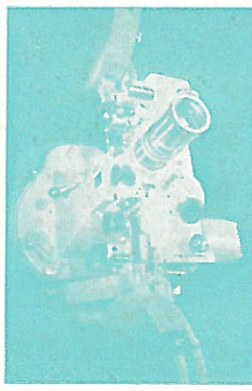
PHILIPS Cinema



EQUIPMENT NEWS

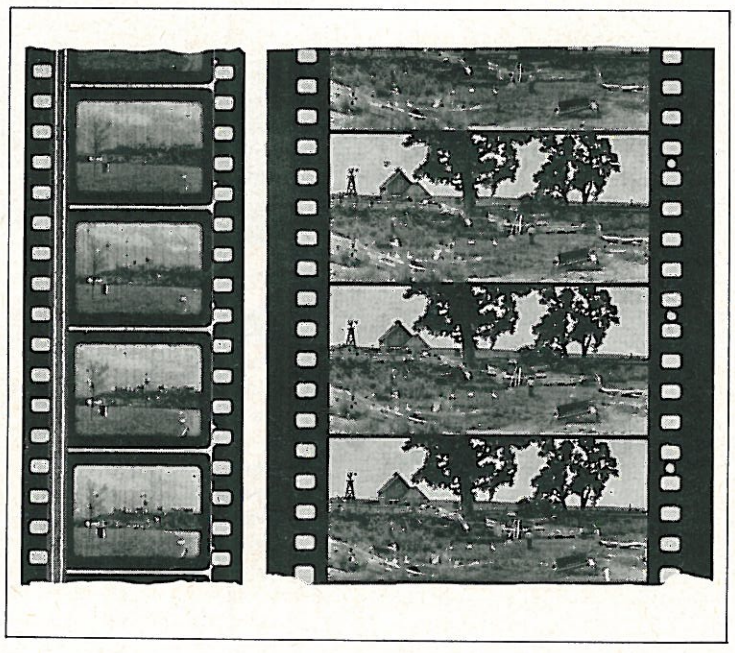
PRESENTING THE PHILIPS 70/35 mm ALL-PURPOSE TODD-AO PROJECTOR

Philips All-Purpose 70/35 mm Todd-AO film projector is a machine capable of projecting films made in any of the motion picture systems in practical use to-day!
It offers all facilities for Large Picture Projection and Multiple Track Magnetic Sound Reproduction.

The projector is suitable for:

1. 70 mm film provided with up to six magnetic sound tracks.
2. 70 mm film with separate sound copy.
3. CinemaScope film provided with 4 magnetic sound tracks.
4. CinemaScope film with optical sound track or PerspectaSound.
5. Wide Screen films of any aspect ratio, provided with magnetic or optical sound tracks.
6. Standard 35 mm films.
7. 3-D films according to the single-film system.
8. 3-D films according to the twin-film system.

Versatility is such that changing from one projection system to another (i.e. from 70 mm to 35 mm systems and vice versa) takes only a few minutes.
This projector, designed and built by Philips in close co-operation with the American Optical Company, Southbridge, Mass., U.S.A. is the only one in the world capable of projecting films shot in the Todd-AO system. The technical qualities of the projector as well as the principle of the Todd-AO process are described on the following pages.



Comparison between 35 mm and 70 mm film ...
Whilst standard film accommodates one optical sound track, the wide film has six magnetic tracks ...

Sommaire en français

Le projecteur cinématographique universel Philips Todd-AO 70/35 mm permet de projeter des films réalisés suivant tous les systèmes utilisés à l'heure actuelle. Construit par la société Philips en étroite collaboration avec l'American Optical Company, Southbridge, Mass., Etats-Unis, ce projecteur est en outre le seul au monde capable de reproduire les films réalisés suivant le système Todd-AO.
Cet appareil présente toutes les possibilités de projection sur grand écran et de reproduction sonore magnétique multipiste. L'une des caractéristiques les plus remarquables de ce projecteur est que pour passer d'un système de projection à un autre, par exemple du système 70 mm au système 35 mm, il suffit d'échanger quelques pièces faciles à enlever. Les qualités techniques de ce projecteur ainsi que le principe du système Todd-AO sont décrits dans les pages suivantes.

Auszug in Deutsch

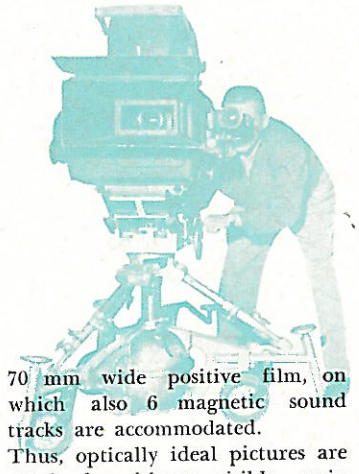
Der Philips 70/35 mm Todd-AO Universalprojektor ermöglicht es, Filme nach sämtlichen z. Z. praktisch verwendeten Systemen zu projizieren.
Dieser Projektor, konstruiert in enger Zusammenarbeit mit der American Optical Company, Southbridge, Mass., U.S.A., ist überdies die einzige Maschine der Welt, die zur Wiedergabe von Todd-AO-Filmen eingerichtet ist. Im neuen Projektor sind sämtliche Möglichkeiten für Großbildprojektion und mehrspurige magnetische Tonwiedergabe kombiniert. Eines der auffallendsten Merkmale dieser Konstruktion besteht darin, dass zum Übergang von dem einen auf das andere Projektionssystem - z.B. von 70 mm auf 35 mm oder umgekehrt - nur einige leicht herausnehmbare Einzelteile ausgewechselt zu werden brauchen. Die technischen Vorzüge dieses Projektors sowie das Prinzip des Todd-AO-Systems werden nachstehend beschrieben.

Sumario en español

El proyector "Universal" Philips para películas de 70 mm (Todd-AO) y de 35 mm es apto para la proyección de películas de todos los sistemas en uso práctico hoy día. Este proyector, construído por Philips en estrecha colaboración con la American Optical Company, Southbridge, Mass., EE.UU., es, además, el único aparato del mundo que puede proyectar películas, rodadas según el sistema Todd-AO.

Abarca todas las posibilidades para la proyección a gran imagen y reproducción sonora magnética multipista. Una de las ventajas más destacadas es que para la adaptación de un sistema de proyección a otro, p.e. del de 70 mm al de 35 mm o viceversa, no se precisan sino algunas piezas fácilmente desmontables. Las propiedades técnicas de este proyector, así como el principio del sistema Todd-AO, se describirán en las páginas siguientes.

WHAT IS TODD-AO?



TODD-AO is a new process for motion picture shooting and reproduction, that gives the audience in the theatre *a sense of participation* in the action—the feeling of presence in every scene...

The system was developed by American Optical Company engineers under the direction of Prof. Brian O'Brien, to bring into being an idea envisioned by Michael Todd.

The goal was to develop "a motion picture system that would photograph action in a very wide angle... with one camera... on one strip of film... to be projected from a single machine... onto a very large and deeply curved screen... with a quality so perfect that the audience will be part of the action, not just passive spectators."

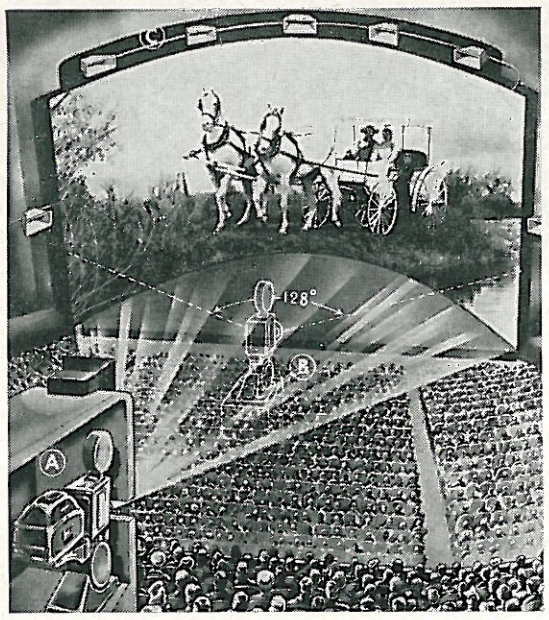
Films in the process are made with different wide-angle camera lenses, covering angles up to 128°. For achieving the highest picture quality, the factor of magnification had to be reduced, which was accomplished by using a wide-gauge film. This large-area negative is printed on a 70 mm wide positive film, on which also 6 magnetic sound tracks are accommodated.

Thus, optically ideal pictures are obtained, without visible grain patterns, without unsharpness or other losses of definition, brilliancy, etc.

Sound recording, on six high-fidelity magnetic sound tracks, fulfils the most critical requirements. These standards, carried through in reproduction, fully satisfy the highest demands of both public and sound specialists.

It is no co-incidence that PHILIPS were approached by the American Optical Company for the development and manufacture of the projector, which basically had to be suitable for Todd-AO as well as for 35 mm film reproduction.

The design of this equipment had to be faultless! Philips—with their many years' reputation in the international cinema field—could meet the highest requirements of ingenuity of invention, quality and reliability. The outcome: Philips' DP 70 projector, gives proof of their professional skill in this domain.



How Todd-AO will be projected

Photo-diagram of a Todd-AO theatre installation shows the Philips "All-Purpose" Todd-AO projector (A) above and behind the balcony, although it can be set up for straight level projection as well as for angled throw. The special wide-angle lenses can create screen coverage which could only be obtained with conventional optics by a "phantom" projector (B) set wel up front and blocking out a huge proportion of orchestra seats. Recorded sound, from 96 separate sources on six magnetic sound tracks, is reproduced on six sound channels, with five high-fidelity loudspeakers placed above the deeply-curved screen. The photographic values of Todd-AO can be seen in the picture of the team with two white horses and the surrey with the fringe on top, moving across screen as "Curly" (Gordon MacRae) sings to "Laurey" (Shirley Jones) in one of the best-known sequences in "Oklahoma!"

Qu'est-ce que le système Todd-AO?

Il s'agit d'un nouveau procédé d'enregistrement et de reproduction cinématographique qui veut suggérer mieux aux spectateurs qu'ils *participent à l'action* qui se déroule sur l'écran. Le système a été mis au point par l'American Optical Company, d'après des idées formulées par Michael Todd.

On voulait créer un système de cinématographie qui photographierait l'action sous un très grand angle de vision, à l'aide d'une seule camera, sur une seule pellicule, le film réalisé devant pouvoir être projeté au moyen d'un seul appareil sur un très grand écran courbé et devant être d'une qualité à tel point parfaite que le public participe réellement à l'action au lieu de se contenter de la contempler passivement.

Les films Todd-AO sont tournés avec des objectifs à grand angle. L'objectif le plus grand possède un angle de pas moins de 128 °. Pour que la qualité de l'image soit optimum, il fallait réduire le facteur d'agrandissement. On a trouvé la solution en employant un film large. On utilise pour la projection un film de 70 mm, qui porte également les 6 pistes sonores magnétiques.

Ce système a permis de réaliser des images idéales du point de vue de l'optique, sans grain visible, sans flou ni autres défauts dans la définition, la luminance, etc. Le son, enregistré sur six pistes magnétiques, répond lui aussi aux conditions les plus rigoureuses.

Ce n'est pas un fait du hasard que la société Philips ait été invitée par l'American Optical Company à réaliser et à fabriquer le projecteur nécessaire au nouveau système. La construction de cet appareil, destiné à permettre la reproduction cinématographique tant du système Todd-AO que des films de 35 mm courants, devait être irréprochable. Jouissant depuis des années d'une excellente réputation dans le domaine de la technique cinématographique internationale, la société Philips était à même de satisfaire à ces exigences sévères d'ingéniosité, de qualité et de sécurité de fonctionnement. Le résultat, soit le projecteur Philips DP 70, atteste ses qualités professionnelles dans le domaine de la cinématographie!

Was ist Todd-AO?

Todd-AO ist ein neues Filmaufnahme- und wiedergabeverfahren, das dem Publikum ein stärkeres Miterleben der Handlung *ermöglichen soll. Das System wurde, nach Ideen von Michael Todd, von der American Optical Company geschaffen. Ziel war es, ein Filmsystem zu entwickeln, das die Szene unter einem sehr grossen Gesichtswinkel mit nur einer Kamera auf nur einem Filmstreifen aufnimmt und bei dem auch die Projektion wiederum mit nur einer Maschine auf einer sehr breiten, gekrümmten Bildwand erfolgt, und zwar in einer solchen technischen Vollkommenheit, dass sich das Publikum unmittelbar in die Szene versetzt fühlt und nicht mehr wie bisher die Handlung passiv als Zuschauer verfolgt.*

Todd-AO-Filme werden mit Weitwinkelobjektiven aufgenommen. Die grösste Optik besitzt einen Aufnahmewinkel von nicht weniger als 128 °. Um ein Höchstmass an Bildqualität zu erreichen, musste der durch die Projektion bedingte Vergrösserungsfaktor reduziert werden; die Lösung dieses Problems wurde in der Anwendung von 70-mm-Breitfilm gefunden, auf dem auch die sechs magnetischen Tonspuren untergebracht sind.

Hierdurch ist eine bisher unerreichte Bildqualität möglich geworden, und zwar zeigt das Bild kein sichtbares Korn, keine Unschärfe oder sonstige Verluste an Auflösung, Brillianz und dgl. Auch der Ton, magnetisch aufgezeichnet auf sechs verschiedene Spuren, genügt den höchsten Anforderungen.

Es ist kein Zufall, dass die American Optical Company die Entwicklung und Fertigung des Projektors für das neue System der Firma Philips übertrug. Die Konstruktion der Apparatur, die sowohl für Todd-AO als auch für 35-mm-Filmwiedergabe geeignet sein sollte, musste in jeder Beziehung einwandfrei sein. Philips mit seinem seit Jahren auf dem internationalen Kinosektor gefestigten Ruf konnte den hohen in bezug auf konstruktive Durchgestaltung, Qualität und Zuverlässigkeit gestellten Forderungen voll entsprechen. Das Resultat, der Philips Projektor DP 70, beweist erneut die Leistungsfähigkeit der Philips Werke auf dem Kinogebiet.

¿Qué es Todd-AO?

Todd-AO es un nuevo método para el rodaje y la proyección de películas, destinado a proporcionar al público la sensación de que vive la escena representada en la pantalla. El sistema fué creado por la American Optical Company, según las ideas de Michael Todd.

El objeto fué desarrollar un sistema de proyección que filmase las escenas bajo un ángulo óptico muy grande, con una sola cámara y en una sola película, y que las proyectase luego con el uso de un solo aparato, en una pantalla muy ancha y curvada; todo esto, de manera tan perfecta que el público participa, en efecto, en la acción en vez de contemplarla pasivamente.

Las películas Todd-AO se ruedan con lentes de gran ángulo. La mayor de ellas tiene un ángulo nada menos que de 128°. A fin de obtener una óptima calidad de imagen, había que reducir el factor de aumento en la proyección, lo cual se resolvió empleando una película ancha. Para la proyección se emplea película de 70 mm, que también lleva grabadas las 6 pistas sonoras magnéticas. Gracias a esto, ha sido posible obtener imágenes ideales ópticamente, sin visibilidad del grano, y sin disminución de la nitidez, definición, brillo, etc. También el sonido, grabado en seis pistas sonoras magnéticas, satisface los requisitos más rigurosos.

No es casualidad, ni mucho menos, que la American Optical Company haya elegido a Philips para el desarrollo y la fabricación del nuevo sistema. El diseño de este equipo, que había de servir indistintamente para películas para Todd-AO, y para películas de 35 mm, tenía que ser perfecto. Philips, cuya reputación mundial se remonta a tantos años en el terreno cinematográfico, ha podido satisfacer las altas exigencias de inventiva, calidad y fidelidad. Resultado: ¡el proyector Philips DP 70 es un testimonio de su capacidad técnica en el campo de la cinematografía!

CONSTRUCTION ALL TODD-AO

Driving mechanism

For the projection of 70 mm films the driving mechanism has to be much more rugged than for normal 35 mm films, since:

1. 70 mm films have a much greater mass than 35 mm films; not only are these films twice as wide but also the picture frames on 70 mm films are higher: there are five perforations per frame instead of the usual four.
2. The speed of 70 mm films is 30 frames/sec instead of 24 frames/sec.

The driving mechanism of the Philips DP 70 projector (Fig. 1) is housed in an oil-tight casing (Fig. 2), closed hermetically by means of a large cover, which protects it completely against dust. The cover is fixed with five screws only and can therefore easily be removed for inspection of the mechanism and simply be re-fitted. The driving mechanism itself is very sturdy and at the same time very simple, making it perfectly reliable.

As in the well-known Philips FP 56 and FP 7 projectors, all the sprockets, the intermittent mechanism, the shutter and the take-up spool are driven by a

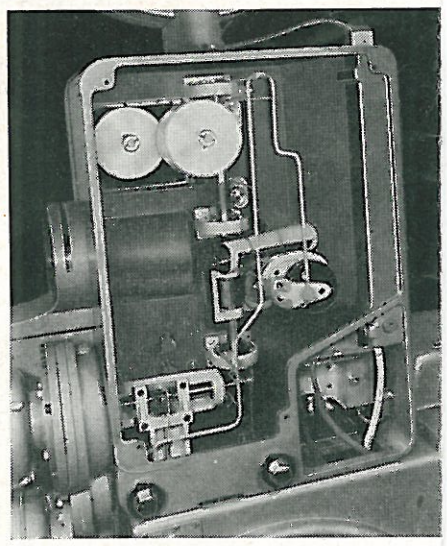


Fig. 2 - Driving mechanism ...

OF THE PHILIPS PURPOSE 70/35 mm PROJECTOR DP 70

It will be obvious that for the projection of 70 mm films a projector must satisfy special demands.

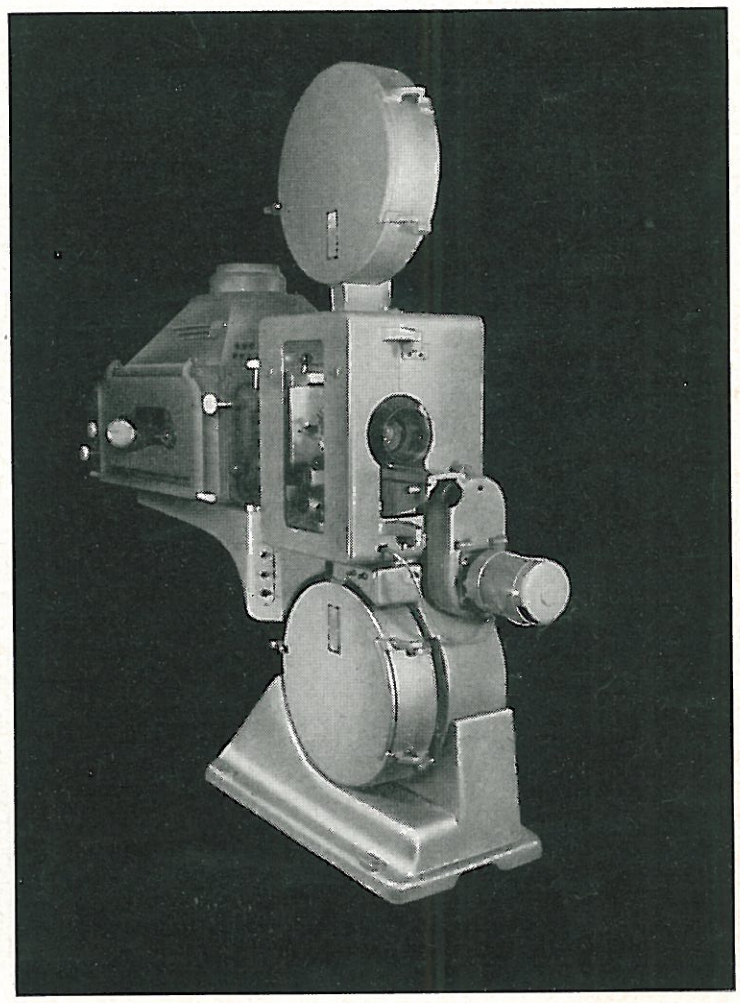


Fig. 1 - The DP 70 ...

stout vertical main shaft. In the DP 70 projector this shaft is driven by a horizontal shaft, which also drives the spur-gear oil pump which is located in the base of the projector housing and hence is always below the oil level. All the gear-wheel transmissions and bearings are richly lubricated via an oil conduit with tappings.

The horizontal driving shaft is coupled to a friction clutch, which provides a simple means of changing the speed from 30 frames/sec to 24 frames/sec and vice versa. The asynchronous motor is located on the drive housing which contains the two V-belts, their pullies and the clutch, used for the change-over from one speed to the other—simply by shifting the friction discs. This has the advantage over a gear-box in that the construction is simpler and therefore more reliable.

Intermittent mechanism

The intermittent mechanism of a projector for 70 mm films has a heavy task to fulfil. In principle, the intermittent mechanism of the DP 70 projector equals

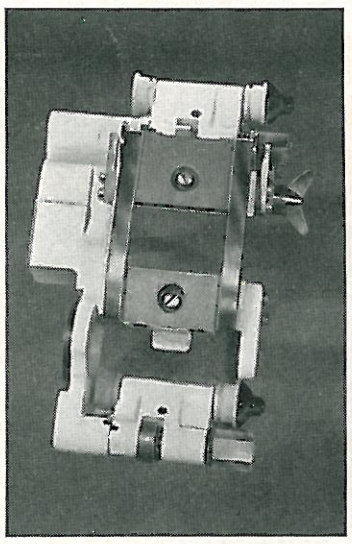


Fig. 3 - Curved runner plate ...

that of normal 35 mm mechanisms, but it is of much more robust construction. However, to keep the acceleration forces and therefore wear of the mechanism as low as possible, it is of the utmost importance that the Maltese cross and the intermittent sprocket be light. As the sprocket has to be wider and of greater diameter than a normal intermittent sprocket, it was not so easy to solve this problem.

Aluminium was the most obvious material, since it is light in weight, but it is also soft and therefore at first sight did not seem suitable for the manufacture of sprockets. After many experiments, a special method was found for hardening the surface of the aluminium and a life test proved that aluminium sprockets treated in this way compared very well with chrome-nickel sprockets.

Since aluminium has furthermore the great advantage that it is anti-magnetic, it was also used for the manufacture of the other sprockets.

Picture gate

The larger size of the picture frames entails also a different construction of the picture gate. The steadiness of the picture on the screen depends to a great extent on the way in which the film stops in the gate after the intermittent sprocket has moved it over the distance of one frame. Due to the greater mass of the 70 mm film, the normal construction (a flat runner plate and resilient pressure skates) provides inadequate braking power.

For a good definition it is furthermore necessary that the distance between the film in the gate and the projection lens should not vary.

When a flat gate is used, 70 mm film is liable to bend in a transverse direction and this cannot

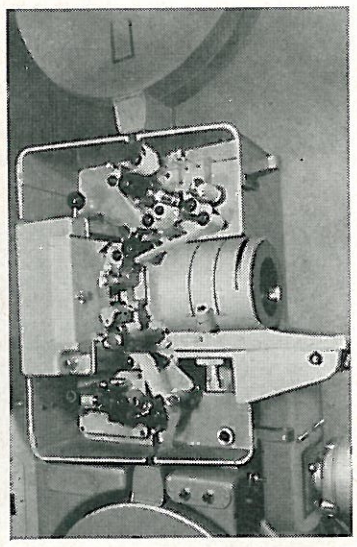


Fig. 4 - Film path for 70 mm film..

be remedied. For this reason, the DP 70 projector is equipped with a *curved* runner plate (Fig. 3). The slight bend in a longitudinal direction gives the film a greater transversal stiffness. The concave side of the runner plate faces the lens. It is impossible to use normal pressure skates with a curved runner plate. The pressure skates have therefore been replaced by thin steel strips which are fixed to a hinged plate. The pressure in the gate can be adjusted by slightly tightening or slackening these strips.

Apart from the smaller distance between the running faces of the plate and the smaller aperture, the construction for 35 mm projection is just the same as that for 70 mm projection.

The hinged plate faces the shutter and has to be pushed aside for threading the film. This formed another problem for the designer, since the shutter is placed close behind the gate. This problem was successfully overcome by designing a construction in such a way that the knob for pushing aside the plate (Fig. 4, round knob at the left) can only be operated when the shutter is in such a position that the plate can pass freely, indicated on the second feed-sprocket, whilst it is furthermore impossible to start the projector when the plate is pushed aside.

Shutter

The DP 70 projector is equipped with a one-blade conical shutter with a very large diameter. At a film speed of 30 frames/sec the shutter rotates at a speed of 3600 r.p.m., and at a film speed of 24 frames/sec at a speed of 2800 r.p.m.

This type of shutter has been chosen for the following reasons: The Todd-AO system is intended in the first place for the projection of very large pictures. Loss of light therefore must be avoided as much as possible. The large cross section of the light beam (the image of the crater must cover the mask of 48 × 22 mm) makes it impossible to use a drum shutter which is eminently suitable for the projection of normal films. The conical shutter can be mounted close behind the mask, so that it intercepts the light beam where it is narrowest. This, in conjunction with the large diameter and the high speed, guarantees the smallest possible angle of interception and the highest efficiency for this type of projector.

Cooling

The high light-intensity and the great heat it generates require powerful and efficient cooling of both the film and the projector. For this reason, the plate on which the pressure strips are mounted is watercooled and hence the film gate, the projector mechanism and the edges of the film remain perfectly cool. However, the image area on the film still becomes very hot and as the difference in temperature between the image area and the rest of the film increases, the risk of buckling increases too.

As the image area of the film can only be cooled by air, the shutter of the DP 70 projector has been constructed as a powerful fan which sucks in the cold air from the rear of the projector and blows it against the film in the gate.

Lens holder

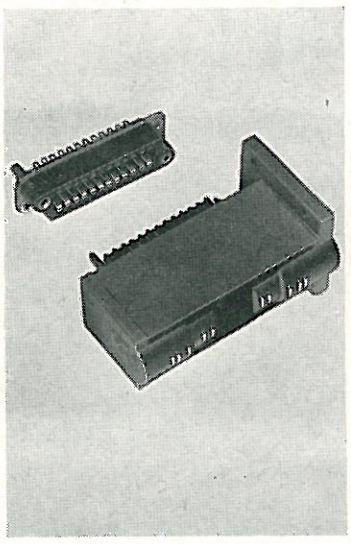
The Todd-AO system requires a very large optical system. The size of this system determines that of the lens holder. The lens is focused by means of the knob underneath the lens mount bracket (Fig. 1) over which the entire lens holder slides during focusing; this adjustment is free of any backlash. Special attention has been paid to the precision of this adjustment, since either a too fine or a too coarse adjustment may render focusing difficult.

An eccentric adapter tube and adapters with different internal diameters can be mounted into the lens holder to fit the lenses necessary for the different projection systems. For the projection of 35 mm films the optical axis is shifted over the required distance by turning the eccentric adapter tube through 180°.

Soundheads

The soundhead for the scanning of magnetic sound tracks is located in the top right-hand part of the projector. A combined scanning head (Fig. 5) for 70 mm films and CinemaScope films is located at the top of the two rotating sound drums of anti-magnetic material.

Fig. 5 - Magnetic scanning head..

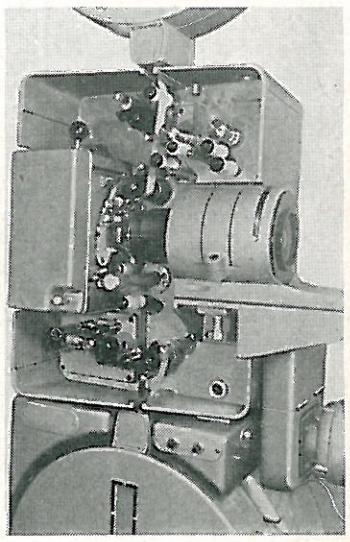


The two flywheels on the shafts of the sound drums are shown in Fig. 2 (at the top to the left).

The guide rollers of the soundhead and all other guide and pad rollers which are in contact with the magnetic soundtracks are made of nylon. The soundhead forms one unit which can be removed after loosening four screws.

The path of a normal film through the projector and the optical soundhead is shown in Fig. 6. This soundhead is located at the bottom, to the left; it also forms one, easily removable, unit. One of the most important characteristics of this soundhead is that in the scanning system a 13.5 times enlarged picture of the

Fig. 6 - Film path for normal 35 mm film ...



sound track is projected on to the scanning slit. This picture is visible through an observation window, so that the position of the sound track with respect to the slit can easily be adjusted by the projectionist. The same system is also used in the normal Philips projectors.

Spool boxes

As the size of the film is larger and the film speed is higher than for normal projection, the spool boxes of the DP 70 projector are much larger than normal ones; they are suitable for 950 m (3100 ft) of 70 mm film which corresponds to a projection time of 22 minutes.

The spools are much heavier than the normal 35 mm spools and therefore it was not possible to use the standard 3/8" spool shafts; the spool shafts of the DP 70 projector have a diameter of 1/2".

Both spool boxes are provided with adjustable friction devices. The upper spool box is illuminated and equipped with time scales for the projection of both 70 and 35 mm films.

The rollers in the fire traps have a large diameter so that even warped films can pass through without risk of damage.

Light source

The shape of the projector and of the mounting table are such that any light source can be used, provided that its optical properties match the image size.

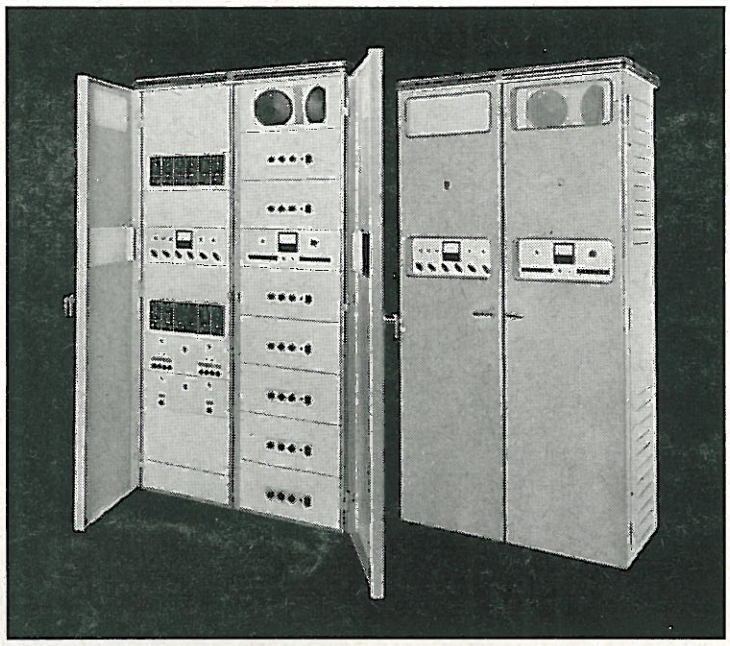
Parts for modifying the projector

As, for the time being, it is not to be expected that a given theatre will show only 70 mm films, it is necessary that the projectors can also be made suitable for running 35 mm films.

The DP 70 projector is undoubtedly most universal in this respect: films shot in any of the previously mentioned systems can be shown with this projector.

The modification from 70 mm to 35 mm film projection or vice versa takes only a few minutes. The mask of the gate for 35 mm films can be replaced in a few seconds by that for CinemaScope films or by a wide-screen mask. All the sprockets used in this projector and the rollers of the fire traps are universal and need not be replaced. Each sprocket is provided with two sets of teeth, one set spaced for 70 mm film and the other spaced for 35 mm film which are located between the outer or 70 mm set of teeth. The outer flanges of the intermittent sprocket have 20 teeth and the inner flanges 16 teeth; for the other sprockets the number of teeth is 30 and 24 respectivily. The teeth have the required shape for CinemaScope film. The motor can be coupled in a simple way with an interlock motor for showing pictures with separate sound copy and for 3-D projection according to the twin-film system.

AMPLIFIER ASSEMBLY FOR TODD-AO SOUND REPRODUCTION



A complete sound reproduction system can be supplied together with Philips 70/35 mm Todd-AO projectors.

The sound amplification part consists of a Twin-Cabinet, housing all apparatus necessary for pre-amplification, power amplification and pre-adjustment. However, actual operation takes place via push-buttons on a separate control box of small dimensions, which can be mounted between the projectors.

For volume control in the auditorium itself, a special remote-control box can be supplied.

The left part of the Twin-Cabinet contains 7 magnetic pre-amplifiers, 2 optical pre-amplifiers, a non-sync pre-amplifier, a 12 kc/s unit, supply unit for exciter lamp and change-over relay, and a pre-amplifier control panel.

Selector switches, a measuring instrument and change-over pilot lamps on the pre-amplifier control panel facilitate checking and quick change-over of pre-amplifiers and feed units. The pre-amplifiers are of the plug-in type; they can be withdrawn from the cabinet easily, as they are provided with plugs and sockets to facilitate servicing and interchanging.

Two blind panels are mounted in front of the compartments provided for a PerspectaSound integrator and its feed-unit, if required. All the connections and wiring for this equipment are already in position.

The right-hand part of the assembly houses the 7 power-amplifiers. Each of them can be pre-adjusted separately to the acoustical requirements of the theatre, by means of individual bass, treble and volume controls. Two monitor loudspeakers are built in which guarantee a uniform sound distribution in the projection room.

The power amplifier control panel is provided with:

a. the mains switch with pilot lamp for the complete sound equipment;

b. seven push-buttons for standby switching. When the button of one of the power amplifiers Nos. 1 to 6 is depressed, this amplifier is replaced by the standby amplifier No. 7;

c. push-buttons for selection of the channel to be monitored;

d. monitor volume control;

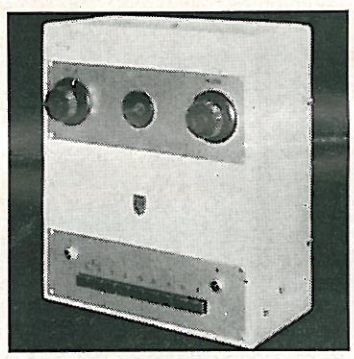
e. measuring instrument for checking the output level of the six channels.

The cabinet is completely enclosed by doors, which can be locked to avoid accidental alteration to pre-adjusted controls. The two control panels, however, are left free for easy operation. The cabinet is air-cooled by a fan.

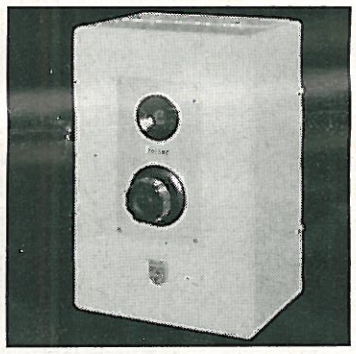
Operation during the performance requires only pressing of the push-buttons on the separate control box between the projectors. The sound source required for reproduction can be selected from among the 9 push buttons on this box: either Todd-AO 6-channel magnetic sound, or 35 mm CinemaScope 4-channel or single-channel magnetic sound, normal optical sound, PerspectaSound, pick-up, microphone, gong, or an extra signal.

A selector switch allows either the master volume control on the box or the auditorium volume control to be used. Pilot lamps on the box indicate which of the projectors is connected to the sound system.

Loudspeaker combinations required for Todd-AO reproduction can all be supplied from the normal range of Philips Cinema equipment.

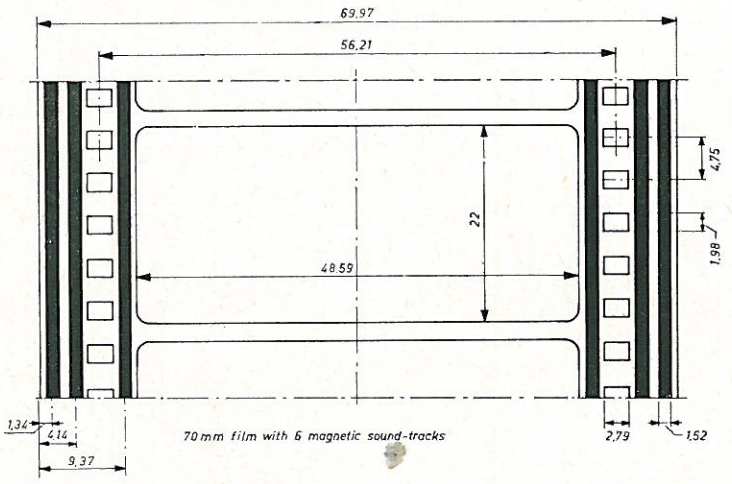


Master control box ...



Remote volume control ...

Dimensions of 70 mm Wide Film and position of the six sound tracks



Parts of the mechanisms shown in figure are:

1. upper fire trap guide roller; 2. fire trap rollers: 3. upper pad roller; 4. feed sprocket; 5. nylon pressure roller; 6. tension indicator; 7. piloting guide roller; 8. adjustable guide roller; 9. lens mount clamping bolt; 10. lower pad roller; 11. lower fire trap rollers; 12. fire trap guide roller; 13. hold-back sprocket; 14. optical soundhead; 15. sound drum; 16. pressure roller; 17. guide roller; 18. lower film gate pad roller; 19. intermittent film sprocket; 20. aperture plate; 21. pressure bands; 22. upper loop; 23. intermediate sprocket; 24. upper film gate pad roller; 25. film gate; 26. lower loop; 27. lens mount lever; 28. exciter lamp.