Film-Tech

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Bauer

Universal Sound-Film Projector U 2

for 70 and 35 mm Film

INSTRUCTION MANUAL

UNIVERSAL SOUND-FILM PROJECTOR

BAUER U 2

for 70 and 35 mm Film

INSTRUCTION MANUAL

EUGEN BAUER GMBH STUTTGART-UNTERTÜRKHEIM

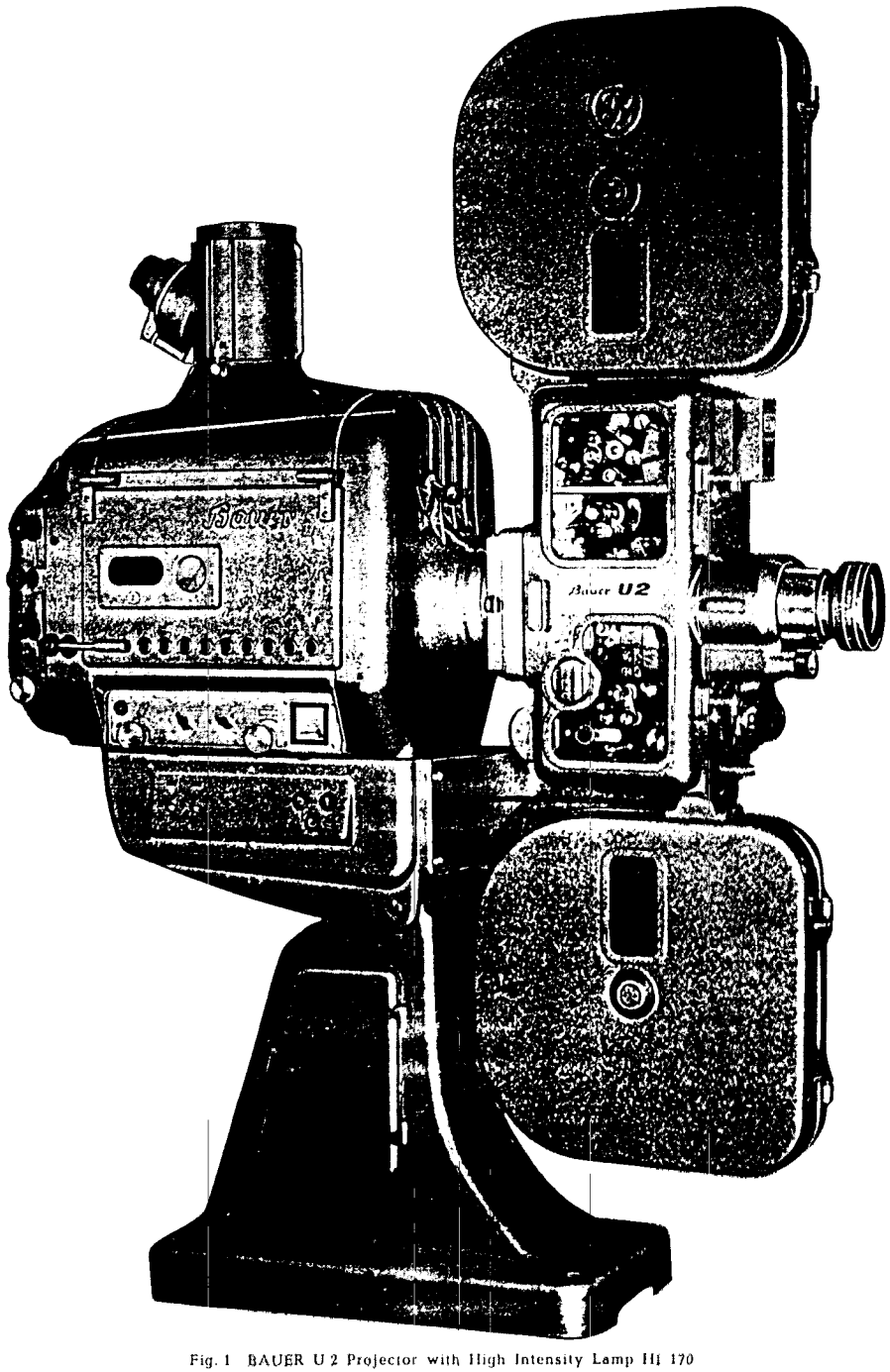


Fig. 1 BAUER U 2 Projector with High Intensity Lamp HI 170

General Description

The BAUER U 2 is a true universal projector for 70 and 35 mm films. Owing to its modern design presenting the possibility of rapid conversion over to any of the different systems of film projection, it is sufficient if the projection room is equipped with just two of these universal projectors. With a design based on all that up to now has been experienced with the 70 mm-wide form of film, and with careful consideration having been given to all the latest aspects of this system of film projectioin, the U 2 projector has been developed primarily for the medium-large and large cinema. Its switching system has been planned in such a way that in large cinemas three of these projectors can be switch-coupled together without any modification of the cabling layout.

Apart from the facility of conversion to Todd AO projection, one can go over with ease and rapidity to any of the 35 mm shapes of screen picture, i.e. standard form, wide-screen or Cinemascope with optical- or magnetic-track sound. All that is involved thereby is just exchanging the lens holders and the aperture-mask slides for each of the respective shapes of 35 mm screen picture.

The U 2 is equipped with a conical shutter which interrupts the conical beam of arc-light at its most constricted point, i.e. directly behind the picture aperture. Hence the shutter possesses a favourably low obturation period which in turn endows the machine with a very high degree of light-technical efficiency. It is for this reason that large widths of screen are able to be adequately illuminated with the U 2 at comparatively low lamp-current loads.

The magnetic sound head forms a completed whole with the projector proper and, in the same way as the optical sound head, has been included inside the head-enclosure.

The standard arc lamp for the BAUER U 2 is the BAUER HI 170, although quite apart from this lamp the U 2 can also be equipped with the smaller HI 110 lamp, with the BAUER BL 9 X Xenon lamp or the BAUER HI 75 B.

The individual mirror-arcs naturally endow the U 2 projector with individual values of light-output efficiency.

One can project

Todd AO pictures with	Cinemascope pictures
BAUER U 2 with BL 9 X Xenon lamp	
up to 36 ft. or 50 ft.	up to 36 ft. or 50 ft.
BAUER U 2 with HI 75 B	
up to 53 ft. or 72 ft.	up to 52 ft. or 66 ft.
BAUER U 2 with HI 110	
up to 62 ft. or 89 ft.	up to 62 ft. or 82 ft.
BAUER U 2 with HI 170	
up to 85 ft. or 115 ft.	up to 79 ft. or 108 ft.

These widths of screen picture can be attained by the U 2 projector working in conjunction with the appropriate type of lamp when employing a white screen (first figures) or a metallised screen (second figures).

Installation Instructions

Unpacking the Equipment

If the equipment arrives crated, care should be taken when unpacking it to ensure that none of the smaller parts (screws and so on) are overlooked amongst the packing material.

The parts of the machine should only be brought into the projection room after all construction work has been completed there, and then only when plaster and decoration work has dried out. The dust arising from building work is extremely harmful to the projection equipment, whilst the dampness still present in newly-finished buildings leads very quickly to rusting of the bright parts of the machines. Practical experience has taught that a certain amount of wall and plaster work such as knocking out holes for wall-plugs) is usually necessary after the projectors have been installed, even when construction-work details have been carefully planned beforehand. In this case the machines should be kept well covered up whilst such work is being carried out.

Erection Procedure

Setting Up the Pedestal and Table

The pedestal bases for the projectors are not as a rule fastened directly to the floor but on a low wooden plinth. This is an advantageous method in so far as positions decided upon during the erection of the equipment do not always agree with the working positions obtaining when assembly is completed.

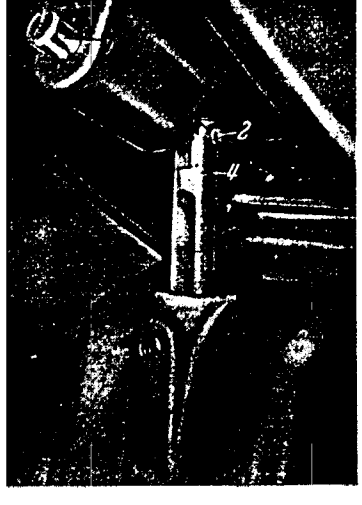


Fig. 2 Table and Pedestal Base
Pos. 1: Guide bolt for table
Pos. 2: Cross-pin connecting table and pedestal
Pos. 3: Snap-rings
Pos. 4: Tapered guide-rod in pedestal
Pos. 5: Screw for locking table in position

The height of the projection ports above the floor-level is so chosen as to allow a plinth of 1 to 2½ inches for the projector. The cast-iron pedestal is screwed on to this wooden plinth which must be provided with an opening in the centre for leading up into the projector base the cables and conduit tubing run under the floor.

Should there be danger of machine vibration being transferred over to the auditorium, especially likely with reinforced-concrete floors or when the auditorium seating area extends back underneath the projection room, the projectors must be mounted on some sort of sound-insulating material. This can consist of a sheet of rubber or cork, for instance, placed between projector base and the floor. The gauge of the particular material selected must be taken into account however, for if it is too thick the projector will tend to lose its firm stand.

Before screwing the pedestal base to the plinth it is best to assemble the complete projector and then centre its beam on the screen. The equipment can be levelled up by means of four adjusting screws in the base.

The table is secured to the front end of the pedestal with a pivot shaft which is locked to the base by a hexagon socket-screw at one side ,and to the table by a further socket-screw at the other. When assembly is taking place this shaft is slid through the eyes provided for it in the table and the pedestal. Care must be taken to see that the sloped-off surface of the shaft faces forward. The table can now be tilted and the tapered support underneath the table inserted in the hole bored for it in the rear part of the pedestal-top. This tapered support is connected by a cross-pin to the guide-rod underneath the table. The cross-pin is secured by two snap-rings.

The guide-rod leading down inside the pedestal can now be tightened up.

The pivot shaft at the forward part of the pedestal can now be secured in position by first screwing home the socket-screw on the lower part of the table and then the socket-screw at the front of the pedestal.

Assembling the Projector Head

Mounting the Head-Enclosing Parts and the Sound Heads

The BAUER U 2 head is fastened to the base table with 4 screws. The optical sound head is then fixed in position with 3 socket-screws, after which the various parts for enclosing the projector head can be mounted. One of these enclosing parts fits between exciter lamp housing and Flammex and is secured to the optical sound head with one screw. The lower cover part is secured to the projector base with 3 screws. The front part between fire-trap rollers and lens holder is fixed to the projector with 2 screws.

Mounting the magnetic sound head then follows, this being secured to the top of the head with 3 socket-screws. Take care that the rubber coupling is properly inserted between the coupling-piece on the vertical shaft and the coupling-piece on the magnetic sound head. The rear panel on this sound head is taken off after removing the 4 screws. The large flywheel has already been removed for transit

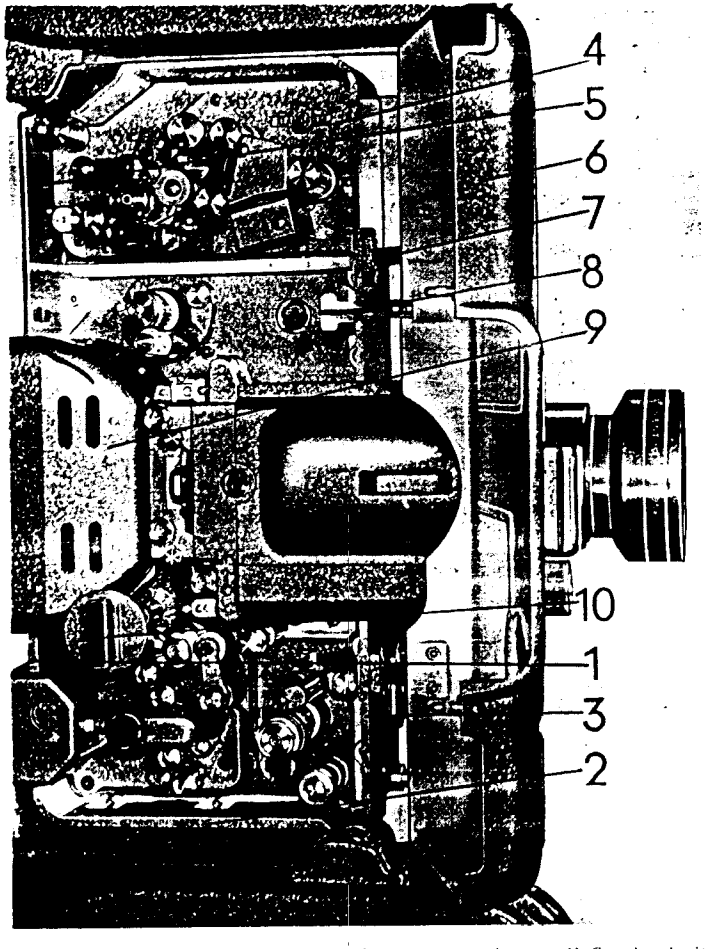


Fig. 3

Operating side of the U 2 projector with the housing cover of the projector head open

1 covering part between exciter-lamp case and shutter cover housing
2 lower covering part
3 front covering part
4 magnetic sound reproducer
5 upper part of the projector head housing
6 housing cover of the projector head
7 hinge for cover of projector head
8 catch for cover of projector head
9 shutter-cover housing
10 hand lever for framing of picture

reasons, and for assembly purposes the small flywheel situated behind and to the left must also be removed. This is done by pressing the split washer out of its groove with the aid of a screw-driver. In this way access is gained to the third fixing screw in the corner of the magnetic sound head. The alignment of sound-head rollers with projector-head rollers is then checked before the screws are finally screwed home. The two flywheels can now be re-assembled and the cover replaced on the sound head. The upper part of the head enclosure can also be fixed in position now by means of 3 screws, the most expedient method being to remove the lower roller on the magnetic sound head, and first replace it when the en-

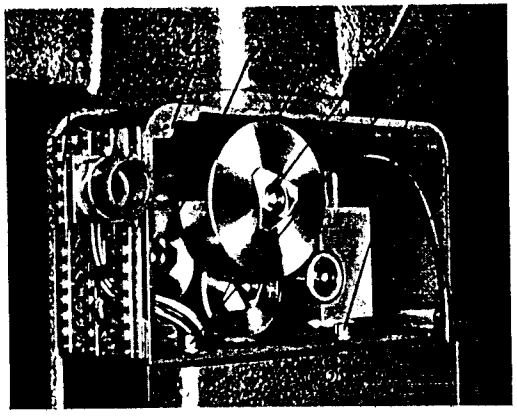


Fig. 4

Magnetic Sound Reproducer — rear side open

1 large fly wheel to be taken off prior to assembly
2 small fly wheel to be taken off prior to assembly
3 split washer for holding the fly wheel
4 4 fixing holes for cover of magnetic sound head
5 cable for spool box pilot light
6 connecting terminals for magnetic heads
7 leading-in of connecting cables for magnetic heads
8 fixing screws for magnetic sound head

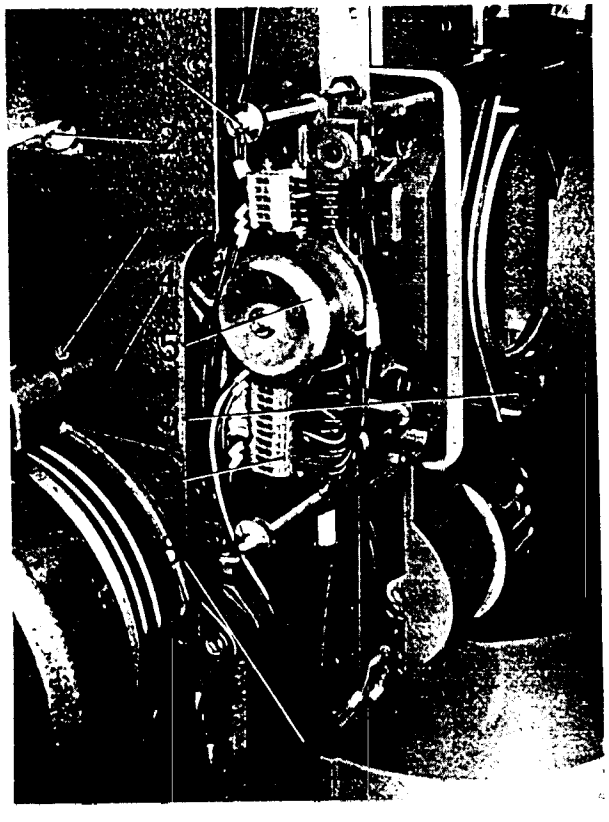


Fig. 5

Rear Side of Projector Head Flammex-part open

1 bolts with nuts for rear shutter housing part
2 oil filler screw at the upper head cover
3 fixing screw for air channel cover
4 air channel cover
5 rotating magnet for actuating the Flammex flaps
6 fitting for condenser lens
7 terminal block for connecting the electrical leads
8 hole in console for feeding cable and air pipe of air blower

closing cover has been attached. The head enclosure is now of uniform height with respect to the side of the head, so that the door panels enclosing the film-path can now be hung on the two hinges. The flat rail for limiting the extent to which the door panel opens is pressed between the two eyes on the upper part of the head enclosure so that is comes to rest in the spring parts.
The plate spring fixed to the upper pad roller must be turned to the opposite direction so that its free end presses onto an angle lever which is situated at the magnetic sound head to stop the movement of the damping roller during lacing the film.
The shutter-cover housing will be found already mounted to the head when the machine is delivered, and for connecting the various cables the rear part of the shutter housing must first be removed. This is done by unscrewing the two knurled nuts and withdrawing the cover by angling it slightly past the main-drive motor. The front shutter-cover housing is merely slid over two bolts and can easily be removed from the operating side. This housing may remain in position during assembly work. The framing knob is held in position with a spring which enables it to be withdrawn without the need of tools. This knob has to be removed whenever the shutter-cover housing is taken off for cleaning or checking purposes.

BAUER Air Blower

Air-Blower Connection

An air pipe can be seen beneath the magnet housing in the Flammex, this pipe conducting the cooling air from the air blower on through to the film. One end of the 1/2" hose-piping supplied is connected to this pipe, the other end of the hose being led down through the base-table console to the air blower in the projector base and clamped with a hose-clip to the 1/2" nipple on the blower. The electrical leads for the air blower are permanently fixed in place.
The air blower can also be supplied for mounting separately, in which case it is furnished with a cast base for fixing purposes. The output pipe then possesses a 3/4" nipple to which is connected the 3/4" hose-pipe supplied, the nipple on the end of the hose being connected in turn to a 3/4" gas-pipe. The gas-piping must be laid under the floor-surface of the projection room with its end protruding up inside the projector base. Do not employ any elbow-bends when laying the gas-piping, but instead arrange for any bends to run in large-radius curves. The projector-end of the pipe is then fitted with a 1/2" nipple and connected to the length of 1/2" hose leading up to the air pipe in the Flammex.
The efficacy of this air cooling arises from the compressed air produced by the BAUER air blower being forced at high speed out of four jets situated in the film channel and picture aperture of the projector. The actual temperature of the compressed air is of smaller significance here than the volume and emersion-speed of the cooling air which disperses the heated air concentrating at the picture aperture, thus preventing impermissible heating of the film.

Method of Working

The BAUER air blower is a rotary type. It consists of an eccentrically-arranged rotor fitted with loose-inserted Resitex blades mounted inside its housing. Centrifugal force causes the blades to move outwards when the rotor revolves and maintain sliding contact with the interior wall of the housing. By his means, cavities of continually varying volume are formed between the blades owing to the eccentric positioning of the rotor, resulting in the air being sucked in and compressed. The air blower and its driving motor are mounted together.

Installation and Electrical Connection

The air blower should be installed in a room adjoining the projection room. It is of advantage to mount it on a shelf bracketed to the wall about 3 to 5 ft. above floor-level because the indrawn air will then contain less dust than if the blower is placed directly on the floor. The feet on which both blower and motor are mounted are fixed to the console with 4 screws. Vibration dampers to minimise running-noise should be fitted between feet and console. Whenever possible a location should be chosen for installing the air blower where the indrawn air will not already be pre-warmed to any extent. It follows that such places as above heating radiators, arc-lamp ballast resistances or other such places radiating warmth in their vicinity should be avoided.
The electrical supply cables should be laid in steel conduit, the individual leads being at least of 3/0.036 NBS gauge copper.

Care and Maintenance

The sturdy construction of the air blower reduces the attention it requires to a very modest amount indeed. The intake socket-piece is fitted with a grease cap for lubricating the blower with the special grease supplied in a tin with it. Do not attach the filled grease cap with the blower running, however, otherwise it will immediately be sucked empty.
The cup should be replenished with this special grease once per month, whereby the full cap is slowly screwed into the running blower until about a quarter of its contents has been pressed in. Each week thereafter a further quarter of the contents should be screwed in with the blower in operation. Thus one full replenishment will last for one month's working.

Cleaning

Dust contained in the air collects at the input suction point, whilst the minute particles of grease present in the compressed air are deposited at the exit point for the air. The composition-foam filters, each lying between two wire-mesh sieves and being indentical for input and output points, can be removed once the hexagon screw and the caps on the input and output socket-pieces have been taken off. These foam filters should be washed out with petrol each month. The filter from the pressure output side will be found discoloured by a running-additive contained in the grease. This filter will not regain its original colour even after being thoroughly washed out.

A thorough overhaul and cleaning every two years is to be recommended. This entails removing the filters in input and output socket-pieces, switching on the blower with the air hose removed from the oil separator and allowing a gill or so of petrol to run through the machine. Any dirt in the interior is freed by this means and then blown out. The blower, however, must be allowed to continue to run until such time as one is absolutely certain that every trace of petrol has been washed out of the interior. Finally the two socket-pieces are cleaned out and the composition-foam filters renewed. The housing should not be opened. Before taking the blower into use again, 1—2 grease-cups full of grease should be pressed slowly through the cup into the running blower.

Fitting the 2-Speed Motor

The 3-phase or the single-phase AC synchronous motor is screwed to the rear of the projector head. The fan-housing part can then be fixed to the lower head-cover with two socket-screws.
The cable for feeding the motor is drawn out through the lower bearing-rod. The fan together with the inner-toothed gear wheel is then slid onto the shaft (note shaft-key) and secured at the shaft-end. After this the motor, whose clamping arms must be in the open position, can be slid over the upper und lower bearing-rods. The motor should not be slid right home however. The metal cover which rests between motor unit and fan housing is now mounted in position with the four

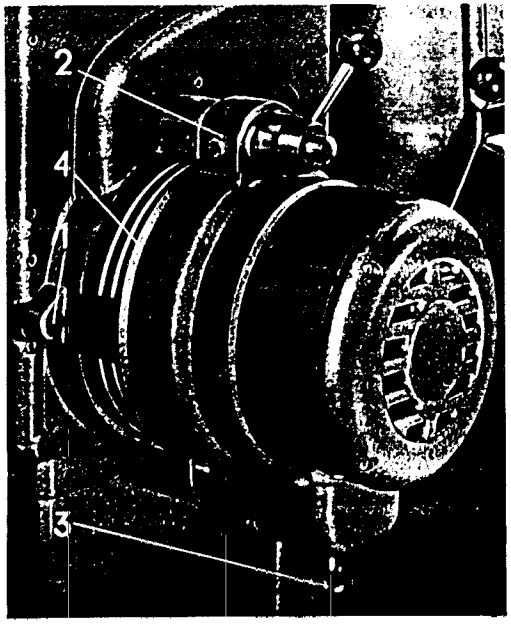


Fig. 6

Main Drive motor

1 fixing screws of the fan housing at the lower cover of the projector
2 stopping device with tightening lever
3 tightening lever at the oscillatory bearing
4 cover ring between motor and fan housing

springs belonging to it, so that it will enclose the space between these two items in either of the two operating positions of the motor. A spring-clip for limiting the movement of the motor along the direction of its axis is then clipped onto the end of the lower bearing-rod. The double-geared wheel of the motor unit, which engages in the inner-toothing of the fan unit, is damped by means of a rubber coupling.
Adjustment of the motor-position for working on different frame-speeds is described in the section 'Conversion from 70 to 35 mm Film', page 33.
The motor is fitted with a starting resistor for protection of film and head mechanism when starting up. This resistor is short-circuited by a centrifugal switch as soon as nominal projector-speed has been reached. The value of the resistor, which is situated in the base-table, can be altered by moving the centre tapping-clip on the resistor-body and the speed of motor run-up suited in this way to the particular working conditions obtaining.

Connections

The next operation comprises feeding the cables coming from the terminal points in the table up through the console and into the Flammex unit, so that they can be connected to the terminal blocks on the Flammex base-plate. The same path is taken by the leads to the sound head, both those for current-feeding the exciter lamp and also the cable to the photo-electric cell. The cable containing the leads for feeding the projector motor is led through a bore in the console rear and out to the motor. Actual connection to the motor has been described in the instructions for fitting it. All cable-ends are marked and should be connected to their correspondingly-marked terminal points.
Once all the leads to the shutter-cover housing and to the motor have been connected-up, the shutter housing can be replaced. The air-channel cover at the rear of the head can then be screwed over the motor with one screw. Finally the protective cover must be slid over the motor terminal-strip and fixed in place with two screws.
The fitting carrying the condenser lens or plane glass, supplied separately, must be slid into the end of the shutter-cover housing, thus isolating the air space in the shutter housing from the arc-lamp.

Assembling the Spoolboxes

The foot of the take-off spool box is fitted on the magnetic sound head by means of three screws. Assembly involves pressing the cover plate in the one half of the box upwards and drawing it forwards. This permits it then to be swung to the side and provide access to the interior of the spool-box arm. The lead for the spool-box pilot light is laid through the magnetic sound head so that when the spool box is mounted its upper end protrudes up into the foot of the arm and can be connected to the connecting block situated inside. The lower end of the lead is led down from the sound head to the terminals on the Flammex base-plate. After aligning the fire-trap rollers with those on the magnetic sound head, the spool-box can be screwed down and the cover plate swung back into its proper position again.

The take-up arm is then mounted beneath the console which is screwed tight to the box-shaped part of the base-table. The cover plate in the spool-box interior, as well as the magnet held in position by two screws form the rear of the spool-box, must first be removed to give access to the three fixing screws in the spool-box arm. The connecting leads, which are appropriately marked, are connected to the terminal strip and the magnet inside the arm. These connections completed, the magnet and cover plate can be secured in position again. The draw-spring from the magnet core must be hung in the tensioning-bar between two pins.

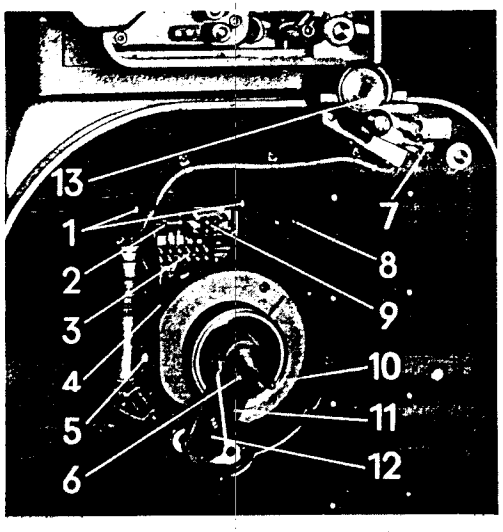


Fig. 7

Take-up spool box — interior

1 fixing screws
2 draw spring at the armature of the magnet
3 terminal strip
4 tensioning bar
5 driving gear of the take-up motor
6 driving pin
7 roller lever for actuating the micro-switch for the take-up motor
8 angle piece for magnet with 2 fixing screws
9 magnet with terminals S1 - S2
10 spool shaft
11 marking (must stand vertical)
12 oscillatory lever
13 large fire-trap roller

In the case of inclined or declined projection the pivoted lever with the spool shaft must be inserted in one of the five bore-holes in such a way that the white line on the lever stands vertical. The suspension-shaft part of the pivoted lever has a groove projecting out of the rear of the spool box. A cast cap covers up the five bore holes and simultaneously holds the suspension shaft secure in the direction of its length. This cap possesses three screws, the particular screw employed for securing purpose depending on the position of the pivoted lever. Pay attention here that this lever still possesses a little play when the screw has been tightened up. The cast cap must not foul the cast part of the spool box.

Mounting the Arc-lamp

The four fixing screws with their spacing washers have been screwed in the base-table for purposes of transport. They should be removed, and the spacing washers left lying over the threaded holes in the table. The arc-lamp is then placed on the

spacing washers and pushed forward until the front funnelled wall forms a light-tight fit with the shutter housing. Do not forget to insert the base-tray in the lamp-house before screwing it down to the base-table. The fixing screws are then screwed into the threaded holes in the table from the interior of the lamp.

With the three-phase type there are 2 terminals accommodated in the pedestal for D. C. connection of arc lamp-cables. For the A. C. type, however, the construction plan should provide a terminal box inside the pedestal from which the arc lamp cables lead to the terminals of the rear wall of the lamp house. Further, there exists a 220 V ~ leading cable for the high intensity arc lamps as well as for the Xenon lamps.

The front-wall funnel for the BAUER HI 170 lamp is conical, whilst being cylindrical for all other types of BAUER lamps. The rim of each funnel is cut back half way on the operating side so that the holder for the lens-fitting can be slid in from this side. Lens holder and funnel form a light-tight fit together when the mirror-lamp has been correctly positioned. Each of the funnels is fixed to the forward lamp-house wall by means of three angled brackets.

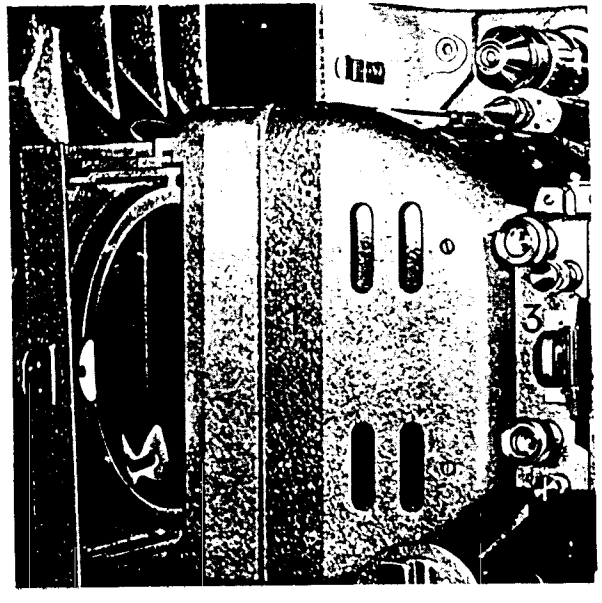


Fig. 8

Shutter cover housing

1 shutter cover housing with air slits
2 lens holder (only half-way slid-in)
3 picture aperture holder

The projector's cooling system requires that the shutter-cover housing always be closed in by a BAUER condenser lens, or a plane glass should no lens be necessary. If no air cut-off is present at this point, the turbo fan on the motor shaft will draw in the warm air from the interior of the lamp and furthermore give rise to an unsteady arc-flame. This lens holder must be lifted up and withdrawn for exchanging or cleaning the lens.
A cylindrical lens is inserted in the lens holder for Todd AO projection. In order to obtain the correct operating position for this lens when inserting it, a flat has been ground on one point on its diameter which must rest against the two tension-pins at the rear on the holder.

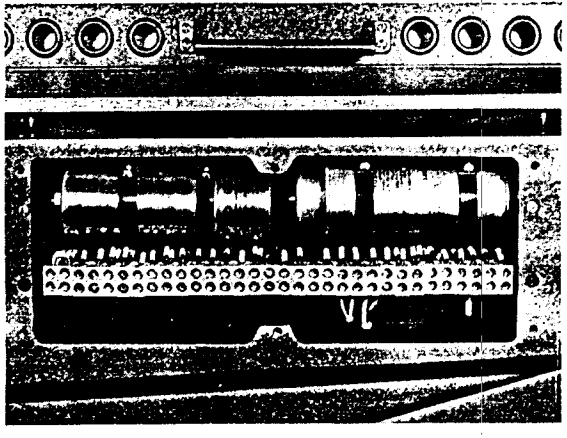


Fig. 9

The connecting blocks accommodated in the base-table are plainly marked and easily accessible.

The remaining connecting blocks are easy to reach by removing the cover from the rear of the pedestal. The various terminal points are plainly marked, and the necessary wiring can be carried out in accordance with the wiring diagram given in the Instruction Book.

Inserting the Projection Lens

The projection of several different film reproduction systems such as Todd AO, standard-film, Cinemascope and wide-screen naturally also entails the use of several different lenses. All these lenses can be pre-adjusted and locked in separate fittings. Then when it becomes necessary later on to exchange the lens, e. g. between 70 and 35 mm film or between 35 mm standard-film and Cinemascope, the pre-adjusted lens in its fitting can be removed from or attached to the projector without the focus having to be re-adjusted in any way whatever. The lens groups need only be given one initial adjustment in their fittings when the projector is first installed.

Apart from the clamp mount attached to the lens holder on the U 2 projector head, the following fittings are available for the different types of lenses:

For 70 mm projection, concentric fittings for the ISCO T-Kiptagon lens whose clamp-diameter amounts to 4". A long fitting (5) is necessary for the 50—95 mm focal length and a short one (6) for the 100—175 mm focal lengths, their respective positions being laterally fixed in the clamp fitting in each case.

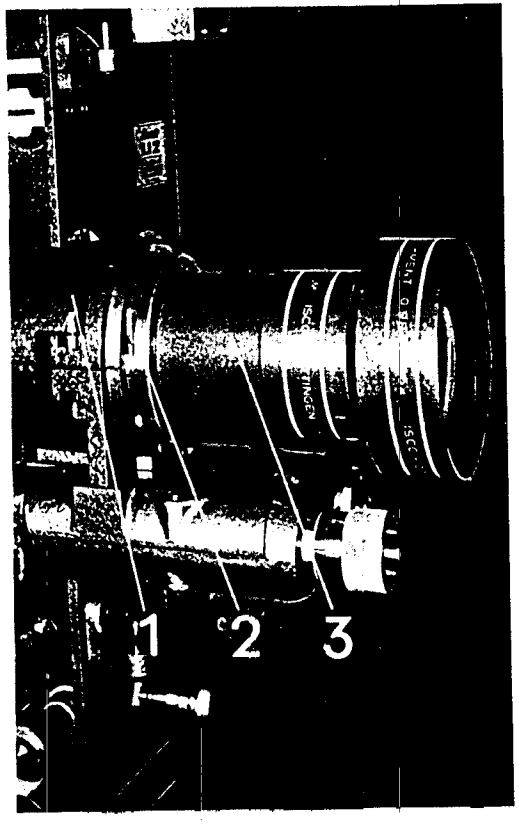


Fig. 10

Lens Fittings for 70 mm Film

1 Clamp fitting (at the head)
2 Lens-fitting (centric, 4" inside-diameter)
3 KIPTAGON-lens

For 35 mm projection with lenses of 4" ∅ (e. g. Super Kiptar S) an eccentric fitting (7) serves to bring the lens to the centre of the optical-track picture. The position of this lens fitting is likewise laterally fixed in the clamp fitting. Should a 4" lens be employed together with a large anamorphic lens, a set of fittings will be required consisting of a lens fitting (10), an intermediate

sleeve and a stop-collar (9). Projection lens and anamorphic lens are clamped in the lens fitting on which is placed a stop-collar fixing the position of the lens in the direction of projection. This collar will then always bring the lens into the position of sharpest focus when going over from centre optical-track picture to centre magnetic-track picture. The lateral positioning of the lens is brought about by the eccentric bore in the intermediate sleeve as well as of the lens fitting. For rotating the combination, the locking screw in the clamping part of the intermediate sleeve (8) must be loosened, the lens fitting (10) moved forward a little and then swung round through 180°. The sleeve is inserted in the fitting in such a way that its locating pin engages in the forward groove in the clamp fitting. In this position the pin engages at the highest point of the sleeve. The lens fitting has a groove at the top and at the bottom; and depending on the particular position one of the grooves must engage with the locating pin on the sleeve when the lens fitting is slid back against the stop-collar. By this means the anamorphic lens remains absolutely vertical in either of the two positions.

Distinguishing mark for lens-position set for centre optical-track picture: All slots lying at height of optical axis and facing operating side of machine (the marking numbers are on the top of the front side).

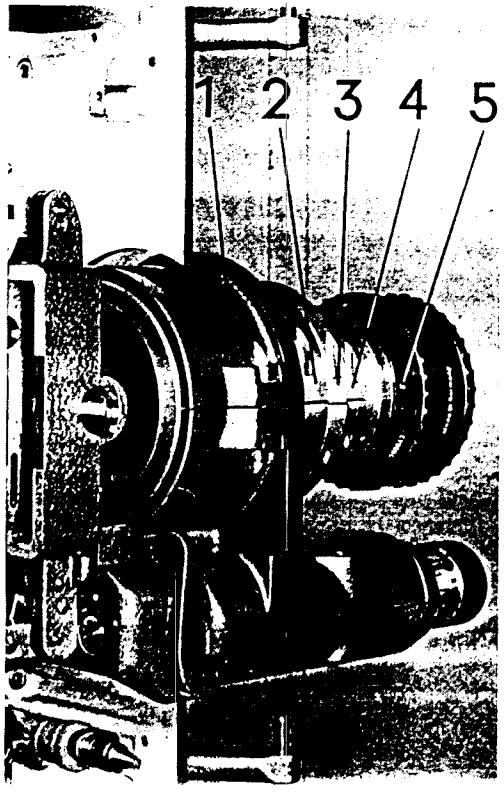


Fig. 11

Lens Fittings for 35 mm Cinemascope Film
centre optical-track picture for anamorphic lens with clamping dia. 79,4 mm

1 clamp fitting (at the head)
2 intermediate sleeve (eccentric)
3 stop collar
4 lens fitting (eccentric)
5 anamorphic lens

Distinguishing mark for lens-position set for centre magnetic,track picture: The slot in the lens fitting lies at height of optical axis on the side opposite the operating side (the marking numbers are on the bottom of the front side).

If the lenses for 35 mm projection are the normal type with a 62.5 or 70.7 mm ∅ they will require sets of fittings comprised of one intermediate sleeve (1), a lens fitting (3), a tubular adaptor and a stop-collar (2). Here there are tubular adaptors with a bore of either 62.5 or 70.7 mm ∅, according to the type of lens desired. As the outside diameter of these tubes amounts to 79.4 mm they fit into the lens-fitting whose outside diameter is 100 mm, and whose inside diameter of 79.4 mm is also suitable for taking an anamorphic lens.

One set of fittings is needed for each of the standard, wide-screen or Cinemascope systems of projection, although only one intermediate sleeve (1) is necessary for all three sets because this item does not have to be exchanged at the same time as the remainder of the set of fittings. The fittings for standard or wide-screen projection remain set to centre optical-track picture, marking numbers on the top. For Cinemascope projection, the lens-fitting together with projection and anamorphic lenses can be changed over from centre optical-track picture, marking numbers on the top to centre magnetic-track picture, marking numbers on the bottom. The procedure is the same as already described for 4" lenses with anamorphic attachments.

The Cinemascope set of fittings has either a short lens-fitting (3) taking lenses up to a focal length of 110 mm together with the anamorphic attachment, or else a long lens-fitting (4) for clamping lenses with focal lengths over 110 mm together with the anamorphic lens. For setting the lateral positioning of these long fittings the locating pin in the second intermediate sleeve must be screwed into the forward hole.

The lens fitting parts carry their marking numbers on the front side (projection direction).

When ordering these parts, just indicate the corresponding number.

The table, on page 18, presents a clear picture of the fittings described.

Sharp Focussing

The lenses for the various projection systems mounted in their lens- and clamp-fittings are now adjusted for sharp focus on the projector with the film running. The lens-fitting and the intermediate sleeve are inserted in the clamping part of the lens holder and the large micrometer-screw with its scaled divisions is set to its fitting until the position of sharpest screen focus has been obtained. The socket-screws on the lens-fitting are then tightened up and the stop-collar secured on the lens-fitting in such a way that this collar will result in the position of sharpest focus being reached each time the lens-fittings are exchanged, without having to set the projector in action.

In the case of film systems employing an anamorphic lens the backing-lens must first be sharply focussed on its own. Only when this has been accomplished and the

Lens-Fitting Parts for mounting Lenses in the U 2 Projector

Parts	Marking-number	Designation	70 mm Film T-Kiptagon 4" ⌀		35 mm Film					
					Standard-film Lens 4"				Lens-diameter 62,5 or 70,7 mm	
		f = 50-95 mm	f = 100-175 mm		Large Anam.-L		Small Anam. Lens			
					St.	W-S	C-opt.-C-mag.	St.	W-S	C-opt. C-mag.	C-opt. C-mag.
					f = 60-160	f = 60-160		f = 60-160	f = 60-160	f = up to 100	f = over 100
Lens-fitting	5	centric	1								
Lens-fitting	6	centric		1							
Lens-fitting	7	eccentric			1	1					
Intermediate sleeve	8	eccentric					1				
Lens-fitting	10	eccentric					1				
Stop-collar	9						1				
Intermediate sleeve	1	eccentric						1	①	①	1
Lens-fitting	3	eccentric						1	1	1	—
Stop-collar	2							1	1	1	1
Tube-adaptor		80/70.7 ⌀						1	1	1	1
or tube adaptor		80/62.5 ⌀						1	1	1	1
Lens-fitting	4	eccentric						—	—	—	1

The parts marked by a cycle can be employed from amongst those of the standard-film fitting.

backing-lens is clamped tight, may the anamorphic lens be attached and adjusted for correct radial positioning and sharpest picture-focus. This entails the use of a special test-film however, as the adjustments required to be made are impossible to carry out with a normal picture-film.

The lenses adjusted in this manner are stored away in their fittings and then mounted to the projector when required, i.e. for Todd AO, standard-film, wide-screen and Cinemascope performances. All one has to do then is merely use the micrometer-screw to compensate for any slight variations resulting from the difference in sharpness of different film copies.

Before commencing projection:

After the projector head has been set up, all those places where a little oil has seeped out during transport must be wiped clean before the equipment is taken into use. The oil in the head-sump was probably drained out before the machine was dispatched. Nevertheless a small amount of oil always remains inside and usually manages to find its way out via the various bearings on account of the crates being tipped up during transport. This surplus oil must be wiped off, otherwise the danger will exist of its providing an easy path for further seepage.

The individual points concerned are:

the space between the enclosing sleeves and the cast bosses for
the take-off and take-up shafts,
the shutter shaft,
the intermittent sprocket and
the control shaft in the change-over housing leading out of the rear of the projector head.

Operation and Maintenance of the Projector

Lubrication Instructions

After the projector has been assembled and connected up, the head mechanism must be supplied with oil. The oil filler cap is situated on the upper head cover. On no account may the motor be switched on before the head mechanism has been given the prescribed amount of oil, neither may the projector be turned over by hand before the head has received its oil.

Grade of Oil

We strongly recommend that only BAUER projector oil be used for lubricating the projector-head mechanism. This special grade of oil is the final result of much experimental and test work and will guarantee uniformly excellent lubrication at all operating temperatures. If the oil is changed regularly no signs of gumming will be apparent and the head gearing will be subjected to an absolute minimum of wear and tear. The viscosity and composition of this BAUER oil make it equally suitable for summer and winter use, and hence it is not necessary to change to a thinner oil during cold weather. Should BAUER oil not be available at any time and some substitute is urgently required, a good-quality brand of automobile winter oil will serve as a temporary stop-gap.

Mechanism Oil-Filling

The oil funnel fitted with a fine-mesh sieve is used to pour the oil into the head. With level or declined-rake projection and with the mechanism at rest, the oil should rise to the upper half of the oil-level gauge but should not fill more than three-quarters of the observation glass. If the projector is supplied with too much oil the excess may leak out through the drive-shaft bearings.
Should the projector be raked upwards at all, the normal amount of oil showing half-way up the observation glass may not be sufficient. This discrepancy will be indicated if large air bubbles appear in the upper observation glass, in which case additional oil must be supplied until the bubbles disappear.

Oil-Circulation Control

Oil circulation can be checked when the projector is running by observing the passage of the oil past the upper observation glass. No large air bubbles should be apparent in the oil circulating past this point. These are usually a sign that the oil sieve is partially blocked with dirt and is not allowing sufficent oil to pass through.

Changing the Oil

The first oil change should take place fairly early, after say about 50 running hours, as the oil becomes dirty more quickly during the running-in period of the mechanism. The oil sieve situated at the inlet oil pump (Fig. 13) becomes clogged with fine sediment which hinders the flow of oil. The next oil change should take place after a further 100 running hours and thereafter every 200 running hours.
It is of great importance that the oil always should be drained off immediately after a show has finished, whilst it is still warm and fluid. Oil change is carried out by first removing the drain plug (Fig. 12) at the front of the head (unscrew only the threaded plug, not the socket!) then taking out the oil sieve (Fig. 13) and, where no downward rake is already being employed, tilting the projector forward so that all the oil can run out. After the oil has been drained off it is recommended that the mechanism be rinsed out with flushing oil of the kind obtainable from any automobile repair shop. Oil sieve and drain plug are re-inserted for this purpose and the motor switched on for a few moments until the flushing oil becomes visible in the upper oil observation glass. This oil is then completely drained off again and the oil sieve given a thorough cleaning. This sieve must be so inserted that the circular red mark (0) points upwards. The locating pin will then come to rest in a groove in the oil pump. Make certain the locating pin is properly inserted by pressing the oil sieve well in. Finally the required quantity of BAUER projector oil is poured into the housing in the normal way. It is especially important never to add new oil to old — always change the old oil completely.

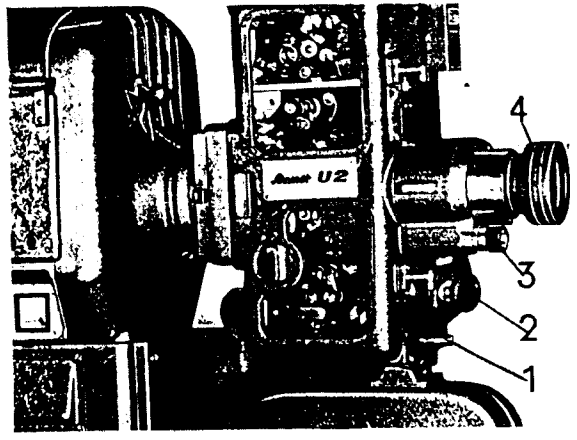


Fig. 12

U 2 projector head — the cover parts being closed

1 oil drain plug (at the front of the head)
2 knob for starting the mechanism
3 knurled nut for fine adjustment of lens focus with scaled ring
4 T-Kiptagon lens inserted in the lens hting

Lubrication Plan

There is nothing requiring to be lubricated on the take-up and take-off arms or on the pad and idler rollers made of nylon material.
Under normal working involving several performances per day the following should be lubricated weekly:
all metal pad and idler rollers on the head, the optical sound head, the magnetic sound head and the fire-trap channels (remove rollers, clean bores and shafts and lightly oil), the sliding guide and the operating lever on the lens holder, and the feed cranks and shafts of the arc-lamp feed mechanism.
The following parts should be lightly oiled once per month: the spool-box hinges and the head-panel hinge, the various oiling points in the arc-lamp, the compensating stabiliser on the sound head, and the film-break release lever in the take-up spool box. Lubricate the air blower according to special instructions page 9.

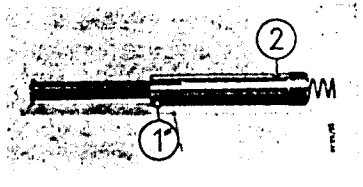


Fig. 13 *Oil sieve*

Pos. 1: Locating pin
Pos. 2: "O" mark

Projector Head

The layout and construction of the projector head mechanism is similar to that of the other BAUER machines which are still continuing to give years of trouble-free service everywhere. The new head distinguishes itself through its quiet running and great operational reliability.
The U 2 projector head possesses a drive with an elastic rubber coupling, led out through the top, to permit the use of the driven-type magnetic sound head.

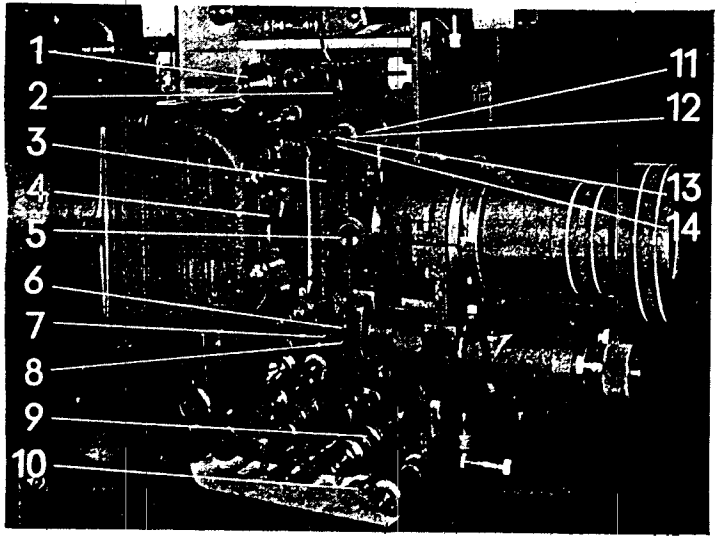


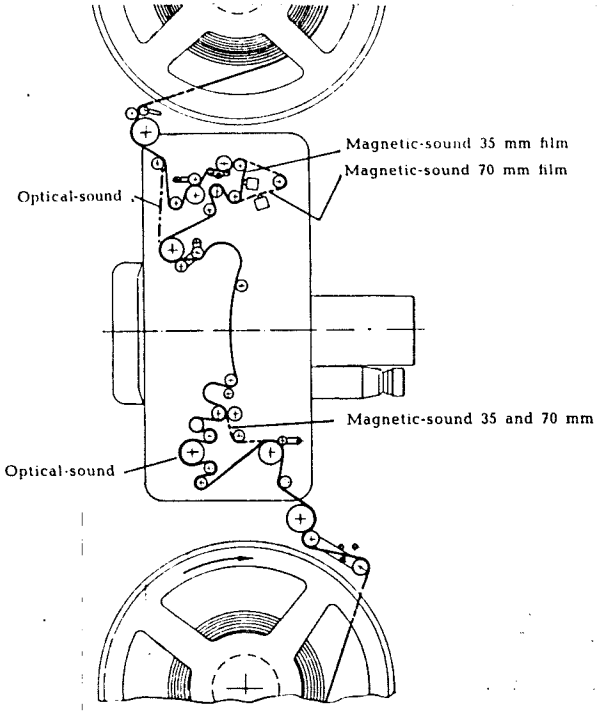
Fig. 14

Operating Side of the U 2 Projector Head
— cover taken off and film gate opened

1 take-off sprocket with conical cover
2 (with plate spring for damping roller)
2 upper pad roller cradle
3 film gate
4 picture aperture holder
5 magnifying glass for setting the starting mark
6 eccentric bolt (catch for cross roller cradle)
7 cross roller cradle
8 bearing bolt for cross roller cradle
9 take-up sprocket with loop former assembly
10 knob for stripper at the take-up sprocket
11 lateral elastic film guide roller
12 grub screw at the front eye of the film gate
13 roller-shaft bearing
14 set screw for roller shaft-bearing

The Film Path

The film is laced through the projector and optical sound head in such a way that loops are formed above the film gate and below the intermittent sprocket. These loops are necessary to allow for the jerky movement of the film past the picture aperture and to filter out to a certain extent the flutter caused by this jerky movement.
The path taken by the film for optical-track copies as well as for 35 and 70 mm magnetic track films is shown in the accompanying diagram.



Loop Former

The U 2 machine is fournished with a loop former on the take-up sprocket, with which the projectionist can adjust for the most favourable size of loop whilst the projector is running.
The end of the take-up sprocket shaft is fitted with two knurled rings, one large and one small (Fig. 14). Normally these rings revolve with twe sprocket shaft. If the large ring be braked to a stop, the associated loop will enlarge; whereas if the smaller ring be braked the loop becomes smaller. The size of loop is correct when the noise produced by the running film has been reduced to a minimum.

Film Spools

Outside diameter of a BAUER spool for 2000 ft. of 35 mm film = 15"; core diameter = 5". Outside diameter of BAUER film spools for 4260 ft. of 70 mm Film = 20.9"; core diameter = 5". The take-up friction device is matched for these core diameters, and has been so calculated that the film is taken up smoothly right from the start and will not be subjected to any undue take-up pull. Other makes of spool with smaller core diameters should not, therefore, be used with the U 2 projector. For the same reason the BAUER split spool with a core diameter of only 2" should never be used in the projector itself.
With BAUER spools, insertion and securing of the film-end are greatly facilitated by a movable clamping pin. The film is pushed under this pin and the pin slid down to clamp it in a semi-circular groove in the core. As the film runs out in the upper spool box the film-end is drawn out from under the pin.

Spool Boxes

The spool boxes take up to 4260 ft. of film. Spool box and door thereby are of equal depth and permit the spool to be easily grasped and removed. An illuminated scale is incorporated in the take-off spool box and indicates the exact amount of film still remaining on the spool. The fire-trap assembly is fitted with a large guide roller actuated by the pull of the film passing over. Because the film is not confined between two fixed fire-trap walls but runs taut and flat over the surface of this large roller, the fire-trap channel could be kept very narrow indeed. Any risk of fire creeping into the spool box has been very effectively met indeed by this special fire-trap assembly. The inside of the spool box door is fitted with a boss which presses against the reel and holds it in correct running position when the door is closed.

The fire-traps should be cleaned daily. The large fire-trap roller can easily be removed after the catch (Fig. 7) has been pressed down. Shaft and bore should be cleaned and lightly greased, after which the roller can be replaced in the assembly. It is also an advantage to lightly grease the groove in the roller in which the catch rests. Special attention should be paid to the running surface of this roller and also to the stationary side walls of the fire-trap channel. These parts must always be kept free from dust and dirt.

The small exit rollers on the fire-traps should also be checked daily for free running.

Take-Off Arm

The upper spool shaft is fitted with a braking device to prevent the spool from turning too fast and thus feed off more film than the projector can deal with. The braking tension can be set by the milled nut at the rear of the spool arm. The amount of braking effect exerted should be just sufficient to prevent the film from overrunning. Too much tension here will damage the film.

A pilot light for illuminating the interior of the spool box is mounted in the spool arm. The 6 V. .5 W. double-ended tubular lamp can be reached by removing the cover carrying the footage scale in the upper spool box.

Take-Up Arm

A load-dependent friction take-up device mounted in the take-up arm of the U 2 projector provides for an even pull on the film, quite independent of the diameter of the film already taken up on the spool. The drive for the take-up device takes place over a separate take-up motor which is controlled automatically through two micro-switches. As soon as a loop forms when the film is being laced at the start-mark, the micro-switch switches the motor on until the film is taut once more. The re-tensioned film then opens the micro-switch, thus switching off the motor. This micro-switch stays out of operation all the time the projector motor and with it the take-up motor are switched on.

If the film breaks or when the end of the film runs out, a second micro-switch opens and switches off both take-up and projector motors.

In order to guarantee non-retarded start of the large, heavy spools when starting up, a magnet drawing its current supply from the 60 v. rectifier for the change-over

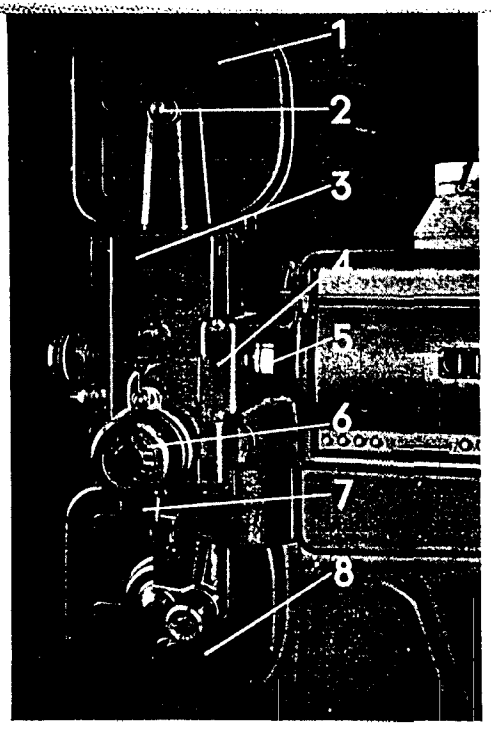


Fig. 16

U 2 Projector — Rear Side

1 Tacke-off spool box
2 milled nut for take-off friction
3 magnetic sound head
4 rear shutter cover housing
5 lamp funnel
6 main drive motor
7 connecting cover
8 take-up spool box

is momentarily switched in when the main motor runs up, the effect of this magnet in-circuit time can be altered at the slotted brass pin on the delay relay (clockwise turning results in longer incircuit time). The delay relay for single-phase AC working is situated on the switch panel; with three-phase working it is in the base-table. The length of in-circuit time is set correctly in the factory and normally will require no correction.

Film Gate and Back-Plate Unit (Picture-Aperture Holder)

The two important parts of the film channel on the BAUER U 2 projector are provided with air channels permitting the film in front of the aperture to be effectively cooled by means of powerful jets of air. The film channel is curved for the projection of both sizes of film (35 and 70 mm), thus effectively hindering any buckling of the film. The film is held in the curve of the gate by two plastic band-runners which possess excellent slip characteristics and have no tendency to gather film-emulsion deposit. The tension of the runners can easily be adjusted to obtain correct film traction through the gate. Any necessity for gate velvet to accept the emulsion from "green" prints has been eliminated on this projector.

The film gate is hung on two bolts in the projection-lens mount, its curved channel being interchangeable. The film is guided into the channel by a laterally-sprung

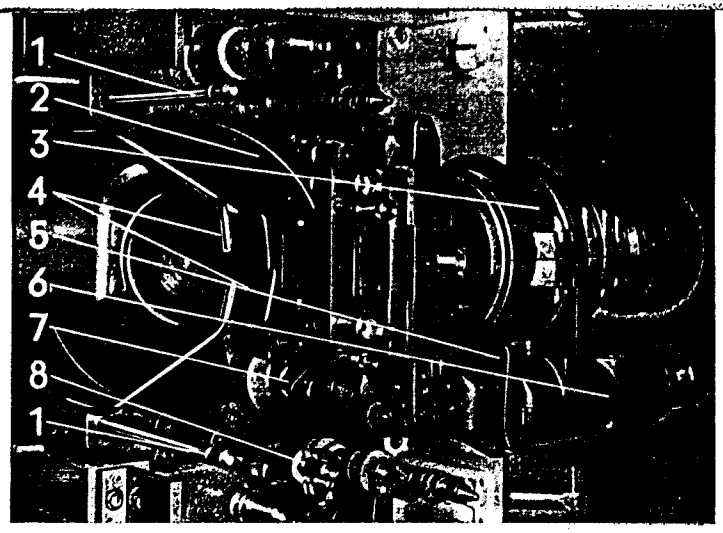


Fig. 17

Operating Side of the U 2 Projector head shutter cover housing removed

1 2 threaded bolts for fixing the shutter cover housing
2 cone shutter
3 clamp fitting
4 Flammex flaps
5 handle for opening the lens holder
6 lens holder
7 stripper at the intermittent sprocket (swung out)
8 framing axle with coupling part for framing knob

shouldered alignment roller. A small magnifying-glass has been mounted on the film gate on level with the picture aperture to facilitate correct framing of the start-mark.

Cross-Sprocket Roller Cradle

The film is held in contact with a large part of the periphery of the cross sprocket by means of a pad roller. The separation between sprocket and roller should equal two thicknesses of film. It is very important that this distance be maintained and checked from time to time. If the separation is too small, the pad roller assembly might be forced open by the passage of a film splice. The actual distance can be adjusted with the set-screw at the lower end of the gate which operates an eccentric against which the roller bracket is maintained under spring pressure.

Film-Gate Pad and Guide Rollers

All idler and pad rollers in the film gate run on ful-length shafts and are easy to remove for cleaning or replacement purposes without the necessity of having to remove the shafts as well. It is best, however, first to remove the film gate when carrying this out.

The shaft of the upper film-guide roller can be taken out after the small grub-screw on the rear eye of the film channel has been loosened. The other grub-screw on the front eye secures the roller-shaft bearing. If this screw is slackened off it is possible to alter the horizontal setting of the bearing by turning the small adjust-ment set-screw at the side of the roller shaft (Fig. 14). The position of this roller-shaft bearing determines, however, the lateral positioning of the film guide rollers and hence the position of the film in the gate, so its set adjustment should not be altered. The set-screw has been accurately set in the factory and should not require adjustment for a long time to come, just as in the case of the pressure-cheek beneath the film channel whose eccentric adjusting screws are locked at the front.

The pad-roller shaft below on the sprocket cradle can be taken out after removing the small fillister-head screw near its front end, and slipping out the retaining ring from the slot in the shaft-end.

The tension of the cradle can be readjusted at its slotted bearing pin below on the film gate. This involves slackening the two holding screws at the front of the film gate, screwing them well home again afterwards.

It is extremely important that none of the idler or pad roller bind or stick. A non-rotating roller would immediately cause running scratches along the film emulsion. All film-gate rollers including those on the sprocket cradle should therefore be checked daily for free-running. They should be removed every eight days and their shafts and bores cleaned, the shafts for the metal rollers being slightly oiled. Rollers evidencing any signs of surface wear should be replaced at once.

Picture-Aperture Bracket

The picture-aperture bracket serves the double purpose of holding the aperture-mask slides for the different shapes of screen picture, and also the two plastic band-runners which press the film into the curved film channel. These bands possess excellent slip characteristics and show no tendency to gather emulsion deposited by new copies. They are fitted with metal ends with which they are hung at the top and bottom of the aperture bracket so that their **plastic surfaces** face **towards the film.** The lower ends of the bands rest in a fixed guide, whereas the upper ends are drawn over a tensioning device for compensating purposes. The tension of the bands is likewise adjusted by means of this device. The point of operation for this lies on the operating side of the aperture holder above the aperture-mask slide.

Plastic Runners with Band-Steel Bases

The following points should be given attention when inserting the plastic band-runners:

1. Hang both bands in the claws on the aperture bracket and raw them over the tensioning roller,
2. Put strong tension on the bands by using a hexagon-socket spanner at the front face of the aperture bracket. (Counter-clockwise rotation.)
3. Press the thumbs on the tensioned bands, sliding the thumbs downwards so that the plastic bands lie flat on the steel ones.
4. Reduce the tension on the band-runners as far as faultless film run-through necessitates.

Once the plastic bands have been pressed onto the steel ones the two remain firmly together and no longer alter position. An operating control is located below, with which the film-stripper can be swung out of the cross sprocket. This control knob must first be pulled out and then swung round.

The band-runners should only exert sufficient pressure on the film to maintain a steady picture on the screen. Increasing the runner pressure above this point

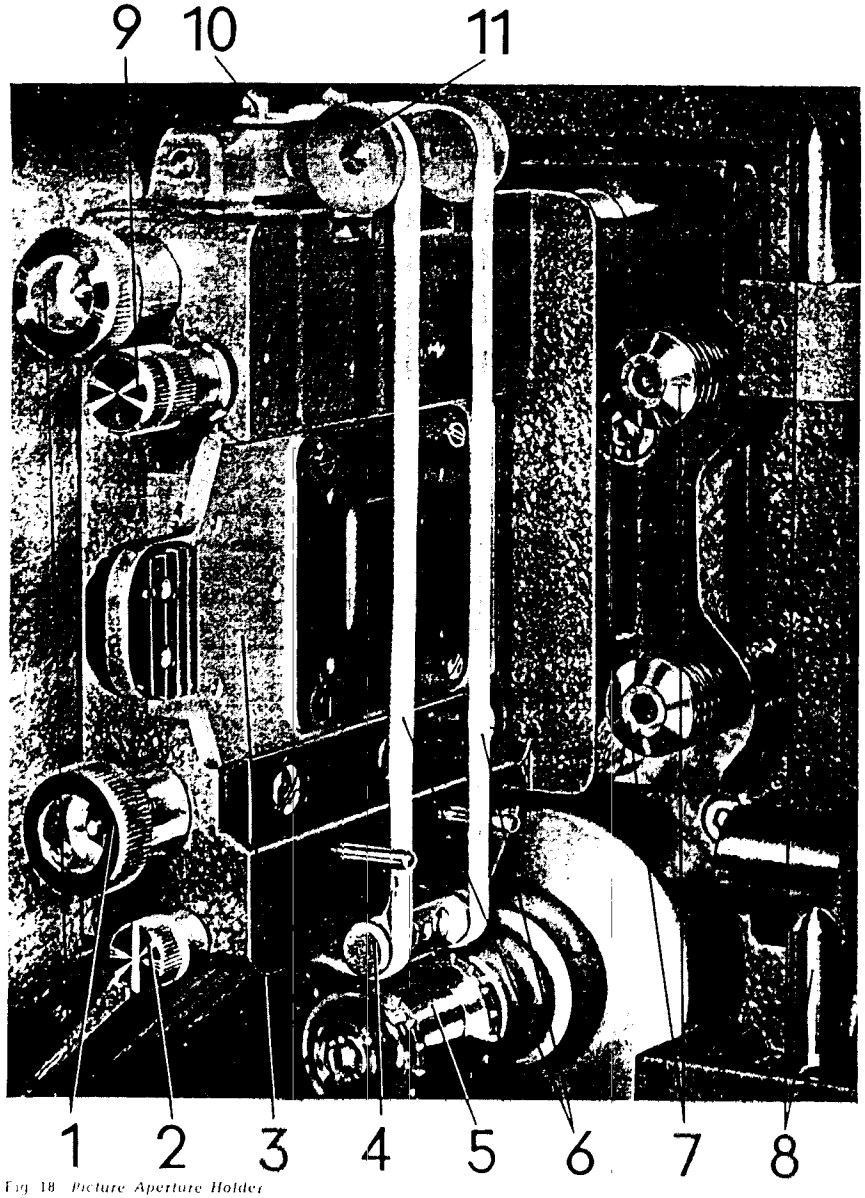


Fig 18 *Picture Aperture Holder*

1 fixing nuts for the picture aperture holder
2 knob for stripper at the intermittent sprocket (observe the marking)
3 picture aperture slide with mask
4 guide for the band runners
5 intermittent sprocket
6 plastic band runners
7 air feeding for film channel
8 2 bolts to hold up the film channel
9 tensioning knob for band runners
10 claws for band runners
11 tensioning device for band runners

would only lead to film damage, as the increased drag which the cross sprocket would be forced to exercise on the perforations could cause them to tear through.
Adjustment of the band-tension is carried out by turning the tensioning control clockwise until the spring pressure is slackened right off. If a film is now projected, a very unsteady picture will be apparent on the screen. The control is now turned so far anti-clockwise until the last trace of picture-jump has just disappeared.
It is of greatest importance that the band-runners and the running surfaces of the channel plate be cleaned off with a cloth after the projection of each reel of film. Neither dust nor emulsion deposit may be allowed to remain adhering to these parts. Should any emulsion deposit already have hardened, it must be removed with a special scraper made of aluminium, hardwood or copper. Steel implements (screw-driver) must never be used for this purpose.

Sprockets

The teeth of the sprockets (take-off, take-up and intermittent) must be cleaned daily with a small stiff brush such as a tooth-brush. When take-off and take-up sprockets show signs of wear or evidence hooked teeth, the toothed sprocket-shells must be renewed.
On the other hand, the intermittent sprocket can be revered if its teeth show signs of wear on one tooth-profile only. The stripper fixed to the aperture bracket and projecting between the two rows of sprocket teeth must first be swung clear for this.

Upper and Lower Pad-Roller Cradles

The pad-roller cradles press the film into the teeth of the sprockets by means of their rollers. Each cradle has two eccentrics for 70 or 35 mm sprockets respectively, with which the separation between roller and sprocket is adjusted to 1½ times the thickness of the film. Adjustment for 70 mm sprockets: pull out knurled ring on front of shaft and rotate until two red spots are side by side. Adjustment for 35 mm sprockets: the same procedure until the two white spots are side by side.
Whenever the rollers are renewed this separation must be checked and if necessary corrected. A pad roller should not revolve when a single strip of film is slid between roller and sprocket along the side of the sprocket teeth. On the other hand two strips of film laid on top each other should cause the roller to turn.
The upper as well as the lower roller cradle are each held in the open position with a catch. It must not be forgotten, therefore ,to close them against the sprockets once the film has been laced. The shafts of the rollers are retained in the cradle by the eccentric part. When their screws are slackened off the shaft can be withdrawn and the roller slid off.

Main Drive

The powerful driving motor on the BAUER U 2 projector is flange-mounted to the rear of the head. By fitting the motor in this manner the motor shaft still remains horizontal even with raked projection, and hence its bearings are subjected to no axial thrush at all. The motor carries on its shaft the large exhaust fan for cooling the projector-head mechanism, the motor itself being squat and compact. Normally the motor is a three-phase synchronous type (220/380 V.) with a power output of 300 W. at 1500 r.p.m. If required, the U 2 can alternatively be supplied with a single-phase AC synchronous motor of equivalent output.

Conversion from 70 mm (Red) to 35 mm (White) Width of Film

Converting from 70 mm to 35 mm films the following red-marked parts have to be exchanged against the white-marked ones. The set not being needed has to be kept clearly arranged in a cabinet.

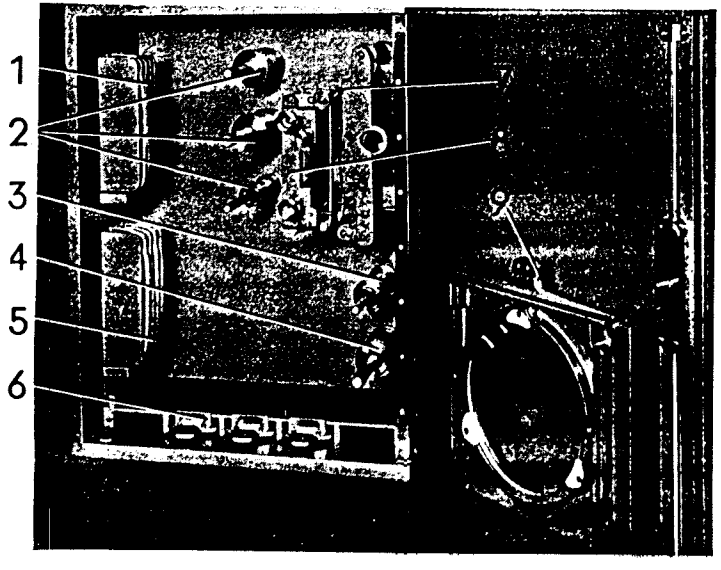


Fig. 19

Cabinet (opened) with one set of interchangeable parts

1 film band runners for 35 mm film
2 sprockets of the projector (take-up, take-off and intermittent sprocket)
3 braking roller for optical sound head
4 sprocket for magnetic sound head
5 film band runners for 70 mm film slides with masks
6 picture. aperture
7 film gate
8 picture aperture holder
9 lens fitting

1. The Sprockets

The take-off and take-up sprockets as also the sprocket on the magnetic sound head have the same method of fixing as the cross sprocket, each being capable of removal after removing one screw in the shaft-end, when they can immediately be replaced by sprockets for 35 mm film. The take-off sprocket is removed together with the conical engaging part, this part then being placed on the 35 mm sprocket in such a way that its groove engages with the pin on the shaft whilst its own pin engages in the sprocket. The take-up sprocket is removed together

with the loop former, which is mounted as a complete group on a sleeve. This loop-former group is inserted in like manner in front of the 35 mm sprocket again in such a way that its groove engages with the shaft-pin, and the loop-former pin in the sprocket. Before drawing off the take-up sprocket the film stripper lying below it must be swung downwards. After the 35 mm take-up sprocket has been attached, the catch-lever for the stripper is to be swung in the take-up sprocket.

The Intermittent Sprocket

The intermittent sprocket can be removed after the hexagon socket-screw in the front of the cross-shaft has been unscrewed (first swing back the stripper, though, at the aperture holder). No special drawing tools are required thereby.

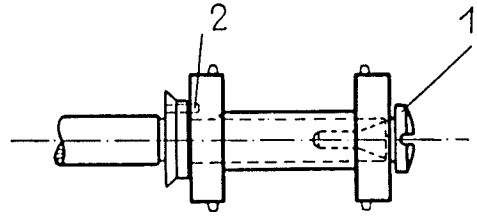


Fig. 20 Method of fixing intermittent sprocket
1 Retaining screw
2 Locating pin on oil retainer

A point to watch when replacing the cross sprocket is to see that the locating pin on the oil retainer (Pos. 2) fits into the corresponding groove on the sprocket. The sprocket is then pushed right back until its inside skirt rests against the oil retainer, and the socket-screw again screwed in tight. The coned part of this screw forces the split ends of the shaft apart, thus holding the sprocket firmly on the shaft.

The Sprocket on the Magnetic Sound Head

This sprocket is all in one piece and can be drawn off after the socket-screw has been removed. When attaching the 35 mm sprocket it is pushed right in and then turned until the engaging-pin engages. The retaining screw can then be screwed home again.
The pad roller must previously have been slackened off by turning the knurled part of the bracket to the right. Once the film has been laced the roller bracket is simply pressed onto the sprocket — it will then lock itself on its own.

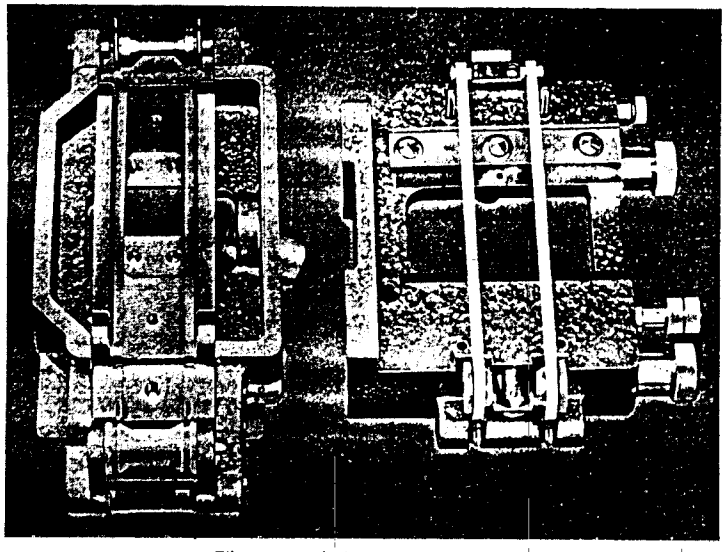
The Braking Roller on the Optical Sound-head

This roller with its built-in friction device must be exchanged in the same manner as the sprocket on the magnetic sound head after removing one screw. When fitting the 35 mm roller, the retaining screw must be fastened tightly.

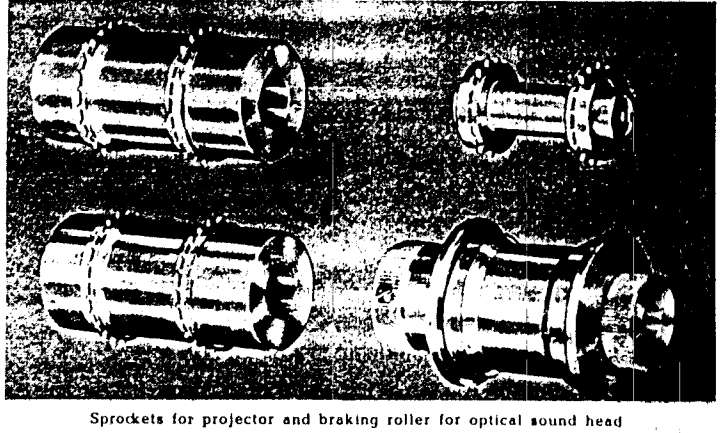
2. Film Gate and Picture-Aperture Holder

The film gate can be drawn upwards off its two holding bolts and so out of the open lens-mount, after which it can be replaced by the 35 mm film gate.

Fig. 21 *Interchangeable parts*



Film gate and picture aperture slide



Sprockets for projector and braking roller for optical sound head

As regards the aperture holder, the film stripper is first swung clear of the cross-sprocket, the two non-withdrawable screws slackened off and the 70 mm aperture bracket exchanged for its 35 mm counterpart. The aperture-mask slide can remain in position in each case.

3. In addition to exchanging the parts already described, the following procedure is also necessary:

The roller shafts on the take-off and take-up roller cradles are pulled out and rotated from the red-spot setting to the white-spot setting and again locked. By this means a separation of 1½ thicknesses of film between roller and 35 mm sprocket is produced by the pre-adjusted eccentrics.

After lacing the 35 mm film through the magnetic sound head, passing the white-marked four-track magnetic head, the knurled sleeve for the rubber pressure roller is turned to the left until the white spot lies underneath.

The rubber roller for 35 mm film is moved into its operating position, by this means, in respect to the steel stabilising roller. The roller bracket is pressed down towards the sprocket where it automatically locks in position.

The spool-engaging pin in the take-off spool box must be drawn forward, swung to the right and then pushed back in again a little. The equivalent part in the take-up spool box is drawn forward, swung to the left and again pushed in somewhat. The engaging part will be held in this position by the rotation of the spool. The counter-bearings in the spool-box doors have spring catches and need only to be pulled out whereby they will lock in the forward adjustment position.

For projector-motor conversion both upper and lower clamp levers are first slackened until the motor has been moved into correct working position, when they are well tightened up again. Simultaneously with pushing in the motor, the knob on the front wall of the U 2 projector head should be rotated so that the gear-wheels in the reduction-gearing slide easily into mesh.

	for 60-cycle AC mains	for 50-cycle AC mains
Operation on 24 f.p.s.	Motor drawn back to stop position at rear, and swung round against right-hand stop. ↓ →	Motor swung round against left-hand stop and pushed towards projector head up to forward stop. ↑ ←
Operation on 30 f.p.s.	Motor swung round to left-hand stop and pushed towards projector head up to forward stop. ↑ ←	Motor drawn back to stop at rear, and swung round against right-hand stop. ↓ →

Change the objective lens mounts to coincide with aperture plate selected and condensing lens if used.

Cooling System

Two very effective cooling systems, one for the film and one for the head mechanism, functioning independent of each other provide the U 2 projector with excellent operational safety even with high arc-lamp loads. Owing to the combined efficiency of these two cooling systems the temperature of both film and head mechanism can never rise above permissible limits.

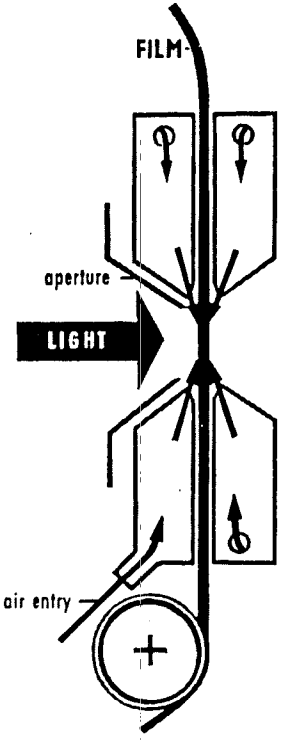
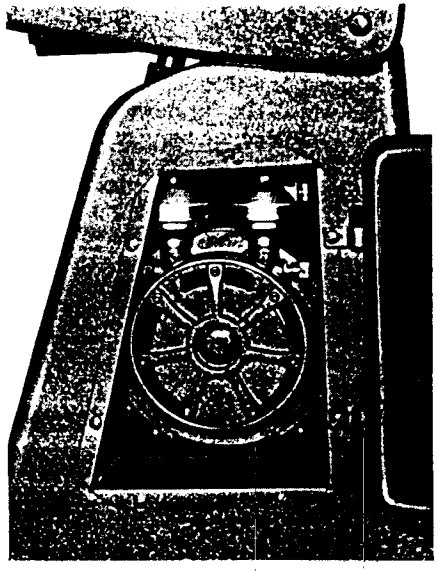


Fig. 22
Schematical performance of the film cooling in the film channel and the picture aperture slide

Fig. 23
BAUER air blower inside the pedestal



Film Cooling

Jets in the film channel and picture-aperture holder are so positioned that the cooling air is placed uniformly on the film from top to bottom as well as from both sides. The film lying over the aperture is hence subjected to equal pressure from either side and so remains absolutely flat. The air emerging at high speed from the jets carries off the heat accumulating on the film. This pressurised air has to pass through film channel and aperture bracket before reaching the jets, thereby keeping these two important parts very cool. The efficiency of the cooling is yet further increased by the fact that picture aperture and film channel are separated and also heat-insulated.

The aperture-mask slides have special reflecting plates on their mirror-lamp sides, which apart from direct back-beaming of the light have the task of guiding the cooling air coming from the air blower through onto the film. This reflecting plate must be removed when inserting picture-aperture lenses. The cooling air for the film is supplied by the BAUER air blower.

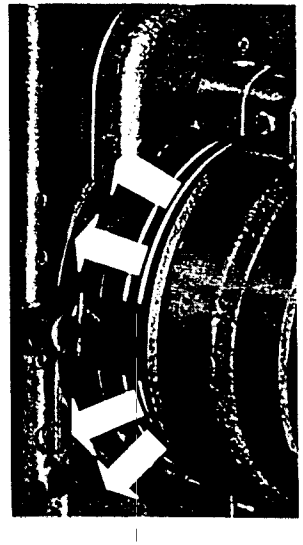


Fig. 24
Turbo-fan at main drive motor

Projector Cooling

The large exhaust fan on the motor shaft forms the second cooling system for the projector. This turbo fan extracts the heated air from the shutter chamber via a housing extending from this chamber at the rear right round to the motor. Fresh air to replace the vitiated air drawn out can only be sucked in through cooling slots in the shutter housing and at the film gate. The whole shutter area and the film gate parts are effectively cooled and ventilated by this means. Because an air space exists between arc-lamp and projector head in which air is continually being renewed, the head mechanism also receives adequate protection against undue heating, uniformly-good lubrication and high operational safety being thus guaranteed.

Shutter Housing

The shutter housing is easy to withdraw from the front of the head for inspecting and cleaning the shutter parts, as it is simply fitted over two tension-bolts. The lens holder should first be withdrawn from the housing so that the space between lamphouse funnel and shutter-cover housing is free.

Timing the Shutter

The shutter has been accurately timed with the cross-sprocket movement by means of special test equipment when the projector was assembled and tested in the factory. If for some reason the shutter needs to be re-timed at a later date, the four screws on the shutter flange are slackened off so that the shutter can now be turned freely in either direction. Correct shutter timing can be recognised when the picture on the screen appears clear and reasonably distinct. If the timing is out, travel-ghost will be indicated on the screen by a white streakiness appearing to travel upwards or downwards from any bright objects in the picture. If this streakiness appears to travel upwards, the shutter must be advanced a little in the direction of normal rotation; whereas a downward or bottom ghost calls for retarding the shutter by moving it back counter to its direction of rotation.

Interchangeable Aperture Masks

The U 2 projector is supplied with various sizes of aperture masks for projecting the different film systems. The individual masks needed for the various systems are mounted on slides which can be exchanged both quickly and easily. BAUER aperture masks are produced with under-sized apertures for filing out, as well as with the standardised masks for each system.

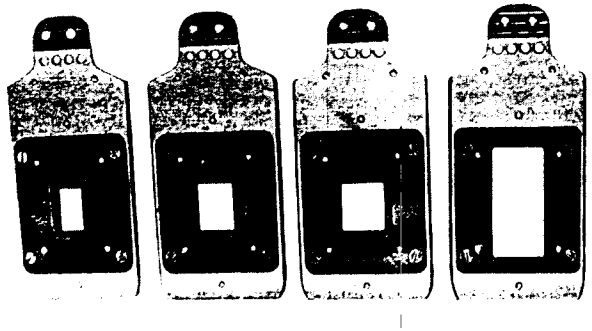


Fig. 25

Interchangeable aperture mask slides with various masks. From left to right: wide-screen, standard-film, Cinemascope and TODD AO

Standardised masks can be used in all locations where little or no projection rake exists and uncurved screens are employed. In cases of raked projection onto heavily-curved screens, or when the screen-picture aspect ratio laid down for the individual systems is not being adhered to, the smaller type of aperture mask must be mounted on the slides. All these masks can then be filed out to correspond exactly with the screen masking. Smaller masks for filing out are also available for the 70 mm film.

Picture Aperture Lenses

The U 2 aperture masks can be supplied with so-called picture-aperture lenses for projection employing short-focus projection-lenses.

Picture-aperture lenses become a necessity when projection-lenses with extremely short focal lengths (50—80 mm) are used. These short-focus lenses possess a very small aperture. The picture-aperture lens then ensures that practically all the light emerging from the aperture mask falls on the light-entry aperture of the short-focus projection-lens. The entry aperture of longer focus lenses is so large that such difficulties do not arise. If a picture-aperture lens is removed, its place must be taken by a reflecting plate so that proper air-guiding will be guaranteed.

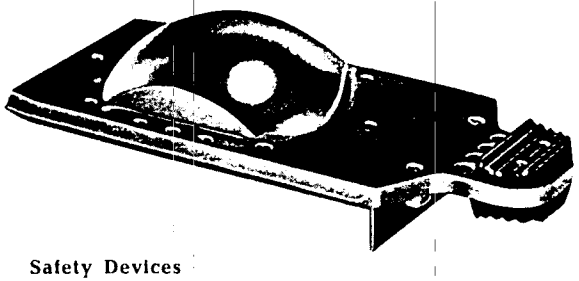


Fig. 26

Interchangeable picture aperture mask slide with inserted picture aperture lens

Safety Devices

The BAUER U 2 projector is equipped with a series of safety devices whose function is to prevent projection taking place should any fault in motor-speed or film-running occur. The fire shutter in the shutter housing, also employed for change-over purposes, automatically drops

1. if the supply current is interrupted or
2. if the film tears or a splice comes apart, in which case a roller bracket in the take-up spool box causes the projector motor as well as the take-up motor to switch off. This device also comes into action when the film-end runs out. (Fig. 7).

Switch Panel and Change-Over Apparatus

The switching units are accommodated on a switch panel on the box-shaped part of the U 2 base-table (Fig. 27).

The switch panel possesses the following control buttons on the model for three-phase operation with combined picture/sound change-over:

At the left are one on- and one off-switching push-button respectively for the arc-lamp DC, with which the relay-switch in the rectifier is controlled. Below these two buttons is the emergency button with which either the projection equipment or else the whole projection-room can be switched off, depending on the particular switching arrangements. At the right are one on- and one off-switching button for the combined switching of the two relays controlling the projector motor and the air-blower motor. Below these buttons is the so-called tip-button with whose aid the start-mark on the film can easily be inched into the picture aperture, for the projector motor only runs as long as this button is kept pressed.

The white change-over push-button is situated lower-centre. This button causes the Flammex flap of the same projector to open when it is pressed, as well as causing the exciter lamp to switch on. Simultaneously with these actions the Flammex flap on the second projector drops, switching off its exciter lamp.
Two toggle switches are mounted to the right and left of the push-buttons. That at the left serves to switch the pilot lighting on and off (spool-box lighting and framing light), that at the right to switch the exciter lamp on and off. The functions of the switches are indicated by engraved pictorial symbols.

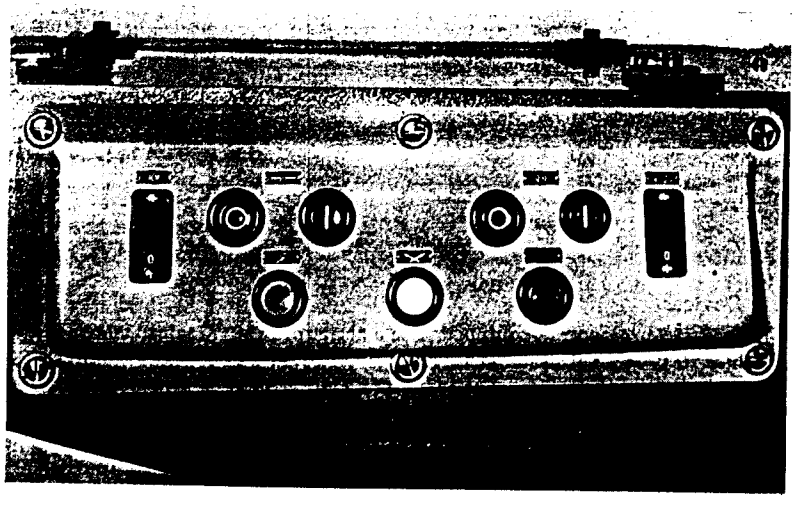


Fig. 27 Switching panel for the three-phase current type

In the case of the single-phase AC model with separate picture/sound change-over, the switch panel contains the following controls:
Two toggle switches are situated at the left, the one for switching the rectifier relay-switch on and off, and the other for controlling the pilot lighting. At the right are respectively one on- and one off-switching button for the combined switching of the relays controlling the projector motor and the air-blower motor. Below these is situated the tip-button, possessing the same function as that described above for the three-phase model.
Once the toggle switch for the rectifier has been operated, the DC from the rectifier will be present and the change-over device in readiness for action. If this switch is employed for switching arc lamp or rectifier off, this action will also mean that the Flammex flap will close as well. In so far as the film sound-track still contains a sound recording, this will continue to be scanned from the film still running through the projector.

Two leads from the toggle switch controlling the lamp-relay have been looped through the whole machine to the terminals 17 and 18. Current connection must be carried out at the relay-switch itself.
The foot-contact for picture change-over should be connected to the terminals 15 and 16 on the terminal strip at the rear of the base-table.
Two contacts l and m in the Flammex are free for completing combination of sound change-over with picture change-over. (Possibility of combined sound/picture change-over.)

Switching Units
The motor relay switches are fitted with bi-metal overload controls which release the relay in the case of overload. The two relay-switches for projector motor and air-blower are electrically interlocked. Should one motor drop out, then the other also goes out of action. By this means the security is achieved that projection can never take place without air-cooling being present at the picture aperture. Regarding the change-over system, provision has also been made for working with two and also three projectors. The positions of the shorting-strips for the respective form of change-over can be derived from the information provided in the switching diagrams.

Care and Maintenance
The BAUER U 2 projector head is of extremely robust construction, designed for conditions of out-and-out continuous working. Nevertheless it needs a certain amount of care and maintenance, if only to prevent damage to the film from the detrimental effects of dirt and dust.
The following parts should be cleaned daily:

Band-runners and film-channel tracks, and
the entire film path (sprockets, idler and pad rollers, fire-trap assemblies) using a stiffish brush.

Care of the Cold-Light Mirror
In order to guarantee long life for the mirror without appreciable light-loss, it is necessary for the mirror to be cleaned daily. Any surface deposit arising from the vaporisation of the coresalts in the carbons should be carefully removed with a pad of cotton-wool dipped in alcohol. A solution of any good soap-detergent can alternatively be used instead of alcohol. Finger-prints can be eliminated with a soft cotton cloth, available from us under the Order No. BZ 103 NF 1/1 X.

The parts to be cleaned weekly are:

the entire head, cleaning and oiling the rollers (see Lubrication Plan),
the interior of the shutter housing, especially the actual shutter chamber itself, and
the complete arc-lamp.

All terminal connecting points, especially those carrying high current, should also be given a weekly check and tightened up where necessary.

Optical Sound Head

The standard BAUER optical sound head for the BAUER U 2 is unit-mounted to the projector head. Its function is to scan the tracks of normal optical-sound films and also those whose optical tracks work on an overlay control-frequency system.
The sound head is a modern pull-through type, with a double compensating roller assembly, whose special design characteristics assure outstanding speed-constancy at the point of sound scanning as well as optimum exploitation of the optical sound-track recording.

Film Stabilisation and Speed Constancy

Following its jerky movement past the aperture by means of the cross sprocket, the film is then fed into the sound head where its speed is first pre-smoothed by an adjustable friction-controlled stabiliser employing a rubber pad roller. A system of smoothing rollers and a large flywheel-controlled sound-drum then guide the film at absolutely constant speed past the scanning point. In case any slight

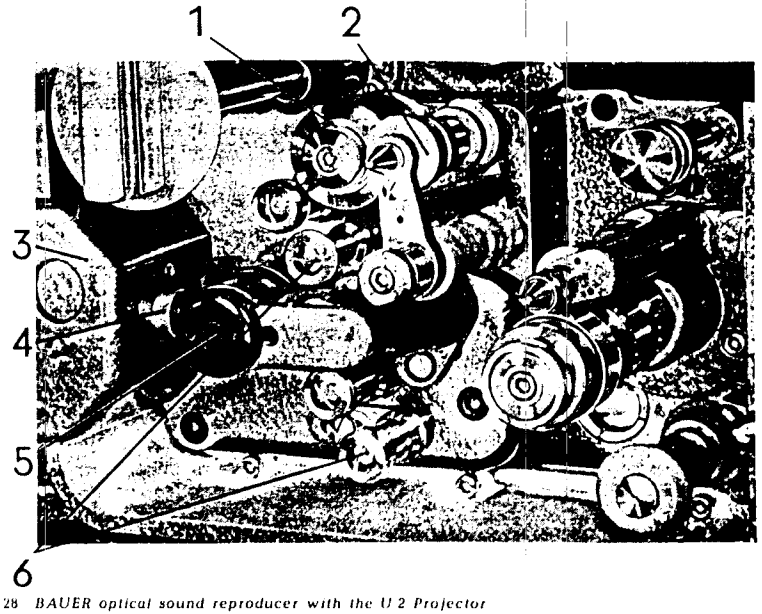


Fig. 28 *BAUER optical sound reproducer with the U 2 Projector*

1 braking roller (must be interchanged for 35 and 70 mm films)
2 rubber pad roller
3 exciter lamp case
4 slit optic
5 photo-electric cell
6 smoothing roller

longitudinal variations in film speed should occur, such as might be caused by uneven take-up pull or defective take-up sprocket teeth, a double oscillatory roller assembly with its roller arranged before and after the sound-drum balances out even the slightest of such irregularities in speed and keeps them well away from the point of sound scanning.
The two rollers on the double compensating assembly should take up such a position when the film is running that they are able to swing an equal distance to either side. In other words they must not remain resting against one side of their permissible travel. The factor deciding the position these rollers will finally swing into, is the particular setting of the lowest of the sound-head rollers. The bracket carrying this roller has been provided with a slotted fixing hole and can be moved with its roller either to the right or to the left. The working position of the oscillatory compensator is correctly set by means of this roller before the projector leaves the factory.
The upper of the two compensator rollers has a flange at its outside end which must face outwards. The preceeding roller situated above it has its flange on the inside. The film is held in correct running alignment by this means.

Lacing Path of Film

The path taken by the film with optical sound track through the optical sound head is illustrated in Fig. 29. After leaving the cross sprocket the film is drawn into a loop and then threaded through the sound head in accordance with the lacing schematic.
The path for 70 mm and 35 mm films with magnetic sound track is also to be seen from Fig. 29 (dotted line). Their path leads directly from braking roller to the take-up sprocket.
The size of loop below the cross sprocket should be so chosen that film-run noise will be as low as possible. Too small a loop can be reduced to zero by the take-up sprocket during the stillstand period of the cross sprocket.

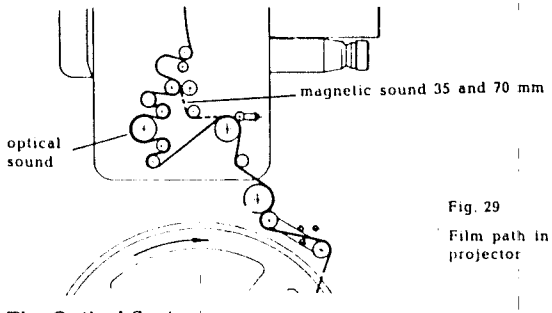


Fig. 29
Film path in the optical Sound head of U 2 projector

The Optical System

A micro-optic images a fine slit of light on the film for scanning the optical sound track. The source of light employed for this slit optic assembly is an exciter lamp

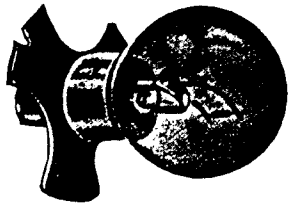


Fig. 30
Original BAUER exciter lamp

(standard type 6 V 30 W, American type 9 V 36 W). These exciter lamps possess special centering flanges so that they can never be incorrectly inserted in their sockets.
The correct position of the flange in relation to the lamp filament spiral is pre-checked with special care in order that the slit optic will receive adequate light coverage and the sound reproduction be sufficiently loud. Hence when ordering replacements always demand original BAUER exciter lamps only, such as are available direct from us or through our sales agencies.

Slit Optic Assembly

A brilliant image of the exciter-lamp spiral is reproduced on the film's sound track as an extremely fine slit of light, only a few μ in width, by the so-named slit optic assembly (Fig. 28). The sharpness and alignment of the light-slit is adjusted by us on the optical test-bench in our works with the aid of specialised test equipment. Any liability for faultless sound reproduction within the period covered by guarantee will only be accepted by us providing the seals over the fixing screws are still intact.
The length of the light-slit and its lateral positioning on the other hand, may be re-adjusted if necessary. The slit optic assembly is furnished with two small adjusting pins for this, access to the pins being gained by swinging aside the little coper on the front of the exciter-lamp housing (Fig. 28). Such re-adjustments, however, never entail more than very minute corrections, and this facility of light-slit adjustment must not be the cause of leading the projectionist to think that the slit must now be specially re-aligned for every new film he shows.

Photo-Electric Cell

In its standard form the photo-electric cell is supplied cushioned inside a special housing. The glass envelope of the cell should not be pressed into the housing, as this tends to loosen the elastic cushioning of the cell and may under certain circumstances even break the wire-connection between housing and cell.
The operating voltage amounts to 110—130 volts.

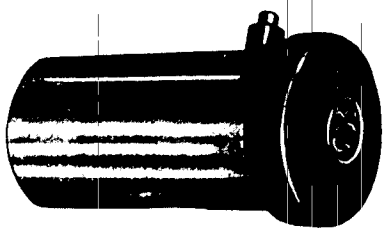


Fig. 31
Photo-electric cell for the U 2 optical sound head

The American photo-electric cell is constructed like a radio valve and is plugged into a corresponding type of valve-socket. Its working voltage is around 70 volts.
On no account may the cells be subjected to a higher value of exciting voltage than that prescribed, as this would lead to flash-over inside the cell and to its being rendered useless within a very short time.
Any complaints regarding photo cells can only be entertained if the cell housing is undamaged, just as we can only recognise the same guarantee limits as those extended us by the cell manufacturer.

Cable Connections

The points for connecting the photo-cell cable, which are accessible from the rear of the sound head, become visible when the cover (Fig. 16, pos. 4) has been removed. The cell cable is led up from below through the console and soldered to the triple-tag terminal strip. (3rd. tag for earthing connection.) A connecting block for taking the exciter-lamp feed cable is positioned below.

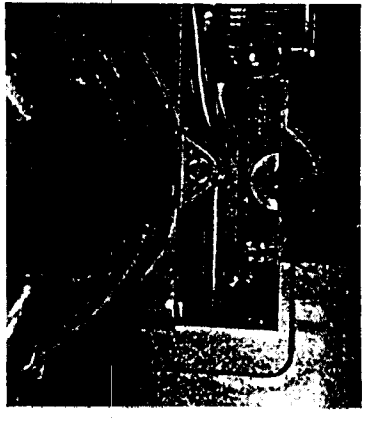


Fig. 32
Projector Head — Rear Side
connections for optical sound head
1 terminals for exciter lamp feed-cable
2 tripple-tag terminal strip for the photo-cell cable

Although the actual cell cable can be supplied in any desired length, it is advisable not to go beyond a length of 26 ft. as otherwise the high frequencies will be lost to the final sound reproduction owing to the leakage path provided by the cable capacity. As a rule the cell cable is led down through the projector pedestal and then on the pre-amplifier via large-diameter conduit laid under the floor.

Braking Roller

The braking roller with its built-in friction device must be exchanged for its respective counterpart when showing either 35 or 70 mm films. Just as with the sprockets on the projector head, this roller can be withdrawn after removing one screw. The friction-drag is so adjusted that the run-up time of the sound-drum

flywheel takes no longer than 3—4 seconds. The pressure of the friction-spring can easily be re-adjusted at the knurled sleeve accessible after removing the braking roller. This sleeve forms the spring's counterbearing and is held by a grub-screw. The spring-pressure works outwards against a washer which in turn presses a felt washer against the rear of the braking roller. At the front a plastic washer has been inserted between braking roller and aligning shoulder. Care should be taken to ensure that the roller shaft is always kept well lubricated, as the braking roller must always revolve at film-speed and may on no account stand still. The felt washer should also be provided with some few drops of oil weekly.

Switching of the Optical-Sound Amplifier

The standard model of optical sound head has been fitted with a conversion lever positioned above the sound-drum. If this lever is turned so that the white markings coincide, the path over the sound-head braking roller is then free for 35 mm optical track film. With the lever set to the red-spot setting, the guide roller is free and both 35 and 70 mm magnetic-track film can travel between braking and pad roller direct over the nylon guide roller to the projector take-up sprocket. By going over to the setting for running optical sound films, the optical-sound amplifier is switched on by the sound head itself with the aid of a micro-switch.

This switching device is only built into those optical sound heads intended to work with Siemens amplifiers.

Cleaning and Care of the Sound Head

The primary condition for ensuring faultlessly good sound reproduction lies in meticulous care of the optical sound head. Rollers not revolving freely lead to irregularities in the run of the film which in turn adversely influence the speed of the film at the point of sound scanning. Dirt and dust on the lenses in the slit optic assembly are accompanied by a considerable reduction in volume and also by distortion in the overall reproduction. On this account the front lenses in the optic assembly must be wiped clean with a soft chamois leather at relatively short intervals. Do not touch the lens surfaces with the fingers!

When 2—5 performances are taking place each day, the smoothing rollers on the sound head should be removed once per week and their shafts cleaned and at the same time oiled. It is best to use the normal BAUER projector oil for this.

The running surfaces of the smoothing rollers must always be clean and may not be greased.

Special attention must also be given to the contacts inside the photo-electric cell holder and in the exciter-lamp housing. The contact surfaces must always be clean and bright.

Magnetic Sound Head

The sound head mounted on top of the projector head, whose function is to reproduce the sound-record from 70 mm 6-track and 35 mm 4-track magnetic-sound films, is the Siemens Klangfilm magnetic sound head. This head is supplied in the form of a driven model and possesses the advantage of producing absolute sound-speed constancy whilst placing but little stress on the film.

Components responsible for this uniform sound-speed,apart from the driven sprocket, are the stabilising braking roller with its rubber pad rollers for 35 and 70 mm film and the damping roller following the magnetic scanning-heads.

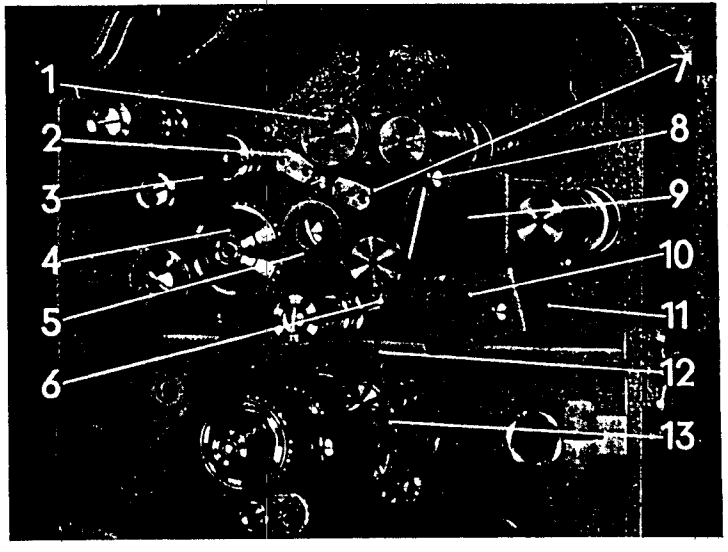


Fig. 33 *SIEMENS-Klangfilm magnetic sound reproducer*

1 braking roller with knurled sleeve
2 rubber pad roller for 35 mm film
3 pad roller cradle
4 sprocket (interchangeable part for 35 and 70 mm film)
5 damping roller
6 angle shaped lever for damping roller
7 rubber pad roller for 70 mm film
8 setting screws for magnetic head shield box
9 four-track magnetic head
10 six-track magnetic head
11 shield box for magnetic heads
12 plate spring for angle shaped lever of damping roller
13 fixing the plate spring at the upper pad roller cradle of the projector

Lacing the Film

Before lacing the film, the pad roller cradle is to be lifted by turning the release knob on the oscillatory axis of the cradle to the right. In order to lift the rubber pad rollers from the braking roller turn the knurled sleeve (pos. 1) clockwise or counter clockwise. Before this, draw the knurled sleeve slightly forward; in each final position it will engage again. The upper pad roller cradle at the take-off sprocket of the U 2 projector must be open. Thus the plate spring is out of action and the damping roller (pos. 5) is kept in its upper position by an angle lever. The film path, to be seen from the figure below, is different for the 35 and 70 mm magnetic sound films. The 70 mm magnetic sound film passes the very right roller

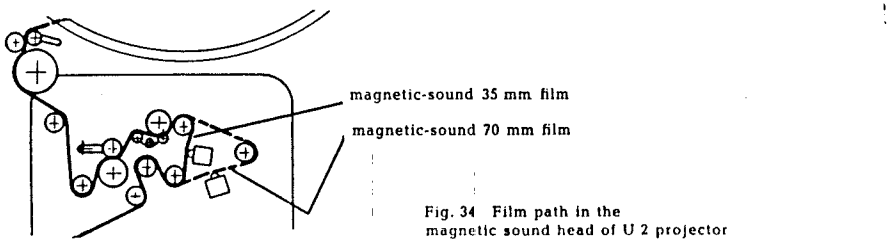


Fig. 34 Film path in the magnetic sound head of U 2 projector

and thus alongside the six-track magnetic head (pos. 10) the cover of which is marked with a red line. The 35 mm magnetic sound film, however, passes the four-track magnetic head fig. 33 (pos. 9) alongside the white line on the cover. The pad roller cradle is pressed to the sprocket and engages itself. The corresponding rubber roller is pressed into position by turning the knurled sleeve clockwise to the red spot for the 70 mm film and counter clockwise to the white spot for the 35 mm film. Further, a micro-switch comes into action when either of these rubber pad rollers is pressed down actuating the corresponding amplifier for four-track magnetic sound or six-track magnetic sound respectively. For optical track reproduction both rubber rollers remain in the lifted position so that both the switches are out of action. These micro-switches are only built into sound heads for installations comprising SIEMENS amplifier equipment. Now the film must be tightly wrapped round the damping roller fig. 33 (pos. 5) and the guiding roller below as well as around the lower part of the take-off sprocket of the projector, the pad roller cradle being pressed to the sprocket afterwards. Thus the plate spring presses the angle lever out of its stop position and the damping roller of the magnetic sound head can be put into action with the running of the film.
The actual mounting of the magnetic sound head was already described on page 5 of this Instruction Manual, and the conversion of this unit from 70 to 35 mm films on page 31 and 33.

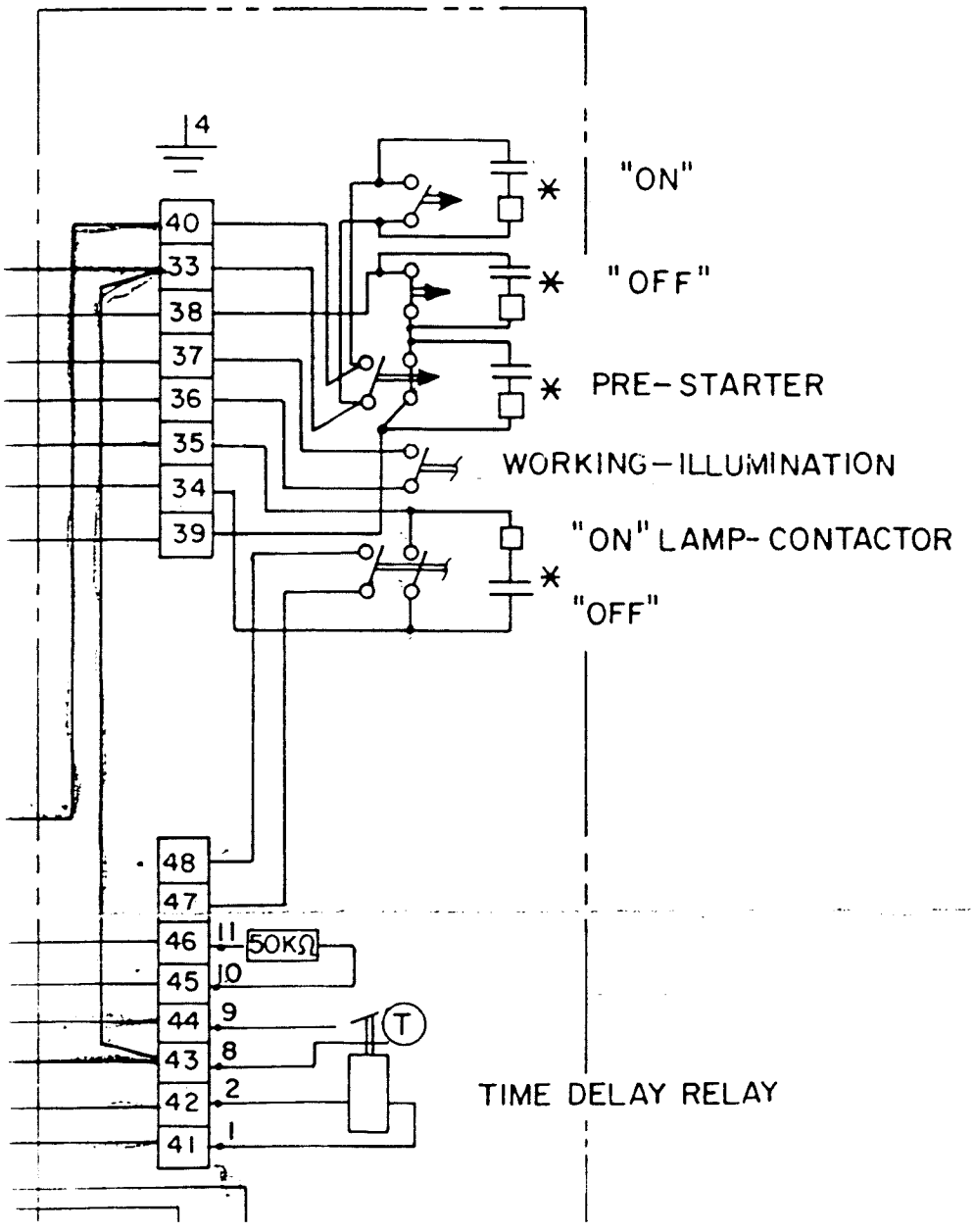
Interchanging of Magnetic Reproduce Head

The magnetic sound scanning requires a close contact between sound track and magnetic head. Therefore, the film transport through the magnetic sound reproducer is so designed that the tracks contact the sheet cores under certain pressure. In course of time the burnishing effect of the magnetite powder, being embedded in the sound track, abrades the magnetic cores more and more. Similar to photocell and exciter lamp in the optical soundhead, the magnetic reproduce heads are thus subject to wear and have to be exchanged after a certain operating period.
At the latest, a magnetic head must be interchanged if the magnetic cores are worn down in contour almost to the insulating plastic, or if, after a longer operating period, either the reproduction of high frequency signals is unsatisfactory or the level of the individual sound channels unequal to such an extent that the equalization by means of treble or level control of the preamplifier is no more possible, which also is a symptom of the head being abraded too far.
The magnetic heads are cut in the electric circuit by means of plug connections; they are fastened to the head base with two screws and shielded against magnetic fields through a mumetal cover. For the purpose of magnetic head interchanging, first of all, after releasing both knurled screws, the mumetal shield has to be taken off; then, after removal of both fixing screws, the head can be pulled out of its plug-in socket. After having plugged the new magnetic head into the socket both fixing screws are set in and tightened. Finally the shield box is put over the head and fastened with both knurled screws.

Maintenance of Magnetic Sound Reproducer

All bearings of the stereodyn magnetic sound reproducer are already lubricated in our factory so that a smooth operation is insured. The ball bearings of the 3 stabilizer drums situated around the four-track magnetic head (fig. 33, pos. 9) are treated with a special grease and should not be lubricated. From time to time the slide bearings of the metal guide rollers have to be slightly lubricated with a thin oil (sewing machine oil) which is free from acid and resin. But doing so, it is important to avoid any oil contamnation of the roller surfaces or other parts. The shafts of the rubber pressure rollers 2 and 7 and the filter roller 6 have, from time to time, to be covered with a thin layer of pure vaseline.
Stabilizer drums and guide rollers must be free from any film emulsion deposit. Special attention should be paid to this fact when using new copies. For removing the emulsion deposit only sticks of hard wood should be employed, in no case metal tools.
When not being operated, the rubber pressure rollers of the loop stabilizer must be lifted from the drag roller pos. 1 because, in course of time a constant contact, when being at rest, would result in its distortion.
The pole pieces of the magnetic heads should always be smooth as a mirror. Dust or film emulsion deposit has to be removed with a soft oil-free rag. On no account a screw-driver should be used for this purpose, because it is nearly always slightly magnetized.

ıe maintenance of the magnetic reproducer also includes the degaussing of the agnetic heads which should be done at regular intervals. For this purpose we :commend to use our degausser Kl U 092. The demagnetizing has to be performed ; per operating instructions attached to the degausser.


14
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"ON"
"OFF"
PRE-STARTER
WORKING-ILLUMINATION
"ON" LAMP-CONTACTOR
"OFF"
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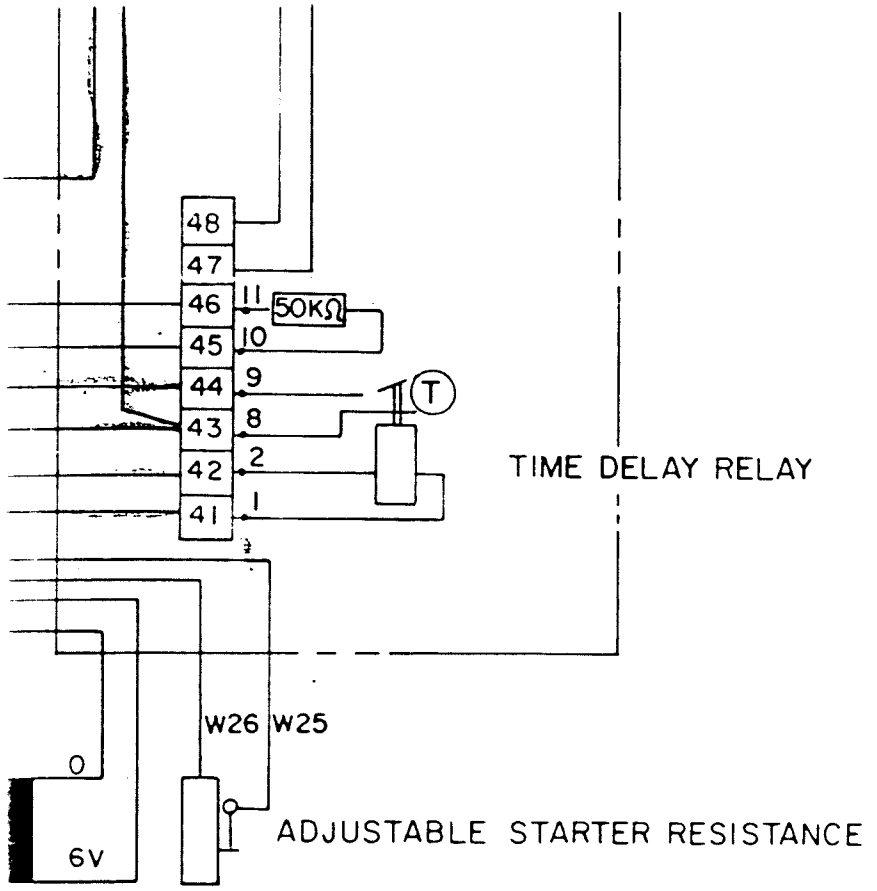
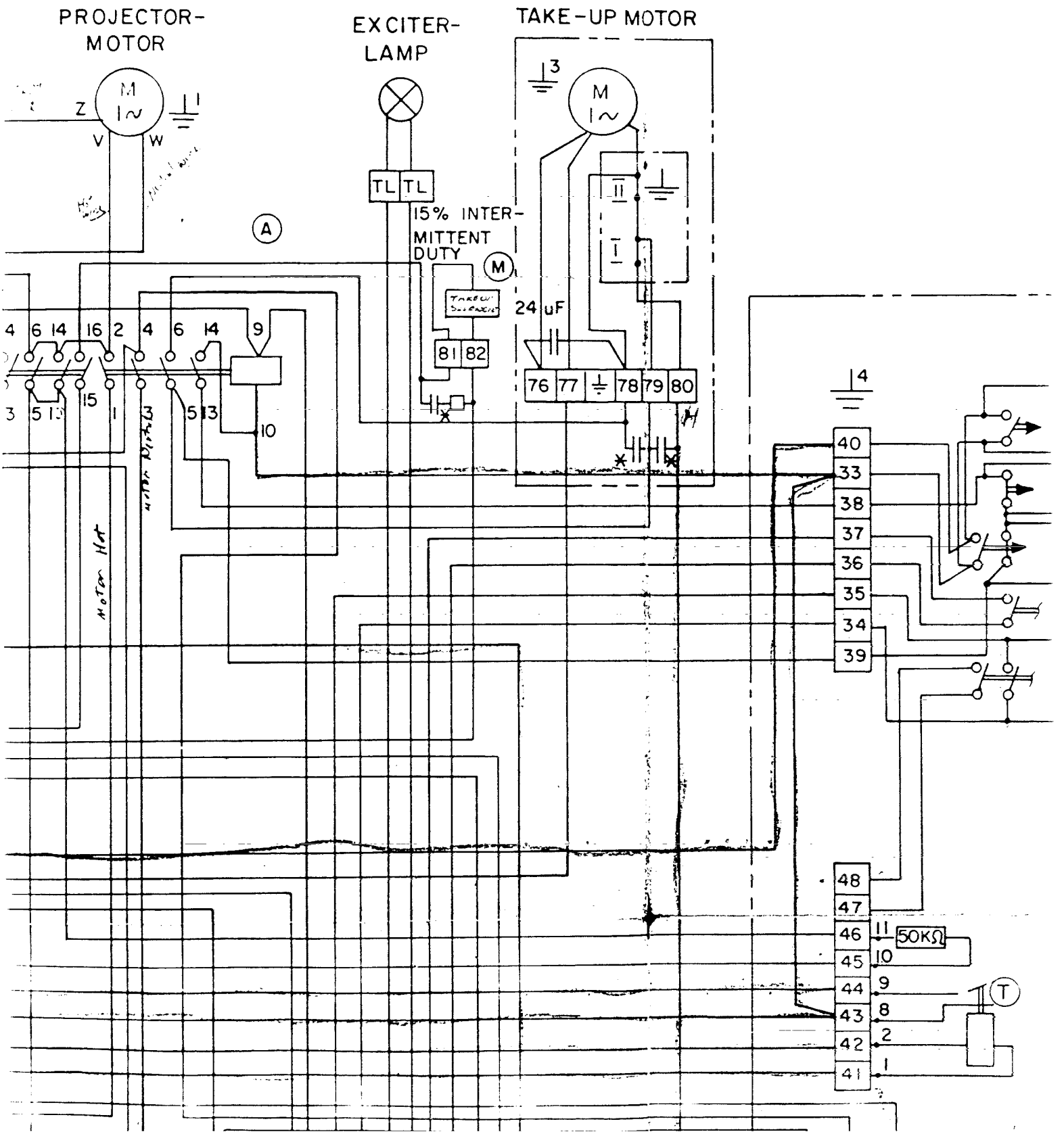
42
41
11
10
9
8
2
1
50KΩ
T
TIME DELAY RELAY



WIRING DIAGRAM
NATIONAL 70 (BAUER 35/70-U2 PROJECTOR


PROJECTOR-
MOTOR
EXCITER-
LAMP
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42 2
41 1
50KΩ
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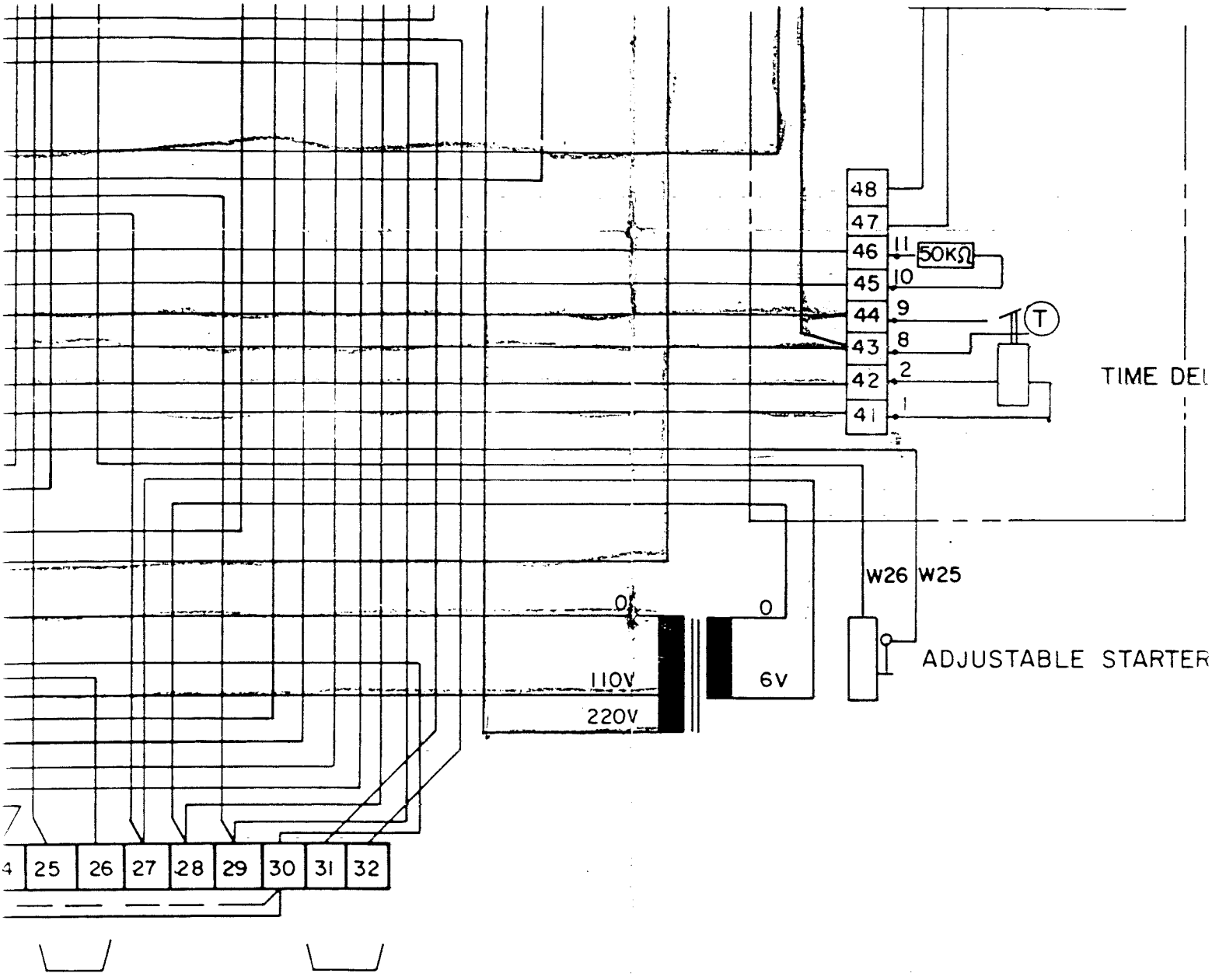
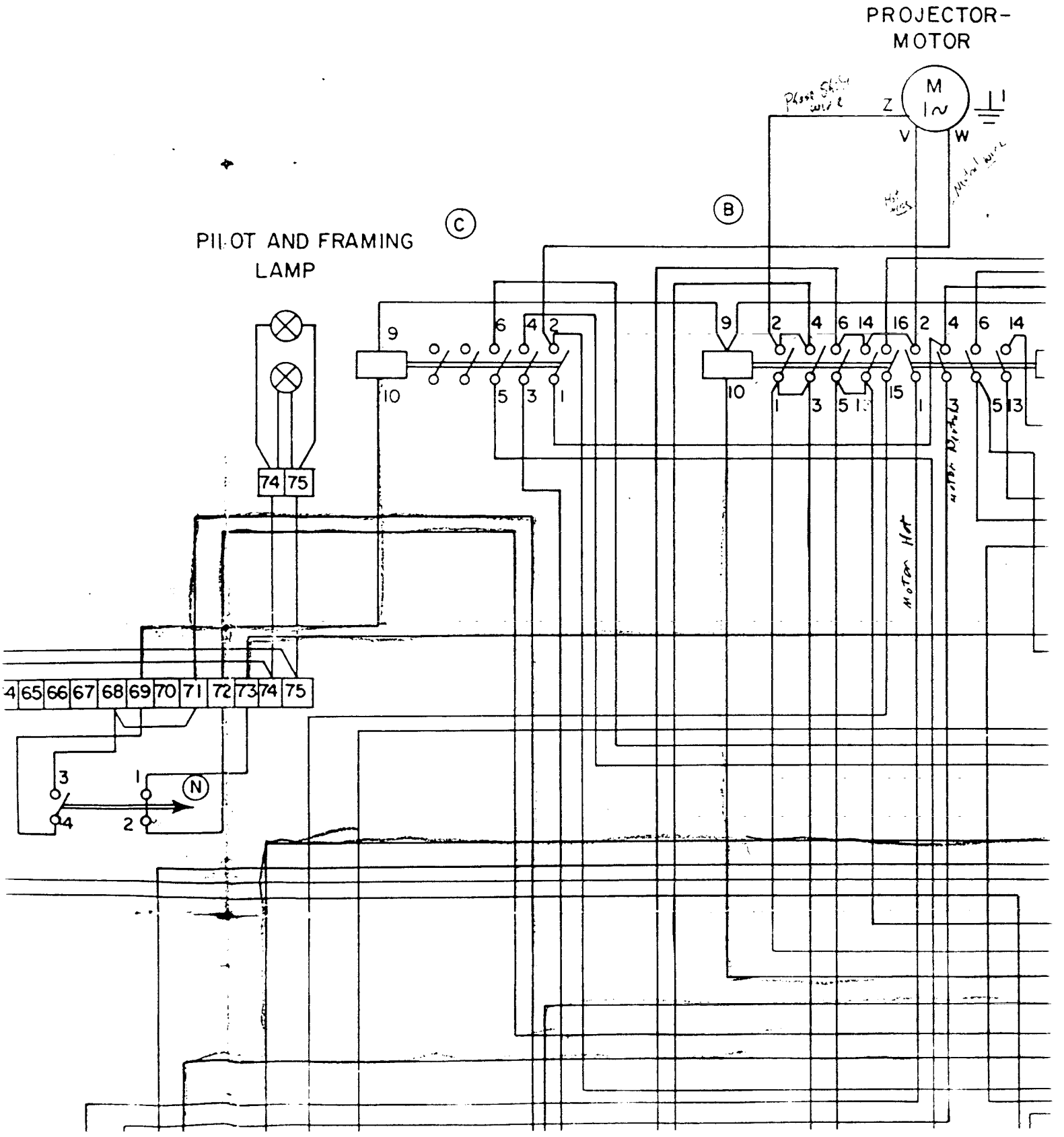


WIRING DI
NATIONAL 70 (BAUER 35

NATIONAL THEATRE SUPPLY COMPANY, PARAMUS, N.J.


PROJECTOR-
MOTOR
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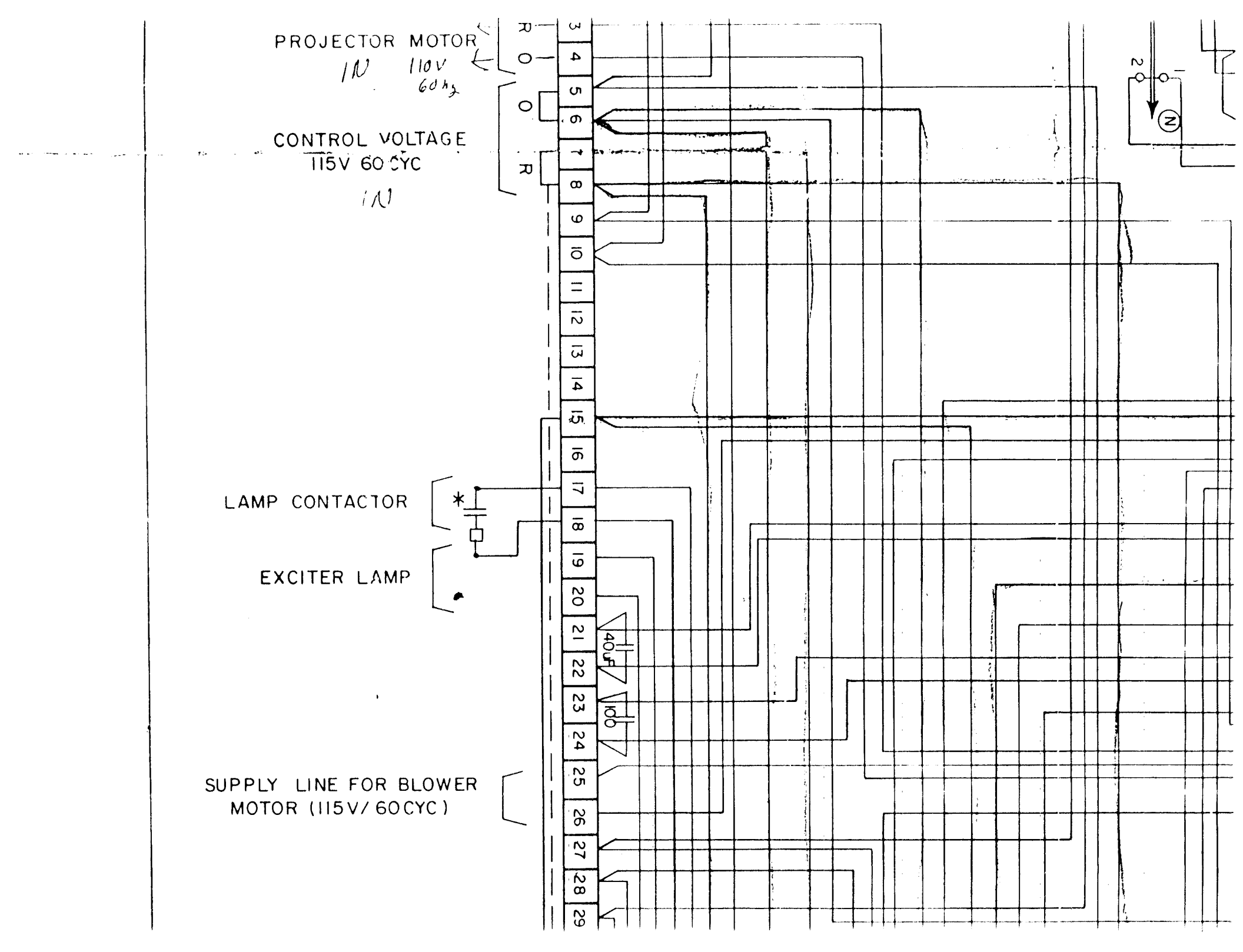
PROJECTOR MOTOR
IN 110V 60hz
CONTROL VOLTAGE
115V 60 CYC
IN
LAMP CONTACTOR
EXCITER LAMP
SUPPLY LINE FOR BLOWER
MOTOR (115V/60CYC)
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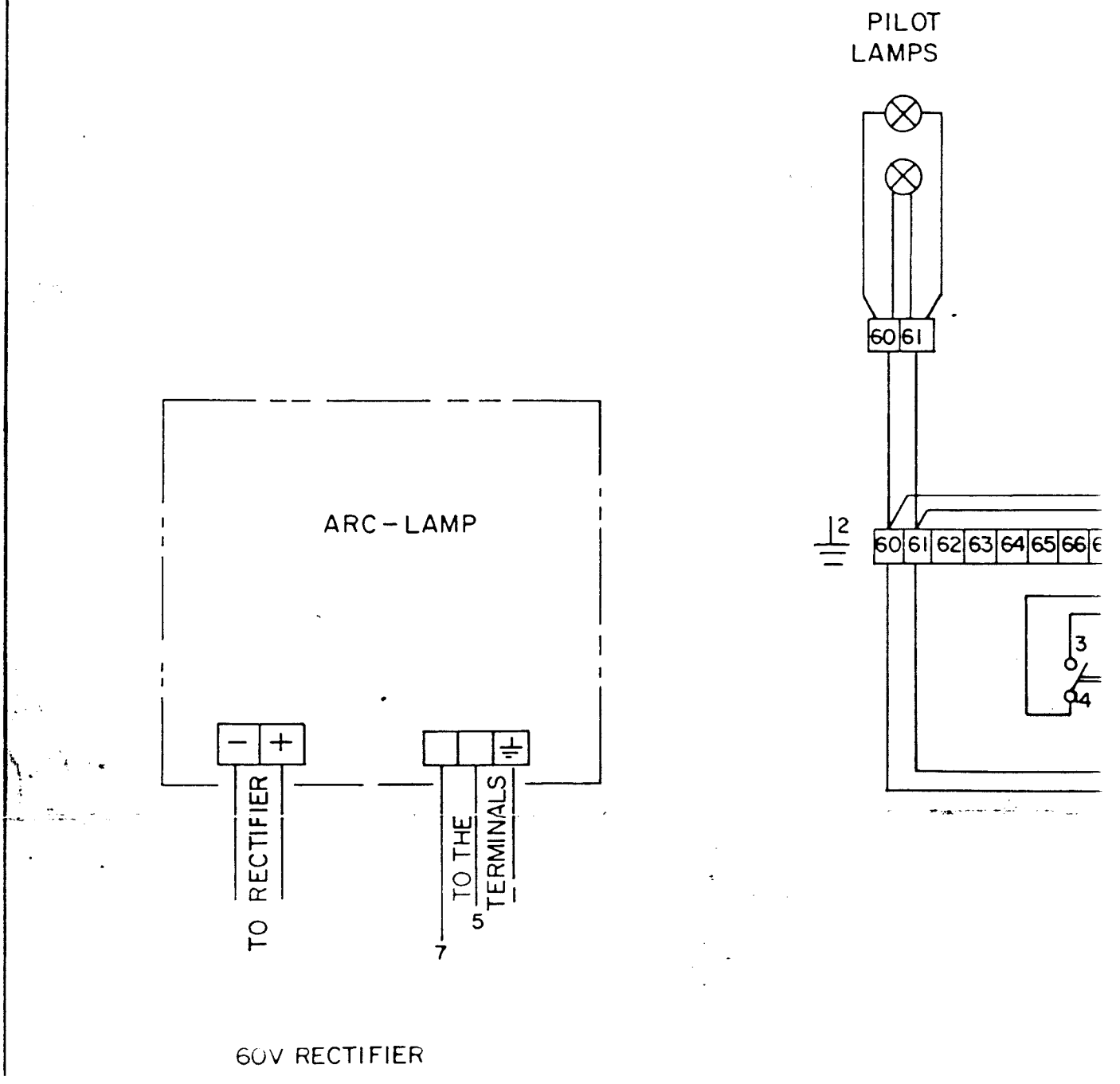
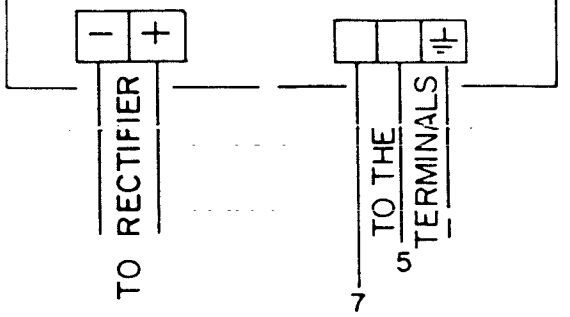
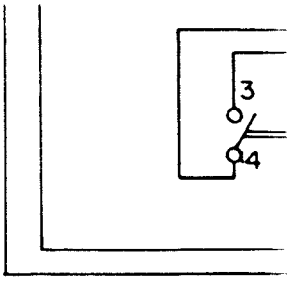
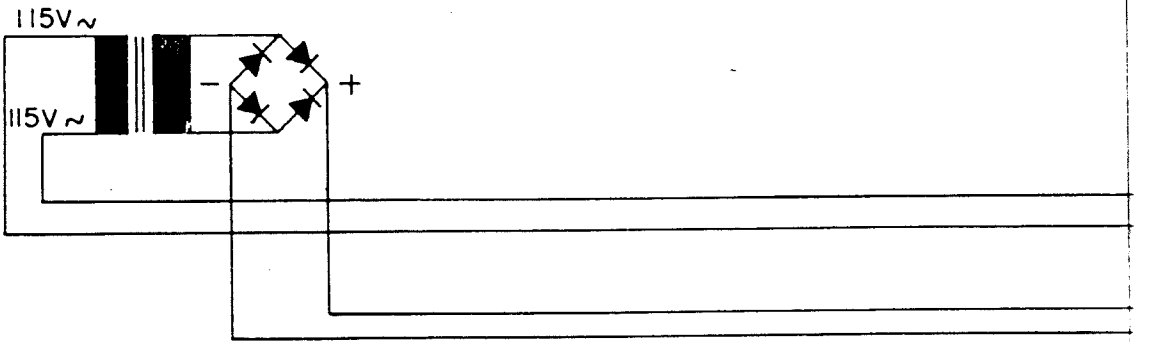
SS655a-NTS


PILOT
LAMPS
60 61
ARC-LAMP
2
60 61 62 63 64 65 66
3
4
TO RECTIFIER
TO THE
TERMINALS
5
7
60V RECTIFIER

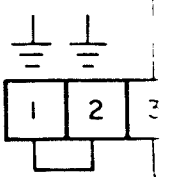




60V RECTIFIER



A CONTACTOR FOR PROJECTOR MOTOR
B STARTER CONTACTOR
C STARTER CONTACTOR
M FRICTION MAGNET
T TIME DELAY RELAY
N CENTRIFUGAL SWITCH



GROUND CONNECTIONS

WHEN THE 60V RECTIFIER HAS FAILED IN ONE OF THE MACHINES, THE CONNECTION 30/15 OF THE OTHER MACHINE MUST BE REPLACED BY THE CONNECTION 30/8.

* – OPTIONAL SURGE SURPRESSORS
.1 MF 600VDC 80–100Ω 1/4 –1/2 WATT