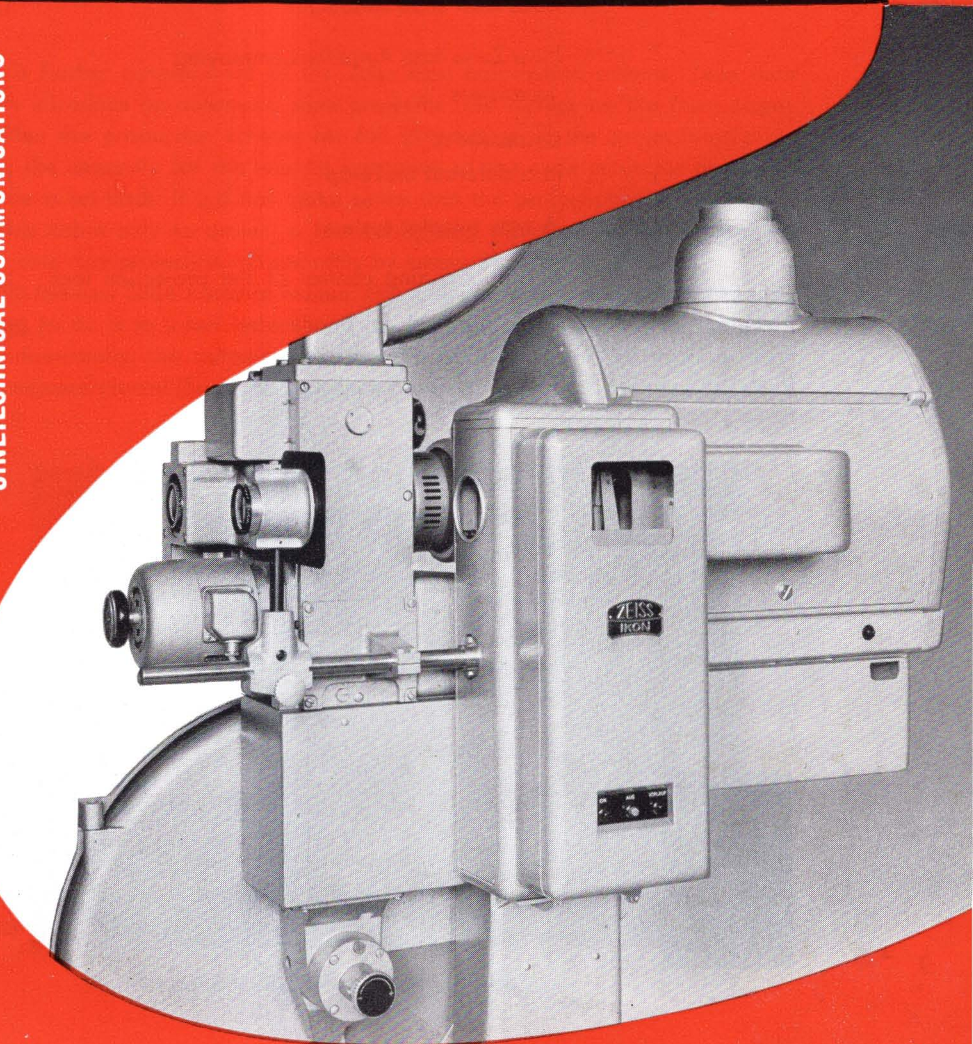
ZEISS IKON

PICTURE AND SOUND

57

FEBRUARY 1959

CINETECHNICAL COMMUNICATIONS



ZEISS IKON AG. WERK KIEL

Contents

Zeiss Ikon Slide Automat	147
New Zeiss Ikon Amplifiers employing transistors	150
ERNEMANN IX in a different make-up	157
A new tweeter system	160
Remote focusing control of the projection lens	165
. . . and finally	168

Cover picture: Slide Automat

Edited by Dipl.Ing. H. Tümmel, Kiel-Wik

Slide Automat

As a further development of the Zeiss Ikon automation scheme, Zeiss Ikon now introduce an automatic slide projector (see picture on the front page). Within the production scheme for full automation of the projectionist's cabin, the necessity for the manual operation of the slide projector appeared to be a set-back. It did not make sense that the projectionist should return to his cabin only to project a few advertising slides, whilst the much more intricate ciné-projection ran smoothly by means of automatic devices.
With the new Slide Automat manual operation is no longer required; the only thing to do is to insert beforehand all the slides required into the automat. Fundamentally, this automat consists of a chain on which 40 slides in their frames are placed (fig. 1). This chain is driven by a motor, the circuit of which

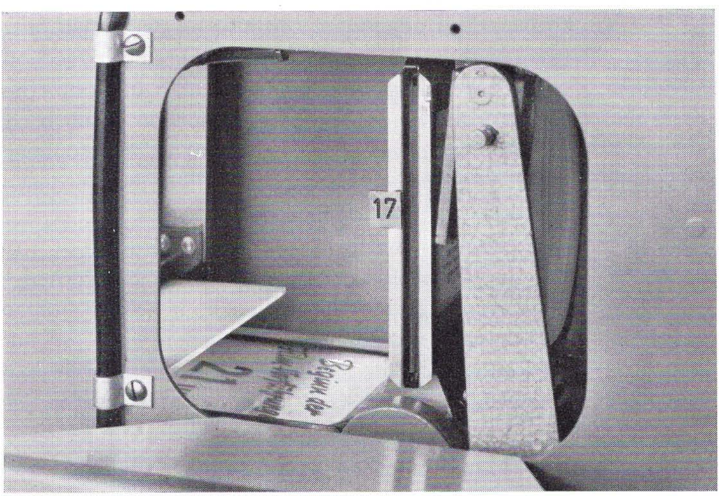


Fig. 1 Interior view: chain with slide frames

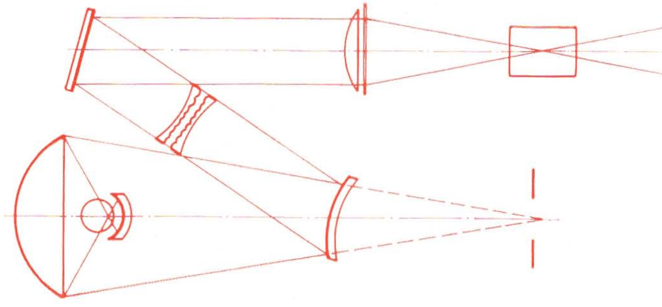


Fig. 2 Principle of supplementary slide projector with mirror system for xenon lamps

is arranged so that the projection time of each slide can be dertermined beforehand by means of a built-in time switch. An ingenious battery of cams ensures that every single slide jumps rapidly from the readiness position into the projection position. The intervals between the individual slides are very short, therefore. The projection time can be adjusted at a ratio of 1:2. When the slides are inserted into the automat every single slide can be adjusted for a projection time of either 10 seconds or 20 seconds by means of special cams which are fixed to the transparency frames. This adjustment can also be performed at a later date if it has been established that the projection time chosen was unsuitable for the slide in question. This possibility of re-adjusting the projection time is of the greatest importance, since there are slides containing so much text that it is impossible to read the wording within the normal projection time of 10 seconds.
The Slide Automat is temporarily constructed as a supplementary lamphouse, that is to say, it is attached to the lamphouse of the cine projector. It has no light source of its own but employs the xenon lamp of the cine projector for slide projection. The beam of rays of the xenon lamp is deflected by a system of mirrors into the lamphouse of the slide automat (see fig. 2).
This optical principle is the same as that used with our other supplementary slide lamphouses. New, however is the fact that the screen mirror is no longer swung in manu-

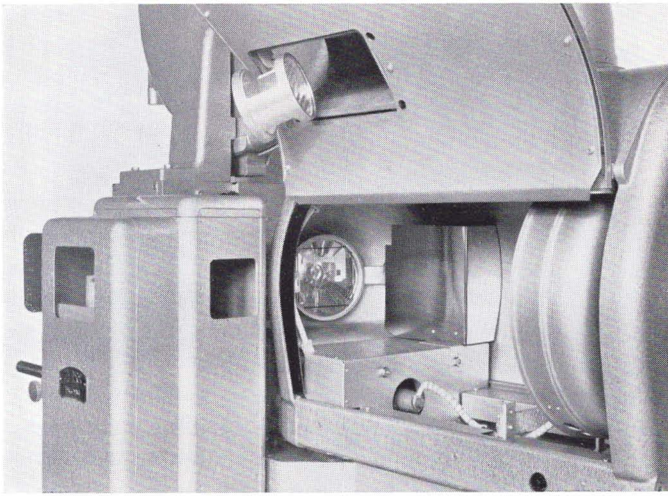


Fig. 3 The deviation mirror is turned by motor

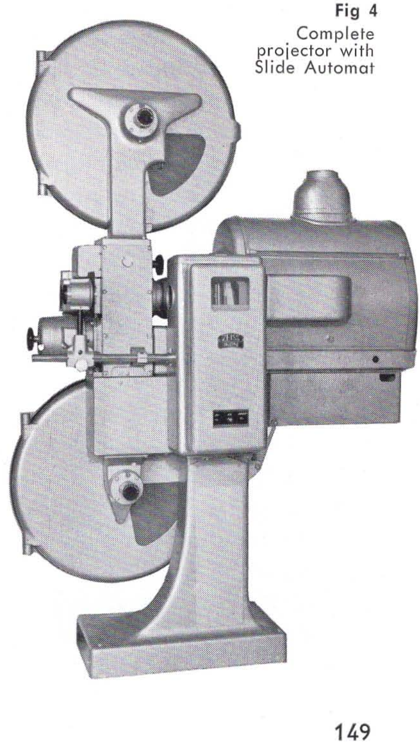
ally but by an electro-motor, automatically (fig. 3).

The entire slide automat is small in bulk but easily accessible and does not take up much space. There is no need for a special working area, the space required corresponds to that needed for our other well-known supplementary lamphouses, that is to say, it can be employed in even the smallest projection cabins. (fig. 4).

Our projection automaton will then not only drive the cine-projector and the other electrical appliances, but also the slide automat.

Tümmel

Fig 4
Complete projector with Slide Automat



New Zeiss Ikon Amplifiers employing Transistors

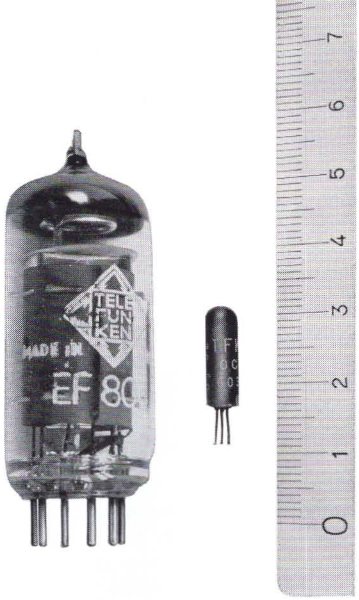


Fig. 1
Comparison
of sizes
valve — transistor

After an initial rather stormy development transistors have now reached a technical perfection which makes it possible to use them, with their remarkable advantages, in many amplifier installations. Without dealing comprehensively with the mode of operation of transistors (which will be explained in a later article), we wish to describe the advantages of these semi-conductors in contrast to valves. These advantages, which are based on the transistor principle itself, are incontestably enormous: small dimensions, greater ruggedness, the elimination of heating and together with it of external voltages from heating current batteries, no heating up time, no tube ringing, a practically unlimited useful life, low operational voltages and lower power consumption.

Fig. 1 shows the difference in size between a valve and a transistor. At present, with the operational voltages supplied by the mains, the employment of valves has certain advantages compared with transistors, when the valves are used in the output stages for an audio-frequency output of $\geqq$ 4 watts. On the other hand, excellent results can be obtained with amplifiers in which valves as well as transistors are employed.

For several years now transistors have been successfully used in our Moviphon, which is part of our 8 mm sound-film installation Movilux 8 B — Moviphon 8 B. In the Moviphon the combined magnetic-sound recording and playback amplifier and the high-frequency generator are based on transistors. The encouraging experience gained with these amplifiers and extensive research work in our laboratories lasting over several years, has been sufficient incitement for the design and the final construction of our new Zeiss Ikon Sound-Film Reproduction Amplifier. The result of this development is quite a range of amplifiers, which, in comparison with comparable valve amplifiers, are smaller, cheaper and more reliable in operation. All these amplifiers, have the same transistor pre-amplifier and are designed for a new type of assembly line. Fig. 2 shows the closed pre-amplifier. After removing the two shells the control elements necessary for the coupling of the three stages (according to fig. 3) become accessible. The frequency response can be switched over to the "magnetic sound" und „optical sound" modes of operation by means of a feedback which is variable with the frequency. Built-in precision regulators permit a level and frequency balance between several amplifiers. The total amplification at 100 cycles in the optical sound mode of operation is x 400, in magnetic sound x 4500. With a theatre fader of 10 k-ohms a maximum output voltage of 1 volt is obtained at a non-linear harmonic distortion factor of <1.3%. Thanks to the transistors OC 603 with their low-noise level, a high sound-volume ratio is ensured, whilst the output transistor OC 76 provides the output necessary for feeding the theatre fader and the output amplifier. The means provided for a suitable stabilisation of the transistor temperature permit faultless operation up to an ambient temperature of 140° F (60° C). If the amplifier is provided with all the transistors (which have interchangeable mounts) it takes a current of approx. 5 mA at an operational voltage of approx. 22 volts. The size of the input- and output resistances are determined by the transistors used; they are R_E =

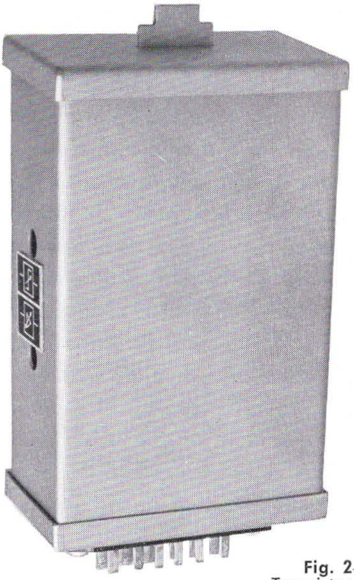
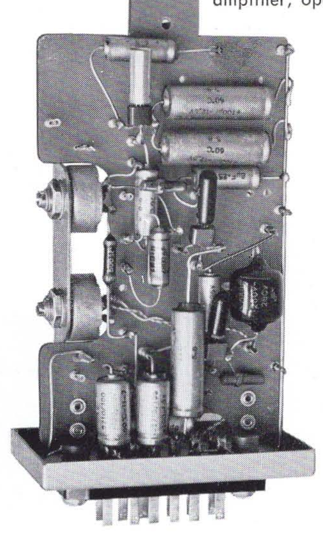


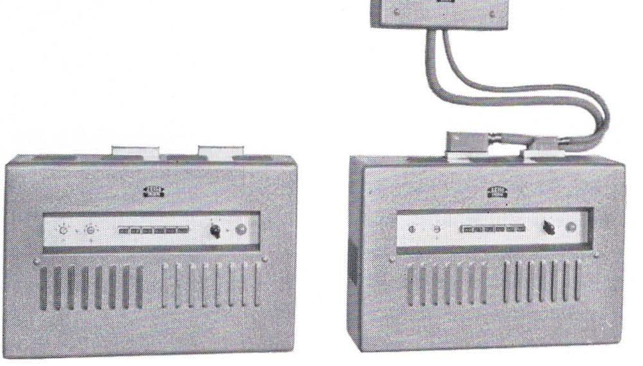
Fig. 2
Transistor pre-amplifier

Fig. 3
Transistor pre-amplifier, open



13 k-ohms, $R_a = 2.3$ k-ohms. Special precautionary measures are provided to make the amplifier insensitive to static and magnetic interference fields. One of these measures is the shells which are made of sheet iron.
All connections end up in a Tuchel plug which, at the same time, serves as the mount for the whole apparatus so that the latter can be exchanged easily without using any tools at all.
Thus the pre-amplifier 32-1361 is a universally useful unit which can be employed for many types of low-frequency pre-ampification.
The above-mentioned new type of amplifier assembly corresponds to the applicability of the 600 range of amplifiers. These amplifiers are self contained units, which, for the purposes of storage and service are spare parts, but are, nevertheless, complete in their individual construction. All these units are housed in flat casings of sheet iron of standard dimensions and are designed for mounting on the cabin wall. The lids are detachable towards the front, which makes accessible the entire circuit. All terminals are on top of the apparatus so that mounting and maintenance are easy to perform.
When, in case of a failure, it becomes necessary to operate a spare amplifier in the most simple way possible, the terminal strips of all these amplifiers can be provided with a Tuchel plug. If need be, a second amplifier can be placed alongside. The connections of all lines to the installations of the cabin are

Fig. 4 Two Transdominar 636 amplifiers connected to each other by means of a Tuchel plug



made via a junction box by means of flexible cables with Tuchel plugs, as can be seen in fig. 4.
In accordance with present requirements, the following amplifiers have been introduced:

Transdominar 636

This is a complete optical sound and single-channel magnetic sound amplifier of 15 watts output. On request, it can be supplied with an exciter lamp rectifier, for exciter lamp change-over with optical sound or manual change-over with magnetic sound, with adjustable bass and treble distortion corrector, output amplifier sound-board 32-1337 connected via Tuchel plug and easily exchanged, frequency response of the output amplifier adjustable in two steps according to the acoustics of the cinema. In fig. 4 the closed Transdominar 636 can be seen, fig. 5 shows the open set.
As shown, the various modes of operation can be switched on by means of push-buttons. The plugged-in transistor pre-amplifier sound-board can be seen on the top left. Beneath it is the output amplifier sound-board provided with the EF 804, the ECC 83,

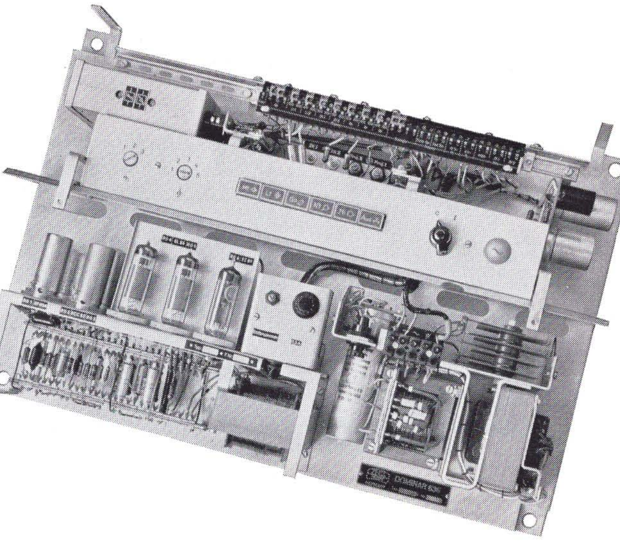


Fig. 5
Transdominar 636, open

Fig. 6
Dominar 696

2 x EL 84 and the EZ 81 valves. The amplifier has terminals for loudspeakers in the cinema and the cabin with 15 ohms impedance each. The exciter-lamp rectifier sound-board 34-08 can be placed beside the output amplifier sound-board, on request.

When an output of higher than 15 watts is required, the Transdominar 636 can be connected to up to ten output amplifiers 696. This then is an apparatus which contains the same output amplifier sound-board as the Transdominar 636, that is to say, the outputs available are 15 watts, 30 watts, 45 watts etc. Each output amplifier is then connected to a cinema loudspeaker, which ensures optimum reliability in operation. Figs. 6 and 7 show the Dominar 696.

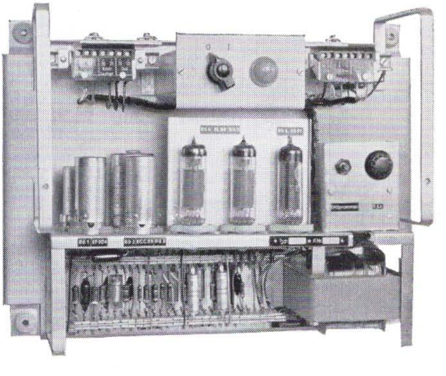


Fig. 7
Dominar 696,
open

Fig. 8
Transdominar 611

Transdominar 611

Remote controlled pre-amplifier for optical sound operation with audio-frequency change-over, e.g. for the purpose of fully automatic projection. This amplifier makes it possible for owners of manually operated amplifiers, e.g. Dominar L, to prepare their installation for cabin automation. The output of the Transdominar 611 should then be connected to the input of the existing amplifier, whilst all audio-frequency sources lie on the input of the Transdominar 611. This amplifier is shown in fig. 8 (closed) and in fig. 9 (open). The transistor pre-amplifier sound-board and the plug-in relays are clearly visible.

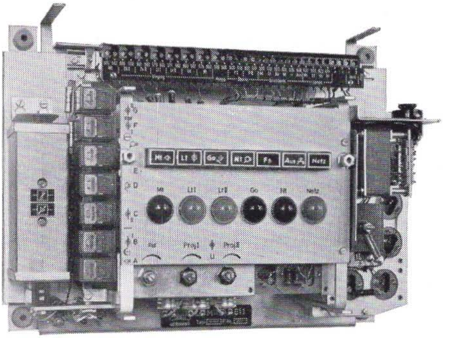


Fig. 9
Transdominar 611,
open

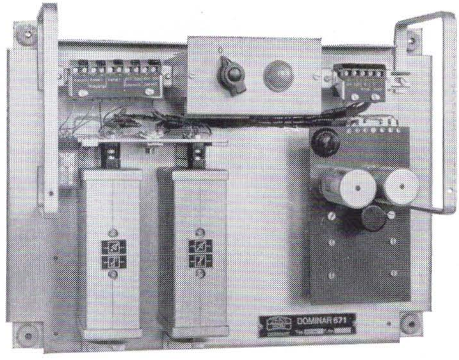


Fig. 10
Transdominar 671,
open

Transdominar 671

This is a pre-amplifier for the stereophonic reproduction of records in conjunction with existing multiple-channel amplifiers, e.g. Dominar Variant 538. It is a well-known fact nowadays that the reproduction quality can be improved considerably when the normal records are replaced by stereophonic records. With the Transdominar 671 and a good magnetic stero-mechanism, the cinema-owner is now enabled to produce a sound quality (also during the intervals) which corresponds to the latest state of technical progress.
The Transdominar 671 contains two plug-in transistor pre-amplifier sound-boards, as shown in fig. 10, and the necessary power-pack. Furthermore, there is a plug-in relay which permits the connexion of the pre-amplifier outputs with the principal amplifier in case of an installation with remote control.
The technology of stereophonic recording by using only one groove in the record will be explained later.

Thiele

ERNEMANN IX

in a different make-up

A little lipstick improves the appearance and even cine-projectors need not look drab and dull. So the ERNEMANN IX has changed its appearance and at the same time has been improved by adding a few technical novelties. The dark madder lacquer has been replaced by a light hammer finish (fig. 1), which has become popular already with the ERNEMANN VIII B.

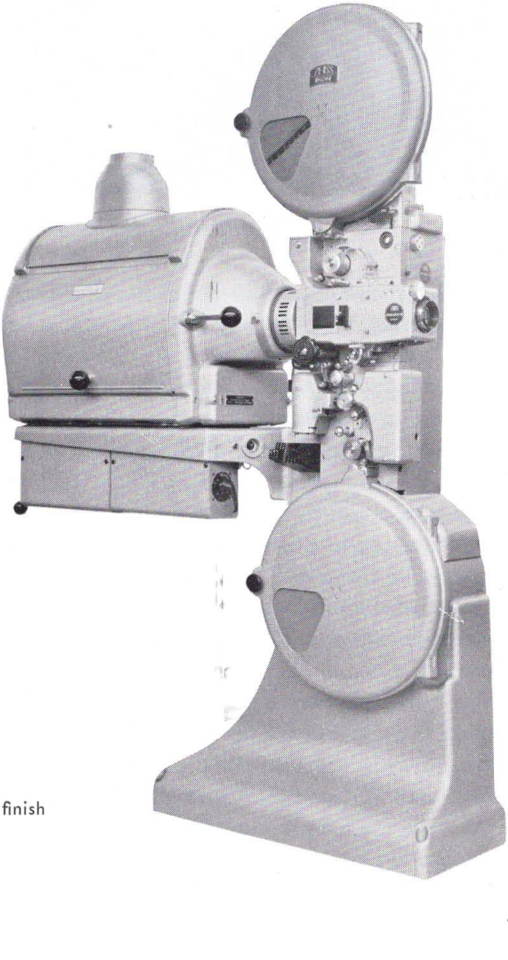


Fig. 1
ERNEMANN IX in light hammer finish

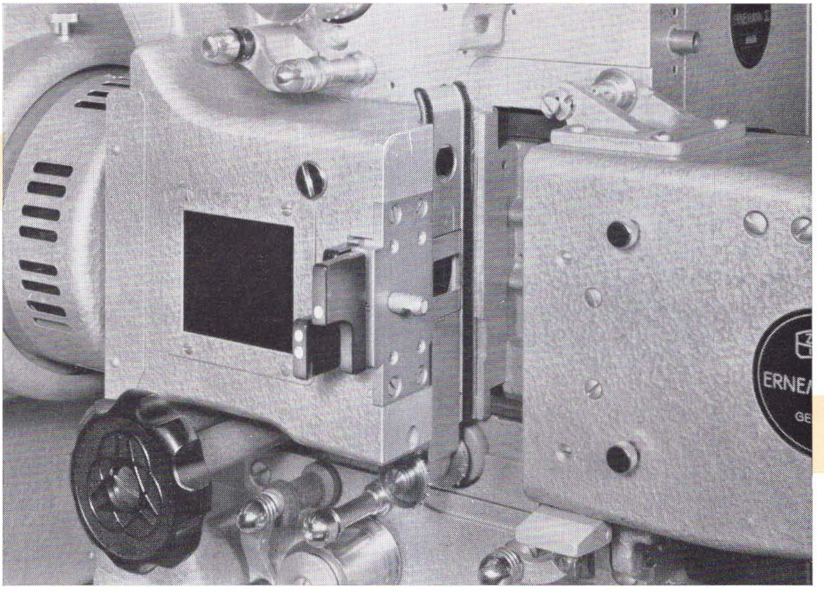


Fig. 2 ERNEMANN with format slide

As to the technical novelties, there are the format slides which have been successfully used in the ERNEMANN VIII B for some time. With this innovation the ERNEMAN IX meets all the requirements of modern cinema operation.

The format slides are pushed into a slide-guide in the shutter housing near the film gate and are positioned in a recess in the film-track adaptor (fig. 2). These format slides are available for the various modern image sizes (standard image 1:1.37, wide screen image 1:1.85 and CinemaScope image 1:2.35). They can also be used in the ERNEMANN VIII B projector. The advantage of these slides is that the format can be changed without removing the film-track adaptor or opening the film track. The film track adaptor remains the same for all formats and no operation is necessary other than to push in the slide. This makes it possible to change format at any time, even when the film is running. Close to the format slide, in the direction of the lamp, the projector is provided with an ante-film gate slide, which serves to limit the heating of the format slide beside it, and also that of the film track, to a minimum. These slides are available in two sizes which differ only in the opening in relation to the image size. One is for the standard and the CinemaScope size, the other for the wide-screen size. At the same time the ante-film gate slides can be used for the insertion of film-gate lenses when short focal length lenses are employed for projec-

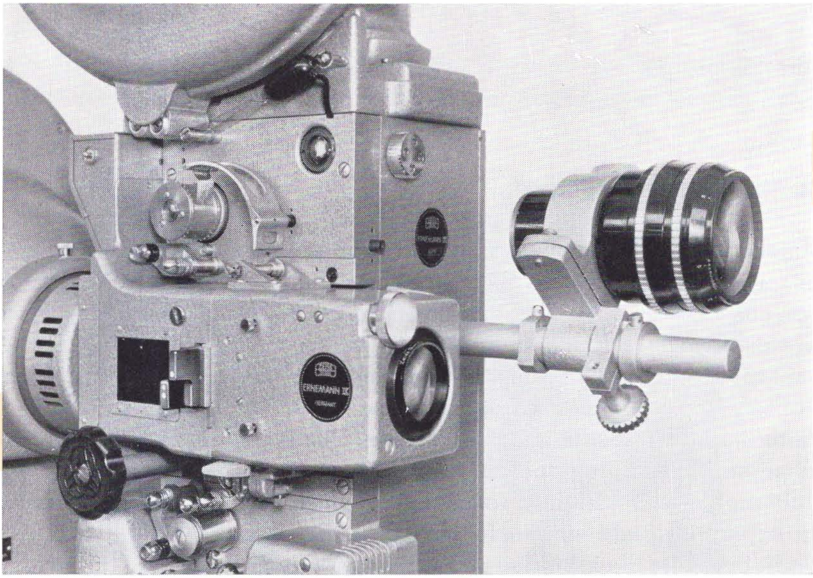
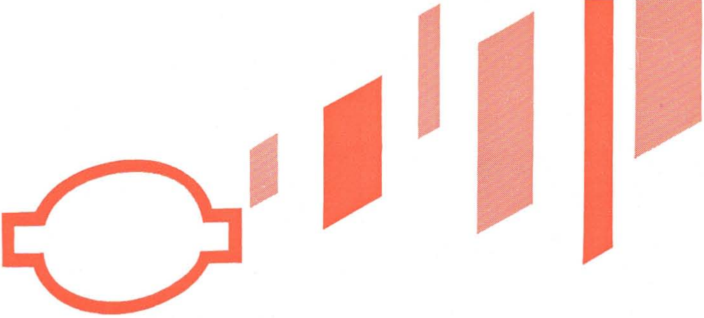


Fig. 3 ERNEMANN IX with larger lens focusing knob

tion. These lenses improve the screen illumination considerably. A special box is provided on the operational side of the projector in which the format and ante-film gate slides can be stored.

A further improvement of the ERNEMANN IX is the altered guiding of the film through the projector, which has been so successful in the ERNEMANN X projector. The new film guide, consisting of a separate system of guide rollers on top of and beneath the film gate, gives the film exact guidance and ensures optimum image quality and steadiness. And finally two less important items: the change-over system is provided with a new type of switch and the lens adjusting knob is made in a new, extremely handy shape which facilitates focusing considerably (fig. 3).

Hoebener



A new tweeter system

A good loudspeaker system has to meet extremely high requirements, since it has to radiate the entire audible frequency spectrum without any linear or non-linear distortions, with as high an efficiency as possible and without selective directivity. Furthermore, the natural oscillations of the system must be kept as low as possible. And these requirements are limited, on the other hand, not only by physical reasons but also by the simple reason of economy.

Since the bass response is based on quite different conditions to the treble response, it has become necessary with high quality installations to divide the frequency spectrum into two ranges and to employ two loudspeaker systems for appropriate radiation, one for bass, the other for treble.

In this article we are interested only in the treble channel.

The occurence of non-linear distortions determines the frequency by which the treble loudspeaker or tweeter takes over the radiation. These distortions can be caused:

1. by deformation of the cone (partial oscillations),
2. by exceeding the homogenity range of the magnet by the moving coil winding,
3. by non-proportionality of the resiliency of the deflection,
4. by excessive air compression in front of the cone,
5. by the occurrence of the Doppler effect and the radiation of high and low frequencies at the same time.

Since a high quality reproduction requires the radiation of approx. eight octaves, it is advisable (especially with regard to point 5) to select the sectional frequency so that the bass and the tweeter system each takes four octaves. This results in a low cut-off frequency of approx. 1000 cycles for the tweeter. This value is favourable especially on account of the still present though small membrane amplitude. Requirement for as high an efficiency as possible can be fulfilled only by employing the pressure transmittance in conjunction with an exponential horn.

The new tweeter system 31—28 deviates considerably from the normal design.

Figs. 1 and 2 show the exterior of the loudspeaker and fig. 3 the principle on which it is based.

In order to use a normal commercial magnet, the inner sound guidance is included in the horn, whilst the core of the annular magnet forms the cap of the

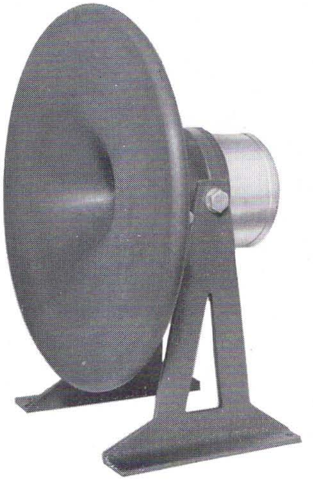


Fig. 1 Tweeter, from the side

Fig. 2 Tweeter, back

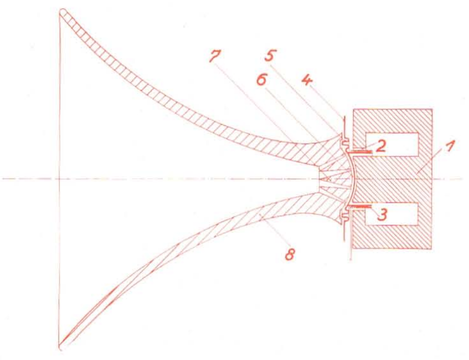


Fig. 3 Principle of the loudspeaker

1 Annular magnet
2 ring slot
3 moving coil (speech coil)
4 membrane
5 the circular stiffing edge corrugations
6 pressure chamber
7 the internal sound guidance
8 horn

pressure chamber as usual. The metal calotte-shaped (hemi-spherical) membrane together with its holder is placed on the magnet. The membrane calotte deviates from the usual ball shape in order to obtain a high stability despite the decreased weight. This appeared necessary to prevent partial oscillations. The low weight and small size are the basic requirements for an irreproachable reproduction of treble. Furthermore, it is interesting to see that the circular stiffening edge corrugations have been omitted. In this form of membrane suspension buckling of the material is possible with large deflections and these will add further non-linear distortions. For this reason a tangential suspension was chosen for the calotte. The membrane is made of a special aluminium alloy, which is not only of high mechanical strength but, moreover, highly resistant against corrosion. The moving coil is centred through the outer edge of the membrane on to the magnet, so that an easy exchange is possible when the membrane unit is demaged by overstress.
In order to obtain as linear a frequency response as possible without acoustic distortions at great expense and, furthermore, to prevent interfering directivity in the radiation of high frequencies, an appropriate horn had to be developed. Normally, an exponential horn follows the exponential opening law as per the formula:

$$S = So \cdot e^{\gamma x}$$

with S = cross section of the horn when the value of the abcissa is x
So = starting cross section
e = base of the natural system of logarithms
γ = constant, calculated from the low basic frequency of the horn.

A horn following this equation is infinitely long and must, therefore, be cut off when the final cross section according to this equation is reached. This leads to leaps in the acoustic resistance which have an unfavourable effect on the frequency response of the loudspeaker. In order to avoid these disturbing interferences at the rim of the funnel the horn jacket curve was corrected so that the line of the acoustic resistance becomes a constant function. The frequency response obtained is reproduced in fig. 4. This far-reaching prevention of rim interferences has another advantage. The directivity of the radiated high frequencies is decreased to a minimum. Fig. 5 shows the

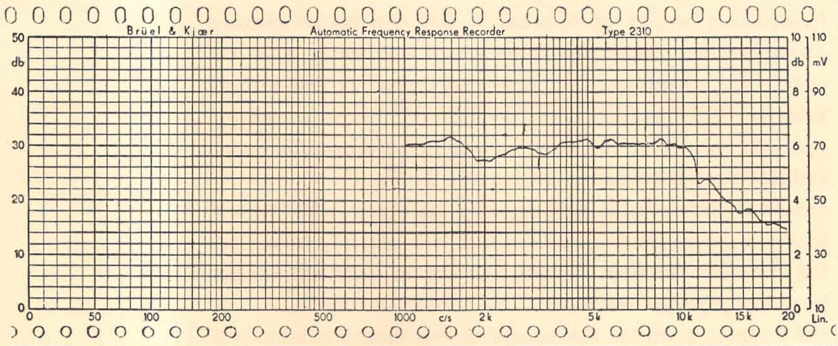


Fig. 4 Frequency response of the tweeter

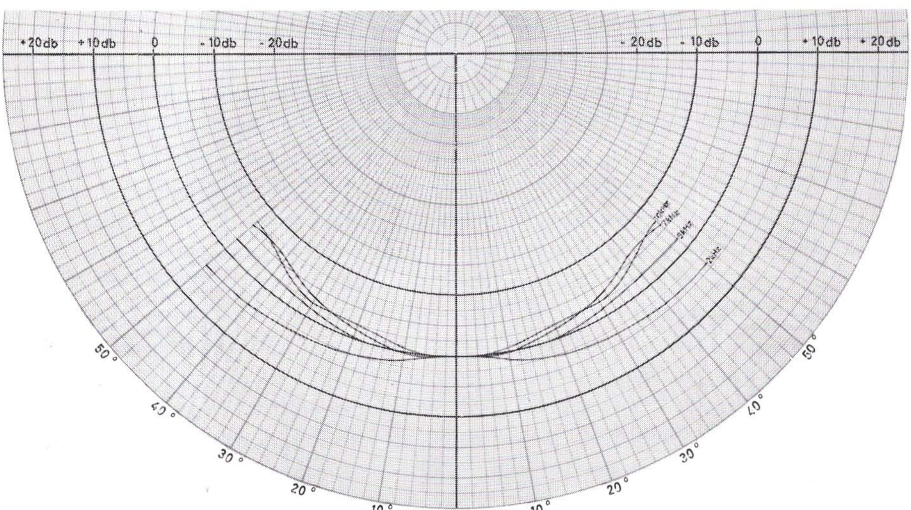


Fig. 5 Dispersion characteristics of the tweeter measured in a non-resonant room

scatter characteristics of the system. The drop in treble up to opening angles of approx. ± 50° can be practically neglected. The result is a value which will hardly even be obtained by multi-cellular horns and then only with strong selective interferences in the overlapping zones of the individual horn cells. The new tweeter is therefore eminently suitable even for cinemas of extreme width.

Extremely favourable values were obtained with regard to the building-up transients, which are actually based on the pressure chamber system, but led to excellent results by constructional measures. The subjective impression of the tweeter confirms the values of the measurement. It is particularly impressive in the precision of the reproduction, which cannot be attained when cone loudspeakers of similar frequency response are used. The Zeiss Ikon Tweeter 31—28 is a very favourable solution of the physical and economical problems, which makes it especially suitable for high quality sound reproduction in cinemas.

Harsdorff

Remote focusing control of the projection lens

The remote focusing control of the projection lens, that is to say, the correct adjustment of the highest possible image sharpness on the sceen, has been created partly in completion of the automatic cinema projection and partly as an important improvement in normal cinema operation. It is also designed for the employment in film studios when the focusing performed in the projectionist's cabin is not sufficient for a critical judgment of the image sharpness. This new device permits remote focusing from any place in the auditorium, since the actual image sharpness can be judged properly only from the auditorium. Focusing is much more difficult for the projectionist, as the distance between the cabin and the screen is usually fairly large and the focusing process is impaired by the reflections from the inspection windows and glare. A correction in focusing will be necessary almost always when the film is changed, e.g. from black-and-white to colour.
The equipment consists of an adjusting device on the projector (fig. 1) and the control device in the auditorium (fig. 2). The adjusting device on the projector is attached to the lens casing. It is a small reversible motor (the direction of rotation can be reversed) with an intermediate gear which controls the adjusting axle of the lens (fig. 3). Manual focusing is still possible, of course. The control device (fig. 2) contains two Kellog switches which operate separately each on one projector. These switches make contact in both directions so that the motors on the lens casing can be operated in either forward or backward direction. In working condition the switches work without a notch, that is to say, when the contact lever is released it will automatically return to zero. This is to avoid incorrect focusing. Other failures are eliminated in an ingenious way in that only that switch will be in working condition which is connected to the projector in operation. If the other switch is operated by mistake this has no effect at all. Furthermore a signal lamp attached to each switch indicates which projector and which switch are in operation. The control device is supplied so that it can be mounted on a control desk or on the wall.

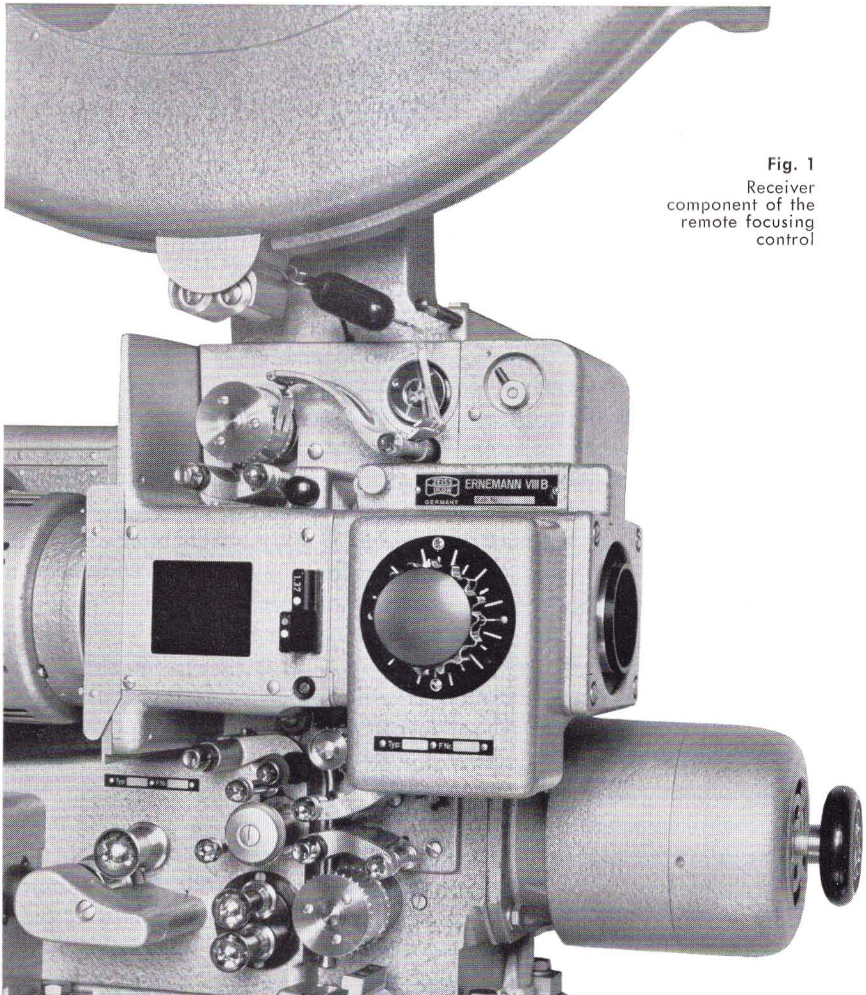


Fig. 1
Receiver component of the remote focusing control

Fig. 2
Control device for remote focusing

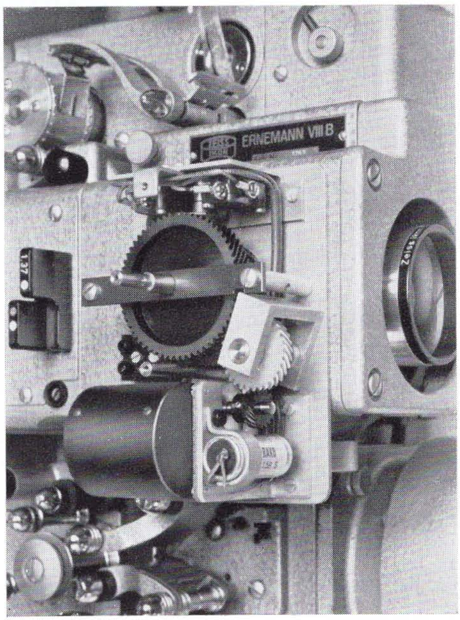


Fig. 3
Receiver component, open

This focusing device is designed for remote focusing of the projection lenses of ERNEMANN VIII, VIII B, IX and X projectors and can be attached to these projectors at any date required.

Hoebener

...AND FINALLY

The cinema audience is deeply puzzeled! Everything has been all right during the last performance but now — there isn't a sound from any of the loudspeakers. What's gone wrong? At last, they found the trouble. Some clever fellow had set the theatre fader to zero!

engl. Printed in Germany 2.5 0259