EMT 927 PROFESSIONAL PLAYBACK TURNTABLE



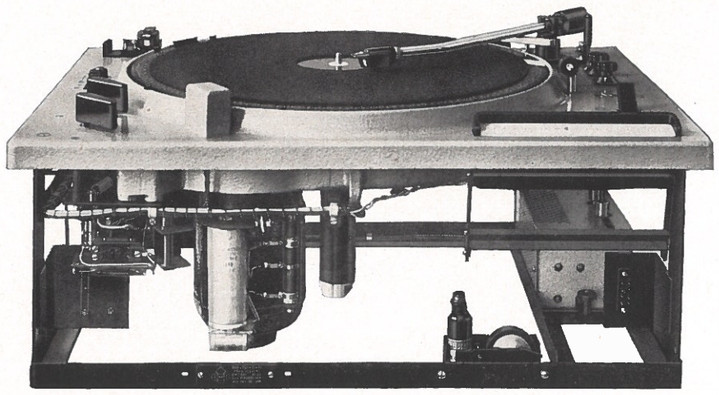
The above picture shows a double playback unit for direct program production, mounted in a metal console. The turntable on the right is shown with optical groove indicator.

A top quality unit

for program reproduction and research work
for broadcasting, TV and recording studio,
for radio play production,
for the record manufacturing industry.

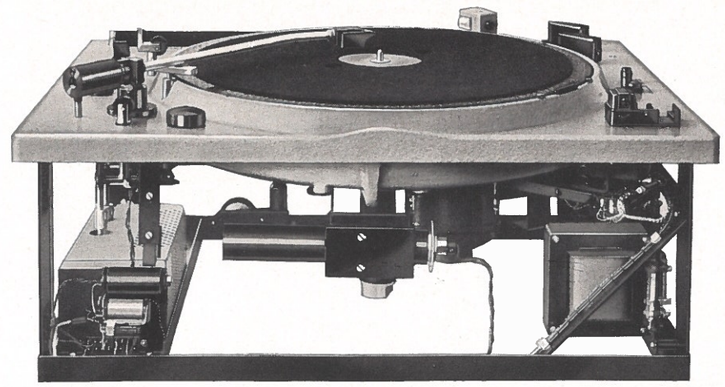
Built-in equalizer-amplifier:
Intermodulation factor < 0,5%
Output level up to 4 volts (+14 db)
Separate monitoring channel
Exact equalization for DIN, BBC, IEC, and NARTB curves
Infinitely variable surface noise filter.
Pickup/tonearm system:
newly developed dynamic EMT-Ortofon cartridge
interchangeable pickup cartridge
clearly visible groove and stylus location
built-in optical groove magnifier
focussed playing area illumination
attached record cleaning brush
automatic pickup weight and output level balance
Effective remote control:
Accurate sound and cueing insertion
Switching-in of program from the control room
Highly developed signal system.

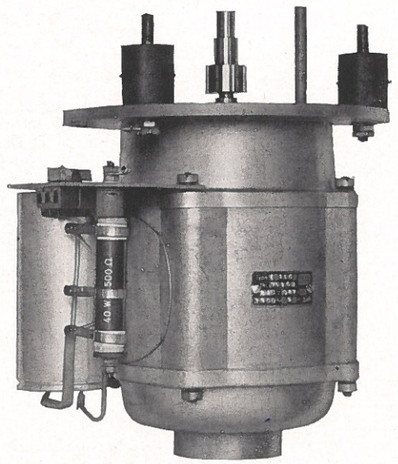
Printed in Germany



Front View:
(left to right) locking switch, illumination and motor, main bearing, spare parts, optical groove indicator and equalizer-amplifier.

Rear View:
Left to right: equalizer-amplifier with connections and delay relay, optical projection, power supply and brake.

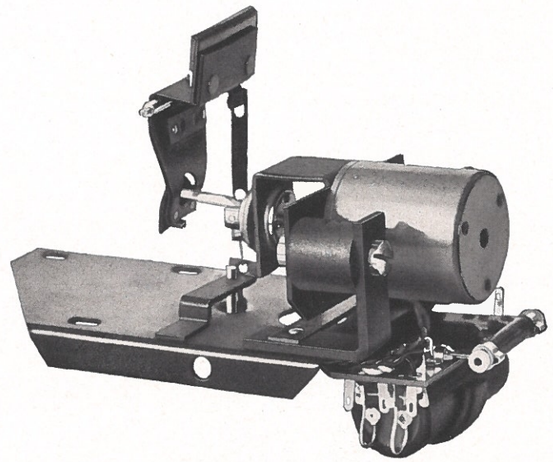




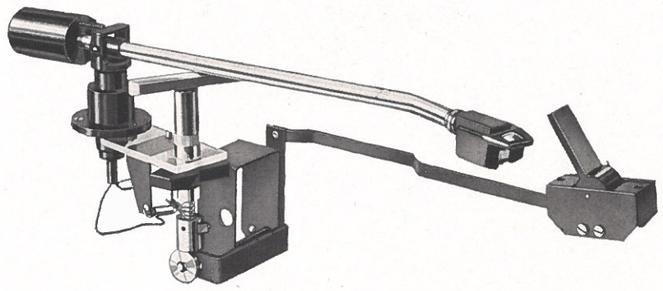
Self-starting, noiseless, single-phase synchronous motor with automatically controlled rotating field. Suspended by three shock absorbers at intermediate roller height in order to dampen vibrations and flutter. Highly important for keeping vibration and wow and flutter down to a minimum!

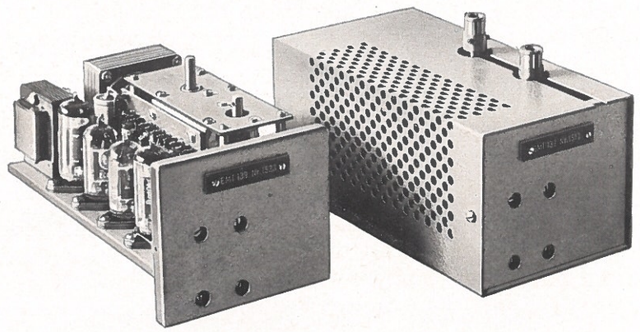
Solenoid brake for fast start/stop. The brake shoe located on top is vulcanised with a special rubber lining and can be readily interchanged.

To avoid noise and shocks, the assembly is mounted on several shock absorbers.



Raising and lowering mechanism for accurate placing of tone-arm onto disc. Tone-arm raise range adjustable from 1-8 mm. Mechanism has no mechanical play and can be supplemented by an optical groove indicator. The cartridge, illuminated from the front by a light is equipped with a lens. Thus a good identification of the grooving and contact point is provided.

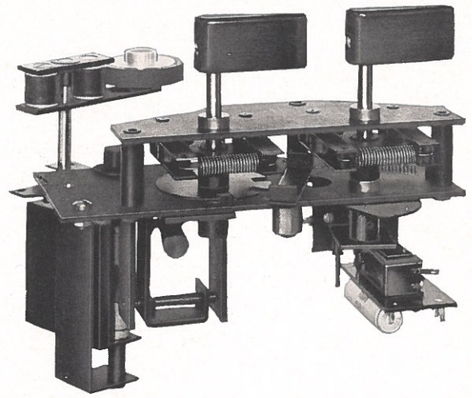




EMT 139 Equalizer-Amplifier
Right – ready for plugging in – left, with cover removed. Rear shaft is for the surface noise filter and front shaft for the equalizer selector.

The two upper controls are for the selection of channel and monitoring levels. The lower two serve for hum elimination. Upon removal of shafts and loosening of a retaining clamp the amplifier can be taken out without disconnecting cables.

Locking switch (upper left corner) assembly with precision tempered and ground drive roller suspended by shock mounts. – (Center) Speed selector and (right) main switch with its three positions: "OFF", "ON" and "OPERATION". In order to avoid damage to drive roller, the speed selector is locked in place and cannot be switched while in operating position.



TECHNICAL DATA OF PLAYBACK TURNTABLE EMT 927

ELECTRICAL DATA:

Wow & flutter: < 0.1 % p/p or < 0.04 % rms of wow.
< 0.1 % p/p or 0.04 % rms of flutter.

Rumble: > 50 db down referred to program level, measured at the output of the amplifier in equalizer position „IEC".

Hum: Better than 60 db below program level.

Magnetic stray field: < 50 mG at 50 mm distance outside the machine.

Mains supply: 110, 200, and 220 volts ±10 % 50 c/s. Model for 60 c/s mains voltage available without additional cost. Power supply for brake and signal system installed.

Power consumption: Approx. 40 watts.

Voltage breakdown: Insulation checked for 1 minute with 1,500 volts, 50 c/s.

MECHANICAL DATA:

Speed: 78, 45, and 33 1/3 rpm ± 0.3 % (measured at 20° C after 10 minutes operation), with pickup in outer groove of 30 cm disc and with exact vernier adjustment at 33 1/3 r.p.m.

Speed control: 3 position stroboscope, with impulse fed neon bulb, and illuminated from below.

Speed change after several hours of operation: < 0.2 % of r.p.m. after 10 minutes operation.

Speed change under pickup load: < 0.2 % on positioning of cartridge in outer groove of modulated disc of 30 cm diameter at 78 r.p.m. or 40 cm diameter at 33 1/3 r.p.m.

Precision of tone or spot selection: ± < 0.1 seconds or < 1/2 syllable length under specified conditions of remote control or direct operation. The desired sound or tone occurs 0.4 seconds after switching in. Start and brake delays are negligible.

Maximum record size: 44 cm or 17 1/4" ∅

Centering stud: Normal 7.14 ± 0.05 mm ∅. For 45 rpm discs with large center hole, an adapter is supplied.

Eccentricity of centering stud: < 0.02 mm.

Surface level of main turntable: Within < 0.2 mm, measured on external rim, machine in operation.

Finish of chassis: Enamel, silver-grey, hammer tone. (Other requests can be accommodated).

Dimensions of chassis: 520 × 675 mm (20 1/2" × 26 1/2") for top plate, 215 mm (8 1/2") depth below chassis for installation. Table cutout should be 500 × 655 mm (19 9/32 × 25 25/32").

Weight of chassis: Approx. 41 kg (90 lbs) including amplifier.

Installation cases: Steel consoles, for one or two machines, for floor or table stand are available.

TECHNICAL DATA OF EMT 139 EQUALIZER-AMPLIFIER

Equalization: DIN, BBC, IEC (RIAA), and NARTB – equalized. Noiseless equalization switching while in operation.

Level variation between equalization positions: < 0.5 db at 1000 c/s.

Frequency response: 30 – 15,000 c/s, within ± 1 db of equalization curve between 60 – 12,000 c/s.

Surface noise filter: Infinitely variable between 15 kc and 2 kc limiting frequency. Noiseless continuous adjustment during operation.

Attenuation of surface noise filter: Approx. 10 db per octave above cut-off frequency.

Modulation output: Balanced ≦ 40 ohms internal source impedance.

Load: 200 – 1000 ohms.

Output: Normal 1.55 volts (+ 6 db), maximum 4 V (+ 14 db).

Gain: Approx. 50 db at 1000 c/s.

Intermodulation factor: ≦ 0.5 % (at 100 and 7000 c/s and 12 db ratio) at 1.55 V output.

Harmonic distortion: ≦ 0.5 % over transmission range at 1.55 V output.

Overload level: 1 % total distortion at end of transmission range, and an output level of 5 V.

Total signal noise: > 70 db, with ear response filter interposed (weighted).

Monitor output: Unbalanced, for high impedance headphones.

Preamplifier controls: Equalization, surface noise filter, main level, monitor level, two hum balancing controls.

Power supply: From separate power supply, installed in EMT 927.

Exchange possibilities: By removal of spring fixed shafts and loosening of retaining clamp without disconnection of screws, or unsoldering.

Tubes: 2 × EF 804, 2 × ECC 82.

Dimensions: Approx. 201 × 105 × 110 mm (8 × 4 1/8 × 4 3/8").

Weight: Approx. 2.5 kg (5 1/2 lbs).

TECHNICAL DATA OF PICKUP SYSTEMS

Two separate dynamic EMT Ortofon cartridges which can be selectively inserted into the tone arm and retained by a ring nut, are designed for:

	Normal grooves	Micro grooves
Radii of styli:	65 µ	25 µ
Identification colour of stud:	green	red
Sensitivity p. cm/sec.:	appr. 0.45 mV	appr. 0.7 mV
Sensitivity p. mm light strip width at	appr. 0.18 mV	appr. 0.12 mV
	78 r.p.m.	33 1/3 r.p.m.
Pickup pressure	appr. 12 grams	appr. 8 grams

The pickups have automatic level and weight equalization. Sapphire and stylus holders can be easily exchanged. Pickups can also be supplied with diamond styli.

Impedance: Approx. 35 ohms.

Frequency response: Flat, from 20 c/s to 15,000 c/s.

Stylus mass equivalent: < 3 milligram on stylus.

Compliance: < 20 milligram per μ displacement of stylus.

Pinch effect: Negligible, due to vertical soft yielding of stylus system.

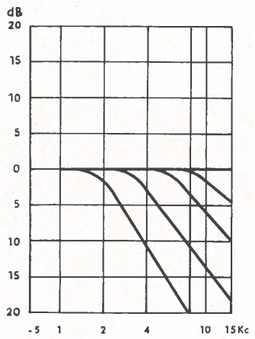
Low frequency resonance: Approx. 18 c/s.

Groove starting point for pickup: Directly visible – simplified by lens on cartridge head, and by area illuminator. A raise and lowering mechanism is used for placing pickup on records.

Other features:

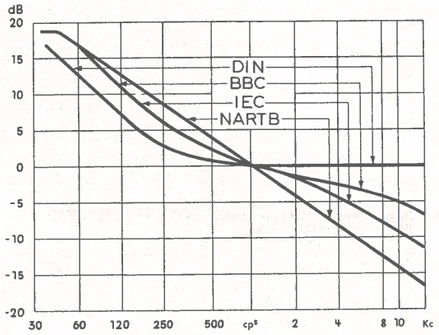
a) An advance groove cleaning brush is attached below the pickup cartridge, which cleans record during operation, thus saving record and stylus and reducing playback noise.

b) A special container for 2 spare cartridges is provided on top of chassis.



SURFACE NOISE FILTER:

The linear frequency response resulting from the recording and reproduction characteristic can be infinitely adjusted by the surface noise filter, according to diagram. This frequency equalization is especially required with old records and severe playback noise.



PLAYBACK EQUALIZATION:

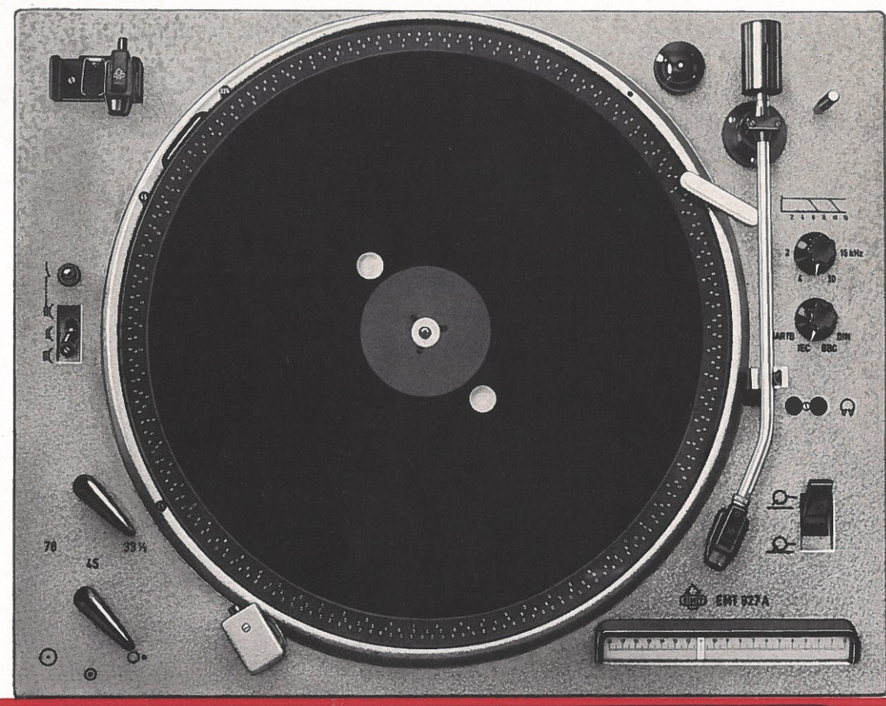
This diagram illustrates the output voltage in db produced by a frequency-constant input voltage. Thus the diagram corresponds to a mirror image characteristic. Reproduction- and recording equalization combined result in a frequency-constant output voltage.

TOP VIEW

Left: Main switch; speed selector; spring-loaded toggle switch with two positions: "brake free" and "brake on" as well as locked "remote control" position; signal lamp indicating "remote ready"; container for 2 cartridges; centering adapter with slip-on bolt for records with large center hole.

Centre: Auxiliary record platter with large center hole for 45 rpm discs with reinforced centre part, three-position stroboscope, brake pad for start/stop mechanism, positioning marks, and illumination.

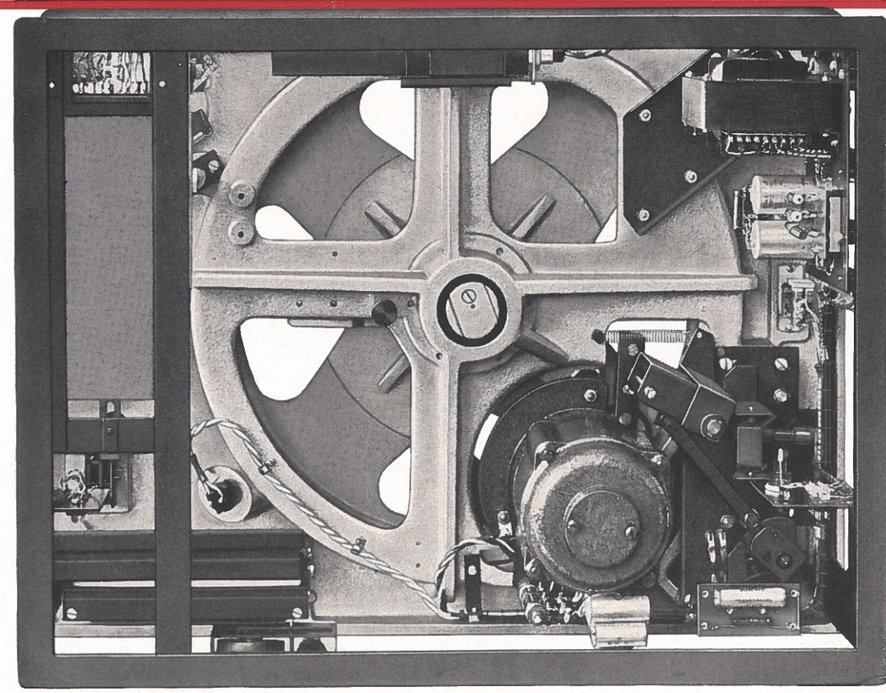
Right: Optical groove indicator with housing and scale (only by special order), pickup raise and lower mechanism, tone arm holder for disc change, equalizer-amplifier with monitor headphone jacks, tone arm raise/lower support, tone arm and pickup cartridge (EMT Ortofon).



Lower left: Deflection mirror and scale of optical groove indicator; attaching plug, stroboscopic illumination, equalizer-amplifier and connecting plug.

Centre: Drive unit, main bearing with vernier brake, and projection optics.

Right: Locking switch assembly, connecting plugs, mains fuse, slow-acting relay, remote control switch, power supply and brake.



VIEW FROM BELOW

GENERAL DESCRIPTION

The transcription turntable type EMT 927 is designed for reproduction of disc records up to 44 cm diameter at speeds of 78, 45, and 33 1/3 rpm. It is used in broadcasting, television, and similar studios, also for broadcast plays, in stage and film production studios, and by record manufacturers. Various designs can be supplied to meet all requirements. They are described in detail under par. "Special Designs" on the last page of this leaflet. EMT 927 permits up-to-date and reliable program production by remote control from the control room which guarantees accurate timing, precise to the syllable. Thus, the work of the operator is less strenuous and it is possible to install the set in a separate room in order to conserve space.

This model is especially constructed for long periods of continuous operation and requires very little maintenance. With expert use, servicing is required only once every 400 hours of running. The materials used as well as the exterior finish have been carefully selected so that the machine may be regarded to withstand any "tropical conditions".

Performance in terms of sound level variation, vibration and dynamic range, is considerably better than the best records available today. The machine will permit full advantage of any future improvements in the technique of recording, matrix production and record processing.

A dynamic pickup system of the firm EMT-ORTOFON which is used in our models has been especially designed for us. The playback unit is mounted in a special case. It is normally equipped with a high-quality sapphire stylus but can also be supplied with diamond stylus at extra charge. Two systems are usually provided: one with a stylus radius of 25 μ for long playing records, the other with a stylus radius of 65 μ for standard records. Pickups with any other radius of curvature can also be supplied on request. Sapphire styli for standard groove records can also be supplied elliptically ground. We have refrained from using a reversible system, as this is usually a compromise in quality. The pickup is held in the tone arm by an easily detachable bayonet lock which reduces the stress on the tone arm bearings to a minimum. A special container is provided on top of the machine for pickup cartridges which are not in use.

Groove location and point of pickup insertion are clearly visible. The coloured sapphire holder protrudes sufficiently from the casing which has been inlaid in white around this section to furnish a good contrast of colours. A lens, attached to the front of the pickup plus the focussed illumination of the machine, improves the visibility of the starting point considerably. These improvements on our previous systems have been made to meet various requests of our customers. They also provide great relief to the operator, enabling him to have alawys a good view of the pickup insertion area as well as of the end of the reproduction which is usually unfamiliar to him. A small cleaning brush is provided beneath the pickup. This helps to improve the quality of reproduction and protects both the record and sapphire. The sapphire stylus can easily be exchanged by the user by simply drawing it away together with the holder.

Another feature of the tone system is the very low dynamic turnback force (highcompliance) which is of considerable importance during reproduction in order to protect disc material. The needle pressure is approx. 8 g on long-playing records and approx. 12 g on standard records. For playing back wax masters or original recordings the stylus pressure can be decreased accordingly. Weight compensation is effected automatically by the differing cartridge weights when changing the pickup elements. Micro-groove cartridges have an increased sensitivity of 3.4 db over standard-groove pickups, to compensate automatically for the output level differences of the two disc types. The pickup/tone-arm combination has a lower resonant frequency of approx. 18 c/s which is sufficiently far below the transmission range and yet high enough not to be unduly sensitive to disturbance by footsteps or other structure borne sounds. The upper limit resonance is determined to a great extent by the disc itself and generally lies far above 15 kc/s. Within the normal audio range, the frequency response is of remarkable constancy. The low-impedance (approx. 35 Ω) systems are made insensitive to external disturbing fields by means of good shielding and are outstanding for their extremely low intermodulation distortion which, as a result of the dynamic principle used, remain unaffected even if readjustment becomes necessary. The tone arm itself is statically balanced by counter weights. This is very advantageous in respect to disc-and sapphire wear, and nonsensitivity to vibrations.

The pickup system operates with a built-in, easily interchangeable equalizer-amplifier with low intermodulation and harmonic distortion and good signal/hum ratio. The symmetrical output of the amplifier (a source impedance of less than 40 Ω) normally provides 1.55 V (+6 db); level up to 4 V (+ 14 db) is possible without noticeable increase in distortion as the distortion factor of 1% is exceeded only at 5 V output. For a monitoring control with high impedance headphones, a separate output is provided, decoupled from the signal output path.

Recording characteristic curve equalization for DIN, BBC, IEC, and NARTB can be selected by means of the selector switch (see illustration). Last named standard agrees practically with the newer regulation by RIAA. A continuosly variable surface noise filter with flat response up to 15 kc/s provides a cut-off possibility down to 2 kc/s. The output voltage above the limit frequency drops at the rate of approx. 10 db per octave (see illustration). Actually tolerances of normal commercial records spread to such an extent as to make the equalization provided almost perfect. Equalization switches and surface noise filters can be noiselessly operated during reproduction. Thus, adaptation to record equalization can be effected during broadcasting.

The drive of the machine is effected peripherally (rimdriven) by means of a self-starting special synchronous motor. A control mechanism, making use of the slip of the rubber-covered drive roller, enables precise speed regulation. This adjustment is carried out normally at 33 1/3 rpm with the pickup in the outer groove of a 30 cm record. Program playback time maximum e rors, irrespective of record diameter and rotation speed, are less than 5 seconds for a program duration of minutes, and therefore almost negligible.

For reliable program production, it is necessary that the required sound effect, whether it is the beginning of a record or an extract from it, must be available for insertion with extreme accuracy, at exactly the required instant and precise to the syllable. In many designs, little or no attention has been paid to this problem. When highest quality reproduction is required it is not possible to arrange, in an economical way, for the whole machine to come to full speed or to rest in about 0.2 seconds. Inaccuracies of records also prevent exact placing of the pickup stylus on the rotating record since the eccentricity of the bore hole, particularly with long-playing records, may exceed several grooves. The difficulties are further increased by the spiral form of the groove and the varying spiral pitch used in modern methods of recording. The idea of lifting the records, although in itself a good principle, cannot be applied to light pickup arms with counterbalance weights since the raising and lowering accelerations are too great. As the record is raised, it is affected by the increased stylus pressure, while, as it is lowered, the pickup arm cannot follow quickly enough, with the result that the needle may sweep over the grooves.

The method of holding the record still and allowing it to slip on the turntable is often used today. This requires, however that the operator stands close to the machine and cannot operate several units simultaneously. This practice must also be regarded as uneconomical because it does not permit the use of remote control, e. g. from the control room. The system developed by us and applied to our playback turntables operates as follows: The auxiliary turntable platter bearing the record is on the continuosly rotating, heavy main turntable.

This platter is relatively light and driven by an intermediate friction coupling. The upper turntable, together with the record, is released and stopped by a magnetic brake, energized by 20 – 26 volts D. C. from the built-in power supply unit. A switch incorporated in the machine permits the preparation and cueing up of a program which then can be run off by remote control from the control panel or the control room. A signal lamp built into the machine indicates the readiness of the control to take over the transmission, whereas a warning lamp in the control room indicates that the transmission is built up and can be commenced. The actual switching in of the program is carried out over an end contact of the level control. With most coupled machines used as double playback sets, a separate level control will be required for each. The special W 66 program level control which can be supplied by us, is suited for this purpose. If an uninterrupted program containing several record sides is to be reproduced, an additional change-over switch is provided which permits changing from one machine to the other. Both machines are synchronized in the conventional manner. Head phone monitoring is provided.

The preparation of the program is carried out as follows: The auxiliary disc plate together with the record, is stopped immediately by means of the quick-action brake after the required item is run through. Now the record disc with the pickup applied upon is positioned to locate the sapphire closely before the begin of the desired sound performance. The record is then turned backwards on the turntable, without removing the pickup, at an angle of approx. 0.4 seconds of the playing time, as marked on the collar of the machine. (This can be done without any danger of damage to the record.) As soon as the transmitting channel is ready for reception – this is indicated by the signal lamp – the toggle switch is moved into "remote control" position. By this movement, the preparation of cueing of the program is completed.

A signal lamp in the control room indicates simultaneously that the program is "ready". By switching in the program level control, the end contact which controls the release is automatically switched in first (indepedenty of the speed used for operating the control) – the sound output will only be audible after the fore-mentioned angle has ben passed, which corresponds to the running-up acceleration time of the auxiliary disc plate with record. This is achieved by a time lag relay which interrupts the modulation until the proper moment.

With this method of production control, working with the pickup resting on the record, it is obviously necessary to have absolutely vibrationless starting and stopping of the record. This has been provided. The motor itself and the various moving parts of the machine are completely noiseless so that, if necessary, the announcer's microphone can be placed beside the machine. Several programs can be produced in the same room. Pickup placing on the record is not done by hand but by means of a precision setting mechanism which prevents damage to the record or to the pickup. After the pickup has been raised, it can be quickly moved in one motion to the magnetic holder. This holder is used during record-changing or for transport.

The low construction height of the machine enables it to be used as table equipment although it is usually installed in a desk. Suitable consoles can be supplied for both methods of installation.

TECHNICAL DESCRIPTION

The machine is assembled in a heavy, ribbed chassis of carefully tempered cast Silumin-Gamma. The upper surface is finished in silver-grey hammer-tone enamel. A frame of angle-section metal is fixed below the chassis plate, assuring protection to motor and component parts.

The record-player can be conveniently installed in a console by attaching the chassis deck which projects beyond the frame, to the console with the soft rubber gasket placed in between.

The chassis carries the main bearing of the machine for the main turntable. This is designed as a plain bearing of highest precision while the vertical thrust is taken up by a special thrust ball bearing. The whole bearing assembly is filled with special oil, which is vital to the reliable operation of the machine and which must not be replaced by any other type. A spare bottle of oil is provided. The main turntable is shrunk on to the main shaft. This table consists of carefully aged and tempered cast Silumin-Gamma. The inner surface for the drive and the friction surface for the auxiliary turntable are finely machined and protected from corrosion by anodizing.

The actual record-carrying platter of plexiglass, the upper edge of which carries stroboscope divisions for 78, 45, and 33 1/3 rpm rests on the main turntable and is illuminated from below by an impulse-excited lamp so that a very clear speed indication is obtained. The stroboscope calibration is arranged for 50 c/s. mains frequency (can be supplied for 60 c/s. frequency). A layer of felt is joined to the underside of the auxiliary turntable to provide a friction coupling to the main turntable. The upper surface is covered with cloth which provides a suitable surface for supporting the record. For records with large center holes, an adaptor is supplied which can be placed ovor the standard centre spindle.

The electromagnetic brake is controlled by a spring-loaded switch with three positions: "brake off", "brake on", and "remote control". The first two positions are independent in relation to the third in order to make unintentional false operation impossible. Since the switch can only be moved into the "remote control" position from the "brake on" position, a signal lamp is provided which lights up when the transmission line is set to "remote control".

A special self-starting single-phase synchronous motor is used to drive the machine. Its rotating field is kept constant by means of a condenser and phase-equalizing resistor. The drive wheel has three steps, corresponding to the three rotation speeds, and drives the inner rim of the main turntable via an intermediate roller with an aged and precision lapped rubber surface. When the machine is switched off, the intermediate roller is automatically left completely free between the turntable and the stepped drive wheel, in order to avoid damage to the running surfaces as a result of "flats". By raising or lowering the transmission roller, it is brought into positive contact with the respective step of the drive wheel corresponding to the required rotation speed. These parts are enclosed in a rigid locking switch assembly which is operated by two convenient knobs. The lower knob has three positions: "machine off", "machine on", and "operation". In the "machine on" position, the main switch is closed, and the amplifier and any auxiliary equipment are brought

into operation. Readiness for operation is indicated by the "lighted" stroboscope lamp. On changing over to the operating position, the mechanical connection between the stepped motor drive roller and the turntable is established, via the intermediate rubber roller and then the drive motor is switched on. This occurs practically noiselessly by means of a microswitch. The upper knob permits a choice of three rotation speeds. It is locked when the lower knob is in the operating position in order to prevent any damage to the rubber roller. Owing to the type of power transmission used, there is only a small amount of slip, which is used for precise adjustment of the rotation speed by means of a vernier brake applied to the main bearing.

The pickup is set on to the record by means of a mechanical raising and lowering mechanism the lift of which is adjustable between 1 and 8 mm. This is operated by means of a suitable knob and gives sure protection against damage to records or pickup. The use of this device is to be preferred to hand setting of the pickup and has been adopted internationally for studio work.

SPECIAL MODELS

An optical groove indicator can be provided in order to facilitate the selection of particular sound effects. The position of the pickup arm is indicated by a bright light spot on a scale 180 mm long, calibrated in millimetres. There is no backlash and no additional load to the pickup. A ratio of about 1 : 1 was selected, i. e. 1 mm groove movement gives about 1 mm movement of light spot.

Measuring units for record manufacturers:
The record industry constantly improves recording methods which increase playing time of discs and must at the same time improve the quality of reproduction with respect to pitch variation, dynamic range, distortion, and a wider frequency response. For optimum production control, a special measuring unit of highest quality is necessary in order to determine the limitations of the record itself, i.e. of the galvanic and matrix production processes (record material) and the limitations imposec by commercial playback equipment.

An elementary part of the measuring unit is an optical groove indicator with a ratio of about 4 : 1, i. e. 0.25 mm groove movement gives a light spot movement of about 1 mm. This special optical assembly permits measurements of the eccentricity of any part of the recorded track in relation to true center. Therefore, the ratio is sufficiently large to measure eccentricity of the record center hole to center groove, distortions of the whole record or record parts which require sound level variations. In order to obtain a really precise record drive, a springloaded centre spindle is provided, which presses up against the record from underneath and equalizes varying centerhole diameters. An accurately-ground rubber-covered crystal glass plate is used as turntable. The quickstarting and -braking device is omitted since it is of no interest for this application. When playing back original instantaneous recordings and masters, the special model C pickup with diamond stylus is recommended. If sapphire styli must be used for 78 rpm records with standard groove spacing, an elliptically-ground sapphire stylus is strongly recommended.

Units with two tone arms: Two tone arms can be fitted to the machine where changing of pickup heads seems to be too tedious. This arrangement, however, is very seldom used. Such machines are fitted with separate raising and lowering devices for each of the two pickups.

We also manufacture other special professional models for an particular application in accordance with requirements of our clients.

ELEKTROMESSTECHNIK W. FRANZ KG
LAHR/SCHWARZWALD · LUISENSTRASSE 23 · WESTERN GERMANY