More Than Just Stereo - Magnetophon 77

TELEFUNKEN

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Illustration 1:
Rotating tape guide roller in Magnetophon77.

The latest polls, conducted with the purpose of determining "the typical tape recorder buyer", show a very interesting result. According to the findings of the poll there are two basic groups of people who buy tape recorders.

1. The "user", who shows no personal initiative with his machine but uses it only for recording any acoustic entertainment offered. That his enthusiasm for the tape recorder rapidly wanes, is substantiated by the fact that he generally buys only two or three tapes. Due to this lack of keenness, the fact that he owns a tape recorder can hardly be considered as having an exemplary effect among his circle of acquaintances.

2. The tape enthusiast, sound collector, tape correspondent, amateur, player, do-it-yourself man, call him what you will. This is the man who uses his tape recorder to the fullest possible extent and elevates it from a primitive record keeping machine to a highly sensitive instrument with boundless possibilities. This is the type of man who exchanges tapes with his friends, dubs tapes for slide or home movie programmes, makes trick and playback recordings, records complete plays and reports, keeps an acoustic diary on his children from the day they are born, mixes, transcribes and cuts.

There were contradictory opinions regarding the proportionate size of these two groups. Pessimists estimated the proportion of people belonging to group 2 in the Federal Republic of Germany at 10%. Then, the TELEFUNKEN Magnetophon 76 fourtrack tape recorder appeared on the scene and immediately started on a triumphal progress which, for home tape recorders, is outstanding. Above all, the possibility, when playing back one track, of being able to hear in perfect synchronization a recording made previously on another track, proved to be ideally suited to so many purposes — dubbing, playback recordings, learning foreign languages — that the development engineers adopted the Magnetophon 76 as a basis from which to work on the creation of a stereophonic parallel type, the Magnetophon 77. The idea was to retain the versatility of the monaural machine in the stereo model and, if possible, to extend this versatility still further. The degree of success achieved in this venture can be seen here.

If one looks at the forebears of the present models Magnetophon 75, 76 and 77, one sees from the whole series, starting with the single-speed Magnetophon 65 and going on via the two-speed Magnetophon 65 S and the ensuing Magnetophon 65 X to the present Magnetophon 75, with its improved technical concept yet practically unchanged outer appearance, that there is such a thing as ageless design. Further, and this is far more important to the buyer, one sees that the retention of a proven mechanical construction which enables more than 200,000 machines to be made without retooling, reflects in the selling price.

Electrical and Mechanical Construction

The Magnetophon 77 is a full stereo machine. This means that it is not only equipped for the playback of professionally pre-recorded four-track stereo tapes but also for making stereo recordings. It contains, therefore, two complete, separate record/playback amplifiers.

If the Magnetophon 75 was so popular for its compact design and resulting handiness, how much more will this popularity apply to the Magnetophon 77. There are, however, in this machine, twice as many electrical components due to the presence of two complete amplifier circuits.

For reasons of both space and heating, the transistorization of the input stage, already started with the Magnetophon 76, has been taken a step further. As a result, each channel comprises two transistors, a twin triode and the output tube and appears as follows: OC 603 — OC 603 — ECC 83 — EL 95. In order not to lose the advantageous signal-to-noise ratio gained by the use of hum-free, low-noise transistorized twin pre. amp. stages, in that section of the amplifier fitted with tubes, both ECC 83 tubes are heated with DC. The magnet for the rubber sheathed pressure rollers is also DC operated in order to avoid disturbing hum fields in the vicinity of the recording head.

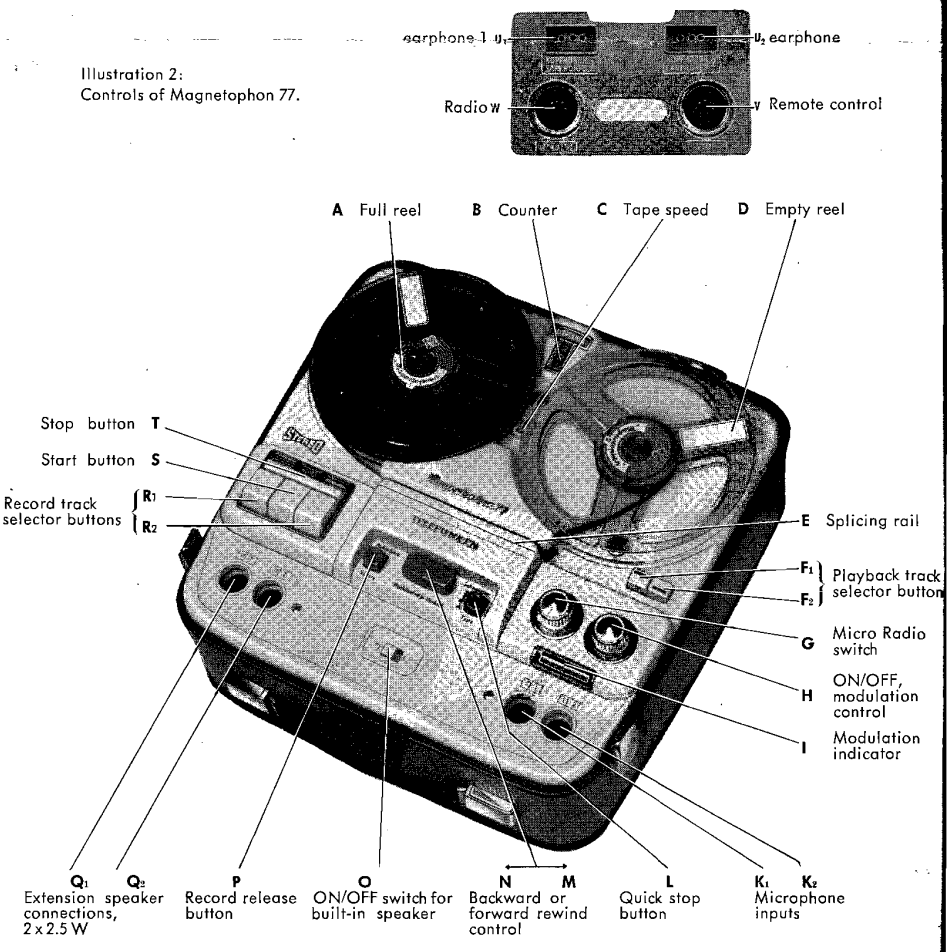
Naturally, the recording head — as is the case with all TELEFUNKEN tape recorders — is surrounded by a double shield of mumetal, while, in the record or playback position, a mumetal flap swings against the head from the front thus completing the shielding.

With the Magnetophon 77, as with the Magnetophon 76, special value is placed on the free running of the tape. The patented TELEFUNKEN automatic tape tension device (German Federal Republic Patent No. 840,014 dated 22/9/1950), not only ensures that tape tension during rewind is constantly kept below 300 gramms, but also, independent of the tape diameter of the LH reel, ensures even tension along the entire length of the tape which in turn effects constantly even tape pressure against the head. The head assembly with its three height guides, is pre-assembled as one unit as this system enables even more exact adjustment of head and height guides to be made. In this connection, special mention must be made of the rotating tape guide roller (Ill. 1), unobtrusively introduced by TELEFUNKEN some time ago in the Magnetophon 75, which in the meantime has proved itself so well in the Magnetophon 76 and 77. Indeed, this device (German Federal Republic Patent No. 848,271 dated 28/7/1950), is one of the little secrets which contribute to the crystal clear tone quality of the TELEFUNKEN Magnetophon tape recorders. The problem of obtaining a free running tape is not one which is solved by simply ensuring that tape height is controlled. Rather the reverse is the case as the tape, which is not a rigid body but an elastic mass, begins to vibrate longitudinally due to the rigidity of the height guides. These longitudinal vibrations are audible during playback as wide side bands to originally clear sounds. This phenomenon, known as "rustle effect", is especially audible with pure or almost pure sinusoidal oscillations, e. g. whistled recordings. The most effective countermeasure to longitudinal vibration is to steady the tape by means of a flywheel mass located as near as possible to the head. For this reason it has long been the practice with studio machines, to fit a large flywheel mass between the recording head and the playback head. A simple experiment will show that the small flywheel mass represented by the tape guide roller in the Magnetophon 75, 76 and 77, serves also to eliminate longitudinal vibration. With the tape running at 1 3/4 i.p.s., whistle into the microphone and, during playback, hold the tape guide roller back with a match. The "rustle effect" will be clearly heard.

Operation and Switch Possibilities

Here too the thoughtfulness of the development engineer can be clearly seen. The convenient push-button control system, taken over practically un-

Illustration 2:
Controls of Magnetophon 77.



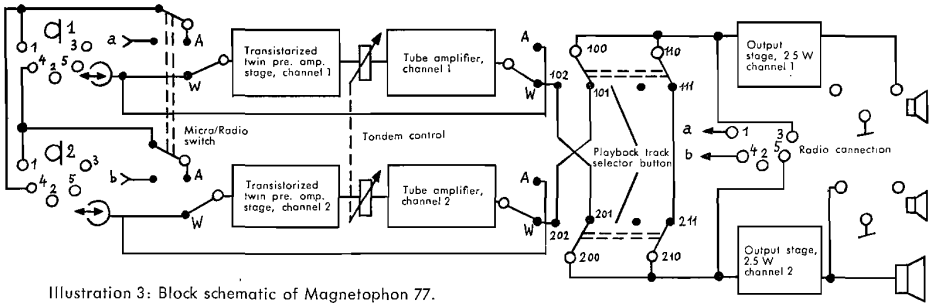


Illustration 3: Block schematic of Magnetophon 77.

changed from the Magnetophon models 75 and 76, allows each of the amplifiers to be switched over separately from record to playback and vice versa. A look at Ill. 2 will make clear the sensible layout for the LH and RH channels, respectively the upper (1) and lower (2) tracks. The block schematic (Ill. 3), shows the carefully thought out operation of the playback track selector buttons. In the position shown, neither of the track selector buttons is pressed. The result is mixed operation, i. e. the separate audio frequencies of channel 1 and channel 2 coming from the tube amplifiers are combined and led to both output stages and to points 3 and 5 of the radio connection. This can be easily seen from the lead connections and switch positions. If the LH playback track selector button (1) is pressed, the audio frequency of channel 1 goes via contacts 102—100 to output stage 1 and to point 3 of the radio connection then, via contacts 201—200, to output stage 2 and point 5 of the radio connection. The audio frequency from channel 2 is interrupted at contacts 202 and 101. Conversely, when the RH playback track selector button (2) is pressed, the audio frequency from channel 2 is led to both output stages and points 3 and 5 of the radio connection while the audio frequency from channel 1 remains unused. Pressing both buttons allows stereo reproduction, i. e. the audio frequency from channel 1 goes to output stage 1 and point 3 of radio connection via contacts 102—100 only, while the audio frequency from channel 2 goes to output stage 2 and point 5 of radio connection via contacts 202—200 only. In practice, the four possible switch positions represent:

(1) Both track selector buttons up: trick operation, upper and lower tracks mixed via the two output stages.

(2) LH track selector button pressed: monaural operation of upper track via both output stages.

(3) RH track selector button pressed: monaural operation of lower track via both output stages.

(4) Both track selector buttons pressed: stereo operation of each channel via its own output stage.

Tricks and Dodges

Now for a few words about the many possibilities resulting from the circuit design described above with its two separately controlled amplifier units. The aim here is not to baffle the reader with a multitude of instructions of which he can make neither head nor tail but to pass on in detail some typical circuit layouts which he will really understand so that he may adapt them to his own purposes.

First place is given to the full-scale demonstration given at the Frankfurt Radio Exhibition and the Berlin Industrial Exhibition with the prototype models of the Magnetophon 77. This demonstration was carried out in and around the glasswalled studio (Ill. 4) and was not intended purely for the entertainment of the interested audience but rather as a test under the most adverse conditions, namely, continuous operation under the influence of dust and heat. Despite the astonishment among the wide-eyed lay audience as the result of a trick duet recording which gave them the impression that one was singing to them from right and left simultaneously, the circuit used was very simple. To record the first voice, an ordinary monaural microphone — D 19 B — was plugged into microphone input K 1, record track selector button R 1 pressed and correct modulation adjusted by means of control H. After the start button had been pressed, the amateur artist sang the first voice into the microphone. The tape was then rewound, an earphone connected to output U 1, record track selector button R 2 pressed, modulation set via control H and the start button pressed. The artist was then able to hear in the earphone the voice he had just recorded and to sing the second voice on channel 2 in perfect synchronization. The tape was then rewound once more, both playback track selector buttons F 1 and F 2 pressed, the start button operated and out came the stereo trick duet to surprise the audience always anew.

If the layman who has not been let in on the secret of the trick effect described above is astonished, the serious technician is deeply impressed with the possibility of transcribing from one track to another or from one section of the head to the other. The cross-talk damping values necessary are quite considerable when the following cycle is understood. The track running in the playback position delivers about 1 mV at the input of the playback amplifier. The sound is carried from the output of the playback amplifier to a mixer circuit, mixed with another sound — otherwise the transcription would be without sense or reason — and led to the input of the recording amplifier of the other track. The recording section of the head receives roughly 100 mV from its amplifier while, as stated at the beginning, there is only 1 mV at the playback section of the head. The danger of an electrical feedback is, therefore, very high. To eliminate any makeshift, do-it-yourself connections and the resulting danger, TELEFUNKEN can supply a carefully developed and tested transcription device, the "Transcription Coupler 77", (Ill. 5). This comprises a small case with a knurled disc control, a network for correction of frequency response, an input connection and two fixed leads. One of the leads terminates in an earphone plug (1) which is plugged into the earphone output of the channel to be played back and from which the transcription is to be made. The other lead terminates in a standard five pin stereo plug (2) which should be plugged into microphone in put 1 of the Magnetophon 77. The standard stereo connection (3) of the Transcription Coupler will take stereo microphone D 77 or any monaural microphone. Provision is made, via an internal connection in the Transcription Coupler, that transcription can be carried out without having to continually change the plug (2) from one microphone connection to the other (1 and 2). The plug (1) must, however, be changed over according to whether transcription is to be made from the lower to the upper track or vice versa.

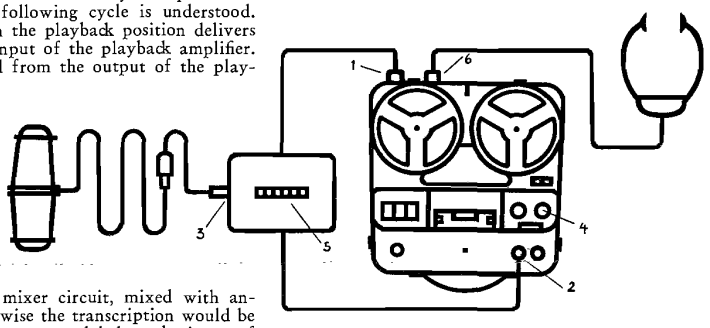


Illustration 5: Connecting diagram for Transcription Coupler 77.

The actual transeription is carried out as follows. After pressing the correct track selector button, modulation for the speaking voice over the microphone is adjusted via control (4) on the Magnetophon 77. Then, after pressing the start button, the sound from the track to be transcribed is faded or boosted via the knurled dise on the Transeription Coupler. The mixture can be monitored via the earphone (6) which is connected to the recording track.

The so-called „two programme opteration" is also very impressive. This can be carried out with the Magnetophon 77 without any extensive preparation or complicated equipment. Light music is recorded on the upper track of a tape and dance music on the lower track. Normally, one would only listen to one or the other recording and press playback track selector button 1 or 2 accordingly. Let us suppose however, that on this occasion there is a dinner and dance being given in the house. While those still seated in the dining room are finishing their meal and enjoying a little conversation, others are impatiently waiting in another room in the house for the dancing to begin. It is possible to keep both parties happy. The tape recorder is set up in the room set aside for dancing, both track selector buttons pressed and an extension speaker connected to speaker connection (1), placed in the dining room. The dancers can now trip the light fantastic to their hearts content without hearing one single note of the light music while those guests still at table can enjoy the light music to the full without being disturbed by the dance music. This is not a miracle, as the cross-talk damping of the Magnetophon 77, even with this type of operation where both tracks are being played back simultaneously, is still > 46 db.

Just now the simultaneous reproduction of two different sound recordings for two different purposes

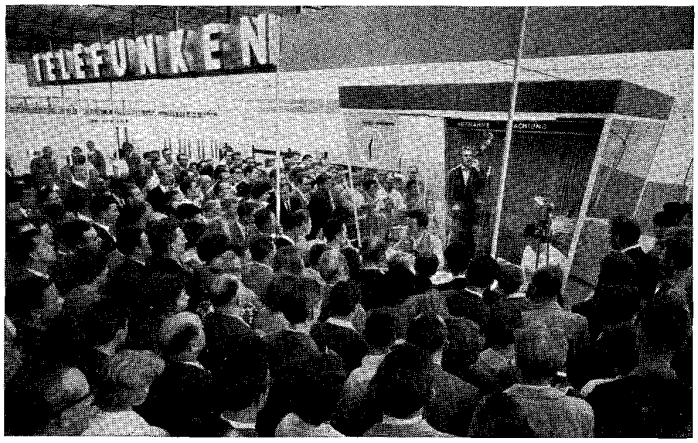


Illustration 4: Glass-walled studio at the Frankfurt Radio Exhibition.

was described. Now we come to an example of the simultaneous recording of two different sounds for the purpose of timing coordination. For quite a long time now in various West German towns the fire brigade have adopted the system of recording on tape all incoming reports. Electrically remote controlled tape recorders such as the Magnetophon 75, 76 and 77 are well suited to this purpose as the tape can be automatically started when the telephone receiver is picked up, by means of a contact on the cradle switch of the phone. By means of this system of recording incoming fire reports, it was, for example, possible to prove that in some cases the caller was so confused that he forgot to give his address. This independent proof was of great importance in cases where redress was demanded from the fire brigade.

One drawback in the system, however, was that the exact time of reporting the fire could not be proved, a fact which was seized upon by claimants whose property had been damaged by fire, as a means of showing the fire brigade to have been at fault. With the Magnetophon 77, the incoming report can be recorded on track 1 while the exact time of the call, relayed via a special Post Office lead, is recorded simultaneously on track 2. Should the subject of the exact time of reporting the fire be a matter for debate at a later date, the exact time and every word spoken can be heard by simultaneously playing back both tracks.

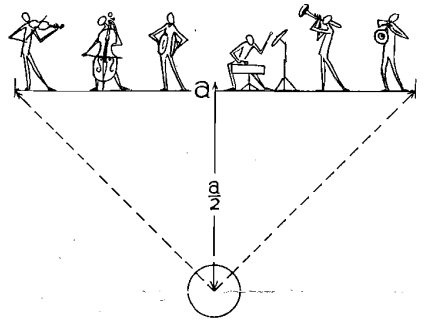


Illustration 8:
"Snapshot" setting of D 77 microphone.

After these examples, which have mainly dealt with the monaural uses of the Magnetophon 77, comes, quite justifiably, the question, "How is the Magnetophon 77 used for stereo?" Although professionally pre-recorded four-track stereo tapes are now on the market, the keen amateur will certainly want to try his hand at recording stereo discs on tape himself. Providing that due attention is paid the copyright law, there will be no objection to this. Practically all present day stereo record players are fitted with the standard three-pin plug, adopted from tape recorder standards, whereby, as shown in Ill. 6 a, channel 1 is connected to pin one, ground to pin 2 and channel 2 to pin 3 of the plug. This plug from the stereo record player should not be connected to either the radio or microphone inputs of the Magnetophon 77 as this would result in a greatly distorted version of channel 1 only being picked up due to the fact that the record player has an output voltage of approximately 1 V while the radio input is fitted for a sensitivity of 5—100 mV and the microphone input for 2—50 mV. One must, therefore, use a stereo/phono coupling with a circuit as shown in Ill. 6 b which simultaneously divides the voltage from the stereo record player and leads it to the correct inputs, namely, points 1 and 4 of the radio connection. The two 2.2 MΩ resistors, together with the 50 kΩ input resistors of the radio connection, form a suitable voltage divider. The 2.2 MΩ resistors can even be arranged in the plug

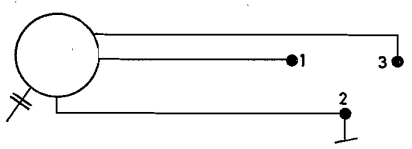


Illustration 6a: Stereo record player circuit.

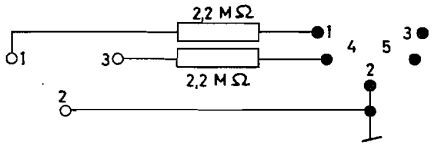


Illustration 6b: Stereo/phono coupling circuit.

or matching piece used as the phono coupling. From a technical point of view, nothing now stands in the way of transcribing stereo records.

The most interesting and widest field for the amteur offer, without doubt, live stereo microphone recordings. The stereo microphone D 77 (Ill. 7), consists of two directional microphones mounted one above the other, the cardioid response patterns of which can be varied in an angle of 60—180° for XY stereophony. Apart from this, the simple press stud connection allows the microphones to be separated easily and quickly thus permitting actual AB effect stereophony with an appreciable distance between the two microphones. Each of the two microphone halves is fitted with a threaded stand connection and the price of the microphone includes two table stands, a 16 foot connecting lead and a twin transformer unit for matching the 200 Ω microphone impedance to the microphone input of the Magnetophon 77. A complete set of instructions is enclosed with each D 77 stereo microphone. In these instructions one can, for example, find the rule of thumb that, for XY stereophony the speech apertures, marked with arrows, of both microphones should point towards the outer edges of the sound source (Ill. 8), and that the distance between the microphone and the sound source should be half the extent of the sound source. The result, in accordance with the theory of our old friend Pythagoras, is the „snapshot setting" of the D 77 stereo microphone at 90°. This setting is marked with red dots. The many possible variations, by changing the angle between the microphones or even separating the two systems from each other, will certainly be very heartily welcomed by the tape enthusiast. Because of the low impedanee cable and the fact that the transformer, which is located close to the Magnetophon 77, is a plug-in type, the D 77 stereo microphone can be placed as far away from the machine as desired. Complete 32 foot extension leads are included in the range of accessories available.

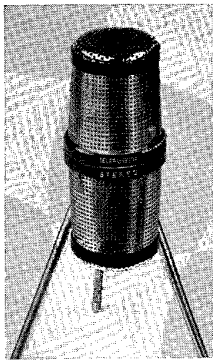


Illustration 7:
Stereo microphone D 77.

Now for stereo playback. It is amazing when one considers that the Magnetophon 77, for its size and moderate price, to say nothing of the stereo recording possibilities, contains two complete output stages. Because of this, it is sufficient for stereo playback to connect the speaker housed in the lid of the case to speaker connection 1. The RH channel is then reproduced via the built-in speaker of the Magnetophon 77 and the LH channel via the speaker in the lid.

Naturally, it is also possible to connect a stereo radio or radio/phono console to the radio connection of the Magnetophon 77 by means of the five pole stereo audio lead. With this connection, the built-in speaker of the Magnetophon 77 should be switched off.

Regardless of how many of the possibilities given here the amateur tries out for himself, he will constantly discover anew that the Magnetophon will inspire still better tricks and even more original ideas. He will find, to his satisfaction, that the Magnetophon 77 really does have more to offer than just stereo.

E. F. Warnke

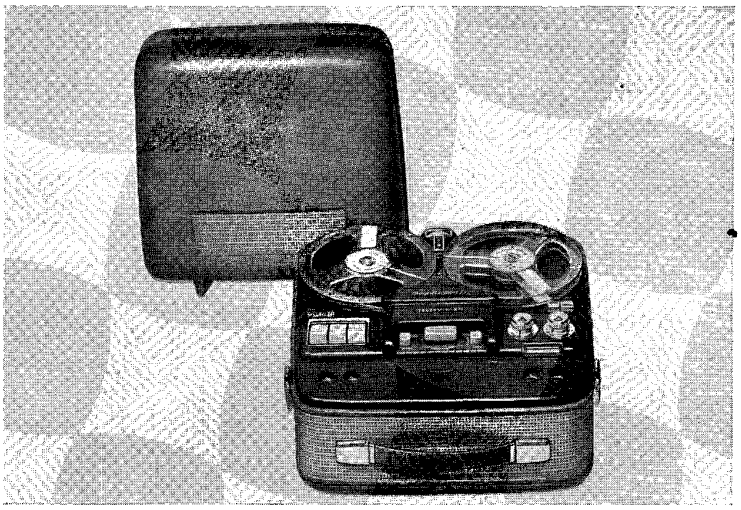


Illustration 9:
Magnetophon 77.