THE WESTINGHOUSE 10 KW

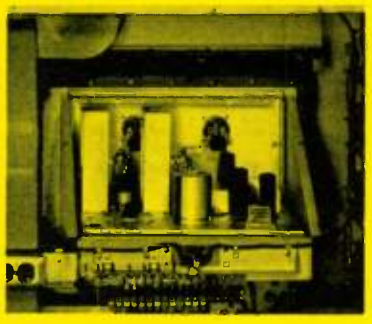
fm

TRANSMITTER

YOU HELPED DESIGN THIS TRANSMITTER FROM THE GROUND UP . . .

This new Westinghouse 10 kw transmitter utilizes many suggestions proposed by engineers in a recent independent survey of 162 FM applicants and engineers in 56 cities.

These suggestions covered everything from colors of the transmitter to tube visibility and interior parts layout. Combined with the working knowledge Westinghouse engineers have gained in operating five FM stations — a background unmatched by any other manufacturer — these ideas bring new advantages to modern transmitter operation.

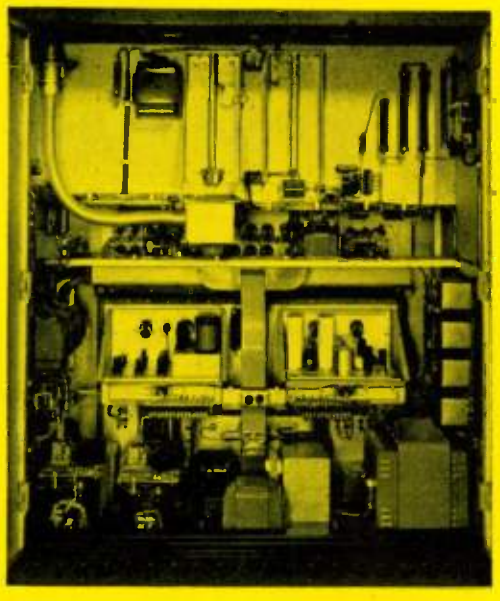


EXAMPLE:

The Frequency Modulated Oscillator, Low Power Driver and the Frequency Control Unit are mounted on standard relay rack chassis equipped with plug-in connectors for quick removal.

EXAMPLE:

Large windows in rear doors permit quick visual inspection of interior.



EXAMPLE:

Vertical open arrangement makes rear compartments easy to inspect and service.

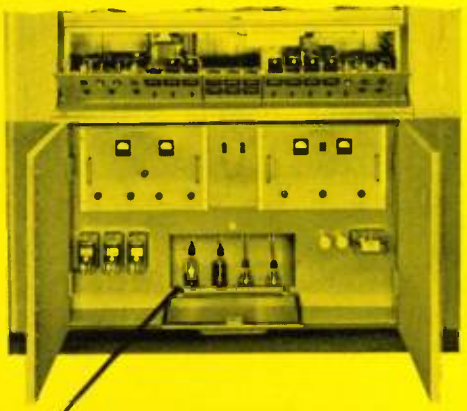
EXAMPLE:

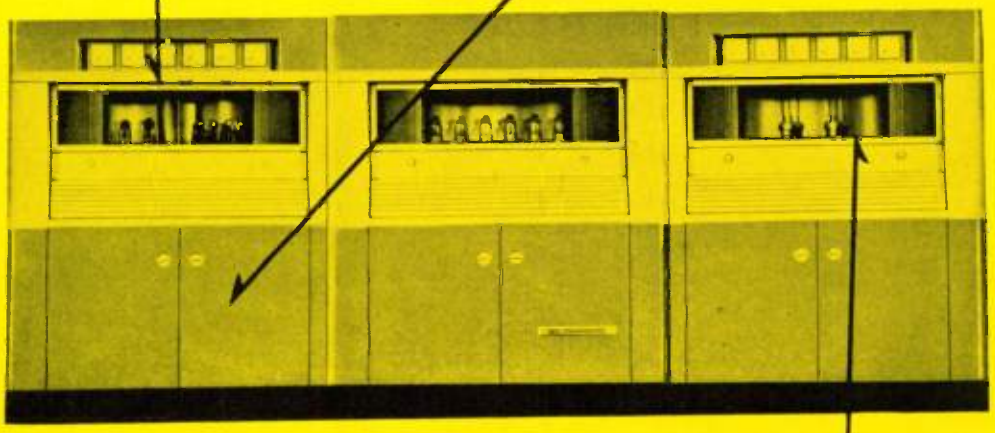
Supervisory control detects and locates outages instantly.

How well these new designs outstrip other types is shown by the comparative table on page 7 . . . only Westinghouse gives you *all* the advantages of improved transmitter operation.

New 270° easy-to-read meters are at eye level.

All doors, panels and windows opening to live circuits are equipped with interlocks and grounding switches.





Driver

High-voltage rectifier

R.F. power amplifier

Front view of 3-cubicle 10 kw FM transmitter. If "in-line" layout is undesirable, rectifier cubicle may be placed elsewhere. Subbase can be omitted, but it contributes to easier installation and alignment and inter-cubicle wiring can be handled through conduit within subbase. If rectifier cubicle is mounted away from exciter and power amplifier, subbase is not used.

Centrally-located control panels are easily accessible on all three cubicles.

THE 10 KW TRANSMITTER COMBINES ADVANCED CIRCUIT DEVELOPMENTS AND SOUND MECHANICAL DESIGN

The complete transmitter is enclosed in three heavy-gauge, sheet-aluminum cubicles that form an integrated, unified design when assembled. The left cubicle is the 3 kw FM transmitter, acting as a driver; center cubicle is the high-voltage rectifier and right cubicle is r.f. power amplifier.

Only five external wiring connections are needed to put the transmitter into operation:

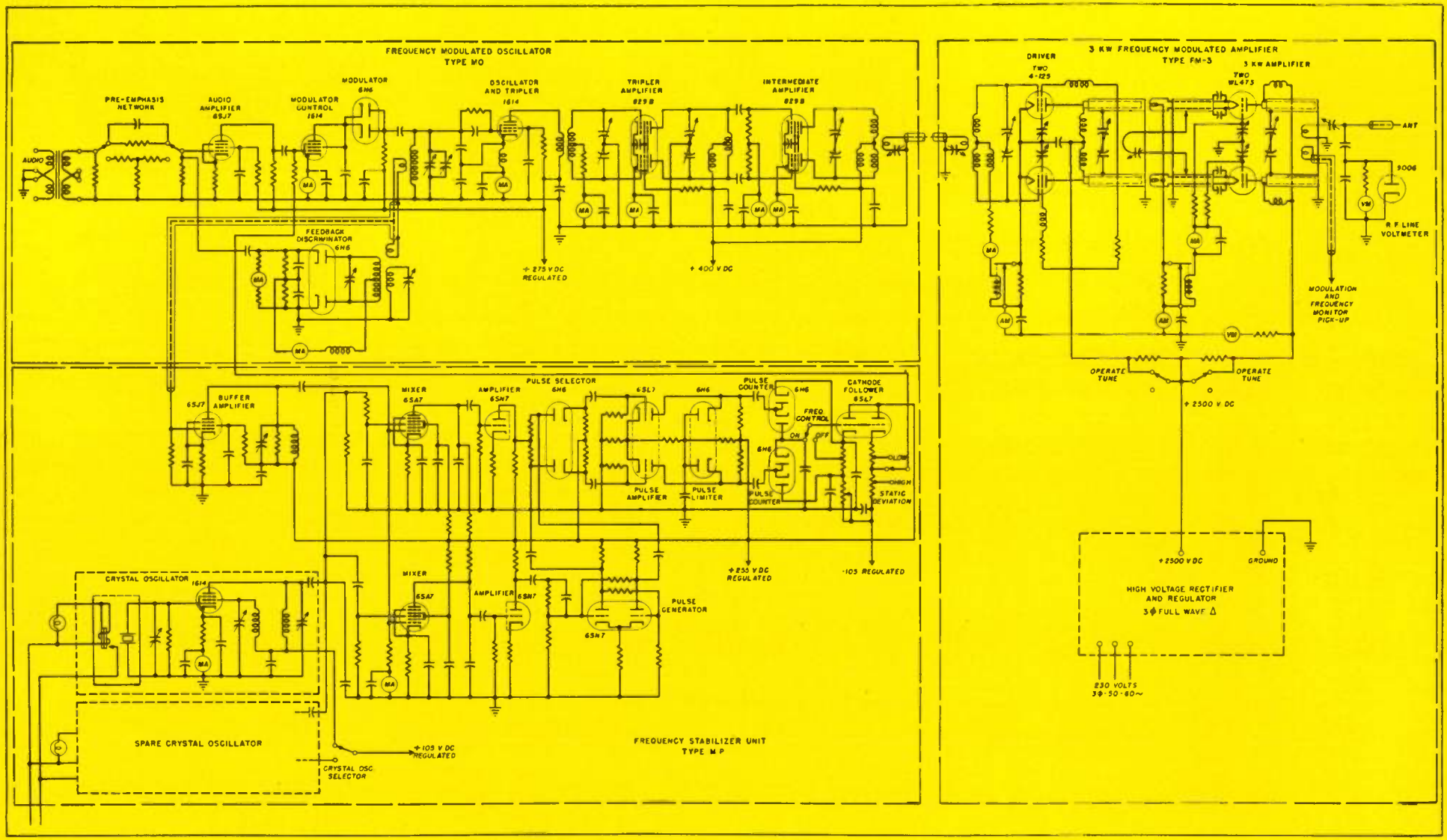
1. 208-240 volt, 3-phase power input.
2. 115-volt, a-c, power input for crystal heaters.
3. r.f. output for connecting modulation monitor and frequency meter.
4. program input.
5. coaxial line to antenna.

All doors opening to parts at dangerous potentials are interlocked for the protection of maintenance personnel. Glass panels in rear doors make inspection of interior easy while transmitter is in operation. The second intermediate amplifier and driver tubes, the intermediate voltage rectifier tubes and the high-voltage rectifier and power amplifier tubes are all visible through safety glass panels in the front of their respective cubicles.

The Type MO Frequency Modulated Oscillator and the Type MP Frequency Stabilizer Unit contain the low-power exciter stages and frequency stabilizing circuits respectively. These plug-in units may be removed easily from their position in the left cubicle.

12 PLUS FEATURES IN THE WESTINGHOUSE 10 KW FM TRANSMITTER

1. Direct generation of frequency modulation.
2. Crystal-derived, center-frequency stablization, independent of circuit tuning.
3. Transformer life practically unlimited; high-temperature Class "B" insulation — impervious to humidity and "aging".
4. Complete fuseless overload protection.
5. Automatic sequence starting.
6. WL-479-R tetrode-type tubes in the 10 kw power amplifier.
7. Supervisory control for immediate outage location.
8. Aluminum cubicles — light weight and better electrical shielding.
9. Easy maintenance — open vertical arrangement of components; large inspection windows in rear.
10. Tubes and components operate well below peak rating to insure long life.
11. Easily adapted for higher power by adding amplifier units.
12. One instrument for each key circuit; no instrument switching.



SCHEMATIC DIAGRAM, 10 KW FM DRIVER

HERE ARE THE IMPORTANT ELECTRICAL AND MECHANICAL SPECIFICATIONS . . .

ELECTRICAL SPECIFICATIONS

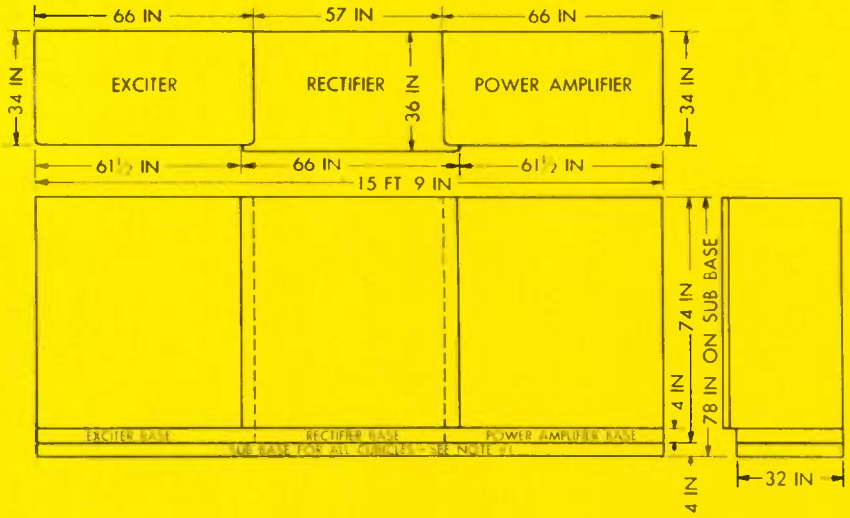
Carrier power output (nominal)	10,000 watts.
Carrier frequency (single specified frequency)	88 to 108 mc.
Frequency stability	Better than ±1,000 cps.
Output line impedance	51.5 ohm line in accordance with R.M.A. standards.
Modulation capability	±100 kc.
Audio frequency response (30 to 15,000 cycles)	Without pre-emphasis, ±1 db from response at 1,000 cycles; with pre-emphasis, ±1 db from 75 microsecond curve.
Audio input for ±75 kc carrier swing	+ 10 dbm at 400 cycles.
Audio input impedance	600/150 ohms.
Harmonic distortion (including all harmonics up to 30 kc at ± 75 kc swing)	Less than 1.0% rms for modulating frequencies between 100 and 7,500 cps. Less than 1.5% rms for frequencies between 50 and 100 cycles and between 7,500 and 15,000 cycles.
FM noise level	At least 65 db below ± 75 kc swing.
AM noise level	At least 50 db below 100% AM modulation.
Power supply	208-240 volts, 50 or 60 cycles, 3-phase; 115 volts, 50/60-cycle, single-phase for crystal heaters.
Power input	31 kw at 90% power factor for full output.

TUBE COMPLEMENT

Type MO Frequency Modulated Oscillator	
Audio amplifier	1 Type 6SJ7
Modulator control	1 Type 1614
Modulator	1 Type 6H6
Feedback discriminator	1 Type 6H6
FM oscillator/tripler	1 Type 1614
Tripler	1 Type 829B
Intermediate amplifier	1 Type 829B
Type MP Frequency Stabilizer	
Buffer amplifier	1 Type 6SJ7
No. 1 crystal oscillator	1 Type 1614
No. 2 crystal oscillator	1 Type 1614
No. 1 mixer	1 Type 6SA7
No. 2 mixer	1 Type 6SA7
Amplifier	1 Type 6SN7
Pulse generator	1 Type 6SN7
Pulse discriminator	1 Type 6H6
Pulse amplifier/limiter	1 Type 6SL7
Pulse limiter	1 Type 6H6
Balanced pulse counter	2 Type 6H6
Cathode follower	1 Type 6SL7
Voltage regulator	1 Type OD3/VR150 1 Type OC3/VR105
Bias rectifier	1 Type 6X5
Bias regulator	1 Type OC3/VR105
Low-voltage regulator	
Regulator	2 Type 6Y6G
Regulator control	1 Type 6SJ7
Control bias	1 Type OC2/VR105
Low-voltage rectifier	2 Type 866A
Intermediate voltage rectifier	6 Type 872A
Intermediate amplifier	2 Type 4-250
Driver amplifier	2 Type WL-473
R.F. voltmeter rectifier	1 Type 9006
Power amplifier bias rectifier	2 Type 5U4-G
High-voltage rectifier	6 Type 575
10 kw power amplifier	2 Type WL-479

MECHANICAL SPECIFICATIONS

Total over-all dimensions	189″ wide, 36″ deep, 78″ high
Side cubicle dimensions	66″ wide, 34″ deep, 74″ high
Central cubicle dimensions	66″ wide, 36″ deep, 74″ high (overlaps and cubicles)
Weight of exciter cubicle	Approximately 1,900 lbs.
Weight of power amplifier cubicle	Approximately 1,900 lbs.
Weight of high-voltage rectifier cubicle	Approximately 2,700 lbs.



✓ CHECK THIS LIST OF COMPARATIVE FEATURES

	FEATURE	MANUFACTURER W	A	B	C
1	Three-cubicle transmitter	✓			✓
2	No critically tuned band-pass circuits used	✓		✓	
3	No special test instruments required for tuning	✓			
4	Nonmicrophonic, diode-type tube modulation	✓			
5	5 R. F. stages or less	✓			
6	High-temperature (class "B" insulation) transformers (open dry-type throughout)	✓			
7	Only 2 stages of frequency multiplication	✓			
8	Frequency multiplication only 9 times or less	✓			
9	Frequency controlled without the use of dividers or locked oscillators	✓	✓		✓
10	Supervisory control system	✓	*		

* Manufacturer's data not available at time of this printing.

WESTINGHOUSE SUPPLIES OTHER EQUIPMENT YOU WANT

Westinghouse antennas and r.f. transmission lines are available, too. Westinghouse 10 kw FM transmitters operate into any suitable combination (R.M.A. approved) of r.f. transmission line and antenna within the 88-108 mc band.

Antennas are horizontally-polarized and can be supplied to fulfill the varying requirements of gain. The transmission line is coaxial pressurized type with solderless couplings. FCC required frequency and modulation monitors are also available.

. . . AND HELP IN APPLICATIONS

Westinghouse engineering and sales offices are ready to help you and your consulting engineer file your FM application by supplying information you need to complete it.

WESTINGHOUSE GIVES YOU THIS UNMATCHED BACKGROUND IN RADIO ENGINEERING AND OPERATION

The Westinghouse engineers who developed a host of important "firsts" in AM transmitter design have a total operating experience in FM of 23 years.

How well this background helps us design transmitters is shown by some of these exclusive Westinghouse "firsts" . . . metal rectifiers; unit cubicle construction; spare rectifier tube available by pushbutton operation; individual regulator for power amplifier plate volts; Fosterite insulation; supervisory control; Hipersil cores for transformers and reactors; multiple terminal connection to facilitate console operation.

For more information — or for help on any FM transmission problem — write, wire or phone your nearest Westinghouse office today.

WESTINGHOUSE HAS THIS OPERATING EXPERIENCE		
1.	KYW-FM (100.3 mc) has been operating for	4 years
2.	KDKA-FM (94.1 mc) has been operating for	4 years
3.	WOWO-FM (95.9 mc) has been operating for	4 years
4.	WBZ-FM (100.7 mc) has been operating for	5 years
5.	WBZA-FM (97.1 mc) has been operating for	6 years
	Total Westinghouse FM operating experience	23 years

Westinghouse

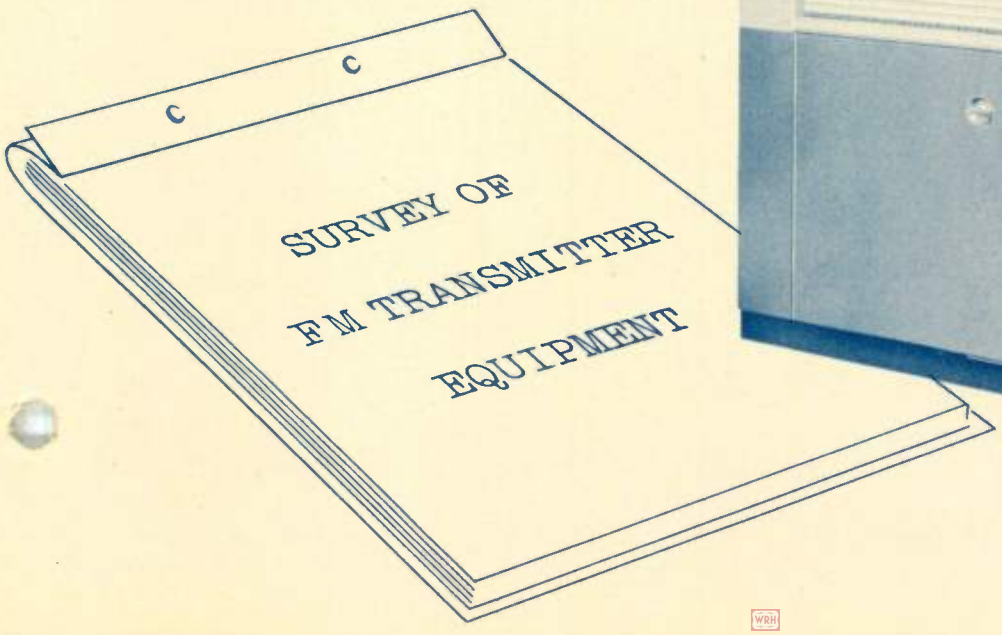
Electronics at Work

WESTINGHOUSE ELECTRIC CORPORATION
INDUSTRIAL ELECTRONICS DIVISION
3601 WASHINGTON BOULEVARD · BALTIMORE, MARYLAND

B-3850-A
WRH 7½M 12-46
Printed in U.S.A.

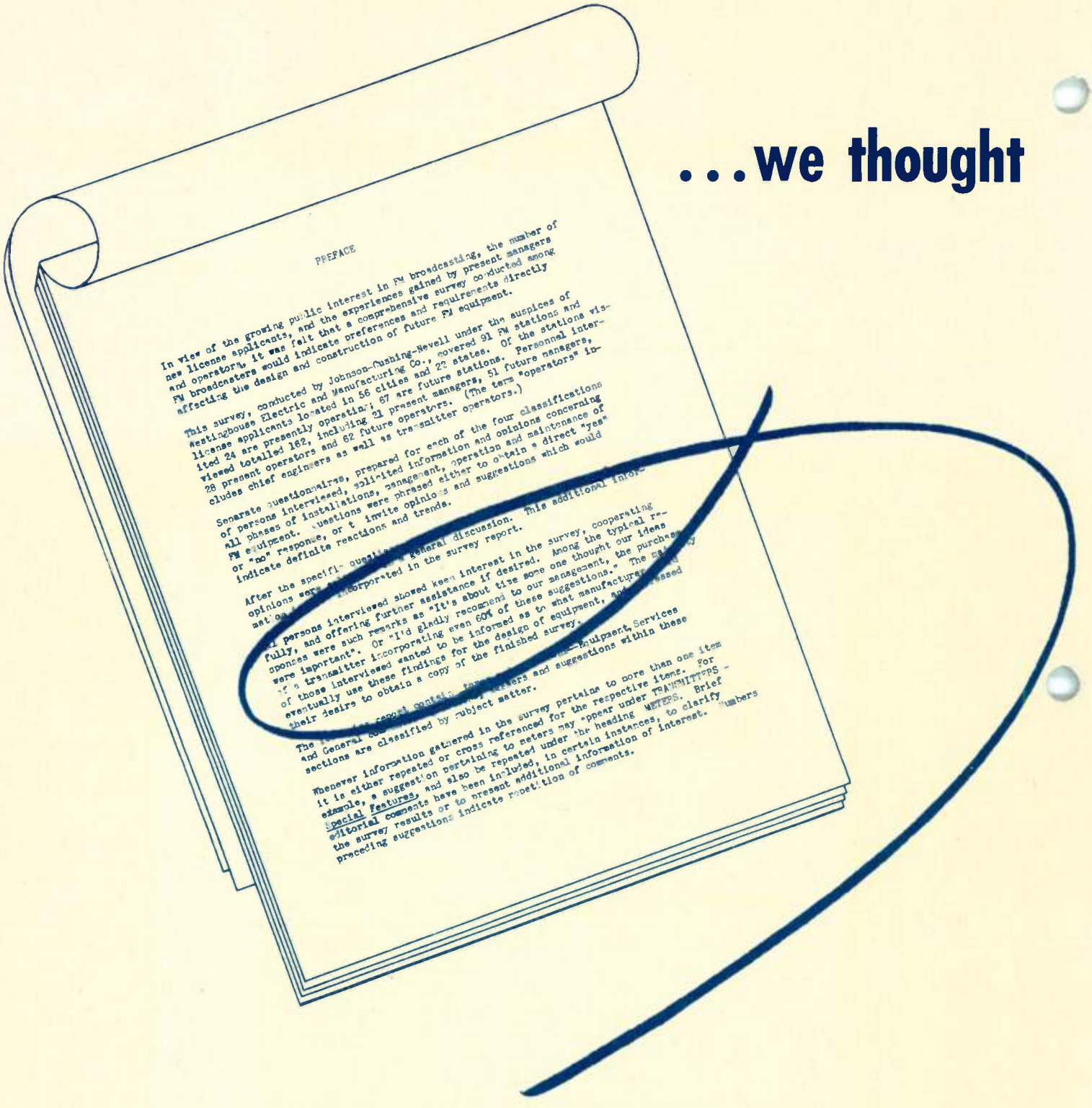
THE OPERATOR'S fm TRANSMITTER

designed by you



WESTINGHOUSE

...we thought



PREFACE

In view of the growing public interest in FM broadcasting, the number of new license applicants, and the experiences gained by present managers and operators, it was felt that a comprehensive survey conducted among FM broadcasters would indicate preferences and requirements directly affecting the design and construction of future FM equipment.

This survey, conducted by Johnson-Gushing-Nevell under the auspices of Westinghouse Electric and Manufacturing Co., covered 91 FM stations and license applicants located in 56 cities and 22 states. Of the stations visited 24 are presently operating; 67 are future stations. Personnel interviewed totalled 162, including 21 present managers, 51 future managers, 28 present operators and 62 future operators. (The term "operators" includes chief engineers as well as transmitter operators.)

Separate questionnaires, prepared for each of the four classifications of persons interviewed, solicited information and opinions concerning all phases of installations, management, operation and maintenance of FM equipment. Questions were phrased either to obtain a direct "yes" or "no" response, or to invite opinions and suggestions which would indicate definite reactions and trends.

After the specific questions were completed, general discussion. This additional information was incorporated in the survey report.

All persons interviewed showed keen interest in the survey, cooperating fully, and offering further assistance if desired. Among the typical responses were such remarks as "It's about time some one thought our ideas were important". Or "I'd gladly recommend to our management, the purchase of a transmitter incorporating even 60% of these suggestions." The majority of those interviewed wanted to be informed as to what manufacturers based eventually use these findings for the design of equipment, and expressed their desire to obtain a copy of the finished survey.

The [illegible] and General Electronic Equipment Services sections are classified by subject matter.

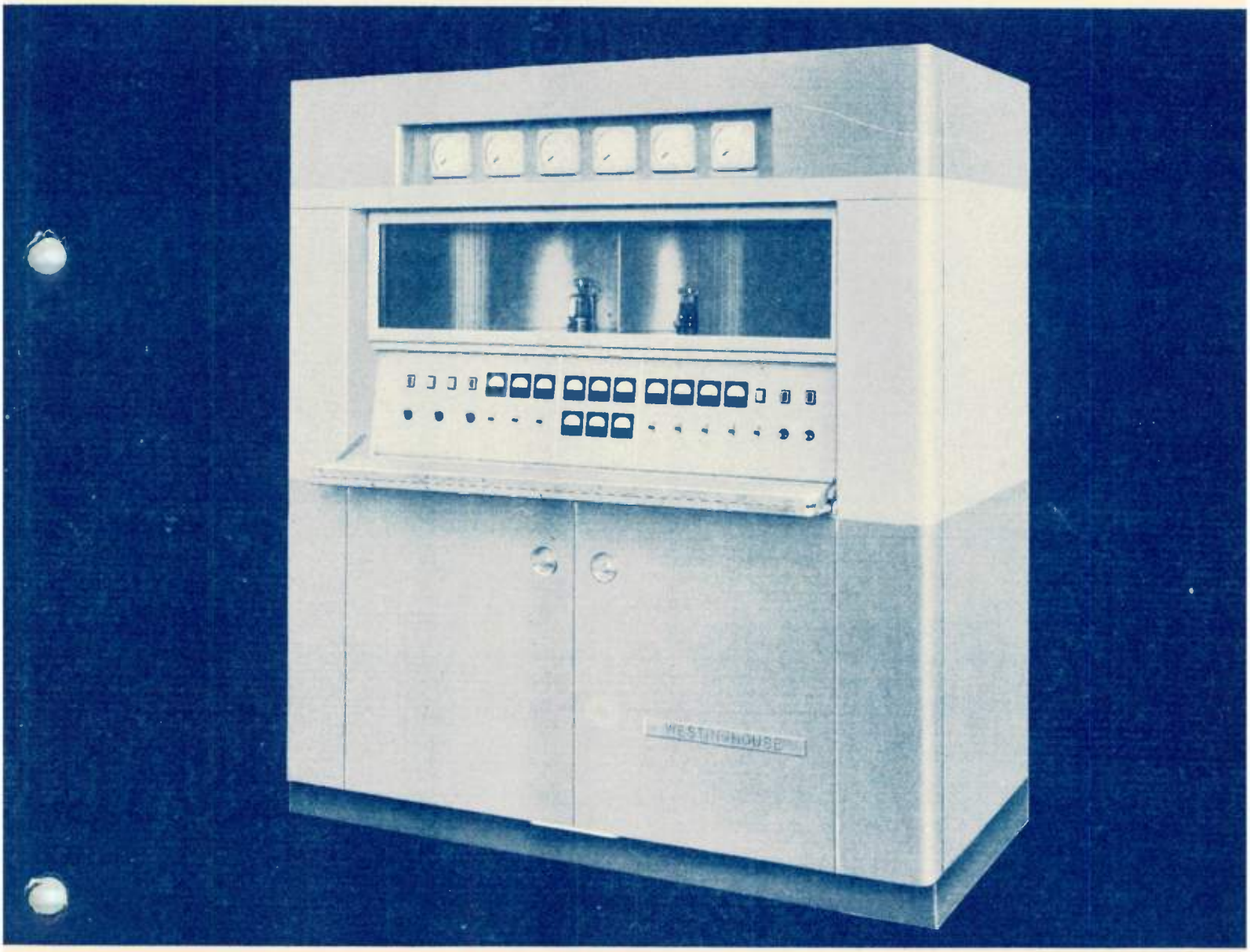
Whenever information gathered in the survey pertains to more than one item it is either repeated or cross referenced for the respective items. For example, a suggestion pertaining to meters may appear under TRANSMITTERS - Special Features, and also be repeated under the heading METERS. Brief editorial comments have been included, in certain instances, to clarify the survey results or to present additional information of interest. Numbers preceding suggestions indicate repetition of comments.

"It's about time someone thought our ideas were important."

they were so important we put them to work

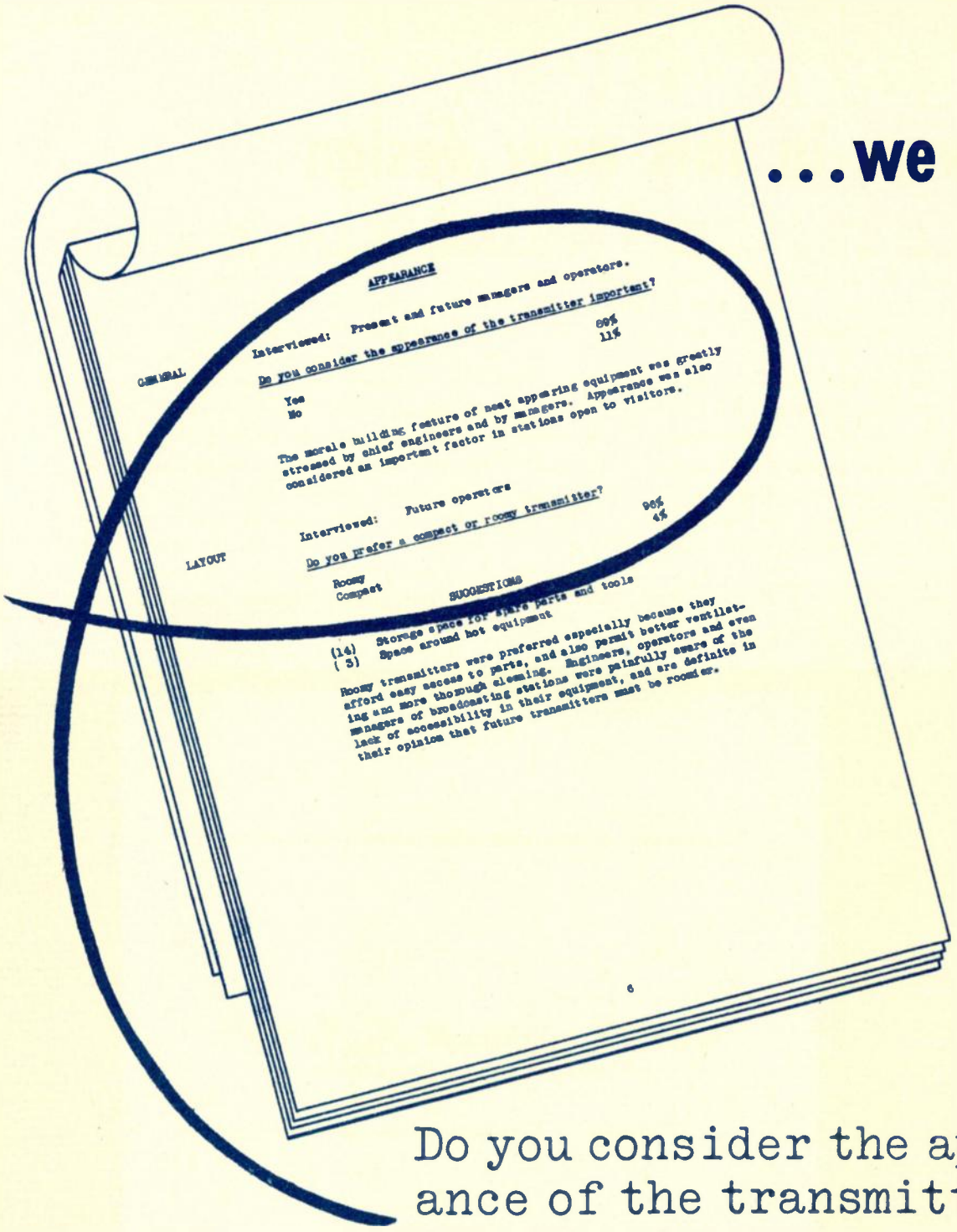
And the result of this extensive survey—162 station managers and operators in 56 cities—is the new 1 and 3-kw FM transmitters by Westinghouse. It's actually an *operator's* transmitter, for its smart styling and advanced design are the products of the ideas of two classes of operators... the ones we interviewed (through an independent, national survey organization) and the Westinghouse engineers who have the actual operating experience of five Westinghouse FM stations.

How well this combination has worked is shown in this booklet . . . photographic evidence of new *operating* ideas in transmitter design.



Centrally-located control panel is easily accessible through door that folds out of the way. Control panel includes power switches; electrically-driven tuning controls and their position indicating instruments; 6 meters in center panel associated with low power stages; controls for continuously variable line voltage and P.A. plate voltage and indicator lights

...we wrapped up



APPEARANCE

Interviewed: Present and future managers and operators.

Do you consider the appearance of the transmitter important?

89%
11%

Yes
No

The morale building feature of neat appearing equipment was greatly stressed by chief engineers and by managers. Appearance was also considered an important factor in stations open to visitors.

GENERAL

Interviewed: Future operators

Do you prefer a compact or roomy transmitter?

96%
4%

LAYOUT

Roomy
Compact

SUGGESTIONS

(14) Storage space for spare parts and tools
(3) Space around hot equipment

Roomy transmitters were preferred especially because they afford easy access to parts, and also permit better ventilating and more thorough cleaning. Engineers, operators and even managers of broadcasting stations were painfully aware of the lack of accessibility in their equipment, and are definite in their opinion that future transmitters must be roomier.

6

Do you consider the appearance of the transmitter important?

Yes . . . 89%
No 11%

Do you prefer a compact or roomy transmitter?

Roomy . . 96%
Compact . . 4%

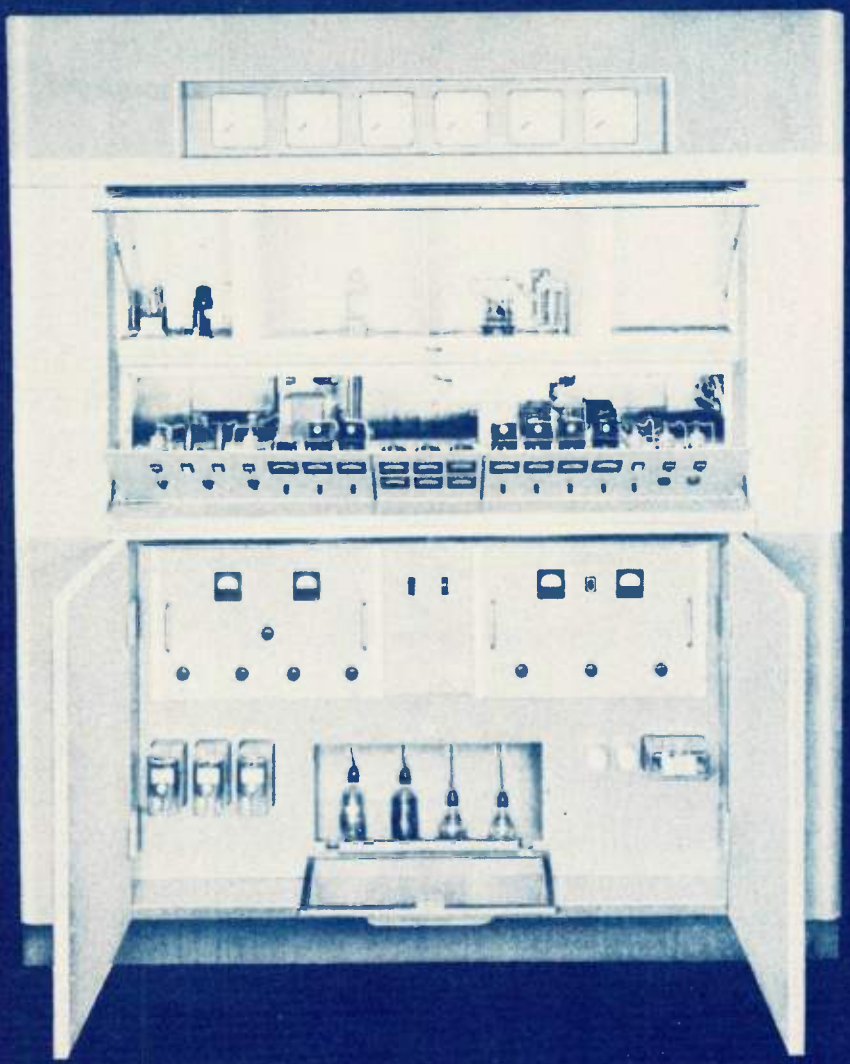
both answers in this new design

This smartly-styled transmitter (in two-tone blue and grey) has an important aid to operators: complete, fast and easy accessibility for servicing. This is so important it gained nearly unanimous opinion in the survey. (See opposite page.)

This new help shows up in many ways: you can reach all tubes quickly from easily-opened front panels (see photograph above); high-voltage rectifier tubes can be checked visually any time through the glass panels; frequency modulated master oscillator unit and the frequency control unit are built on standard relay rack chassis and equipped with plug-in connectors to allow easy removal.

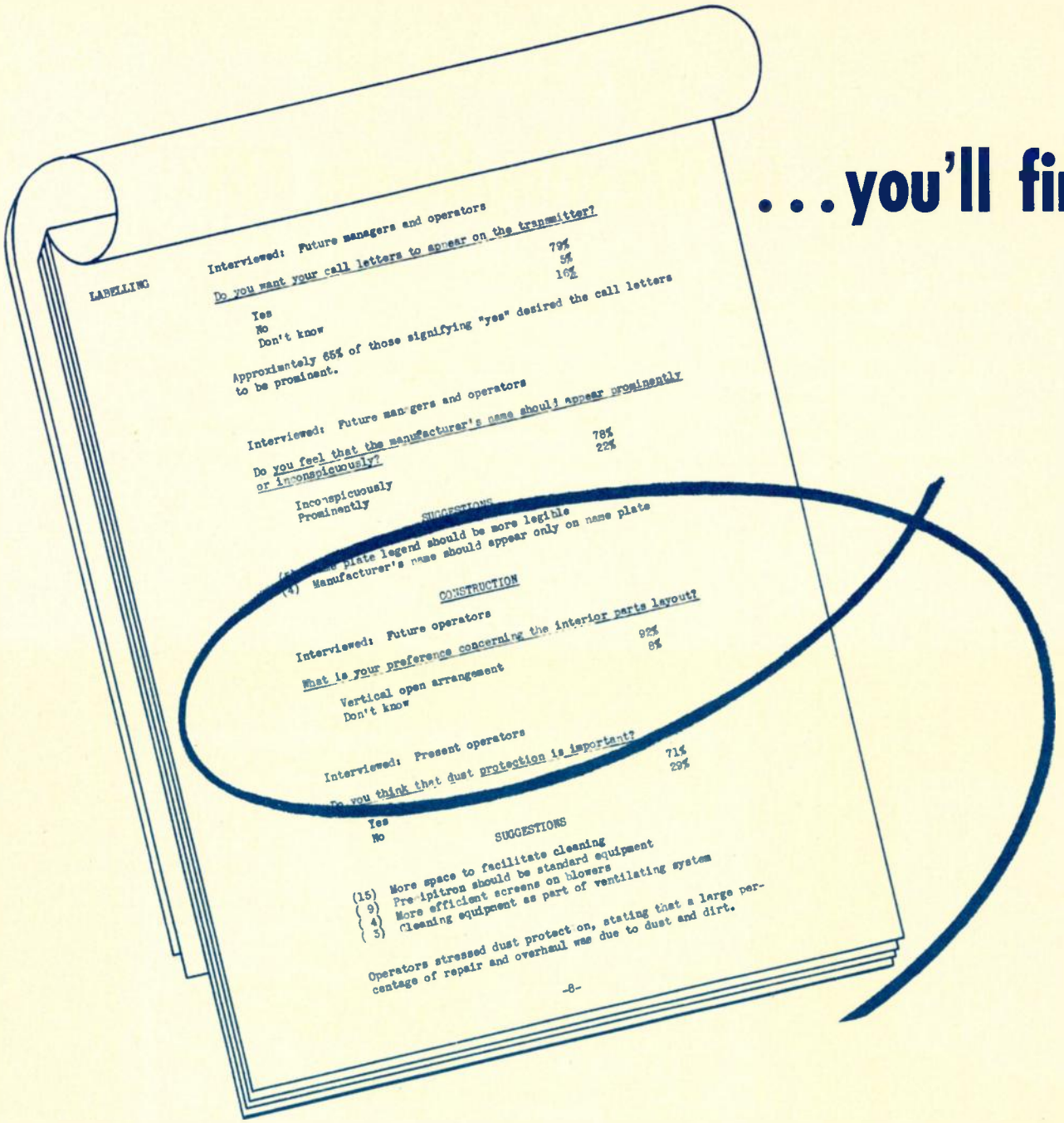
The entire design highlights easy access and plenty of working space. From top to bottom (see photograph) on the front panels are: (1) a hinged window that lifts up and locks in open position, makes it easy to service low-voltage regulator, driver and power amplifier tubes; (2) control-panel door which folds out of the way; and hinged panel comes forward to permit inspection and cleaning; (3) two lower doors open to removable frequency modulated master oscillator and frequency control units, power switches and relays.

Operators have long been painfully aware of poor transmitter designs that created blind corners and cramped working quarters. Here, then, is the solution in a transmitter that gives you what you asked for.



All doors, panels and windows opening to live circuits are equipped with interlocks and grounding switches. Lightweight aluminum cubicle provides excellent shielding at 100 mc. In lower section of cubicle are plug-in frequency modulated master oscillator and frequency control units, low-voltage rectifier tubes and high-voltage rectifier tubes. Relays from left to right are: 250, 400 and 2000-volt overload protection; bias protection for r.f. driver and P.A. tubes, and time delay relay to protect mercury vapor rectifier tubes. All overload protection is fuseless.

. . . you'll find this



LABELLING

Interviewed: Future managers and operators

Do you want your call letters to appear on the transmitter?

Yes	79%
No	5%
Don't know	16%

Approximately 65% of those signifying "yes" desired the call letters to be prominent.

Interviewed: Future managers and operators

Do you feel that the manufacturer's name should appear prominently or inconspicuously?

Inconspicuously	78%
Prominently	22%

SUGGESTIONS

(4) Manufacturer's name should appear only on name plate

CONSTRUCTION

Interviewed: Future operators

What is your preference concerning the interior parts layout?

Vertical open arrangement	92%
Don't know	8%

Interviewed: Present operators

Do you think that dust protection is important?

Yes	71%
No	29%

SUGGESTIONS

(15) More space to facilitate cleaning
(9) Precipitron should be standard equipment
(4) More efficient screens on blowers
(3) Cleaning equipment as part of ventilating system

Operators stressed dust protect on, stating that a large percentage of repair and overhaul was due to dust and dirt.

-8-

What is your preference concerning the interior parts layout?

Vertical open arrangement 92%
Don't know . . 8%

. . . and more . . . in Westinghouse FM

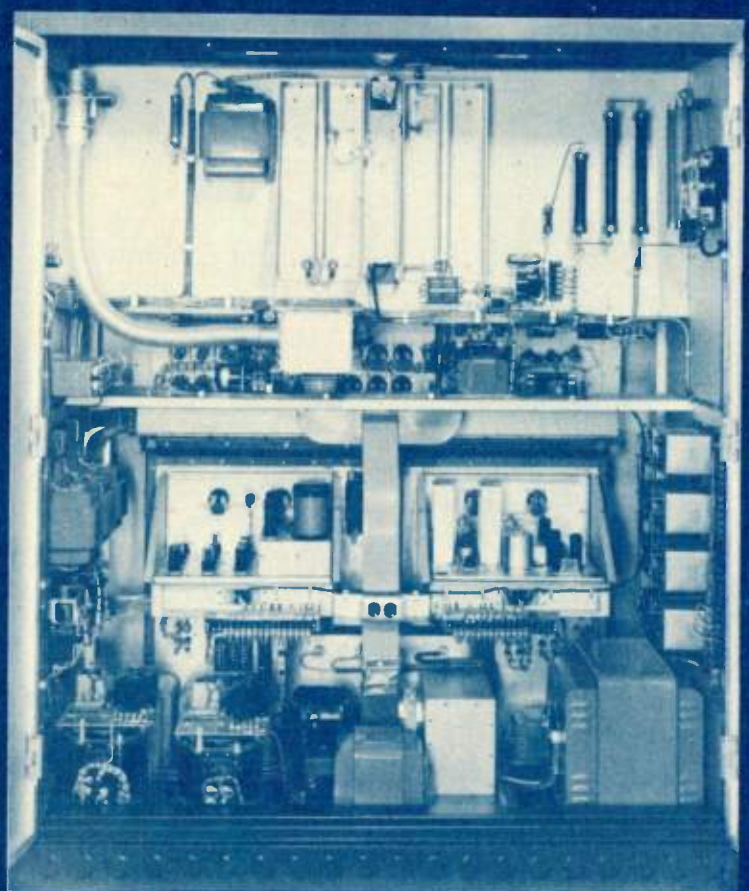
The vertical arrangement already described for the front of Westinghouse transmitters follows through in the easily-serviced rear compartments.

You can see many of these features in the photograph above. In the lower left corner are two motor-driven voltage regulators and immediately to their right is the blower motor and air duct. Dust-tight covers are provided for the plug-in units; and note the two complete crystal oscillator circuits and their plug-in crystals.

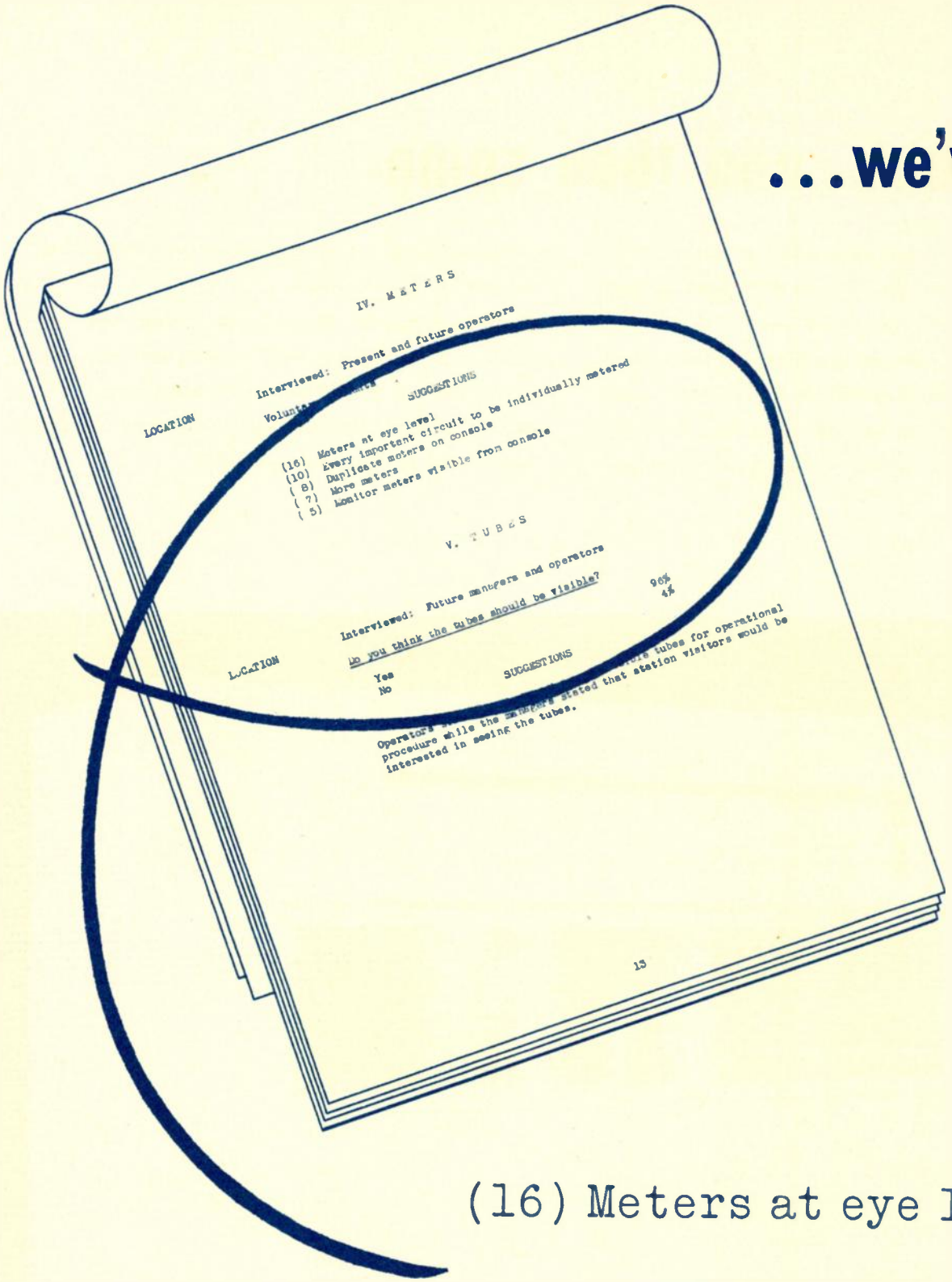
On the upper panel, from right to left, are the r.f. driver, concentric line-type tank circuit, variable coupling loop and P.A. concentric cathode line.

The inside story of new advantages in Westinghouse FM transmitters is backed by even more features that operators want.

Large windows in rear doors permit inspection of interior. Output transmission line (flexible) can be seen through left-hand window and in view at right. Note the convenient power outlet; and lamp for lighting mounted at top of cubicle.



...we've done



IV. M A T E R S

Interviewed: Present and future operators

LOCATION Volunt... SUGGESTIONS

(16) Meters at eye level
(10) Every important circuit to be individually metered
(8) Duplicate meters on console
(7) More meters
(5) Monitor meters visible from console

V. T U B E S

Interviewed: Future managers and operators

Do you think the tubes should be visible? 96% 4%

LOCATION SUGGESTIONS

Yes
No

Operators ... tubes for operational procedure while the managers stated that station visitors would be interested in seeing the tubes.

13

(16) Meters at eye level

Do you think the tubes should be visible?

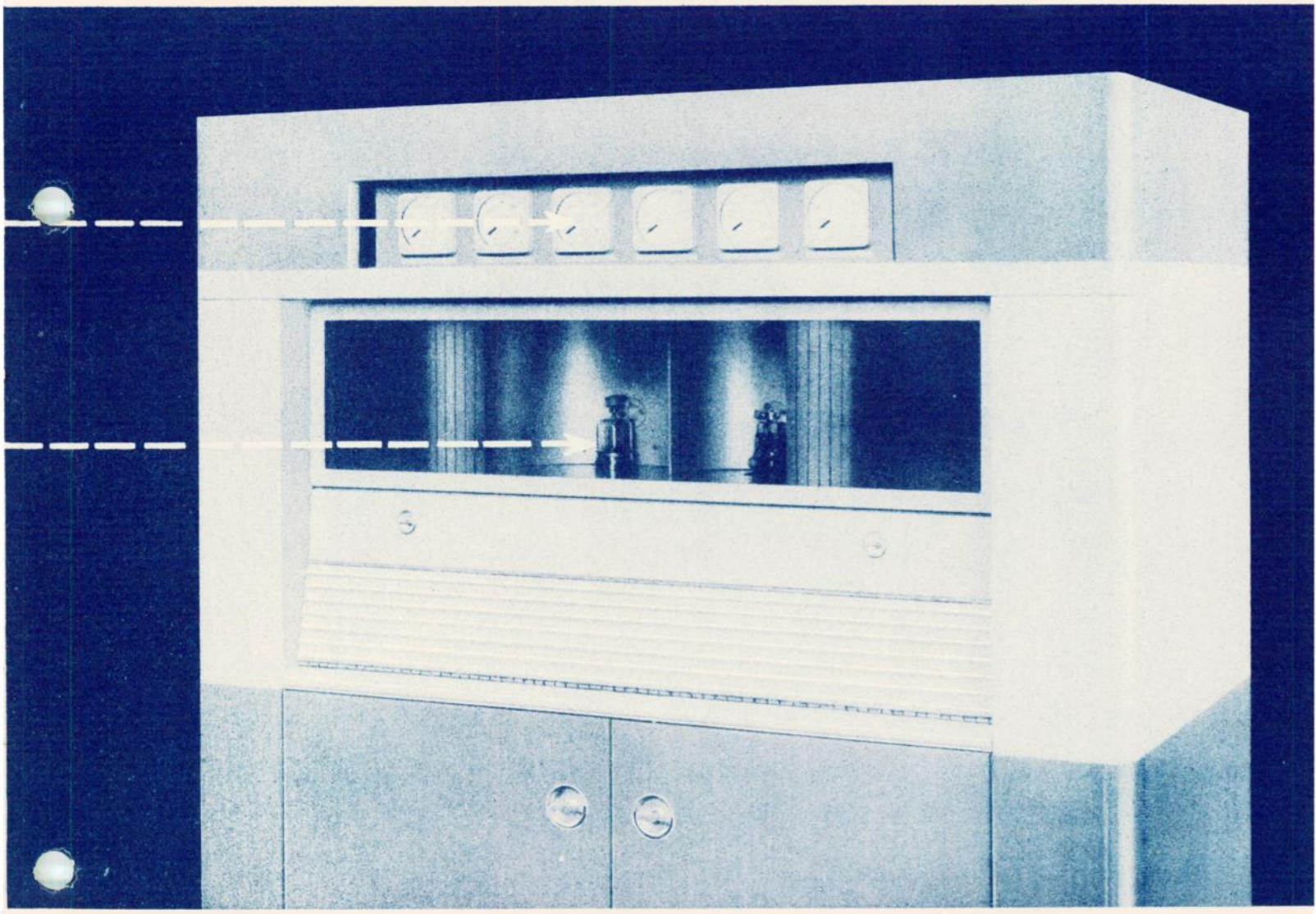
Yes . . . 96%
No 4%

. . . both . . . and then some

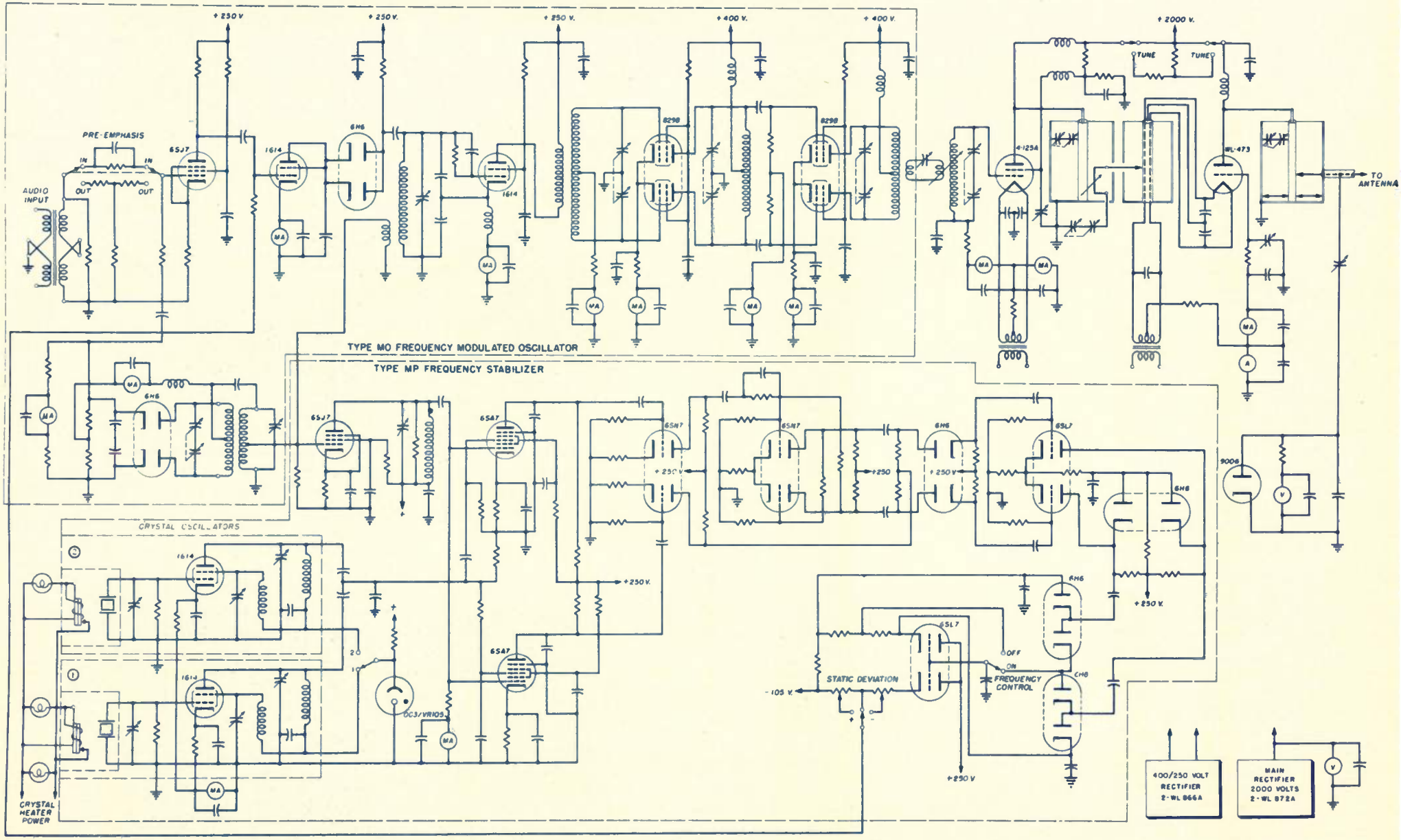
These seemingly minor items rated special attention by operators, as well they should. And Westinghouse incorporated both in the new designs.

But making the job easy is a keynote of the entire construction of these transmitters. To place the transmitter in operation, for example, it is only necessary to connect the audio input, r.f. transmission line and input power supply. You can increase power by adding "building-block" amplifiers.

These mechanical features, of course, are the natural twin of the improved circuits and electrical characteristics of the Westinghouse transmitters. For complete, detailed information about these circuits, ask your nearest Westinghouse office.



Meters (270° non-parallax) are at convenient eye level and r.f. driver and power amplifier tubes are visible through glass window. Both 1 and 3-kw transmitters use same cubicle.



Schematic diagram of 1-kw FM transmitter. In type FM-3 transmitter, the r.f. driver has two type 4-125A tubes, and the power amplifier uses two type WL-473A tubes, both in push-pull, and the h.v. rectifier uses six type WL-872A tubes.

Westinghouse transmission lines and antennas are ready

These Westinghouse FM transmitters will operate into any suitable combination (r.f. output impedance, 40-80 ohms) of r.f. transmission line and antenna within the 88-108 mcs band. The transmission lines are coaxial pressurized for 1, 3 and 10-kw transmitters.

The antenna is a horizontally-polarized turnstile system using folded dipoles. It is equipped to mount a standard 300 mm airways hazard beacon and has facilities for bolting to a supporting tower. The antennas are available with 1, 2, 4, 6 and 8 bays.

Electrical and Mechanical Characteristics of Antennas

Type	No. of Bays	Power Gain	Field Gain	Vertical Dimensions	Weight	Bending Moment
MN-1	1	0.5	0.707	1⅛ in.	360 lbs.	1,190 ft. lbs.
MN-2	2	1.2	1.09	5 ft.	510 lbs.	3,300 ft. lbs.
MN-4	4	2.53	1.58	15 ft.	820 lbs.	8,500 ft. lbs.
MN-6	6	3.85	1.96	25 ft.	1,130 lbs.	17,100 ft. lbs.
MN-8	8	5.2	2.28	35 ft.	1,610 lbs.	28,700 ft. lbs.

Note 1: Bays are spaced one-half wave length apart; approximate vertical dimensions of the radiating portion are given.

Note 2: Bending moments are in accordance with A.I.S.C. standards.

Note 3: Weights given include 300 mm beacon.

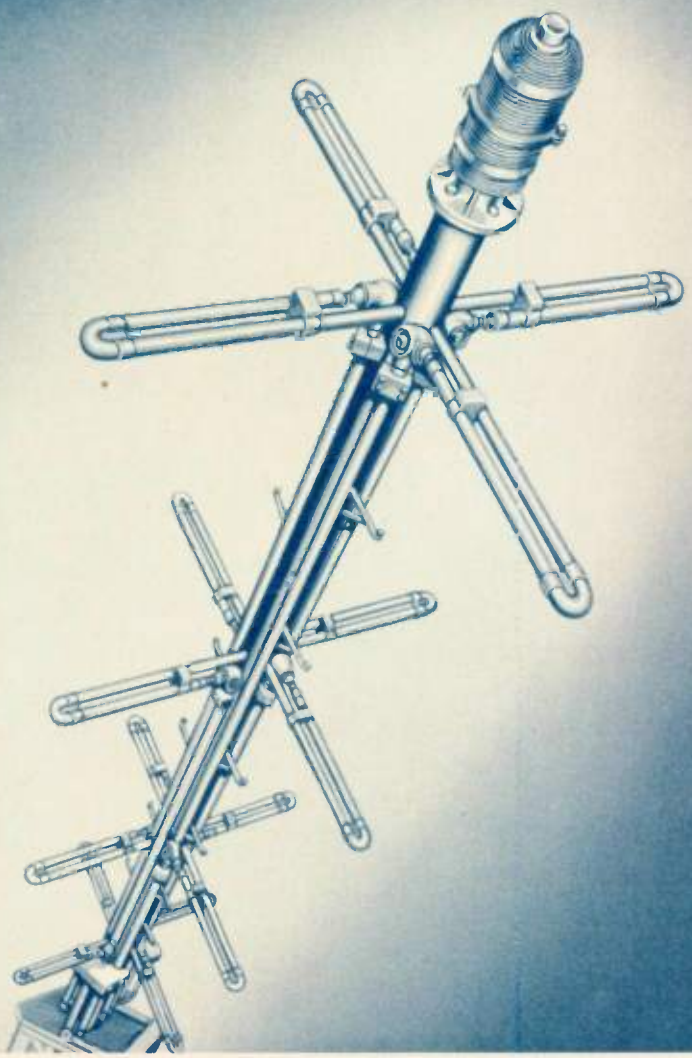
Note 4: Antennas can be supplied with or without sleet melting units. The heater units are installed in the antenna tubing and operate from a 220-volt, single-phase supply.

Electrical and Mechanical Characteristics of Transmission Lines

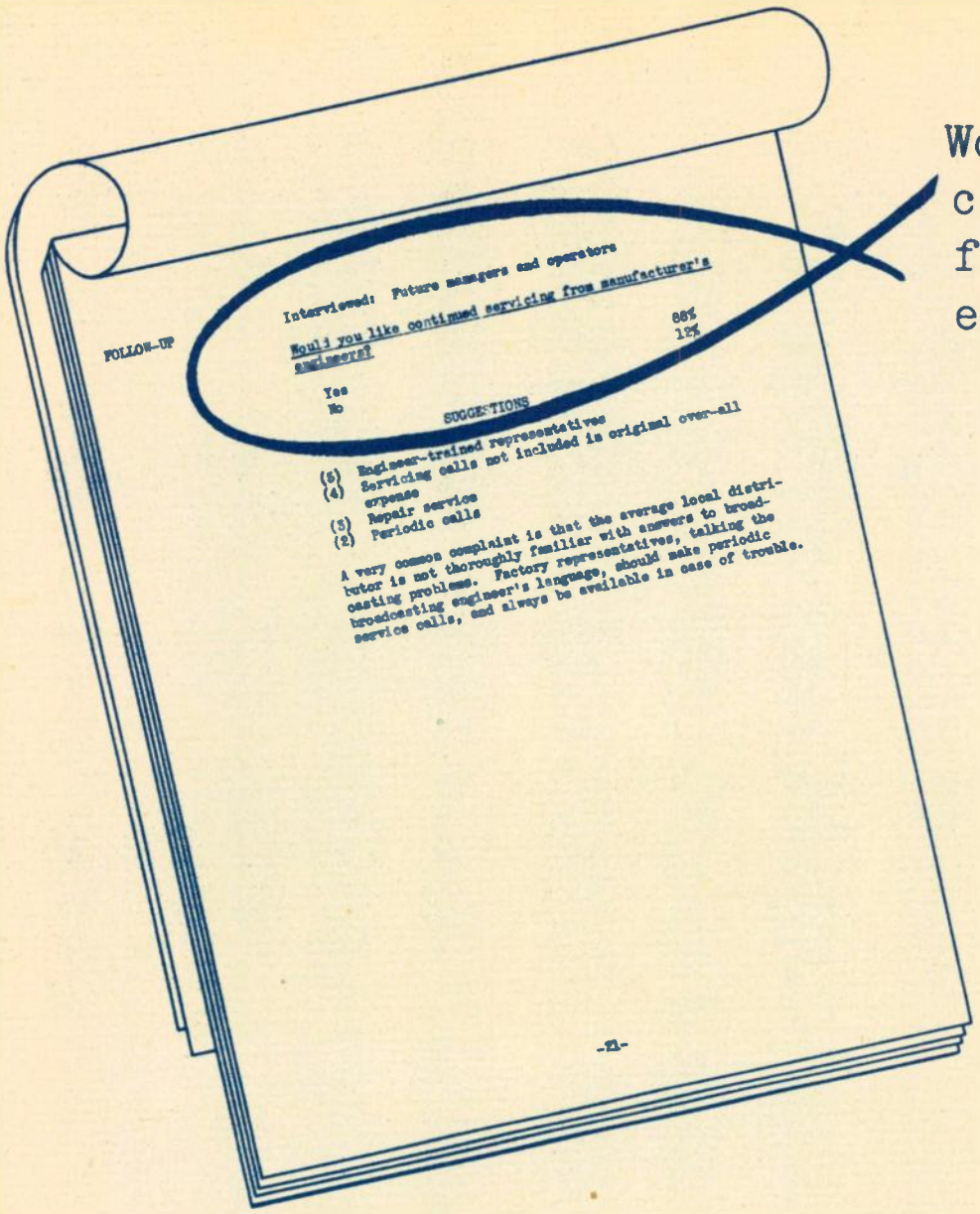
Transmitter Rating	Line Size	Efficiency at 100 mc/s				
		100 ft.	200 ft.	400 ft.	700 ft.	1,000 ft.
1 KW	⅞ in.	90%	81%	65.5%	47.7%	34.7%
3 KW	1⅝ in.	85%	90%	80.5%	68.5%	58.5%
10 KW	3⅛ in.	97%	93.5%	87.5%	79.3%	71.8%

Note 1: Where long lengths of line cause excessive attenuation of power, it may be desirable to select the next larger size line in order to obtain the over-all required efficiency of transmission.

Note 2: Efficiencies given are for inner conductor temperature at 25°C.



Westinghouse type MN-4 antenna. Antennas can be supplied with or without sleet melting units. Heater units are installed in the antenna tubing and operate from a 220-volt, single-phase supply.



Would you like continued servicing from manufacturer's engineers?

Yes . . . 88%
No 12%

You'll get it from Westinghouse

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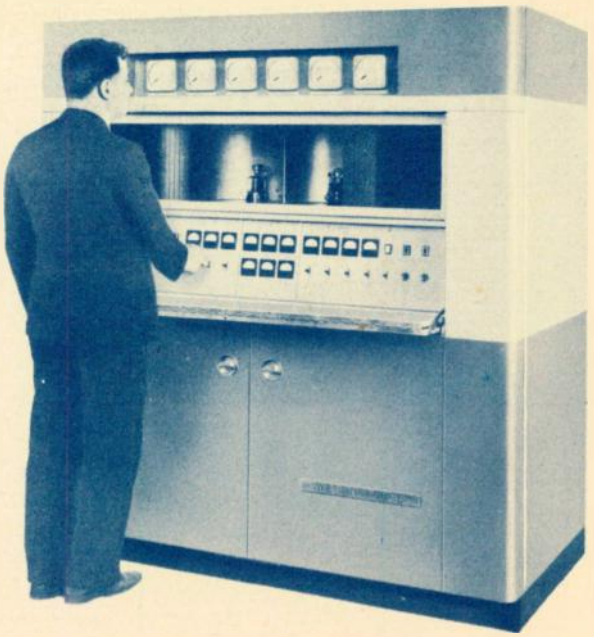

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