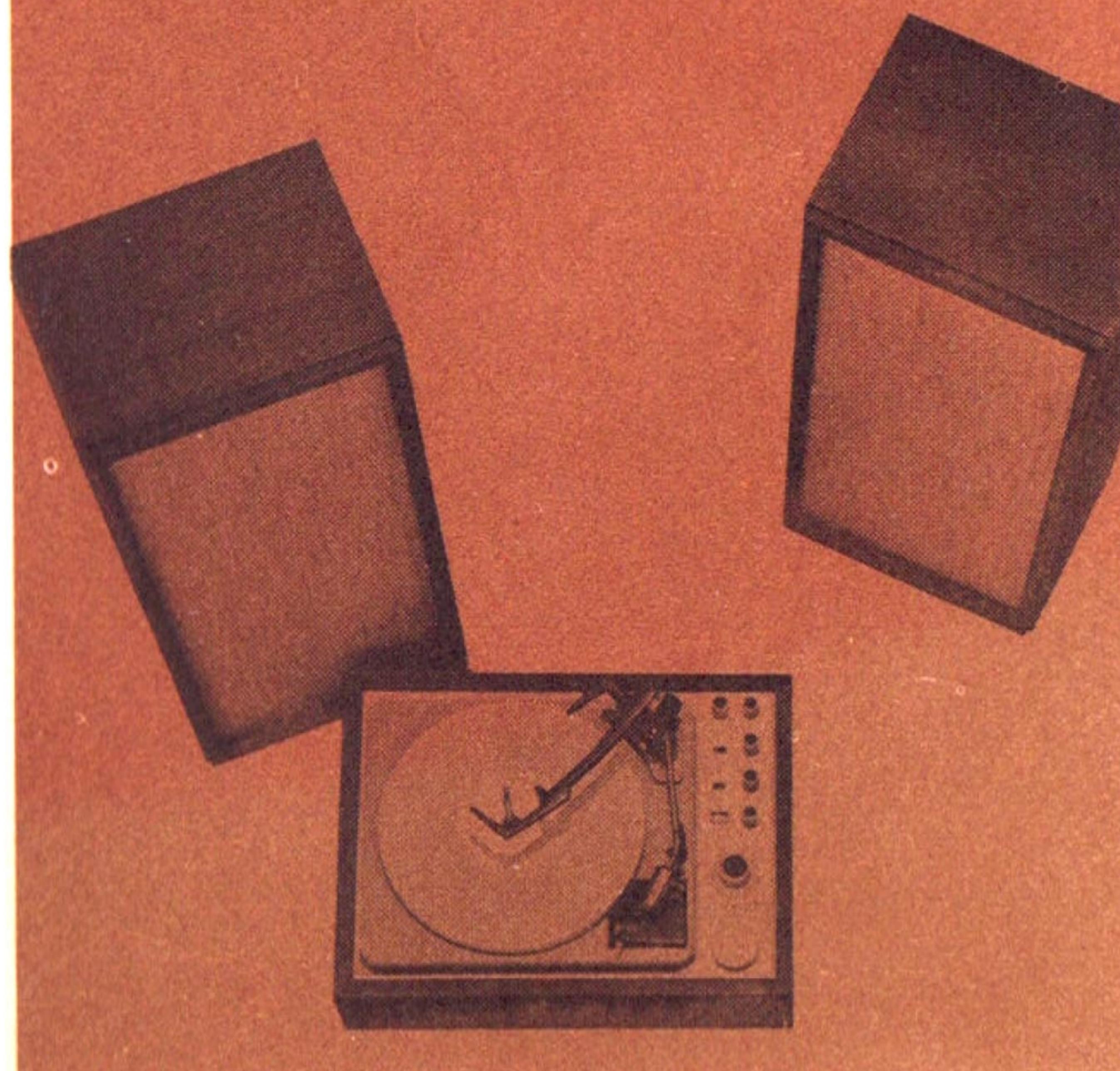


Instructions

KLH MODEL TWENTY STEREOPHONIC MUSIC SYSTEM



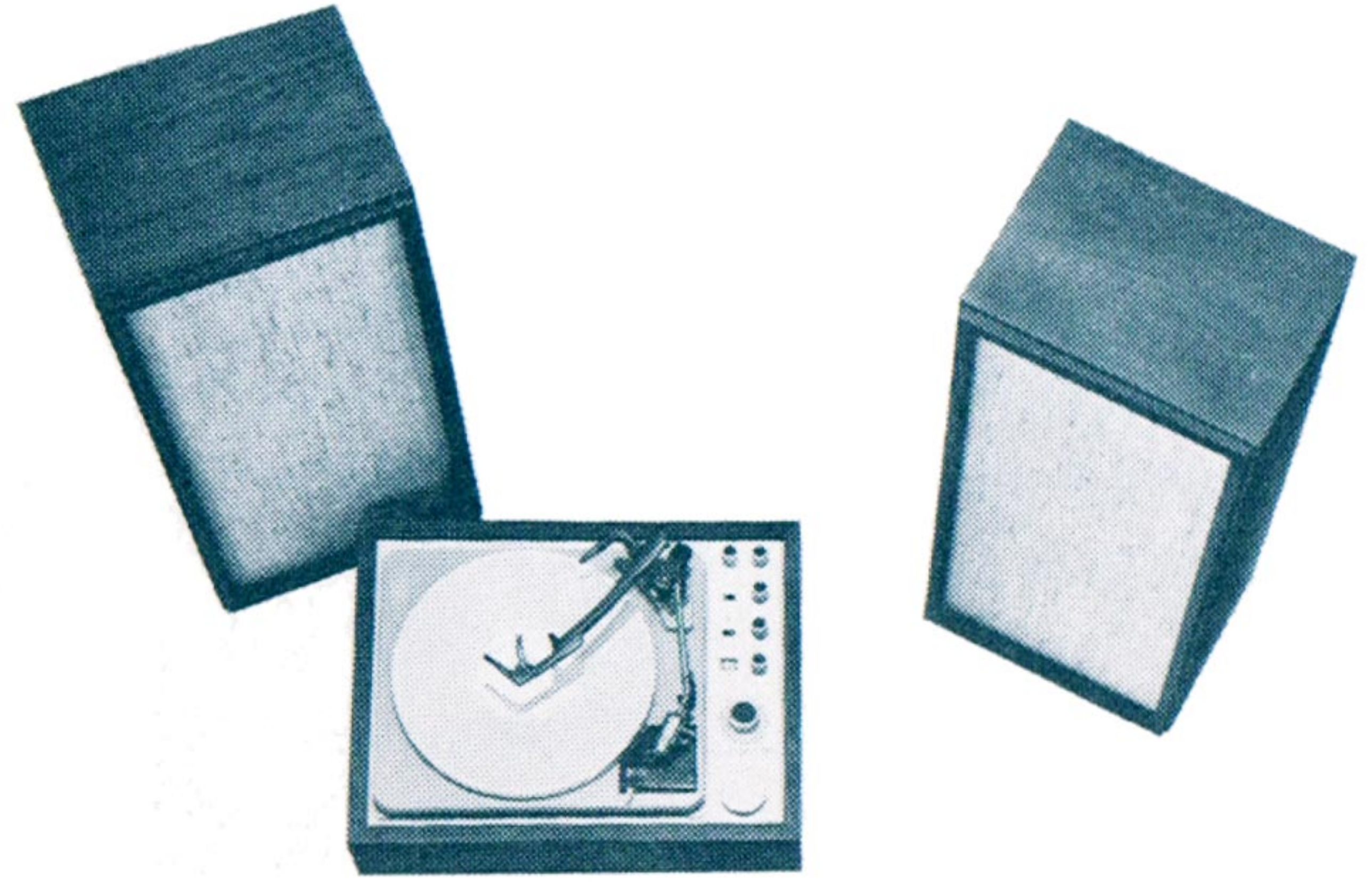
Introduction

The KLH Model Twenty is a stereo music system of a new and distinctive kind. It is intended to provide all of the important advantages of high-performance sound equipment in a simple and functional instrument fully suited to a living room. It is designed to be more flexible and less obtrusive than the traditional console, and to fit gracefully wherever it sounds best and is most convenient to operate.

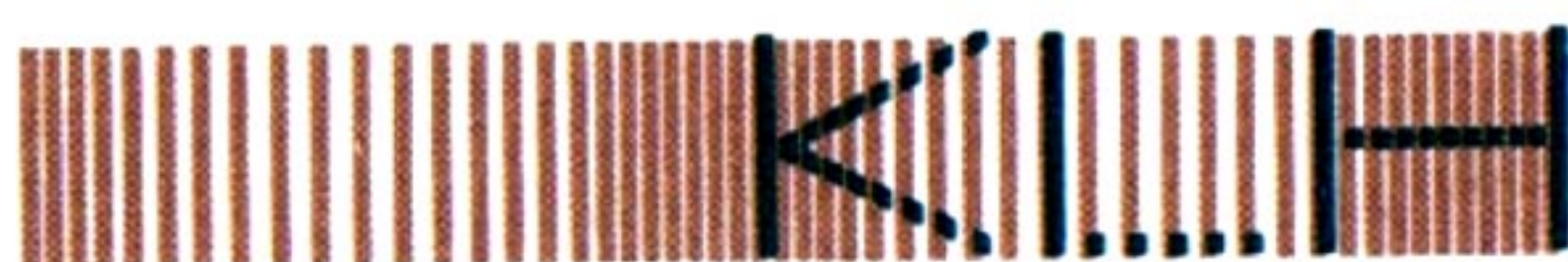
We suggest that you read through and keep this booklet of operating instructions to be sure of obtaining all of the performance that the Model Twenty can provide. While the system is easy to understand and use from the outset, several of its unusual features may not be obvious at first or second glance, and others may be of full value to you only at some time in the future.

We think you will find it worthwhile to take time to explore the full capabilities of the Twenty. Used to advantage, it will provide a level of performance you may never have expected to find in an instrument designed for the home.

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Setting Up the Model Twenty

1. After unpacking the Model Twenty and tentatively placing its speakers, connect the speakers to the LEFT and RIGHT "SPKR" jacks on the rear panel of the center control section, making sure that LEFT and RIGHT cables lead to the appropriate speaker. The cable plugs should be firmly seated in the jacks on the control section and the speakers. If they do not go in easily, use a rotary motion to insert them.



2. A switch labelled "IN-OUT" next to the "SPKR" jacks on the control section allows the speakers to be disconnected internally when headphones are used with the Model Twenty. Make sure that the switch is placed in the "IN" position for operation with the speakers.

3. Remove the wire that holds down the tone arm during shipping and the rubber band that holds down the record changer's overarm. Unhook the tone arm clamp to free the arm for operation.

4. Locate the transit screw tags on the record changer (if the turntable surface were the face of a clock, the tags would be located at four and eleven o'clock). Remove the tags and turn the transit screws clockwise as far as they will go. This will allow the changer to float freely on its suspension.

5. Remove the cardboard wedges placed under the turntable and under the edge of the changer's chassis. Save these, along with the carton and all packing material, for future shipping of the Model Twenty. Remove the transparent plastic guard over the pickup, making sure afterward that the gray stylus assembly is fully inserted into the pickup body.

6. Plug the AC line cord into an electrical outlet (110-120 volts, 60-cycle AC only).

As supplied, the Model Twenty will play and automatically change records of all sizes and speeds now commonly available. To play 78 rpm records, use the 78 stylus (Pickering #D1527, color-coded blue) available as an optional accessory at your dealer.

Records of different sizes can be mixed in any order, provided they are to be played at the same speed. As many as six to eight records can be placed on the automatic spindle, depending on the total thickness of a specific stack of records.

A soft brush, located between the Operating Lever and the Speed Control on the changer, cleans the stylus before and after the playing of a record. Storage clips for the manual and automatic spindles are provided at the rear of the changer.

To Play Records Automatically

1. Grasp the overarm of the record changer at its pivot post, lift the overarm straight up, and swing it to the right.

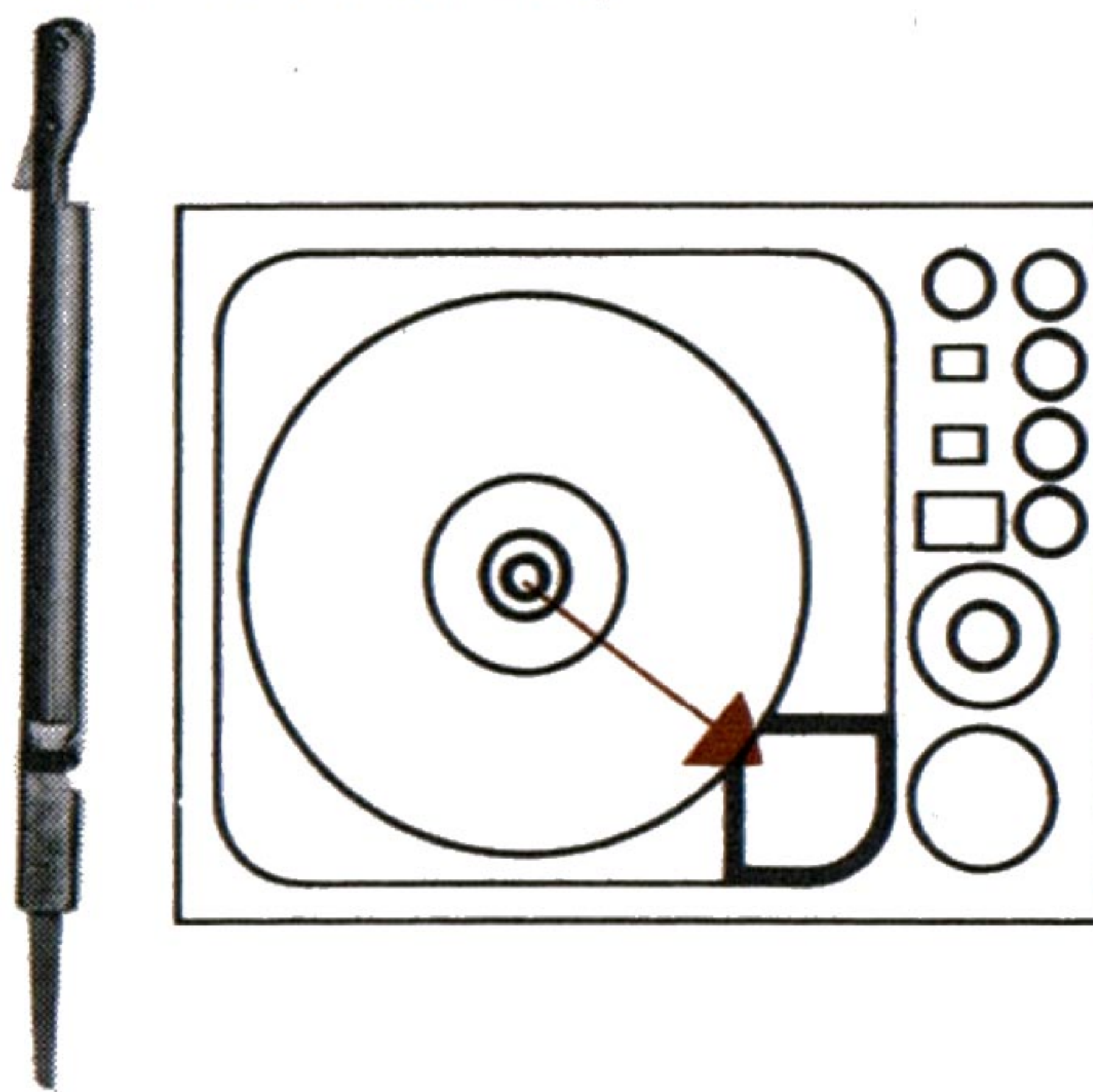
2. Insert the automatic spindle (the longer of the two spindles provided) into its socket at the center of the turntable. Rotate it until the flattened section of the lower part of the spindle faces the "OFF" position of the Operating Lever. Then push the spindle down firmly until it snaps into place.

3. To load the changer, stack the records on the automatic spindle, letting them rest on the spindle's notch. Return the overarm over the spindle and let it drop to the surface of

the topmost record. (Note: If the overarm is not returned to the proper center position, the changer will not operate correctly.)

4. Set the Speed Control Lever to the proper record speed.

5. Slide the changer's Operating Lever to the "AUTO" position and release it. This will turn on the entire set as well as the record changer itself—regardless of the position of the master ON-OFF switch on the control panel. When the last record has been played, the tone arm will return to its rest and the record changer will shut itself off. **Important Note:** To allow the entire Model Twenty to turn off automatically after the last record has been played, leave the master ON-OFF switch on the control panel in the "OFF" ("AUTO") position. (See the section of these instructions on OPERATING CONTROLS for the special function of the master ON-OFF switch.)



To Reject

To reject a record being played, slide the Operating Lever to "AUTO" and then release it.

To Unload

1. When the record changer has turned off, lift the overarm at its pivot post and swing it to the right.

2. Lift the records off the spindle. To replay the same records, lift them completely off the spindle before replacing them on the spindle notch. Otherwise, more than one record may drop at a time during replay, and stylus damage may result.

To Play Records Manually

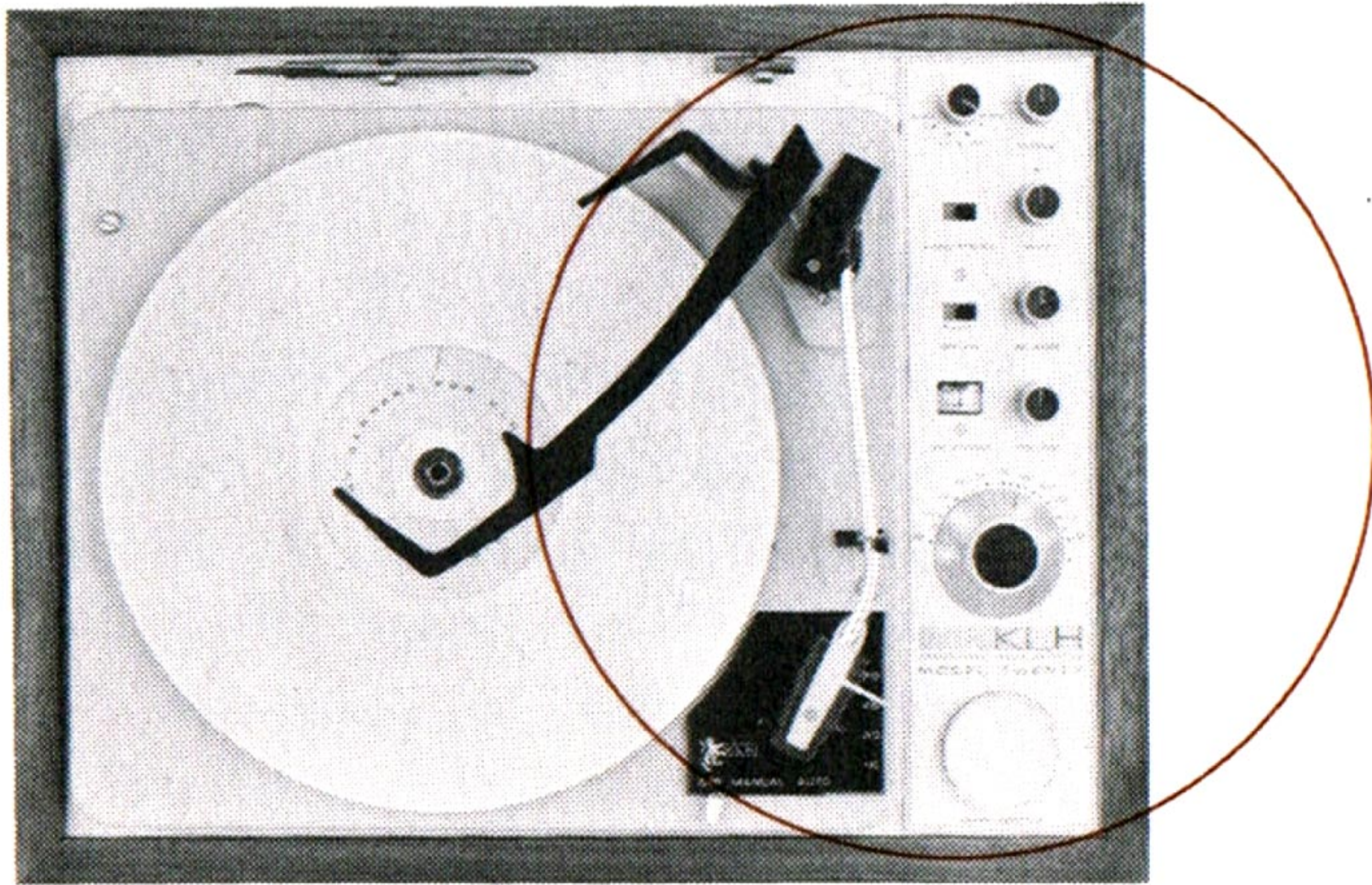
1. Insert the short, manual spindle, rotating it until the flattened section of its lower half faces the "OFF" position of the Operating Lever.

2. Place the record on the turntable and move the changer's overarm to its center position over the spindle.

3. Slide the Operating Lever gently to the "MANUAL" position and place the tone arm on the record. At the end of the record, the tone arm will automatically return to its rest and the turntable will shut off. If the changer overarm has not been placed in its proper center position, however, the tone arm will return to the record, dropping at random at some point on the record surface. (Note: The KLH changer is not designed to repeat the record being played.)

4. To stop the turntable before the end of a record, move the Operating Lever to the "AUTO" position to return the arm automatically to its rest and shut off the turntable. If you want to leave the tone arm in position on the record to resume playing where you left off, you may instead move the Operating Lever to its "OFF" position.

Operating Controls



The Model Twenty offers unusually complete and convenient control facilities. We suggest that you take a few minutes to become familiar with them (and with the input and output jacks on the rear panel) to take full advantage of the features provided.

On-Off Switch

As noted earlier, the master ON-OFF switch works in conjunction with the record changer's Operating Lever. When the master switch is left in the "OFF" ("AUTO") position, the Model Twenty will continue to play as long as the changer mechanism is in operation. For normal listening to FM or other sources without the use of the changer, the master switch may simply be placed in the "ON" position. For your convenience in late-night listening, you may leave the switch in the "OFF" position and use the changer as a timing device to shut off FM broadcasts automatically after a predetermined period; the time-delay, of

course, will depend on the playing-time of the records you choose to do the timing.

Selector Switch

In addition to the customary settings for listening to records and FM, the Model Twenty's Selector Switch has two positions for outside music sources such as tape recorders. These positions correspond to the identically-marked Input jacks on the rear panel. The "AUX 1" position is intended for a monaural source to be connected to the "AUX 1" jack. The "AUX 2" position is for stereo sources, corresponding to the pair of "AUX 2" jacks on the rear panel.

Treble Control

The "twelve o'clock" setting of the TREBLE Control (indicated by a dot on the control panel) is the normal position for listening to records and FM broadcasts. If your listening room acoustics are "dull" (because of heavy

carpeting, padded furniture, or other sound-absorptive surfaces) you may have to turn up the TREBLE Control to achieve a natural musical sound. A “live,” hard-surfaced room may require the control to be turned down somewhat. The control may also be useful in compensating for inadequate or strident treble response from an external piece of equipment connected to the Model Twenty. Except in the case of very unsatisfactory treble response from an external source, it is unlikely that you will often need to move the TREBLE Control very far in either direction from its normal position.

Bass Control

A dot on the control panel also indicates the normal position of the BASS Control. In many cases, this control will be useful in compensating for either inadequate or overprominent bass that is due to poor program sources or unsatisfactory speaker placement. Its primary value, however, is in restoring the proportion of bass that is lost to the ear as listening level is reduced from full “room volume.” The human ear is far less sensitive to bass frequencies at low volume levels, and the Model Twenty’s BASS Control can and should be advanced to provide satisfactorily balanced sound as listening volume is lowered. Note, however, that the increase in available bass output at the control’s extreme setting is roughly 20 times that of the normal bass setting of the control, and that this is far more than will ever be needed at normal volume. Advancing the control near its extreme when

playing the Model Twenty at room volume may cause considerable distortion—particularly when the music played is of very wide dynamic range.

Balance Control

In most cases, the proper setting of the BALANCE control will be at or near its “twelve o’clock” position. To set the control initially, listen to a monaural source while standing between the Model Twenty’s speakers and adjust the control to left or right until the sound seems to be centered between the two speakers. Once the setting is chosen, it may have to be varied occasionally to balance the speakers at very low listening levels or to compensate for unequal signal levels from an outside music source. The extreme left and right settings of the control can be used to channel sound through one speaker system.

Volume Control

The VOLUME Control provides minimum volume at its extreme counterclockwise position and maximum volume at its extreme clockwise setting. Since the Model Twenty can provide very high sound levels, use the control with caution until you are familiar with the range of power it provides.

Mono-Stereo Switch

Whenever you listen to a monaural record or FM broadcast, place the MONO-STEREO switch in the “MONO” position. This will insure that background noise and distortion (particularly surface noise from older LP’s) is kept to a minimum.

FM Reception

Used to full advantage, the FM section of the Model Twenty can provide excellent reception even under very difficult conditions. To be sure of optimum performance, please give especially close attention to the following instructions on antennas. If you live in a difficult reception area for mono and/or stereo FM, or if reception proves unsatisfactory for any reason, consult the later section on "Getting the Most from FM."

Tuning

For easy and precise tuning of FM stations, the Model Twenty employs a vernier tuning knob and planetary dial. Because there is no need for a dial cord in this arrangement, there is virtually no possibility of slippage or of gradual changes in the apparent locations of stations across the dial.

Before tuning, make a habit of placing the MONO-STEREO slide switch in the MONO position. This will insure that conventional mono broadcasts are received without the noise and interference effects that might occur in the stereo position. If the MX STEREO indicator light goes on after you have tuned in a station, this indicates the presence of a stereo broadcast, and you may slide the switch to the STEREO position.

As you tune across the FM band, the tuner's excellent selectivity (its ability to separate the most closely-spaced stations on the dial) will cause stations to "pop in" abruptly. At the same time, the needle of the Tuning Meter

will deflect abruptly from its center rest position. As soon as the needle deflects on a station's signal, you can then tune in the station until the indicator needle moves back to the center position. This is the correct tuning point for best reception of a station. In rare instances—when, for instance, you are tuning in a very weak station located next to a very strong one on the dial—there may be disagreement between the tuning indicator's exact center position and the audible point of best reception. In any such case, of course, your own ear should take precedence over the meter.

You will note that the MX STEREO light often glows when you tune between stations on the dial and that it occasionally flickers on a weak, noisy station. Neither of these conditions indicates a stereo broadcast. Only when a station is fully tuned-in does a steady glow of the light indicate the presence of a stereo broadcast. When the light flickers on a known stereo broadcast, this is often an indication that the stereo signal is too weak for good, noise-free reception. In such a case, the same station's signal in the MONO position may be acceptable.

Using the Indoor Antennas

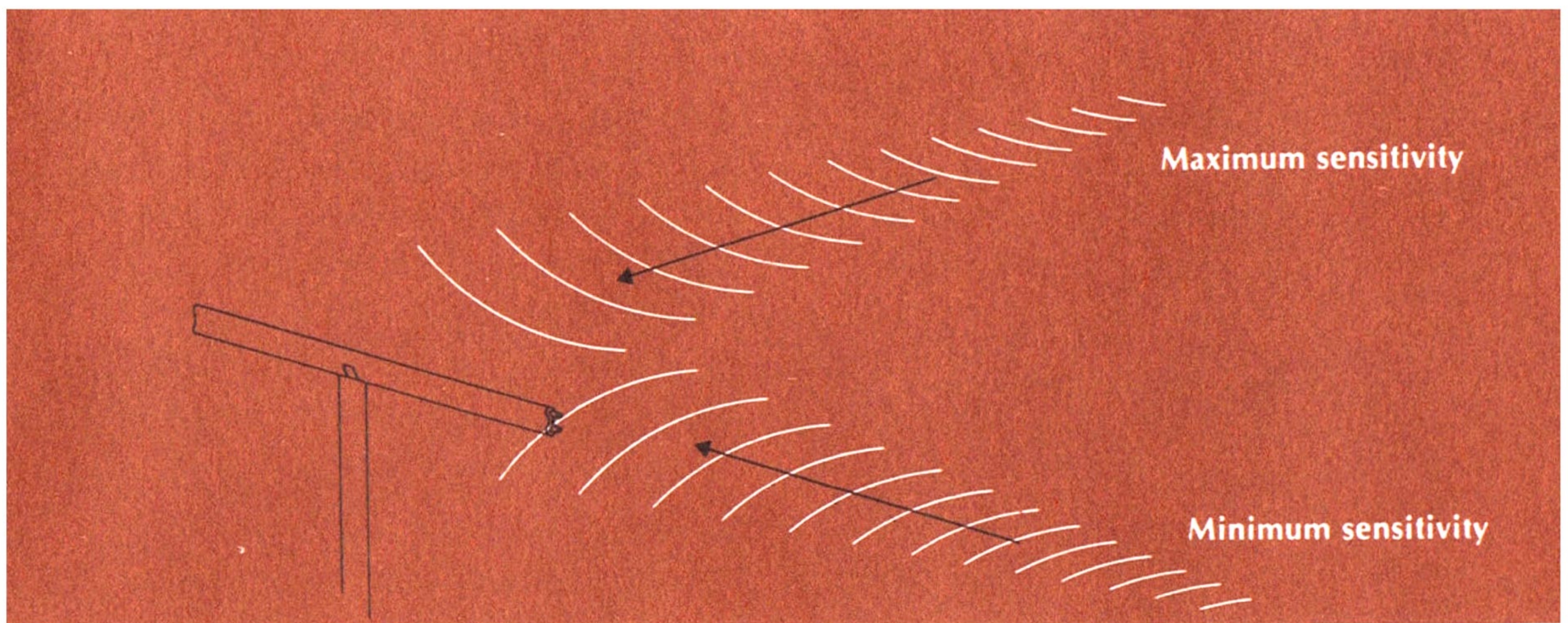
The Model Twenty is supplied with two indoor FM antennas: a simple short-wire antenna (already attached) and a "folded dipole" (a "T"-shaped segment of flat twin-lead cable). In most areas, one or the other will provide good reception, but you may have to do a bit of experimenting to receive all the stations you want with the best listening quality. As you experiment,

keep in mind that FM broadcasting and reception conditions are very similar to those of TV (the FM broadcasting band, in fact, actually lies between TV Channels 6 and 7). If you already are familiar with the importance of antennas in TV reception, and with the improved reception that can often result from minor changes in antenna orientations, you can easily appreciate the role of antennas in FM. In the event that TV reception in your area is troublesome, with severe "ghosts" or other problems, you should be prepared to refer to the special section on "Getting the Most from FM."

The short-wire antenna is supplied connected to the proper screw terminal on the rear panel of the control center. For best results, particularly on stereo, the wire must be stretched flat to full length rather than coiled, kinked, or folded. If reception does not seem satisfactory at first, try different horizontal or vertical orientations of the wire—always keeping it stretched straight—to see whether you can make an improvement.

If the short wire seems inadequate, remove it and connect the folded dipole. (Either of the dipole's two spade lugs may be connected to either of the two screw terminals.) Stretch the dipole to full length to form a "T" shape—as free as possible of kinks, twists, or loops.

The folded dipole's sensitivity ("gain") is significantly greater than the short wire's. Its sensitivity will be greatest when the crossbars of its "T" shape are exactly broadside (90 degrees) to the direction of an incoming



FM signal. When broadside to the signal, it will be equally sensitive to the front and rear. Sensitivity will be least (and possibly less than the short wire's) when the antenna crossbars are pointed in the direction of an FM station.

If all the stations you want lie in the same general direction (or in roughly opposite directions), you may be able to find a single best position for the dipole and tack it permanently into place. But if stations lie in several directions, you may have to reposition the antenna frequently. If so, you may find it easier to use a familiar "rabbit-ears" TV antenna than the flexible dipole. Or you may prefer simply to tack the dipole for easy rotation to two pieces of wood nailed together in a "T" shape. To prevent needless expense and disappointment, you should note that the many elaborate and expensive indoor antenna systems now available are seldom as satisfactory as a properly-used folded dipole or "rabbit-ears."

If you are unable to receive all the stations you want, or if even strong stations frequently sound distorted or "fuzzy," please go on to read "Getting the Most from FM."

Using the Model Twenty with External Equipment

In addition to its built-in facilities for records and FM, the Model Twenty provides inputs for other music sources and outputs for listening through headphones and for making tape recordings.

Auxiliary Inputs

The "AUX 1" input jack on the rear panel is intended for use with monaural sources such as mono tape recorders and AM tuners. In some cases, it will also be possible to play the sound portion of TV broadcasts through this jack. (This requires a TV set of high quality with a special output for this purpose, or one that can be modified by a competent serviceman to provide the correct output.) For proper operation with the Model Twenty, a tape recorder should have an output jack designated for use with external amplifiers. Some recorders that lack an amplifier output but have a jack for external speakers may be connected to the Model Twenty. Others, however, will overload the system. The maximum permissible input voltage from any external source is 1.5 volts. Minimum required input is 0.25 volts.

When a monaural source is connected through a single cable to the "AUX 1" input, its sound will be channeled over both of the Model Twenty's speakers, regardless of the

position of the MONO-STEREO switch on the control panel.

The pair of "AUX 2" inputs on the rear panel are for connection of stereo or mono sources. They are labelled "LEFT" and "RIGHT" for proper stereo connection. The same requirements outlined for use of the "AUX 1" input applies to these jacks. When a mono source is connected to only one of the "AUX 2" inputs, however, the MONO-STEREO switch must be placed in the "MONO" position to channel sound over both of the Model Twenty's speakers.

Headphone Output

Any high-quality headphones of low impedance (4-600 ohms) may be connected to the "HD PHONE" output jack on the rear panel. Connection should be made through a standard three-connector stereo phone plug. To operate more than one set of headphones, parallel them through a junction box that allows two or more outputs to be coupled to the single "HD PHONE" jack on the Model Twenty.

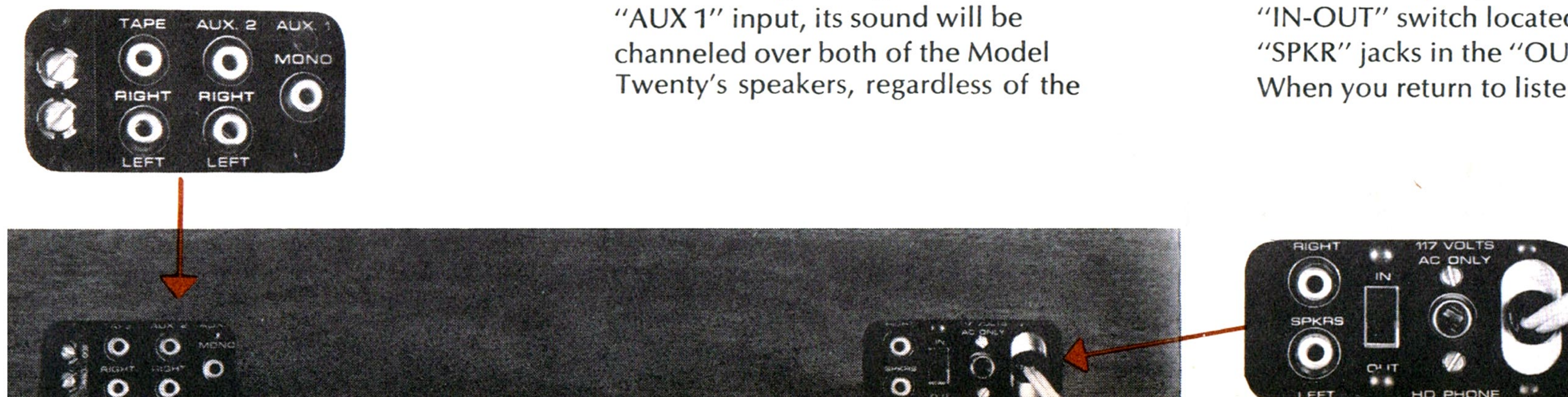
When listening through headphones, you may internally disconnect the Model Twenty's speakers by placing the "IN-OUT" switch located next to the "SPKR" jacks in the "OUT" position. When you return to listening through

the speakers, you should disconnect the headphones to prevent accidental damage to them at very high settings of the VOLUME control.

Tape Outputs

A pair of output jacks marked "TAPE" on the rear panel allow monaural or stereo tape recordings to be made from records, FM broadcasts, or other sources played through the Model Twenty. For the taping of records and FM broadcasts, the output signal level through these jacks is totally independent of the setting of the VOLUME control, and will vary on other sources only when volume is varied at the source itself. This permits the Model Twenty's volume to be raised and lowered for the listener's convenience without affecting the loudness levels of the tape being made. Taping is also independent of the BASS, TREBLE, AND BALANCE controls.

The "TAPE" outputs of the Model Twenty normally should be connected to the inputs marked "Line" or "Radio" on a tape recorder. With some recorders, however, the tape output level supplied by the Model Twenty will not be sufficient for good recording level with these inputs. In such cases, the Model Twenty's recording outputs should be connected to the recorder's "Microphone" inputs to insure adequate signal level for a good recording.



Record Changer Adjustments

The Model Twenty's record changer is carefully adjusted at the factory for proper automatic and manual operation. It is possible, however, that minor adjustments which can be made by the user will be necessary after shipment or a long period of use.

Tone Arm Height

The small screw located on top of the black pivot assembly at the rear of the tone arm adjusts the height at which the arm swings over the record stack during automatic operation. Turn the screw clockwise to decrease the arm's height and counterclockwise to increase it. The arm's height should allow it to clear a stack of at least six—and at most eight—records during automatic-play. If the arm's height is increased too much, the stylus will not contact the stylus-cleaning brush on the changer's control panel.

Tone Arm Dropping Position

The tone arm dropping position can

be adjusted by the horizontal tapered head screw located underneath and to the front of the black pivot assembly. Turn the screw clockwise to move the arm's dropping position in toward the center of the record; turn it counterclockwise to move the position out toward the edge of the record. The correct adjustment will allow the stylus to land in the lead-in grooves of a record—just inside of the slope of the raised edge found on most LP records. If the arm lands on the slope of the edge, it may jump inward past the beginning grooves of a record.

Tracking Force Adjustment

The correct tracking force of the Model Twenty's tone arm and pickup is 3 grams. It should be checked periodically and reset if necessary with the tracking force gauge provided. The adjustment for tracking force is provided by the knurled nut underneath and to the rear of the black pivot assembly. Turn the nut clockwise (as

viewed from the rear of the arm) to decrease tracking force and counterclockwise to increase it. For best results with all records, and for minimum wear of record grooves, tracking force should not be set below 3 grams.

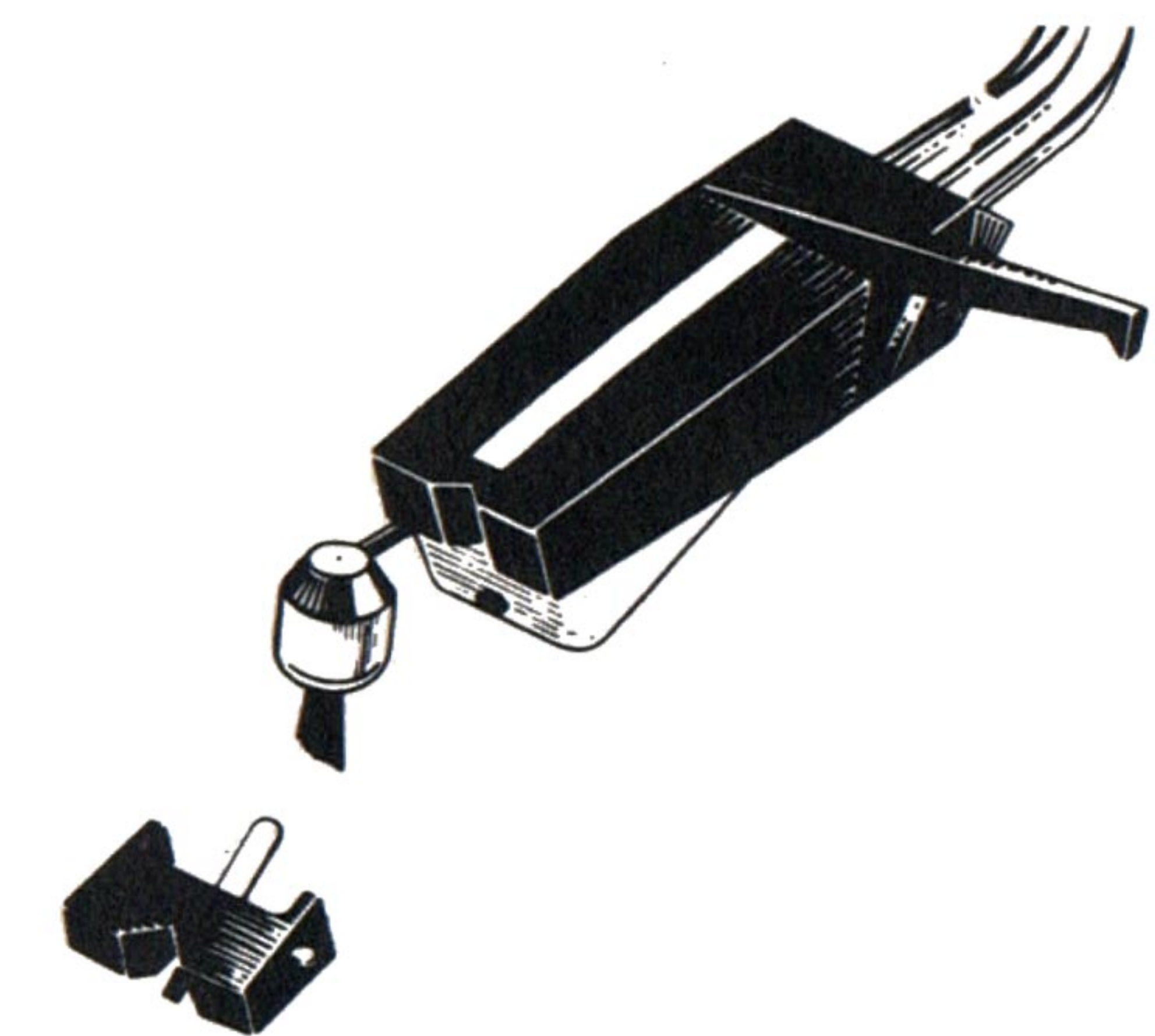
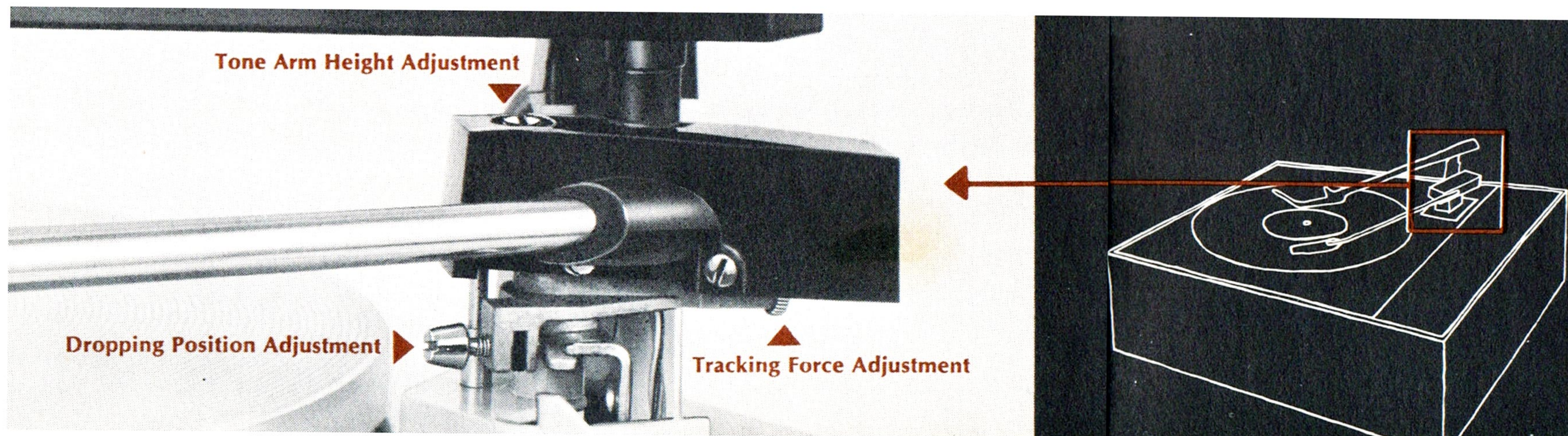
Stylus Replacement

Under normal conditions, the stylus of the Pickering V-15* cartridge used in the Model Twenty probably will not need replacement for a number of years. Abnormal use, however, or abrasive dust on your records, may shorten its life considerably. Therefore, it is a good idea to have your dealer check the stylus under a microscope at least once a year—or whenever you

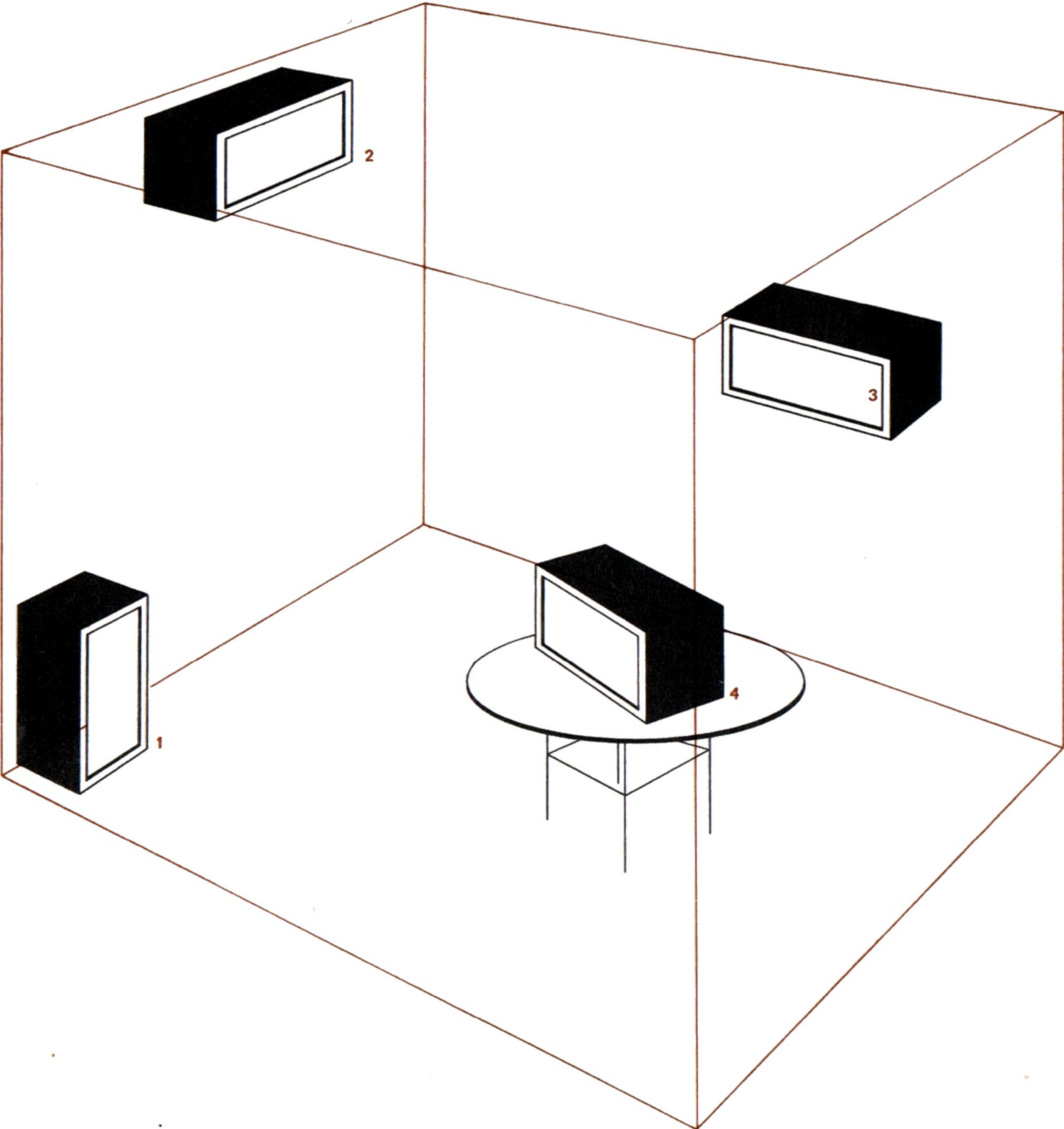
suspect that it may have been damaged. It is important to remember that a record can be permanently damaged by a single playing with a worn stylus.

To Replace the Stylus

1. Gently pull the gray stylus assembly out of the cartridge.
2. Insert the Pickering D1507AT replacement stylus (available at your dealer or direct from KLH). Be sure to use the Pickering D1507AT. Any other brand of replacement stylus will downgrade the performance of your Model Twenty.
3. Make sure the projections at the sides of the stylus assembly are firmly seated against the cartridge housing so that the stylus will be properly aligned. **Note: The Pickering V-15 cartridge is an important component in the carefully integrated design of the Model Twenty. The substitution of any other cartridge, whatever its absolute merits, will degrade the performance of the Model Twenty.*



Positioning the Speakers



Many of those who are unfamiliar with stereo may have been given the impression that there is only one “correct” placement—of loudspeakers and listeners alike—for a satisfactory stereo effect. Nothing could be further from the truth. The chief benefits of stereo are the sense of depth, detail, and spaciousness it provides, and the added ability it offers the listener to follow individual lines of music or speech. These benefits are audible to some extent even when speakers are placed in the worst possible arrangements. In general, it is relatively simple to find the minimum separation of speakers that seems to yield a satisfactory sense of spaciousness over the general listening area. The area of stereo effect will grow as the speakers are moved further apart, and it can be set according to your own taste at any point short of the extreme separation that makes you aware of two separate sound sources.

Although speaker placement for effective stereo is not as critical as generally believed, the overall sound quality of any loudspeaker can be influenced to an almost unbelievable extent by its position in a room. An advantage of the Model Twenty’s relatively compact speaker cabinets is that they can be easily and unobtrusively placed where they sound best. You may find the following considerations helpful for arriving at the most satisfactory placement.

One of the most important factors determining the overall sound quality of any speaker is the proportion of bass in its output. Bass level is radically

affected by the position of the speaker, with the proportion of bass increasing as the normally non-directional low frequencies are “focused” over a narrower angle into a room. The following locations are listed in order of *decreasing* bass level:

1. At or near the intersection of three room surfaces (e.g. in a corner at or near the floor or ceiling).
2. At or near the intersection of two surfaces (e.g. on the floor at the base of the wall, at the junction of wall and ceiling, or in a corner away from the floor and ceiling).
3. In contact with only one surface (wall or floor).
4. In the middle of the room on the edge of a table or cabinet.

While it is impossible to predict the placement that will sound best to you in your own listening room, you can use the four general positions above as an easy rule of thumb to find a satisfactory placement. Very often, the Model Twenty speakers will sound excellent when placed vertically on the floor (low-frequency speaker nearest the floor) within a foot or two of a wall. Depending on the requirements of your own room and its furnishings, however, you will often be able to place the speakers in seemingly extreme positions—such as near the ceiling—with excellent results, providing that the high-frequency speakers are not obstructed.

The Model Twenty speakers are finished on four sides to permit either vertical or horizontal placement. When placed vertically, the cabinets generally

should be positioned with the small opening (behind the grille cloth) for the high-frequency tweeter nearest to ear-level. In horizontal placement, the apparent area of stereo effect may be widened or narrowed to some extent according to the distance between the two high-frequency speakers.

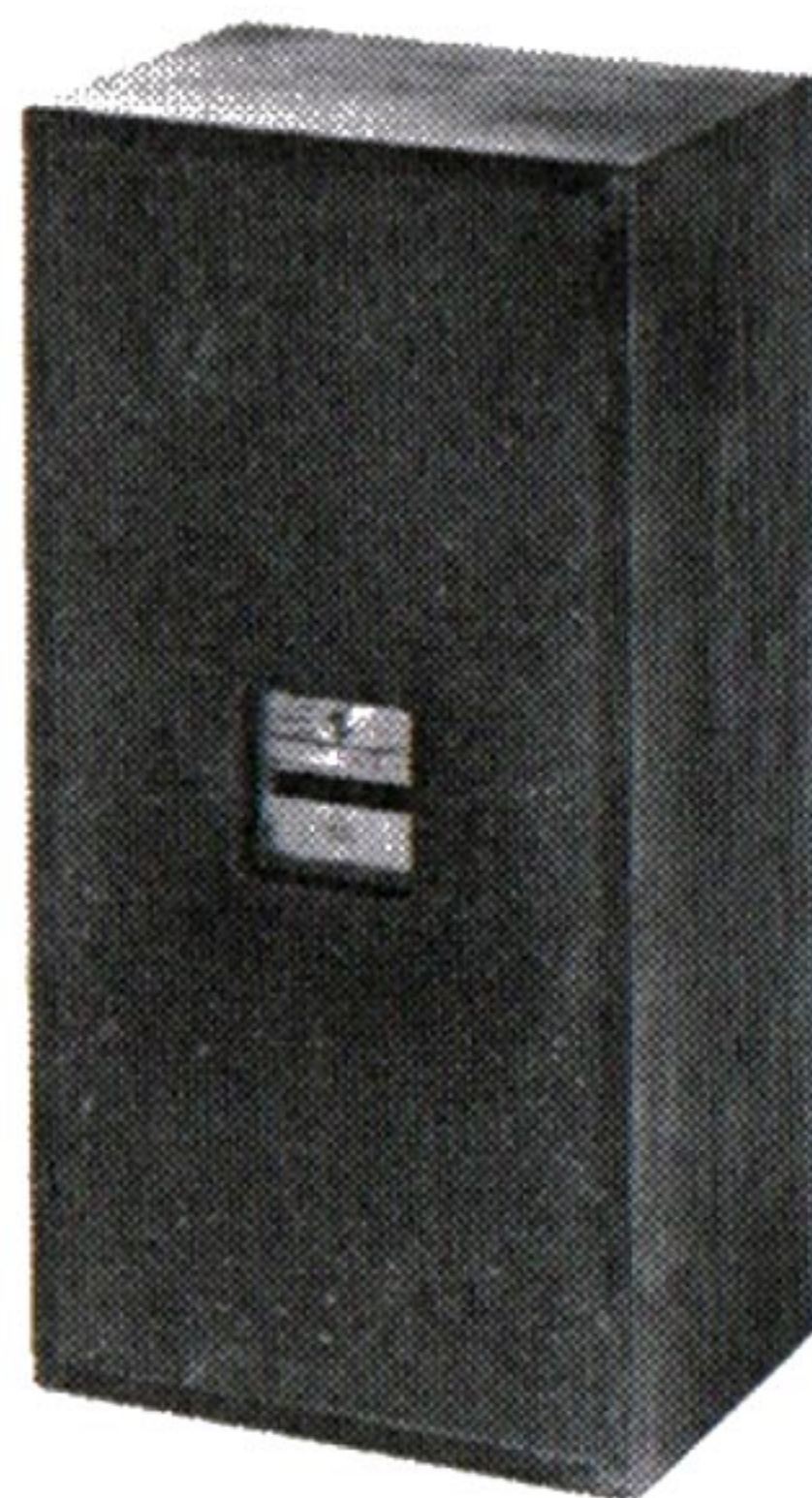
It is usually rewarding to experiment with the various placements feasible in your listening room. Listen to each speaker arrangement long enough to decide which one you really prefer. When you have found the approximate arrangement you like best, try moving the speakers a foot or two to determine whether there is a noticeable improvement. Keep in mind that your own taste—rather than any set of arbitrary standards—should determine the most effective-sounding arrangement.

High-Frequency Level Controls

The Model Twenty speakers are supplied with 3-position switches on their back panels to adjust the relative level of high frequencies. In the "Increase" position of the switches, the level of frequencies above 2500 cps is increased by 2½ db. This should enable you to achieve proper treble balance in a room with padded furniture, heavy rugs and draperies, or other materials that tend to absorb high frequencies. In the "Decrease" position, energy above 2500 cps is decreased by 2½ db. This permits proper balance in a "live," hard-surfaced room (with little or no absorptive materials) that might otherwise make the speakers sound overly

brilliant or strident.

The primary usefulness of the high-frequency switches is in compensating for room acoustics. You can use them freely, however, to help compensate for a loss or an excess of high frequencies caused by less-than-optimum speaker placement. To adjust the treble for different types of program material, use the TREBLE knob on the center control section.



A Word About Record Care

Depending on how they are treated, LP records are either very fragile or amazingly durable products. If handled indifferently, they will collect dust, acquire audibly annoying pops and clicks, and wear rapidly. Treated with reasonable care, however, they will last—and sound excellent—through hundreds of playings. Here are a few easy techniques for keeping your record collection in prime condition:

Handle records only by the edges and center label. The body oil of fingerprints on the grooves collects and retains dust and grit.

Do not leave records out of their jackets when you have finished playing them. Left unprotected, they can be scratched very easily and will accumulate dust rapidly.

If your records are not in plastic sleeves, obtain some to help keep your records dust-free in their jackets.

Store your records vertically rather than stacking them up. The bottom records in a pile tend to have dirt embedded in their grooves by the weight of the records stacked above them.

Keep your records stored away from radiators and direct sunlight.

Most records will attract dust because of their tendency to store static electricity on their surfaces. Keep your records clean with one of the several good record-cleaning devices on the market. Do not use so-called “record cloths,” since they tend to sweep dirt into record grooves.

Getting the Most From FM

There are two especially good reasons why FM broadcasting has become an important entertainment medium. One is the relative ease with which FM handles the full range of musical frequencies. The other is its substantial freedom from static pulses and other forms of interference common to AM broadcasting. But FM has limitations as well. Probably the most important is that FM signals, like those of TV, travel a line-of-sight path from the transmitter. They therefore can not travel more than a fraction of the distance covered by other kinds of radio signals that radiate upward and bounce off the earth’s ionosphere. FM’s effective coverage is limited still further by any obstacles—hills, buildings, trees—between the transmitter and the listener, which serve to dissipate the signal rapidly.

To make the most of the generally limited strength of FM signals, good receivers such as that of the Model Twenty are sensitive enough to receive signals of as low as a few microvolts (millionths of a volt). The tuning circuitry of the Model Twenty is further designed to achieve full “limiting” (suppression of background noise) on signals only a few microvolts stronger than needed for any audible reception. In some locations, however, it is difficult to achieve even the minimal signal-strength needed at the antenna terminals of the Model Twenty. If you live in a “fringe area” thirty miles or

more from most stations, or in any location where signals are very weak for one reason or another, you may need to invest in an outdoor FM antenna with more “gain” than that provided by any indoor antenna.

Whether you live in an area of high or low signal-strength, there is one other very important consideration. The obstacles that an FM signal encounters in its line-of-sight path tend to reflect the signal in many directions. And in many locations, an FM receiver picks up not only the primary signal “beam” of a station but also several secondary reflections of the signal from various directions. These signal reflections arrive at the receiver out of step with the primary signal, and they tend to blur the image picked up by the receiver. The result, known as “multipath distortion,” is the equivalent of the familiar “ghosts” in TV reception. The effect can range from a barely audible “fuzziness” to severely distorted sound quality—depending on the number and relative strength of the signal reflections.

Multipath distortion can be particularly troublesome in FM stereo reception. Stereo broadcasts consist of several signal components transmitted on the same radio wave, and any blurring of the relationship of these signal components can degrade or destroy final stereo quality. This is one reason why an FM station may sound better in mono than in stereo reception.

Since even the best FM receiver can not separate a primary signal from “ghost” reflections, the problem of multipath must be dealt with before

reception takes place. The only fully satisfactory solution is a directional antenna designed to accept signals from one direction and discriminate against reflections from other directions. So far, only outdoor antennas have been successfully designed to be sensitive in only one direction. The indoor dipole is directional to some extent, since it tends to reject signals arriving from its sides. But its equal sensitivity to both front and back leaves it free to pick up spurious signals bounced back over a wide area.

For the sake of its directionality, a good outdoor antenna actually may be more valuable in some metropolitan locations (where the proportion of reflected-to-direct signal may be very high) than in some relatively distant suburban or fringe areas. In areas where FM signals are reasonably strong, an outdoor antenna need not have extremely high gain as long as it is properly directional. In weaker-signal areas, more elaborate, higher-gain antennas will be required. The following antennas have been found to be excellent for FM stereo reception. The first in each pair listed is the lower-priced antenna suited to most general purposes; the second is the more expensive, higher-gain version:

1. Finco FM-4G
2. Finco FM-5G
3. JFD LPL-FM6
4. JFD AFM-350
5. Apparatus Development FM/Q Jr.
6. Apparatus Development FM/Q Super Special

In areas where signals are received from several directions, an antenna

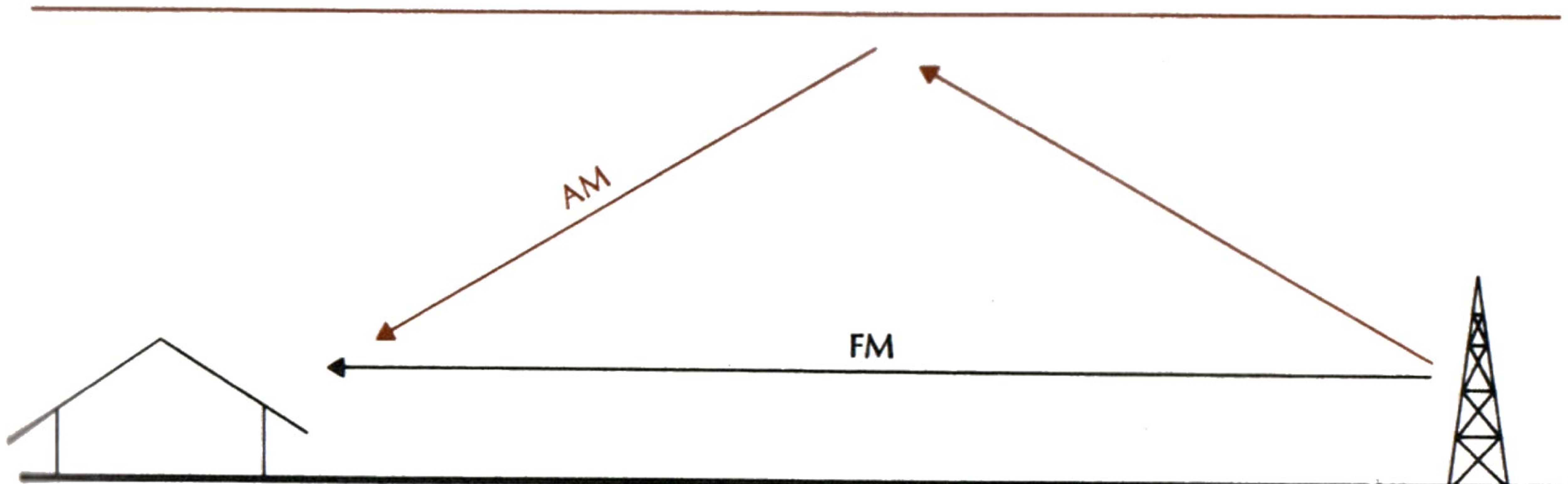
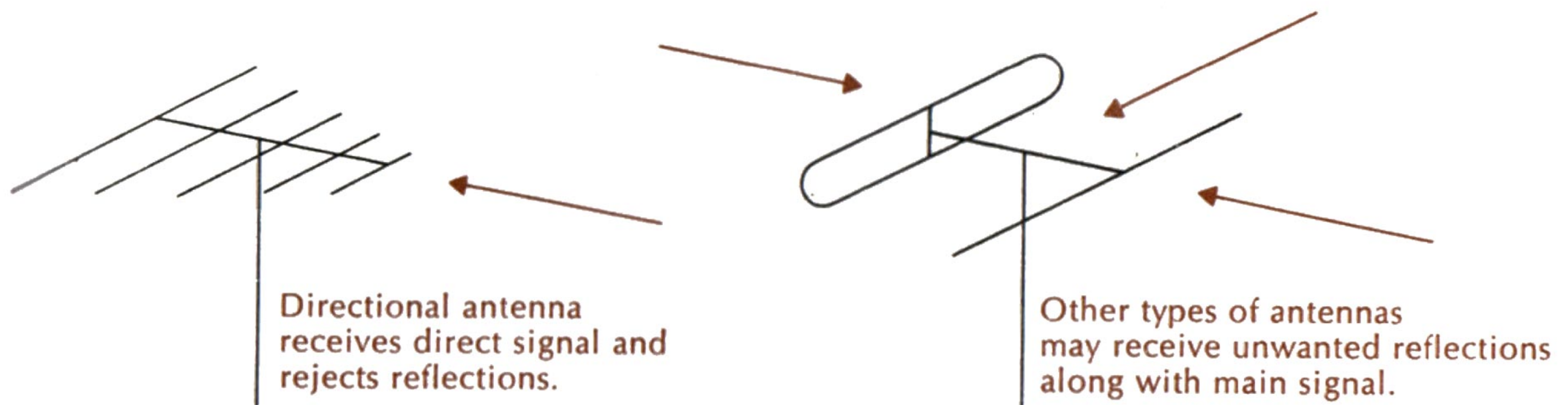
rotor will be necessary to reposition the antenna for various stations. Installation of both rotor and antenna is best left to a competent serviceman.

It is generally not a good idea to buy a TV antenna in the hope that it also will be suitable for FM. Many TV antennas are designed to reject FM to prevent interference with TV signals. If you already own a broadband TV antenna, however, it is worth connecting to the Model Twenty to see if it is of value for FM. If so, the antenna may be connected permanently both to your TV set and the Model Twenty through an "antenna coupler." Among

couplers we have found satisfactory are:

1. Channel Master 0038
2. Blonder-Tongue A-102
3. Tricraft 114-088

In very rare cases, a high-gain antenna will be useful only for one or two distant stations, and stronger stations received through the antenna may overload the Model Twenty and cause distortion. In such a case, it would be necessary either to put a switchable attenuator in the antenna line to reduce the signal when necessary or to disconnect the outdoor antenna for stronger signals.



FM signals travel line-of-sight path from transmitter and are easily obstructed.



In Case of Difficulty

If the Model Twenty, after installation in accordance with these instructions, fails to operate properly, please make the simple checks indicated in the numbered steps below. If the trouble persists, please contact the dealer from whom the system was purchased to arrange for inspection and possible repair or replacement. If your dealer is not within your immediate area or cannot inspect the system for any reason, please write directly to the KLH Customer Service Department (195 Albany Street, Cambridge, Massachusetts), specifying the trouble in as much detail as possible and giving the name of your dealer, date of purchase, and the serial numbers of your system. KLH will make every effort, within the terms of its warranty, to remedy any problem at minimum inconvenience to you.

If your Model Twenty works properly at first, but later develops a malfunction, please re-read these instructions, including the suggestions below for simple troubleshooting measures. You often may be able to save time, trouble, and needless expense if you will take a few minutes to try to track down the trouble yourself.

What To Do:

In Case of Complete Failure (No Sound on Records and Broadcasts)

—If the pilot light does not go on:

1. Make sure the AC line cord is plugged into a wall outlet and into the socket on the right rear jack-panel of the control cabinet.

2. Make sure the wall outlet is energized. (Substitute a lamp or other appliance for the Model Twenty.)

If the pilot light is on:

1. Check to see whether the switch marked "SPKR" on the right rear panel is in the proper "IN" position to channel sound over the speakers.

2. Make certain that the speaker cables are fully inserted in the jacks on the control cabinet and speaker cabinets and that there is no break at any point in the cables. If the cables have been spliced at any time, make sure that the two wires in each cable are not touching each other at a point where they are not insulated.

In Case of Trouble on One Channel Only

1. Interchange the cable connections to your speakers (connecting the Left speaker

cable to the Right speaker and *vice versa*) and note whether the trouble shifts from speaker to speaker or remains in the same speaker at all times. If the trouble remains in the same speaker, regardless of the channel to which it is connected, the speaker itself is at fault.

2. If the trouble remains in the same channel, regardless of the speaker connected, the fault may lie either in the center control section or in one of the cables. Check the latter possibility by interchanging each cable individually between each control-center speaker jack and each speaker proper.

3. If it proves necessary to contact KLH for servicing, please report whether you have made the above two checks and have been able to isolate the problem.

In Case of Trouble on Records Only

1. Inspect the stylus for dust accumulation and damage. If need be, have the stylus tip checked by your dealer with a microscope to see if it is worn excessively.

2. Be certain that the tone arm is set at or slightly above the recommended tracking force of three grams. Insufficient tracking force may cause severe distortion on loud passages.

3. If the distortion is present only on certain records, check to see if the records themselves are faulty. It is almost impossible for a defect in the system itself to be audible only on certain records.

In Case of Trouble on FM only

1. Make certain that the short-wire or dipole antenna is connected properly. If you are using the dipole, be sure that the two metal lugs at the terminals are not touching each other. Make certain that the antenna is not in contact with a metal surface away from the control center.

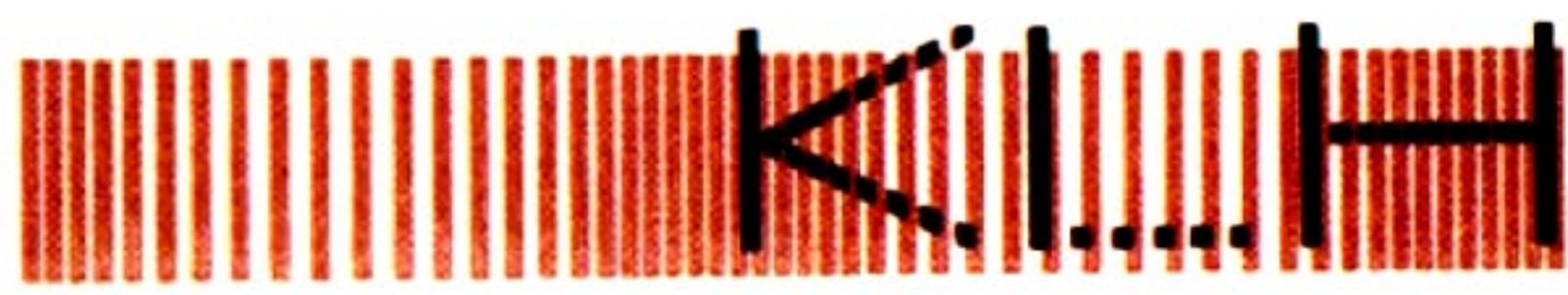
2. Place the MONO-STEREO switch in the MONO position. This will insure that no random interference effects are heard on standard mono broadcasts. In cases where a stereo signal is too weak for noise-free or undistorted reception, the same station may sound perfectly acceptable in mono reception.

3. Be sure you are using the antenna to full advantage as specified earlier in these instructions. If you live in a difficult reception area, see GETTING THE MOST FROM FM.

If you need any information on obtaining proper servicing or on any aspect of the operation of the Model Twenty, please contact the KLH Customer Service Department. Do not attempt to return any part of the Model Twenty to the KLH factory without first having received written authorization and specific shipping instructions. Do not under any circumstances have the Model Twenty serviced by an unauthorized service agency without specific instructions from KLH to do so.

DO NOT SHIP THE MODEL TWENTY BY PARCEL POST

 **Open for
operating controls
illustration**



KLH Research and Development Corporation/30 Cross Street, Cambridge, Massachusetts 02139