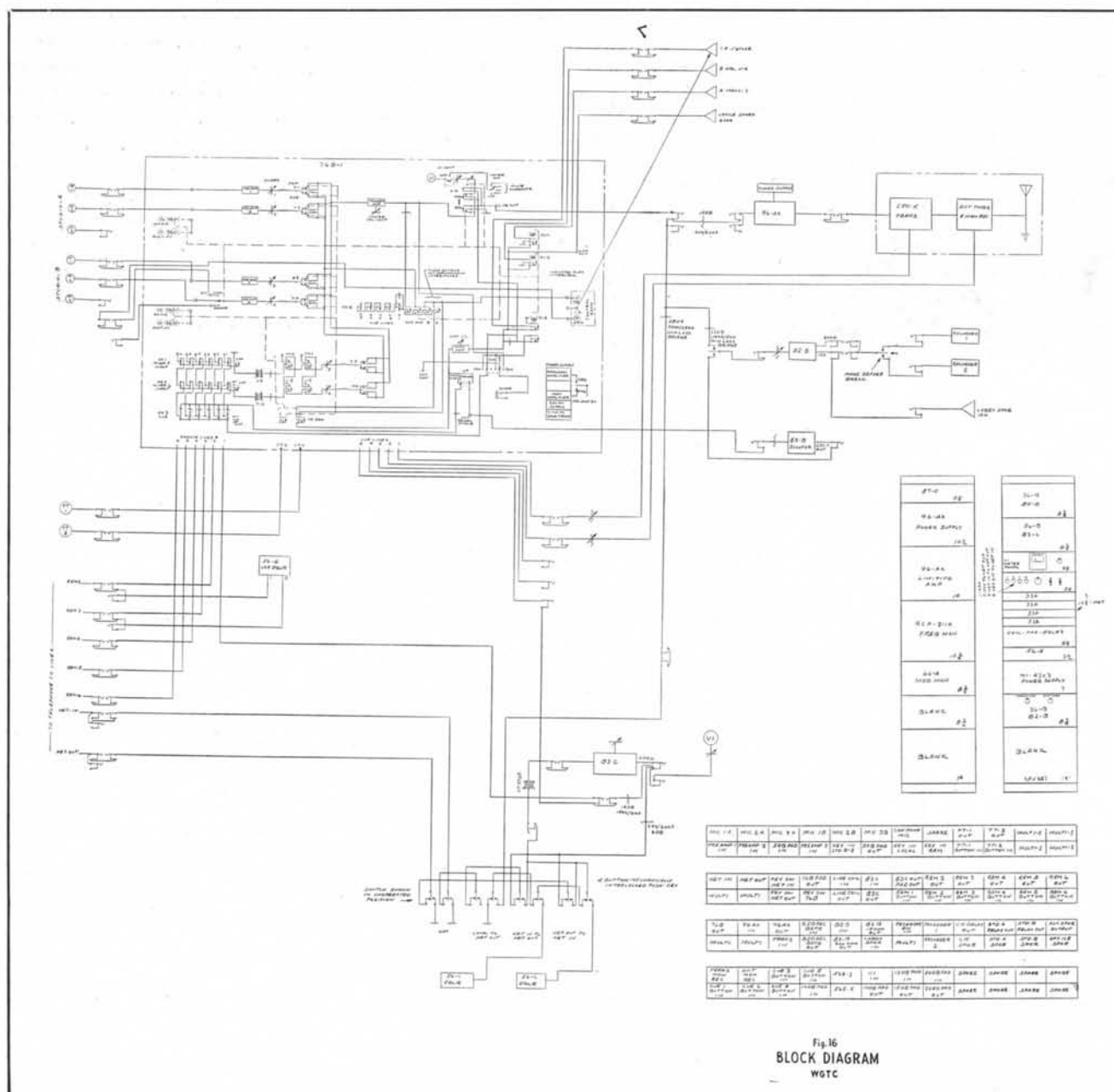
Six mixers are provided and the output of each may be fed into either the program amplifier or to the monitoring amplifier for auditioning. With this arrangement it is possible to be broadcasting from one studio while auditioning from the other. Remote input selector keys permit instantaneous switching of six incoming remotes, one of which (#1 position) is here used for the incoming network. Variable line equalizers are connected across the #2 and #3 outputs. Override and "cue" circuits are provided and are the same as those shown in Fig. 10-C. A bank of mechanically interlocked pushkeys are connected in series with the input to the monitoring amplifier and

provide switching to five incoming cue lines, one of which is the incoming network, one the output of the transmitter and another the output of a monitoring rectifier in the antenna tuner. The additional two cueing inputs are terminated on jacks. Three interlocked relays are furnished to cut off the control room and studio speakers whenever a microphone is on in the same room. In addition to the 15 ohm speaker circuit, a 600 ohm output is taken from the monitoring amplifier for the office speakers. Control Room announce and talkback microphones are furnished and selector switches permit talkback to either of the two studios or to the remote lines. A photograph of the

76-B Console is shown in Fig. 13.

The program leaves the console at the line out switch and goes through a pad to drop the level before going into the 96-AX limiting amplifier. The output of the limiter feeds directly into the 250 watt transmitter, which is located in the same room.

Two bridging pads are connected across the output of the console. One feeds the recording equipment, and the other the net reversal switching arrangement. The recording circuit is taken through a selector switch into the 82-B recording amplifier. By means of this switch, the recording source is taken directly from program line or from the recording terminals of the 76-B. The



latter allows recordings to be made of programs that are in audition, from network, or from other remote lines that do not happen to be on the air at the time. An 85-B booster amplifier is required to increase the level sufficiently to drive the 82-B. The output of the 82-B amplifier feeds into a transfer switch by means of which recordings can be made on either one of two machines. This switch is so arranged that when in the neutral position, both recorders are on the channel. This prevents the losing of any part of a recorded program while switching from one machine to the other.

The other line that bridges the program line into the transmitter is taken down to a network reversing switch shown at the lower center of the figure. (It is one of WGTC's operations to either feed program to a southern net, or to receive program from that southern net and re-broadcast it or feed it on to the main network.) The switch, as shown, is in the "off" position. By pushing the key, labeled "Local to Net Out," program from the studio is fed through to the 83-C line amplifier's input. The output of the amplifier, for this position of the switch, feeds directly to the "net out" which feeds the out to the southern net. By pushing the key marked "net in" to "net out," the program comes in on the line marked "net in," and feeds into the 83-C amplifier. The output of this amplifier then goes to the "net out." In this position WGTC is acting as a repeater station for the network. By pushing the "net out" to "net in" switch, the reverse procedure takes place. The "net out" line feeds up through the 83-C amplifier, the output of which then goes to the line marked "net in." This is the position used when feeding the network from the southern leg of the net. Pushing the "off" button closes both the "net in," the "net out," and the tap from the program line. All lines are terminated in proper values of resistance. The two equalizers, shown connected in this switch, equalize either the "net in" or "net out" depending upon which program is being received. This particular

switch is of the interlock pushkey type, preventing mix-up of programs through failure of an operator clearing one switch before pushing the desired one.

The rack layout is very typical of a station this size. The pre-amplifiers and program amplifier are located at the top of the rack. Next comes the vu meter panel, which is normally on the net reversal line but also goes through a jack, by means of which it can be used to check the levels in any part of the system. A variable attenuator located on this panel extends its range from 4 to 26 vu. The next panel contains the net reversal switch, the gain control of the net reversal circuit, and the two key switches associated with the recording equipment. One switch transfers recorders and the other connecting the input of the recording system to either the program line or the recording connection inside the 76-B.

Next follow four double jack strips, which contain all the jacks that are indicated in the block diagram. Immediately below this is a blank panel on the back of which is mounted the line transformer and various pads. Immediately below this is the 56-E equalizer, which in effect is two variable units mounted on one panel. Below this is the power supply for supplying plate voltage to the 85-B booster amplifier in the recording circuit. Next are two volume controls in the cue lines from the transmitter and the antenna tuning house. Once these two particular units are set, there is not much need for further adjustment. These are mounted on the shelf that mounts the 82-B recording amplifier. The space from here down is taken up with terminal blocks and power fuses.

The second or transmitter control rack, is self-explanatory. The 96-AX limiting amplifier, 311-A frequency monitor, and 66-A modulation monitor comprise all the equipment.

The layout shown in Fig. 17 is that of WREC, in Memphis. This is a considerably larger installation, having three consolettes to handle three studios, but again only one regular outgoing line. In this layout, there exists a problem of switching. The system just

described had only an "on" and "off" switch but this station has to switch from any one of the three studios to their outgoing line. The switching was accomplished by means of relays operated by the console line out switches.

Located on the left side of the figure are the three 76-B consolettes with their outgoing lines feeding into three relays located close to the center of the figure. The output of these three relays then feeds into the "Reg.Emg." switch which picks up either the regular or emergency line to the transmitter. The relays are operated, as mentioned, by the line out switch in the consolette.

For example, if Studio A's line out switch is thrown, Studio A relay will pull up and connect the output of this consolette into the outgoing line. With this condition, it is impossible to pull up either B's or C's relay by throwing the line switch in either of these two consolettes. This is due to the interlock system between the three relays. However, if Studio B is to come on the air during the next program period, it may be prepared to the extent of throwing the line switch and waiting for "A" to sign off. At the time "A" opens his line switch, "B's" relay immediately closes, since his line switch is already in the closed position. This allows for very rapid switching of one consolette to the other. The same applies to the studio "C" line switch and relay. After the "REG-EMG" switch, the output of these three relays feeds through either one or the other of two 83-C's; one is normally used for the regular line, and the other is always ready on the emergency line.

A vu meter selector switch allows the vu meter to be connected across either the outgoing program line, on the network, or directly on the regular or emergency lines. The two other positions on this selector switch terminate on jacks, which permits making readings at various points in the circuit.

The other two feeds from this junction point go to net reversal switches. The one labeled "LITTLE ROCK SWITCH" is

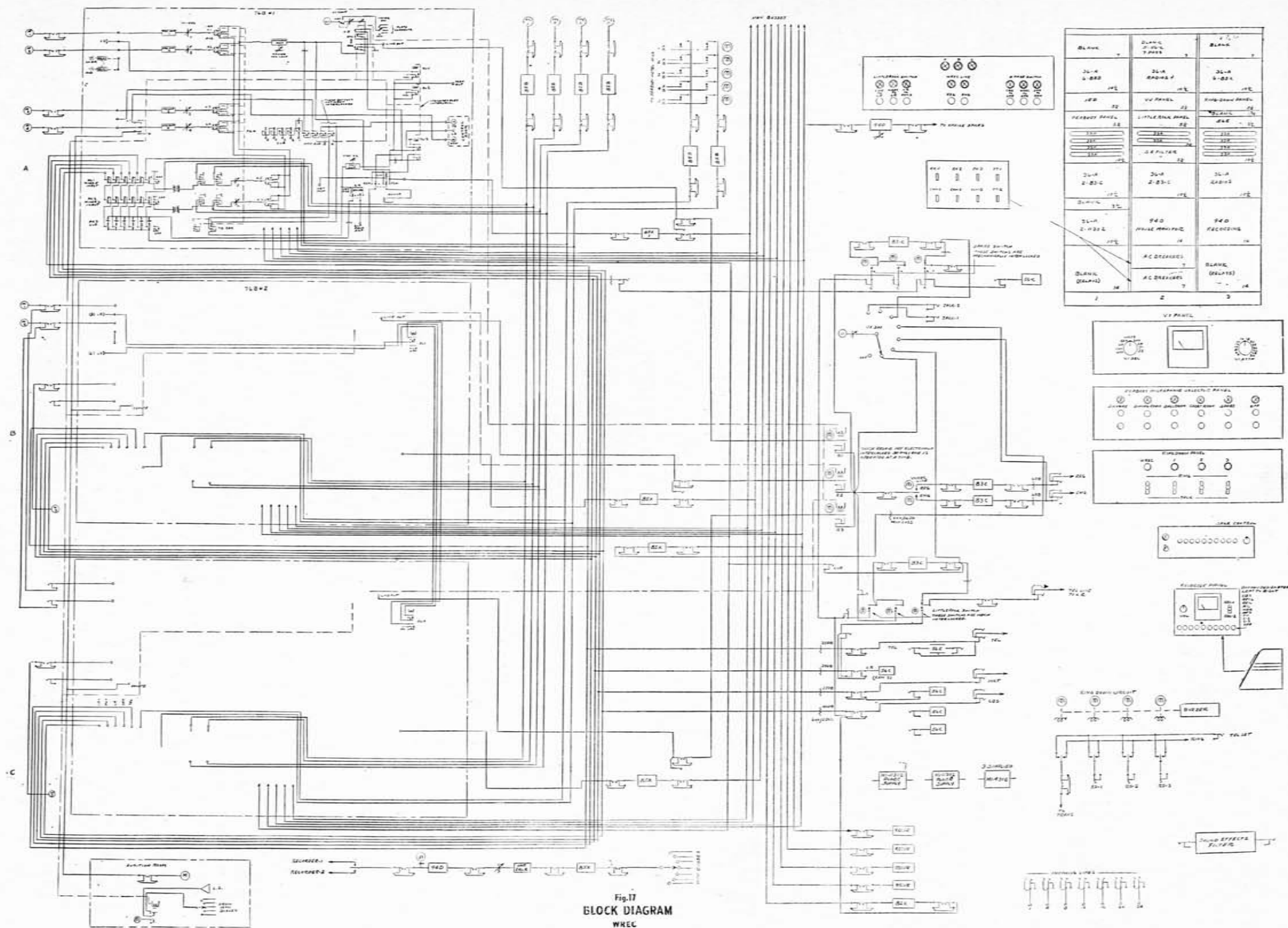


Fig. 17
BLOCK DIAGRAM
WREC



FIGURE 1
BLOCK DIAGRAM OF THE
WIS

TABLE 1

Block	Function	Notes
1	Power Supply	240V AC, 50/60 Hz
2	Rectifier	Full-wave bridge
3	Filter	Electrolytic capacitor
4	Regulator	Variable resistor
5	Transformer	Step-down
6	Relay	Electromechanical
7	Switch	Manual
8	Indicator	Light bulb
9	Control	Microphone
10	Output	Speaker

FIGURE 2
BLOCK DIAGRAM OF THE
WIS

TABLE 2

Block	Function	Notes
11	Power Supply	240V AC, 50/60 Hz
12	Rectifier	Full-wave bridge
13	Filter	Electrolytic capacitor
14	Regulator	Variable resistor
15	Transformer	Step-down
16	Relay	Electromechanical
17	Switch	Manual
18	Indicator	Light bulb
19	Control	Microphone
20	Output	Speaker

FIGURE 3
BLOCK DIAGRAM OF THE
WIS

TABLE 3

Block	Function	Notes
21	Power Supply	240V AC, 50/60 Hz
22	Rectifier	Full-wave bridge
23	Filter	Electrolytic capacitor
24	Regulator	Variable resistor
25	Transformer	Step-down
26	Relay	Electromechanical
27	Switch	Manual
28	Indicator	Light bulb
29	Control	Microphone
30	Output	Speaker

FIGURE 4
BLOCK DIAGRAM OF THE
WIS

TABLE 4

Block	Function	Notes
31	Power Supply	240V AC, 50/60 Hz
32	Rectifier	Full-wave bridge
33	Filter	Electrolytic capacitor
34	Regulator	Variable resistor
35	Transformer	Step-down
36	Relay	Electromechanical
37	Switch	Manual
38	Indicator	Light bulb
39	Control	Microphone
40	Output	Speaker

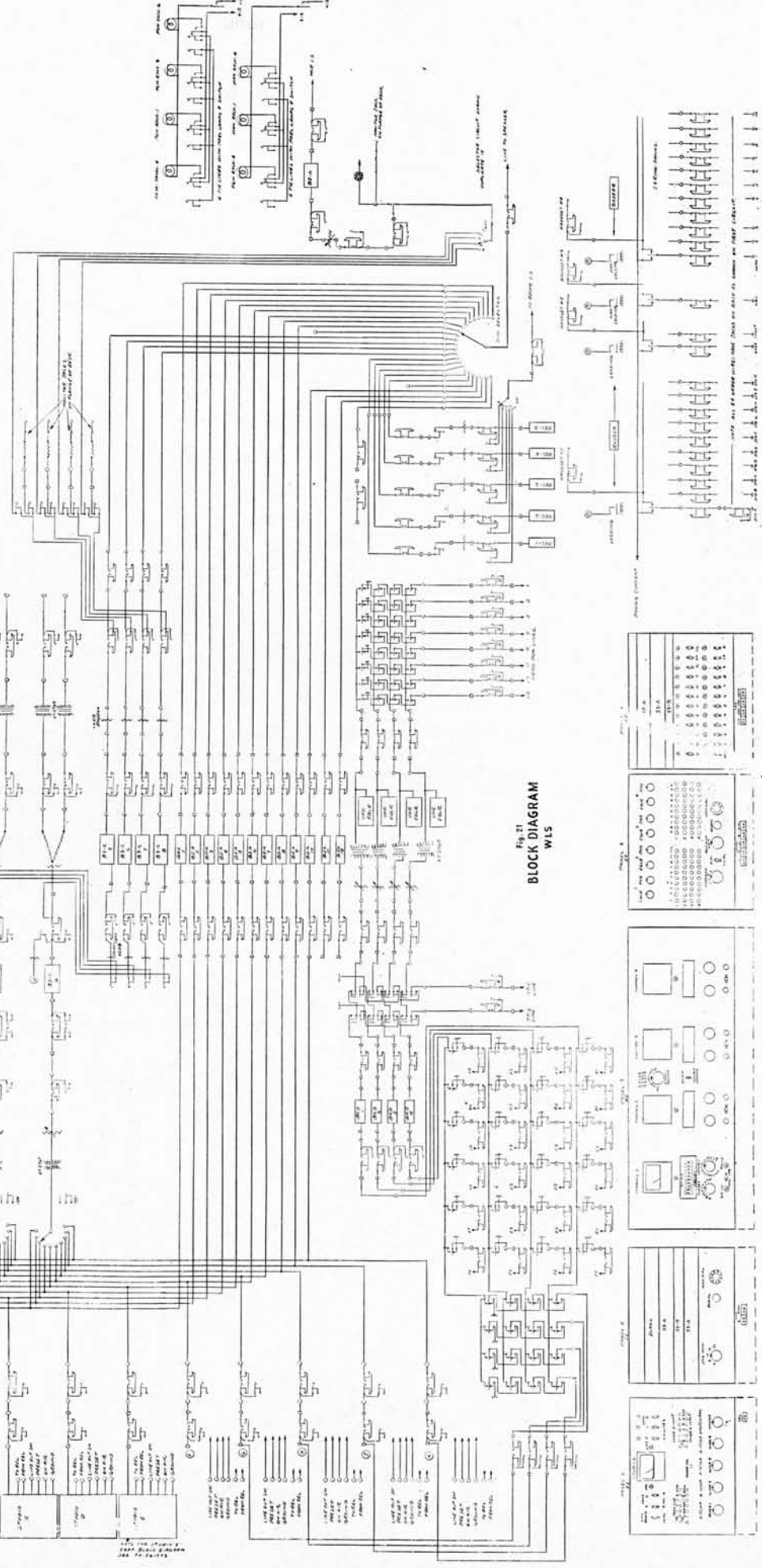
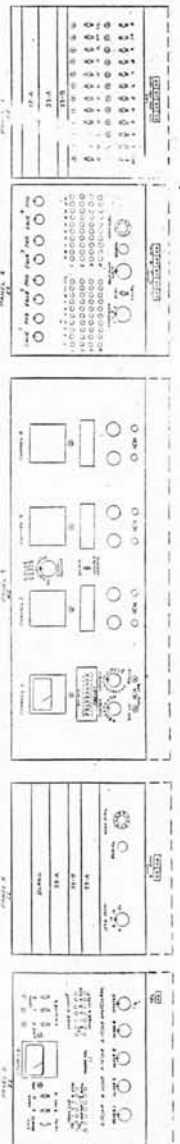


Fig. 21
BLOCK DIAGRAM
WIS



normally connected up with a line to Little Rock. This switch functions quite similarly to the one described in WGTC. By closing the left-hand switch of the three, the WREC program is fed through an RCA 83-C amplifier to the Little Rock line. By closing the middle switch, the CBS line is fed out to Little Rock. In this case WREC is acting as a repeater station for CBS. Pushing the third switch picks up the Little Rock line with an equalizer and takes it directly in to the remote inputs of any of the three 76-B consolettes. The level on this line coming in is sufficient so as not to require the gain of the 83-C line amplifier. The other net receiving switch is an exact duplicate of this one except the remote line terminates on a jack by means of which it can be patched to any line.

A feature of this layout is the picking up from various points

around the Peabody Hotel, in which the station's studios are located. This is done by means of the switches on the "Peabody Selector Panel." The output of these switches feeds through 85-C booster amplifiers, and then into the remote inputs of the consolette where they are handled as a remote. Lights over these three switches indicates which one is closed.

Another feature is the ring-down panel which is a "must" item for a station of this size. It is composed of four standard ring-down type relays, which operate on 20 cycle ringing current and when operated, light the lamp immediately over the switch and start a buzzer. Throwing the switch to the up position closes this relay, stops the buzzer and connects a telephone handset directly to the line. If it is desired to ring out on any of these lines, the switch associated with that line is thrown to the ring position,

which connects to the 20 cycle ringing current and feeds it out on the line.

The monitoring system of this station picks up a number of points in addition to the output of the three consolettes. One is on the CBS net, another is the Little Rock line, one is the spare net reversal switch line, and four others are radio sets which monitor the other stations in Memphis. These lines are carried around through the various offices and appear on monitor selector switches. These switches are of the interlock, pushkey type, and are located in small boxes mounted on the top of the various monitor speakers. Also located on these same boxes are volume controls and an AC switch with a pilot light that controls the monitor amplifier for that speaker. The same monitor busses run to a selector switch in the recording room from which are made his recordings. The selector switch

Fig. 22. WIRE control room.



is mounted on the recording control panel.

On this panel are also located a vu meter and a volume control which governs the recording level. The right hand side of this panel has a recorder selector switch that performs the same function as the one described above for WGTC. The neutral position of this switch also puts both recorders on the recording amplifier. It is true that in this position there is a mis-match and a reduction of recording level, but nothing is lost in the recorded program.

Fig. 18 shows an installation having four studios and three outgoing channels. Like the two previous systems that were described, this station which is WOV in New York City, has the 76-B consolettes for studio control. The output of each consolette feeds directly into the bank of relays located in the center of the diagram. This system of switching is that shown in Fig. 5D and requires a number of relays equal to the product of studio inputs times channel outputs, which in this case makes 15 relays (4 studios plus one spare input times 3 channels). Control for these relays is accomplished from the switching consoles of which there are four, one console being associated with each of the four 76-B's. A picture of one of these consoles is shown in Fig. 5.

If it is desired to put Studio A on Channel 1, the "A" ON button associated with the Channel 1 group of buttons is pushed. That pulls up the relay which takes the output of the studio and feeds it out to Channel 1. With this circuit, it is impossible to operate any of the remaining relays associated with this channel. This allows only one studio to be a channel at a time. However, it is possible to push the "on" button for Studio A in Channel 2 group and/or in the Channel 3 group, and put this same studio on Channel 2 and Channel 3 simultaneously. To take a studio off the channel it is only necessary to push the proper "off" button. The lights and turn-keys located at the bottom of this console are merely reminders for the operator, indicating the switch or switches he is to push at the pro-

gram change period. These are set up during the previous program while there is sufficient time to check with the log sheet. They are in no way interlocked with the relays. The studio that is put on a channel from one switching console can be taken off at any of the other three consoles. This system has no locking-in feature associated with any one console.

The output from the relays feeds into 83-C amplifiers that have bridging inputs. This allows more than one channel to bridge across a studio line at the same time. The outputs of the 83-C amplifiers feed into the bridging networks shown in Fig. 1B. One output of each of these bridging pads connects to one of three outgoing lines, while the other outputs terminate in resistors through jacks, and can be used for any line desired.

The four VI meters indicated at the top of the diagram are those mounted on each of the four switching consoles. Selector switches on each VI meter allow it to be connected to any one of the three outgoing lines, thereby allowing an operator to check the level of any channel at any of the four operating positions.

Fig. 19 shows the larger type of studio installation where all studios are operated from a central control room. This station is WIRE of Indianapolis and is equipped with three studios which are operated from a master control room. The panel layout at the bottom of Fig. 19 shows the panels on their master control desk, as if they were laid out on a flat surface. Actually the panels are mounted on a semi-circular control desk as shown in the photograph of Fig. 20.

The first panel on the left is for Studio A. On this panel are located the mixers for the three microphones, one spare input, and the master gain control. Switches immediately over each mixer turn on that circuit. The switch over the master gain control is the line out switch. In the down position it takes the output of Studio A and feeds it into the master selector switches. In the up position, it takes the output of the studio and puts it on the audition busses. In this installation, the audition

busses are also the monitoring busses. These busses appear on each studio panel as well as in the various offices throughout the building. The switch on Studio A panel marked "CUE" and "TALKBACK" controls the input to the studio speaker. When in the "CUE" position, the studio speaker can be fed with any program appearing on the monitor busses. In the "TALKBACK" position, the input to the studio speaker is interlocked with the microphone switches. The monitor volume control shown on the right side of the panel controls the level of both the studio speaker and the control room speaker associated with Studio A. This same feature appears on the Studio B and Studio C panels.

Studio C, which is the announce and transcription studio, is controlled from the second panel from the left. The first mixer is for the announce microphone, the second is for the output of the two turntables, and the third is the spare input. A small announcer's console is located in Studio C. On it are mounted faders for the two turntables, a switch for headphone monitoring of the turntables not on the air, and a key for turning on the announce microphone. The usual procedure at this station is to use the turntable faders as a switch. In other words, when the turntable is on the air, the fader is advanced to the maximum position. To take that turntable off, the fader is returned to the zero position, and the other one is then advanced. The proper level from these two turntables is controlled by the one fader on the Studio C panel in the master control room.

The right-hand panel is for Studio B and is a duplicate of the one for Studio A.

The second panel from the right contains the ringdown circuits and three strips of double jacks. The ringdown circuits are a little different from the usual procedure in that an operator can talk and ring, feed cue, and receive program all on the same line. This system is shown in Fig. 10B.

The center panel contains the master switching. This is very similar to the switching as shown

and described on WOV, Fig. 5D, except interlock pushkeys are used instead of relay switching. This is possible in this instance since all three studios are located at one central point at which all the master switching can be done. The mechanical interlocking of the switches is such that any one studio can be put on any of the three outgoing channels, or any combination of the three studios can be put on the three outgoing channels. However, it is not possible to put more than one studio on the same channel at the same time. The outputs of the master switches feed into bridging transformers which allows the three channels to be placed on the one studio at the same time. Master gain controls follow the bridging transformers in the circuit and connect to the inputs of the 83-C line amplifiers. The outputs of these amplifiers feed into the recommended 6 db pad and then to the outgoing lines. Directly across the lines are connected 85-X bridging amplifiers that feed the monitor busses. The use of the isolation amplifier for this purpose prevents any possible disturbance in the monitoring system from causing trouble on the three outgoing program lines. There is also an 85-X amplifier across the incoming NBC and Mutual network lines.

One outstanding feature of this installation is the studio announce override switch. The purpose of this switch is to allow the master control operator to override either Studio A, Studio B, the two networks, or the remote lines with an announcement from Studio C. The operation of this arrangement is shown in an example as follows: Should it be desired to make a local station announcement on top of a network program (not breaking for station identification) without cutting off the network, the operator will use his override switch. Assuming the network program is coming in from NBC, through the 83-C amplifier, into the master switching, and out through Channel 1; to make the announcement, the operator closes Studio C's line switch. This connects the output of Studio C up to the master switching, but is dead-ended at

that point, since NBC master selector switch is closed. From this point of Studio C's line, feed is taken to the group of pushkeys that are titled "ANNOUNCE OVERRIDE SWITCH." Desiring to announce on top of the network, he will push the key engraved "NBC." That connects the Studio C line to a pad that bridges the Studio C output and matches into the gain control on the NBC circuit. Thus, to announce on top of NBC, all the operator does is to fade down NBC with his gain control, push the NBC button, and announce from Studio C. This mixes Studio C and the NBC line together. These bridging pads are shown variable in order to more easily regulate the level from Studio C to properly mix in with the NBC line. This same feature is used on the A and B studios, as well as the Mutual and remote lines. These controls are located inside the desk, and once adjusted, require no further attention. This feature is also useful when broadcasting a musical program from remote pickups, over which the master operator has no control. If the program is of such a nature that it can be placed in the background, it will give a better effect on the listener to announce over this music rather than cut it off short.

The last description is shown in Fig. 21 and is representative of the larger installations. This one is WLS, in Chicago. Here both individual studio controls as well as the one master control switching point are utilized.

As in previous layouts, this installation uses 76-B consolettes for studio control. The outputs of the studios feed directly into the master switching system. This master switching system is of the full relay preset type shown in Fig. 7C.

The outputs of the preset system feed in the normal way through bridging transformers, master gain controls, line amplifiers, and out into the bridging type pads which allow two-way feeds from each channel. Across the output of Channel 1, an 82-B amplifier is bridged and used for sound reinforcement in the large studio. Bridged across all four channels are 83-C amplifiers that

are used normally as isolation amplifiers feeding the monitor busses. Type 83-C amplifiers are used in this particular application for the dual purpose of isolation and spare line amplifiers. The normal gain settings of these amplifiers are such that they may be patched in the place of any of the four channel amplifiers without further adjustment. Bridging is accomplished by means of pads located ahead of these amplifiers. The 85-X isolation amplifiers are employed between the studio outputs and the monitoring busses.

The monitoring system is of the dial type, and employs automatic selector relays. Two dials are located on the master desk for control room monitoring of any programs. Dials are located at the monitoring speakers in the various offices throughout the building. This system of monitoring becomes more economical when there are a large number of inputs as well as a large number of listening stations. The cost of the dialing equipment, although high, offsets the cost of the many pairs of monitoring cable and installation necessary to take all the monitoring busses throughout the building. With this system it is only necessary to take one pair for the program and one pair for the control to each station.

The lower part of Fig. 21 shows the panels on the master desk. This first panel controls Studio E, which is the announce and turntable studio. It is, in effect, a duplicate of the 76-B circuit mounted on the desk. In addition to the features normally found in the 76-B, there are included on this panel three order wire ring-down circuits. The purpose of these is to enable the operator in Studio E to talk directly to any remote via the master control room desk.

The next panel contains jack strips. Through these jacks pass all important circuits of the system, and it is possible to patch around any of the channel circuits or studio circuits at the desk. This allows for rapid patching in case of a failure.

The second panel from the right contains interlock pushkeys arranged for the purpose of pick-

ing up any one of ten different remote lines and feeding them through four equalizer and amplifier circuits into the distributing switching which feeds any one of the ten studio inputs. The output of four rows of incoming line selector switches feeds through equalizers and amplifiers into four rows of distributing switches. If the remote that is on row 1 of the line selector switches is to be fed to Studio A, the A button on row 1 of the distributing switches is pushed, and that remote then feeds into the remote switches on "A"'s 76-B console. Likewise any remote on row 2, 3, or 4 may be sent to any of the studios up to Studio E, or master switching input from F to

K. This will allow the operator to have 10 remote lines normaled into these switches, and operate for a long period without going to the rack to change any remote patches.

The monitor selector switch shown on this panel selects the four channel monitor circuits and feeds into the control room loudspeaker directly without the use of the dial system. This will allow the master control room to monitor any of his programs in case of a failure in the dial system. Mounted on the rim of the desk are a number of jacks for head-phone monitoring of the four channels, dial system, and Studio E. Jacks are also provided here for the handset connection to the

ringdown panel.

The ringdowns are shown on the right-hand panel. There are 24 standard ringdown circuits, although they are broken up four ways, one group taking care of the 10 studio positions, one directly to the manager's office, one to the clients' booth, one to NBC, and the remaining for remote lines.

Tie lines are provided between the master racks and the master desk, as well as between individual racks. This allows a very flexible system of patching. Lights are provided on these tie lines to indicate at either end when one is in use.

Fig. 22 is a photograph of the WLS master control room installation.

DELUXE RECORDERS AT WFMJ

F. A. DIERINGER, Chief Engineer

THE WFMJ Recording Studio is equipped with two RCA DeLuxe Recorders. Diameter equalizers and an orthocoustic filter are also provided as well as a suction pump for shaving removal. A 94-D amplifier is used to feed the high-fidelity cutter heads.

Recordings of excellent quality and extremely low noise level are made regularly. The various mechanical features make possible a professional type recording of any pitch, with inside or outside start and at either of the two standard speeds.

We have used the recordings

for delayed network broadcasts such as the British Refugee Children telephone conversations with their parents in England, the foreign policy program, Between the Bookends and various special programs which could not have been broadcast by us because of previous commitments had it not been for the RCA recorders. We have also been able to arrange more convenient work schedules for those performers who conduct seven-day-a-week feature programs, thus permitting a normal work week by recording some programs in advance.

Many enthusiastic comments have been received on the excellent recorded quality and low noise level. Also our operating costs were reduced due to a big decrease in stylus breakage and a consequent reduction in disc wastage. The precision lowering device provided on the DeLuxe recorder for lowering the stylus to the disc has accounted largely for this improvement.

The ease and speed with which these recorders can be adjusted to any standard pitch and turntable speed is valuable to us since we have been called on to make quite a variety of recordings.

