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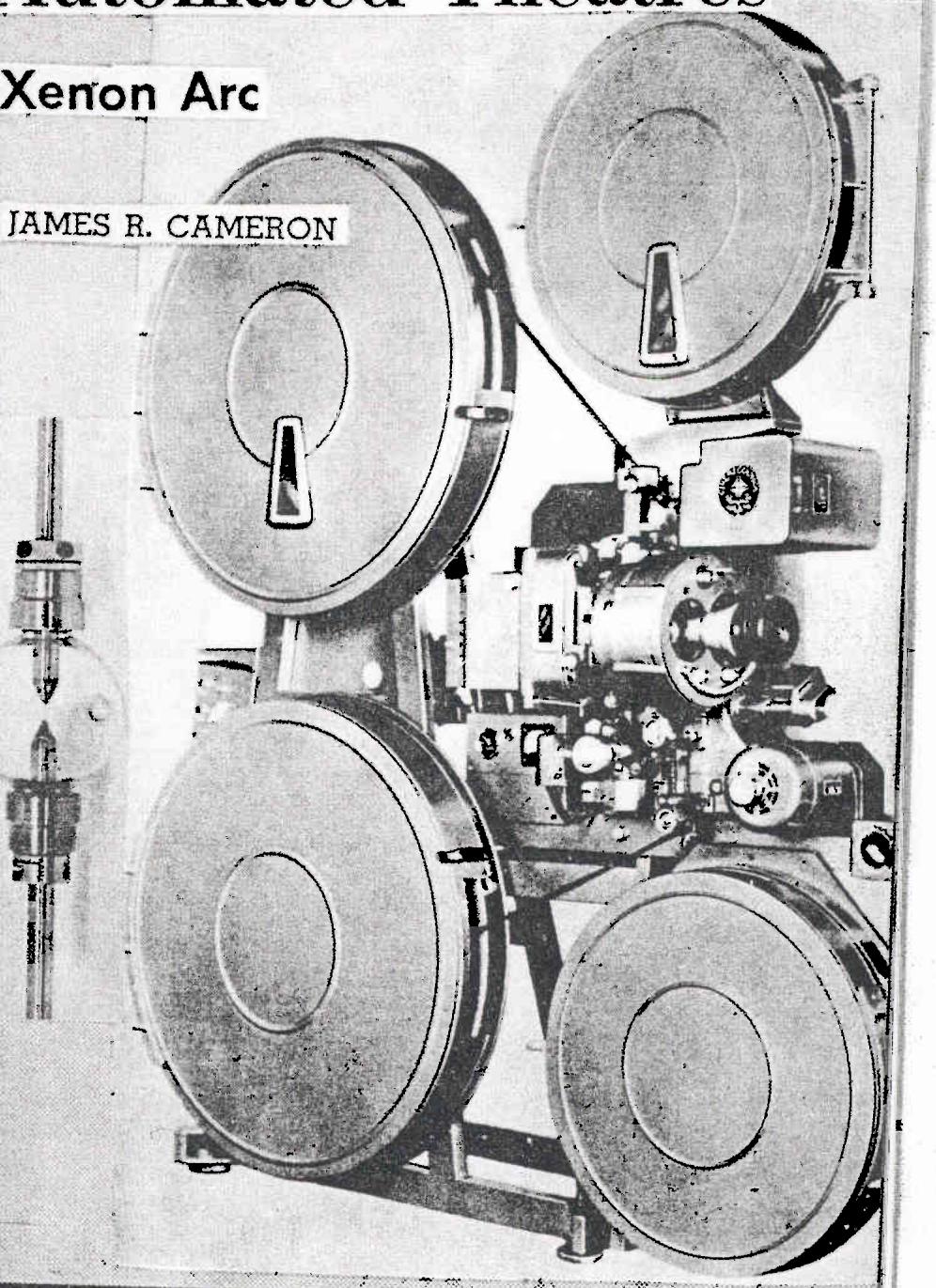
Automated Theatres

Xenon Arc

JAMES R. CAMERON



CAMERON PUBLISHING COMPANY
Established 1915
CORAL GABLES, FLORIDA, U. S. A.

Automated Theatres
Electronic Control System

Xenon Light for Projection Purposes

JAMES R. CAMERON

Fellow, Society of Motion Picture Engineers. Member, Institute of Radio Engineers, The Acoustical Society of America. Late Technical Editor, Motion Picture News and Projection Engineering.

1969

Cameron Publishing Company

ESTABLISHED 1915

CORAL GABLES, FLORIDA, U. S. A.

The data contained in this book is intended for inclusion in the new edition of Cameron's MOTION PICTURE PROJECTION. However we are now releasing the material in this book, because we feel that Automotive Projection Equipment is of upmost importance to Projectionists NOW.

We were prompted to publish this book at this time for the following reasons-----

1---The great number of letters we have received from projectionists asking for information pertaining to Automated Projection room Equipment.

2---That the International Office of the I.A. through the medium of the "Bulletin" suggested that such a book be published and made available to members.

3---That the Rank Organization of London, England, have within the past few months made seventeen 35/70 mm.installations in theaters in this country and Canada, and other installations are pending.

4---That the IN-FLIGHT Corporation are opening a chain of some 300 theaters throughout this country and Canada, all employing this new type of equipment.

ACKNOWLEDGMENT

We wish to acknowledge the cooperation of the following people and concerns for assistance in preparation of data covering the Theater Automotive Equipment------

The Rank Organization of London, England. EPRAD Inc. Toledo, Ohio. franchise holders of Rank Theater Automotive Equipment in this country and Canada. National Theater Supply Company, B.A.Bentley, chief Engineer, Essoldomatic Ltd, London England,, Cinemeccanica of Milan, Italy., and Frank R.Riddle,Pres. Carbons Inc. Cedar Knolls, N.J.

For assistance pertaining to Xenon Arc, we wish to thank the following---- M.E.Pickrell Jr., Vice Pres. Carbons, Inc. for the chapter on the XENON BULB., Roel Elzinga, Manager of Technical Services of the Macbeth Sales Organization.,L.E.Benitez, Pres. of Hughes Electronic Company, Long Beach. Calif. and all others who helped in any way in the production of this book.

The desire for automation in the projection room and theater is by no means something new, in fact, it is as old as the moving picture projector itself.

Old time projectionists will recall the hand-driven projector which required him to stand alongside the projector, using his right hand to continually turn the crank on the projector mechanism, and using his left hand to operate the several adjustment handles on the source of light to satisfactorily keep the picture on the screen.

Over a period of several years the various city and state authorities throughout the country would not allow motors to be installed to drive the projector, claiming this would be a fire hazard, in that the projectionist would be able to wander away from the projector and would not be immediately available in case of a film fire.

It took several years of negotiations between the motion picture craft and these state and city authorities, before permission was granted to install motors, and even then in many cases, it was required that the projectionist had to keep his finger pressed down on the electric starting button, to keep the motor running. This of course was to insure that the projectionist would remain at his position alongside the projector.

The advent of the motor was one of the first major "automatic" advancements made in the projector room.

Many other "automatic" devices were later introduced, some labor saving, some for fire protection.

A motion picture projector whose starting, stopping and re-starting was automatically controlled by sound waves, should be mentioned in this classification. This is the Vivatarg Projector introduced into this country during world war one; and which the writer installed on Broadway New York, and at Camp Utpon. Long Island, New York.

VIVATARG SOUND CONTROLLED PROJECTOR–

This was a projector whose operation, starting, stopping and re-starting was controlled by sound waves. It contained many innovations, it used a water cooling condenser, much like the spherical glass flask first used in the Lumiere projector. This water cooling condenser was necessary due to the fact that the use of the projector called for the film to be held stationary in the gate aperture while being projected on the screen, for a much greater period of time than is necessary in ordinary projectors. The projector was motor driven, but the driving agent could be instantly automatically disengaged by means of a relay which was in turn acted upon by sound waves.

The projector was first installed in this country in a "shooting gallery" in the basement of the Strand Theater on Broadway, New York City. The projector and associated equipment was installed in a booth, this booth being sunk in the floor, so that the top

of the booth was just under a counter, about waist high from the floor, that ran across the room, and on which the rifles were laid and on which the marksman could rest while taking aim at the motion picture.

Some thirty feet away, directly in front of this counter, was a large paper screen on which the pictures were projected. Special film subjects, such as a rabbit running across a field, or birds in flight were projected to test the marksman's aim. The idea was to have the customer shoot at the desired object in the motion picture, the report of his rifle, would automatically stop the projector, leaving the frame of film stationary on the screen for a pre-determined length of time, the bullet would penetrate the paper screen on which the pictures were projected and a light, placed behind the screen would show through this hole, and show the customer just how close he had come to hitting the moving object aimed at. The projector was so adjusted that when it came to rest, the rotating shutter blade was clear of the objective lens.

The sound of the report from the rifle was picked up by one or two telephone receivers which were mounted just above the marksman's head, these were fitted with a horn arrangement and looked much like the old type speakers used in the early days of radio. The sound picked up by these receivers actuated a relay, which in turn operated a clutch arrangement which disengaged the projector mechanism from the driving motor, thus leaving the film stationary. After a period of time, which gave the marksman an opportunity to see where his shot had registered, the clutch again engaged with the projector mechanism and the picture on the screen resumed motion. The length of time the picture stood still on the screen,

was predetermined and preset. The make and break contact, used in stopping the projector and re-starting it was a simple affair, the sound waves actuated a relay, which in turn operated a metal rod plunger, this plunger working in a cylinder of oil. On the report of the gun this metal rod was plunged down into the oil, thus breaking contact and stopping the projector. The electrical circuit remained open until the metal plunger worked its way back through the oil to again make contact and close the electrical circuit. The time it took the plunger to work its way back up through the oil represented the time the picture remained stationary on the screen. This time could be either lengthened or shortened by changing the consistency of the oil in the cylinder, the lighter the consistency the shorter the period of time.

As the top of the metal plunger again made contact with the top of the oil cylinder, this would restart the projector, and also would operate a relay attached to the screen take-up roller, which we will now describe.

The screen was a paper one, at least two layers of paper being used, it measured approximately eight by ten feet. A large roll of paper, much like the rolls of paper seen on trucks on way to newspaper print shops, was placed on end, in suitable supports, at one side of stage, the end of the paper was drawn off, and across the stage, where it was wound around an idler roller, and then the end was drawn back across the stage and attached to the take-up roller. It will thus be seen that we have two layers of paper making up the screen, the front sheet running from left to right across the stage, the back sheet running from right to left across the stage. The two layers were held in close contact, so there was no space between them.

The customer took aim at the picture being projected on to this screen, his bullet passed through two layers of paper, the hole made by the bullet, showing up as a spot of light, as the picture on the screen resumed motion, the relay on the take-up roller on which the paper screen is attached, turns the roller about one-eighth of an inch, thus the paper nearest the marksman travels one-eighth of an inch to the right and the second layer of paper travels one-eighth of an inch to the left, this closes the hole made by the bullet and gives the marksman a clean unperforated surface to again shoot at.

In the construction of the projector, four obstacles had to be overcome. 1, to stop the picture instantly on the report of the gun. 2, to hold the picture stationary on the screen for any desired period. 3, to prevent the film from catching fire while stationary in the gate of projector, and 4, to synchronize the rotating light shutter so that it would be clear of the objective lens when the projector stopped. Once the projector was started, it required no manual attention, it started, stopped, and re-started automatically.

Perhaps it would be appropriate to mention here that the Automatic Projection equipment now being introduced into this country, is not new. The Rank Organization of London, England, started experimenting with this type equipment shortly after the end of World War Two. They at present have some 70 Theaters in London, England, and approximately 200 theaters throughout England all equipped with Automatic Projection Equipment.

Away back in 1935 an automatic projection equipment was built in Cincinnati, Ohio. Associated with

the Western Electric Universal Bases, standard Simplex Projectors and Strong Lamphouses was a control system consisting of a three or four circuit switch operating from the upper magazine spindle and having a centrifugal type linkage. A control cabinet containing several relays did the actual switching operations as selected by the centrifugal unit.

This system did work well. The most interesting idea was that in order to strike the arc, the feed motor was reversed to make the strike, then changed to normal to bring the gap to the correct width. In the normal sequence of operation, the arc lamp would be lighted about one minute before changeover time, the second contact started the projector motor and the third contact made the picture and sound changeover. The outgoing machine was not turned off by this equipment but it did close the lamphouse douser.

This design did not take into consideration the idea of improving the presentation by making fewer changeovers through the use of larger reels. The system had an obvious handicap due to the fact that it depended upon the rotational speed of the upper reel shaft for proper timing. This meant that special reels having a very closely controlled hub diameter must be used in the upper magazine. They were limited to a capacity of 1,000 feet of film and it was necessary to re-wind the incoming show onto these special reels and to make a changeover every eight or ten minutes.

The equipment had very poor prospects from a sales standpoint and it was difficult to justify its existence because it actually increased the amount of work to be done in the projection room.

THE RANK ORGANIZATION AUTOMATIC EQUIPMENT

The Rank Organization of England, has long been recognized as one of the leaders in excellence of projection, and they early made the decision to follow through on the automated projection room, to check its overall results.

They realized the need to reduce the number of changeovers per show and have used large magazines having capacities of 4,000 to 6,000 feet for many years.

While in the process of designing the various components of the overall system, they also realized the need for remote focus and sound control in some of the larger theaters. These features were finalized before the complete automatic system and many of their theaters you will find a position in the auditorium where the projectionist can monitor both the sound and the focus by use of the remote controls.

While there is less need for a remote framing device, this was added as it required only a slight additional modification. This control panel can be covered and locked when not being used by authorized personnel.

Mr. Frank Riffle, President of Carbons Inc. and a brother member of the Society of Motion Picture & Television Engineers made a trip to England as a

guest of the Rank Organization to personally observe the operation of this automatic equipment in one of the Rank Theaters, and here is what he wrote regarding that visit——"This particular theater was scheduled to start the show at 2:00 p.m. As the same program had been running for several days, the system was set up to reproduce the same sequence each day."

"We entered the projection room at 1:45 p.m. and the projectionist gave us a brief description of the equipment being used. At 2:00 p.m. he operated one push-button switch and the scheduled events were under way."

"The house lights were dimmed to approximately half brilliance and the non-sync reproducer was energized for ten minutes of music. At 2:09 p.m. Number 1 machine arc-lamp was lighted, projector started, music faded out, lights dimmed out, incoming picture was projected on the travel curtain which opened immediatedly and the program was under way."

Both projectionists were out of the projection room during this period to demonstrate that it was a programmed automated system which could be relied upon to give satisfactory repeatable results.

"We were alone in the projection room at 2:50 p.m. when the first changeover was made in a very professional manner and the outgoing projector turned off. We noted an audible signal five minutes before the changeover time which was also reproduced in the auditorium position where the chief projectionist is usually stationed."

"Ten minutes before the first intermission, the Manager and concession personnel were notified by a buzzer signal. Curtain close-in, house lights, and non-sync music were automatically controlled for this intermission."

"This equipment is being used with carbon arc lamps and with a different method of striking the arc. This is done by inserting a metallic cylinder of the proper length and wall thickness between the positive and negative carbons. As this metal has a low melting temperature, it practically vaporizes when the power circuit is completed and the carbons are ignited at the proper gap width."

In practically all cases, copper coated carbons are used and apparently very little trouble is experienced with feeding the arc. This does not necessarily imply that the screens are small as they have one such lamphouse using 11 mm. copper coated positives which operate at up to 120 amperes and is capable of delivering 35,000 to 40,000 lumens.

In these theaters there is usually a projectionist in the projection room to look after such things as carbon position and picture focus. A law which stated that there must be a projectionist in the projection room at all times while a projector is in operation, has been changed to read that with the installation of equipment of this type, a projectionist could leave the projection room for a period of 15 minutes at a time providing non-inflammable film was being used.

The same regulation requires that this equipment

stop the projector, extinguish the light, and to sound an alarm at some designated point if there is a failure of the electrical supply or a break in the film.

In the larger theaters, the chief projectionist is charged with the routine service of the equipment although emergency service is available from a Sound Service Company.

Technically, the equipment can be adapted for use with any projection system as every switch normally used by a projectionist is bridged by one or more relays to perform the same function.

Basic control is provided by a rotating drum having 650 holes arranged in 50 horizontal lines of 13 holes each. Actuating pins are placed in these holes in the proper sequence to provide the necessary functions. This drum is rotated electrically through an impulse type motor.

Arranged across the top of the device are 13 microswitches. The operating arms of these switches are so arranged that as the drum rotates, the heads of the inserted pins operate the microswitch and activates the associated circuits such as "open curtain," "start motor" etc, etc.

As a rule, the following functions are supplied;

1---Dim or raise house lights.

2---Turn footlights on or off.

3---Open or close curtain.

4---Change masking according to aspect ratio being used.

5---Turn non-sync on or off.

6---Activate lamphouse, Carbon or Xenon.

7---Start motor and make changeover.

8---Turn off outgoing motor.

As these operations are carefully timed by mechanical means, flawless projection can be expected. The intermission intervals can be made the same length of time between all shows or can be pre-set for other periods of time by the adjustment of a timing clock.

Perhaps the most sophisticated of all such automatic equipment has been installed in the Nottingham Twin Theater (England) where the regular Projectomatic plus the newer Cinemation is being used. Both of these types of equipment are manufactured by Essoldomatic Ltd. (a partner of the Rank Organization).

Odion Theater #1 has 700 seats and is equipped with Philips IL Projectors. The screen width is 52 feet. Odion Theater #2 uses the Cinemation console. This is a 1,450 seat theater using Cinemeccanica projectors and projecting a picture 55 feet wide.

The console can be programed to provide automatic control of heating and cooling equipment, interior and exterior lighting, operate the stage curtains and masking, plus switching of amplifiers from the single to multi-channel sound when necessary. If the program includes mixed material, it will also automatically change lenses and apertures.

A dual programer is supplied in this case which automatically changes from weekday to weekend operation to take care of changes in performance times.

The remote control facilities have been improved to the point, where a radio link is provided and from any point in the theater where the screen can be observed, the focus, framing and sound level can be adjusted and controlled.

Facilities such as improved equipment for the hard of hearing patrons using a radio link in one case and an induction system in the other, are available.

CINEMATION AUTO CHANGE-OVER DEVICE

The Cinemation MK. 6 Auto Change-over device is a simple equipment designed to effect auto change-over sequences of picture and sound between two 35 or 70/35m/m Projectors.

The basic equipment comprises a Main Control Unit approx: 13½" Wide, 10½" High and 11.7/8" Deep designed for shelf mounting and incorporating two 1" Conduit entrues in the base of the unit, together with two static pick-off devices and two stop rollers, these latter items being designed to be mounted in the projector machanisms.

The equipment is operated initially by depressing either the "Start Left or Start Right Projector" Push Button and once a projector is running the equipment will detect the presence of a single mark of self adhesive foil towards the end of each reel of film (via the static pick-off devices) and cause an automatic change-over of picture and sound to take place between the two projectors.

The single mark of self adhesive foil placed towards the end of each reel of film is detected by the static pick-off device on that projector with the effect that a timer motor is caused to operate a number of micro-switches in a set sequence producing in turn the following auto change-over sequence between the projectors.

(1) A warning buzzer sounds.

(2) The incoming projector motor starts and the arc rectifier is switched on.

(3) The Xenon Lamp (if fitted) strike push button is shorted out momentarily to strike the Xenon Lamp.

(4) The Zippa and Sound Change-over Push Buttons are shorted out momentarily to

effect picture and sound change-over.

In the case of either exciter lamp or non-pulsed sound change-over systems a type 1207 relay unit is either energised (when going to the left projector) or de-energised (when going to the right projector), to change-over exciter lamps or speech lines on non-pulse operated sound change-over systems.

(5) The internal relays which have caused the running projector to operate de-energise and the outgoing projector and arc lamp rectifier switch off.

(6) An internal "Projector Change Relay" now energises or de-energises so that the next time the timer motor operates from a mark on the film the opposite set of control relays will operate the opposite projector.

The timer motor has now made a complete cycle and switches itself off via one of its own micro switches and remains dormant until the next change-over.

When no further change-over sequence is desired, for example on the end of a film, no mark is placed on the last reel and the projector and arc rectifier are stopped by putting the Auto/Off/Manual switch for running projector in the OFF position.

The equipment operates from a single phase A.C. mains supply 115-245 volts, 40-60 cycles.

The wiring should be carried in either screwed conduit or trunking and care should be exercised to keep all Cinemation wiring as far away as possible from any sound wiring to minimise pick-up of noise of the sound.

The position of the Main Control Unit is not critical although it must be borne in mind that the Projectionist has need to operate the push buttons and switches at the beginning and end of each performance, the front wall in between the two projectors is an ideal spot.

Note especially that in respect of carbon arc rectifiers the equipment is designed to operate existing contactor controlled rectifiers and it is essential they be converted to contactor controlled type if not so already.

With regard to Xenon rectifiers these of course will already be contactor controlled with the lamphouse door micro switch in series with the coil circuit of the rectifier contactor, also note that some Xenon

Lamphouses are fitted with an Auto Strike Device, whereby the lamp strikes automatically as soon as the rectifier is switched on. Under these conditions the wires marked "To Xenon Lamp Push Button" may be omitted.

On sound systems where a Type 1207 Relay Unit is required to change-over exciter lamps or speech lines this should be positioned as near as possible to the exciter lamp or speech line sound change-over switch to minimise voltage drop in the former and noise on sound in the latter mode of sound change-over.

The pick-off devices and stop rollers come with special adaptation brackets to suit the installed projectors but it should be borne in mind that to be effective under all conditions the stop rollers should be mounted After the last sprocket in the film path.

Great care should be excercised over the fitting and alignment of the pick-offs, remembering always that the entire success of the system depends on good firm contact, over the largest possible area, between the film and the pick-off device.

MARKING THE FILM

The application of the Marking Tape which covers approximately three sprocket holes of the film, should be placed right up to the picture or sound track area, it is perforated by the sprocket teeth when the film runs through the projector.

A single mark is placed towards the end of every reel except where no change-over sequence is desired.

The exact place the mark is placed on the reel is calculated in the following manner:–

1———Switch on the equipment.

2———Set both Auto/Off/Manual switches to the Auto position.

3———Stand by with a watch with a large second hand.

4———Press either the left or right start projector push button and note the time that elapses between pressing the button and the projector motor starting.

5———Convert this time into feet of film i.e. Multiply time in seconds by eighteen and divide by twelve.
Add to this figure the distance between the picture gate and the pick-off device which will now be distance that the mark has to be placed on the film in front of the motor changeover dot.

It only remains now to adjust the cam operating Micro Switch #4 so that the change-over of picture and sound occurs on the change-over dot.

The setting of the cam for Micro Switch

#3 (Xenon Strike) can take place any time between projector motor start and picture and sound change-over, although in practice it is better to have this operate quickly after projector motor start to get the Xenon lamp alight and settled down in ample time before picture change-over.

The setting of the cam for Micro Switch #5 (Stop Opposite Projector) is also not critical, set it up to allow enough time for the tail leader of the outgoing projector film to run through.

The cam setting for Micro Switch #6 (Projector Change) should be organised for the switch to operate three or four seconds after #5.

The cams are already set in their approximate positions, and in practice it is only envisaged that final adjustment to cams 4 and 5 will be required.

The cams are easily adjusted by use of the special adjusting tool which will be found screwed on to the side of the motor assembly.

CINEMATION -- MARK 1 & 2

Cinemation MK. II is the successor of the large console and as will be seen from the illustration, now comprises two separate control instruments, one operating the general theatre services, the other operating the functions associated exclusively with the presentation of the film show. Thus an exhibitor has the option of installing the general theatre services instrument which operates lighting, heating, ventilation, etc., functions on a time basis, the facility being to switch on and off at half-hourly intervals a maximum of 30 different circuits.

If only the film presentation instrument is installed this then becomes known as Cinematic MK. 1.

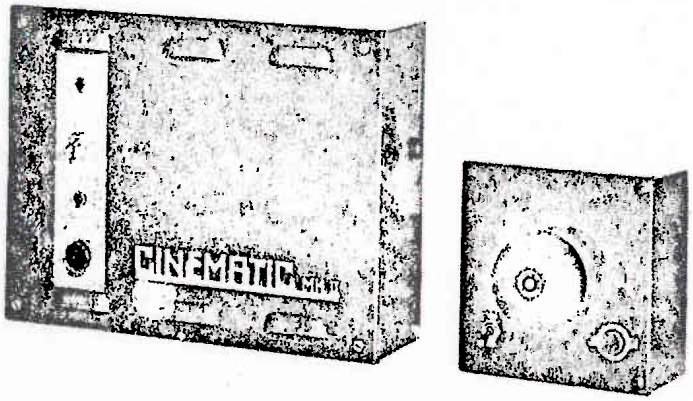
Cinematic Auto-Changeover is a small equipment providing only the facility of auto-changeover of picture and sound between projectors.

The heart of the equipment is a triple layer matrix into which two types of diode pins are inserted. Green diode pins short between decks Nos. 1 and 2; Red diode pins short between decks Nos. 1 and 3.

The equipment is fed by conventional 24v. DC power supply unit/s, the number required depending on the load and number of external relays/contactors controlled. Each power unit delivers 24v. at 10 Amps DC. In addition, a 230v. AC single phase supply is required to operate the continuously rotating synchronous timer motor.

The matrix comprises 48 rows of holes – 30 holes in a row. The 30 holes across are the 30 different switched circuits; the 48 rows correspond to 48 half-hourly periods during a complete 24-hr. time-scale, and are engraved in international time.

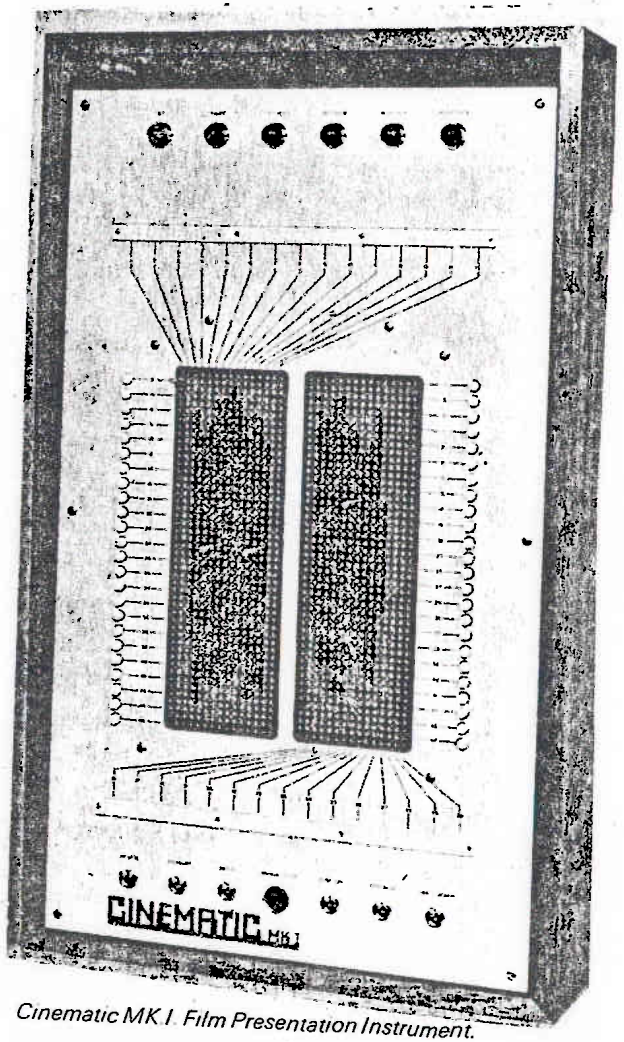
The half-hourly periods are indicated by the 48 miniture amber indicating lamps situated vertically down either side of the matrix, and indication that



Cinematic MK 2 Auto-Changeover Device

any of the 30 switched circuits are on is given by the 30 miniture green indicating lamps situated 15 at the top and 15 at the bottom of the matrix.

These green lamps have been so positioned – 15 at the top and bottom of the matrix ––– to facilitate ease of identification of each circuit which is engraved on the adjacent perspex strip. Thirty lamps in a single row would have led to a cramped condition and difficulty in identifying each circuit.



Cinematic MK I. Film Presentation Instrument.

The 30 miniture green lamps are each associated with a 3-position switch engraved Auto, Off and Manual. In the Auto position the equipment will function as programmed by the Diode Pins in the matrix, in the Off position that particular circuit will be ignored, and if already operating will be switched off, and in the Manual position that particular circuit will be switched on independent of the matrix. Thus complete overriding manual control of all circuits is provided.

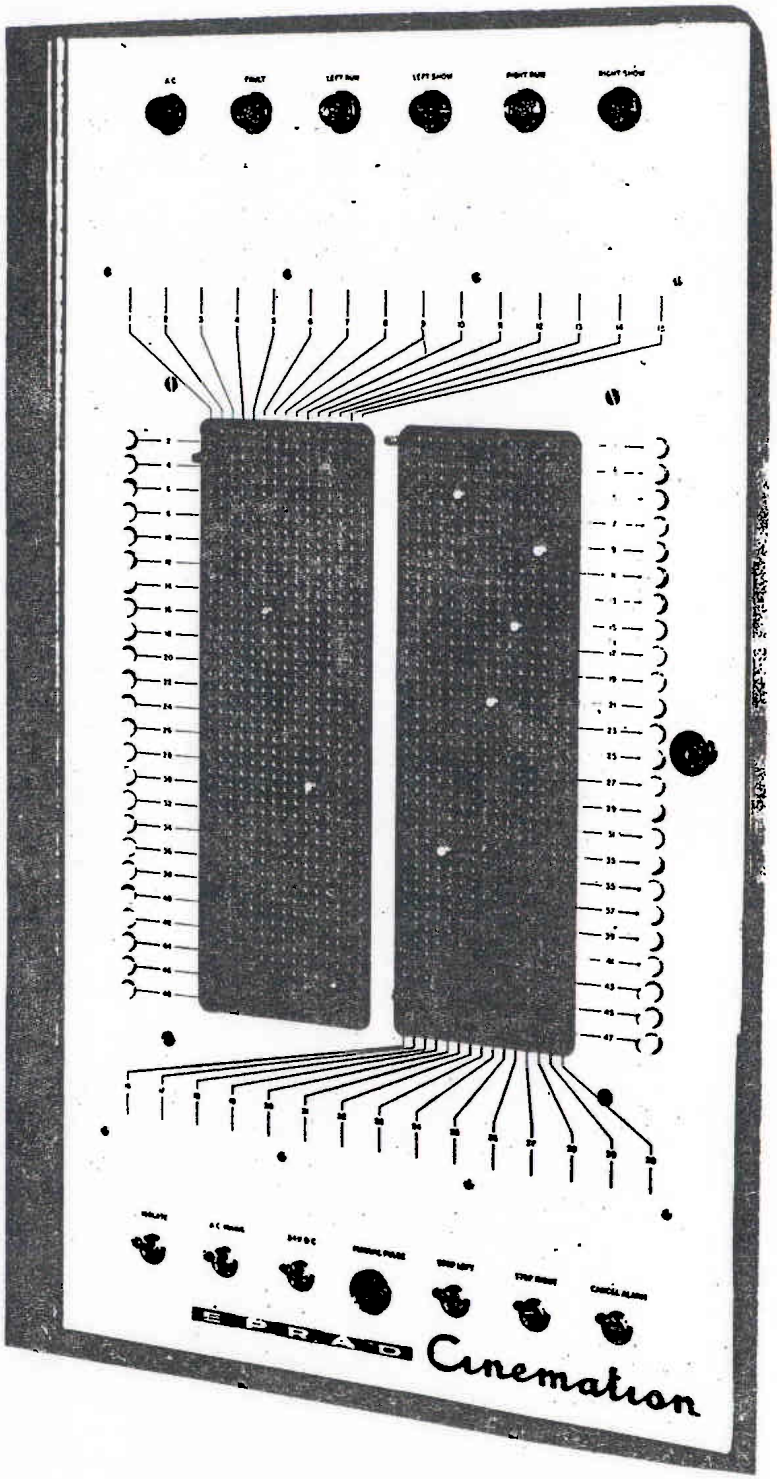
The equipment also contains a 24v. uniselector having the equivalent of three 50-position switch banks.

Any number or combination of circuits up to the maximum of 30 may be switched ON or OFF at predetermined half-hourly intervals by the insertion of either Green or Red Diode pins.

The diagram details the circuit of the control unit of this equipment in addition to which other items of equipment are required and a typical basic specification is as follows:

1 – Cinematic MK. 1 main control unit
2 – 35 mm pick-off devices
2 – 35 mm stop rollers
2 – LDR/03 light detector units
1 – 1207 sound changeover unit
Adhesive silver foil
Fusible Pellets if Carbon Arcs are in use. Nothing additional being necessary where Xenon lamps are installed.

Many different types of pick-off devices ranging from split rollers to photo-transistor types are in



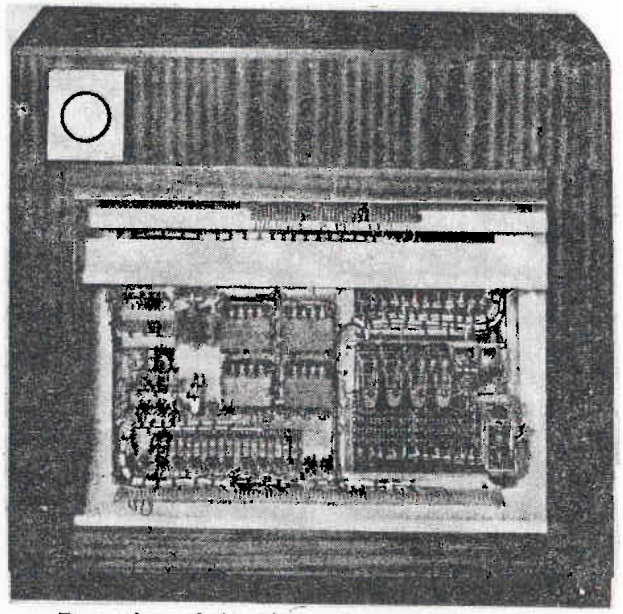
use with equipment manufactured by Essoldomatic Ltd. However, as the majority of Cinematic MK. 1 equipments installed are working in conjunction with Cinemeccanica Victoria 8 projectors, a static or stationary split roller type of pick-off device has now been used because of the ease whereby the pick-off and stop rollers can be mounted in the film path.

A good wrap of film round both the pick-off and the stop rollers produces an extremely simple and reliable method of producing a pulse from a piece of foil less than an inch long placed over the sprocket hole area of the film.

The heart of the equipment is a two-layer matrix with 48 horizontal rows of holes, 30 holes in a row, together with a 3-bank, 50-position uniselector, a timer motor and a collection of relays, all of which are of the enclosed plug-in variety. The equipment uses no tubes or transistors, the object being to create a simple easily understood and serviced equipment using simple electrical switching circuits.

Operation

(1) Set ISOLATE switch to ON. This enables the control unit to be set up without causing spurious operation of the external control circuits.
(2) Switch on AC mains and 24v. DC supply.
(3) Set ALARM switch ON.
(4) Operate MANUAL SELF-PULSE push button until Lamp No. 48 is lit.
(5) Set up program on the matrix, starting with row No. 1, e.g. if the first event is START LEFT PROJECTOR and at the same time FOOTS DOWN, then a peg is plugged into the corresponding holes of row No. 1.
Continue in a similar manner for the other rows, using a new row for each event in time.



Rear view of the Cinemation control console

(6) Set STOP LEFT PROJECTOR and STOP RIGHT PROJECTOR switches to AUTO.
(7) Set ISOLATE switch to OFF. This primes all the external circuits ready to receive instruction from the Program Unit.
(8) Operate the MANUAL SELF-PULSE push button. The left projector will then start up, and the programmed sequence will commence. At any

time it is possible to stop either projector manually by operating the appropriate switch to MANUAL. It is also possible to miss out any desired part of the programmed sequence either by operating the MANUAL SELF-PULSE button, or to run from one part of the program sequence to another using the SELF-PULSE row of holes, with a peg inserted into each appropriate hole

The basic program system consists of a Matrix which is operated sequentially from a 50-way uniselector. The uniselector is arranged to move on one step at a time whenever a metallic foil is detected on the film reels.

Consider that the system is programmed to START LEFT PROJECTOR at position 3, for example. Indicator lamp No. 2 will be on. Assume that the right projector is running. When the metal foil is detected on the film reel, the FILM PULSE DETECTOR circuit will momentarily close, and RL.A will energise. Contacts RL.A-1 will close and the uniselector coil will energise. Also contacts RL.A-2 will operate and provide a 'self hold' path for RL.A, via contacts RL.B-1. After about half a second, RL.B will de-energise, contacts RL.B-1 will open, RL.A will de-energise, and RL.B will re-energise via contacts RL.A-2. Contacts RL.A-1 will open, the uniselector coil will de-energise and it will move on to position 3. Also contacts RL.A-3 will have closed for about half a second and RL.V will be momentarily energised, via contacts RL.A-3, uniselector bank 'B' and a peg in position 3.

Contacts RL.V-3 momentarily close and energise RL.Y, which self-holds via contacts RL.Y-1 and RL.S-1.

Contacts RL.Y-2 are now closed and the timer motor starts up. The timer motor has eight micro-switches which energise one after the other. The first micro-switch is arranged to energise and remain energised for the complete time motor cycle. This is the 'self-hold' micro-switch wired in parallel with contacts RL.Y-2.

The second micro-switch operates and this energises RL.S. Contacts RL.S-1 operate and release the self-hold on RL.Y which de-energises. Contacts RL.S-2 close to provide the projector change-over buzzer or gong circuit. The micro-switch then opens. The third micro-switch operates; since it has been assumed that the right projector is running, RL.T and RL.U are energised, via contacts RL.W-4 and RL.X-4. RL.D will momentarily energise, via the third micro-switch, contacts RL.T-1 and RL.Q-1.

The RUN LEFT PROJECTOR lamp will light, via contacts RL.M-3 and RL.D-5. Contacts RL.D-1, RL.D-2 and RL.D-3 provide the control for the external START circuits to the projector motor.

The fourth micro-switch operates, RL.F energises via contacts RL.T-2 and self-holds via contacts RL.F-5 and RL.Q-1.

Contacts RL.F-1, RL.F-2, RL.F-3 and RL.F-4 provide the control for the external RUN circuits to the projector motor and arc rectifier. The micro-switch

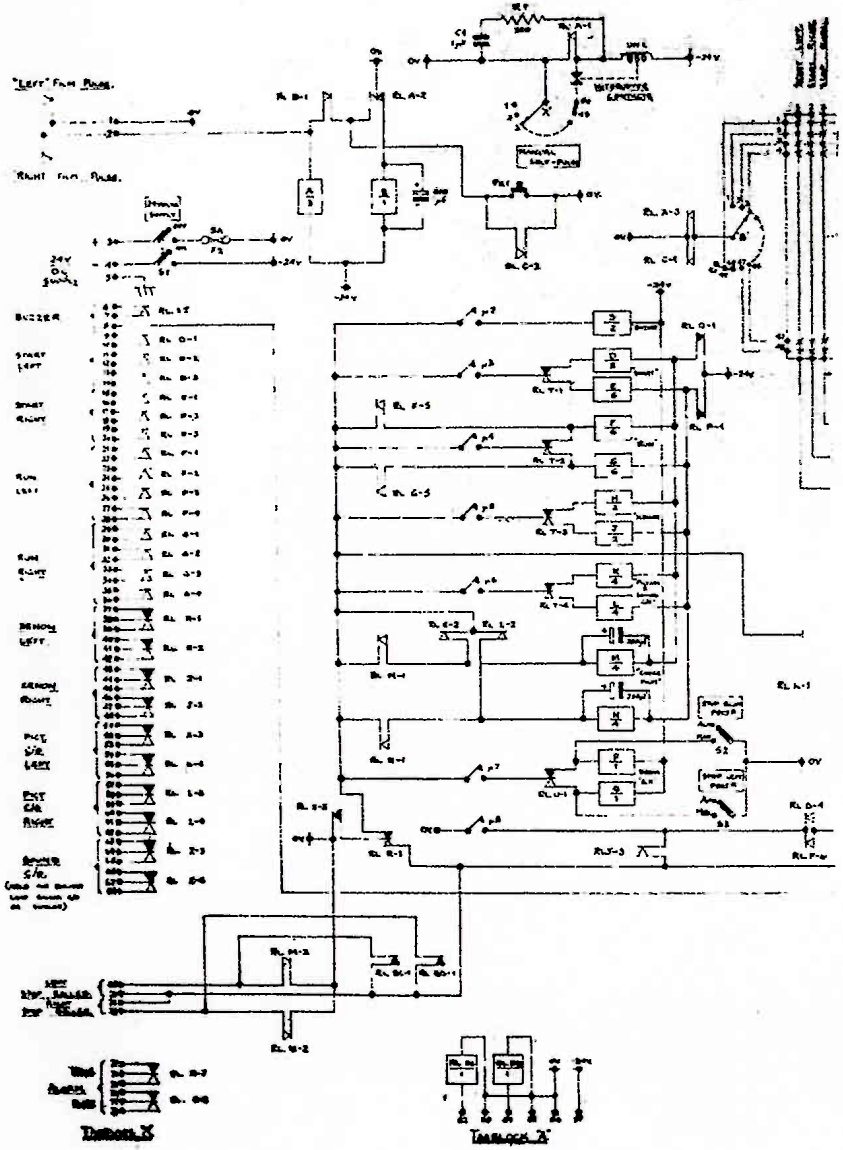


Fig. 5. Circuit of Cinematic MK.1. Film Presentation Instrument.

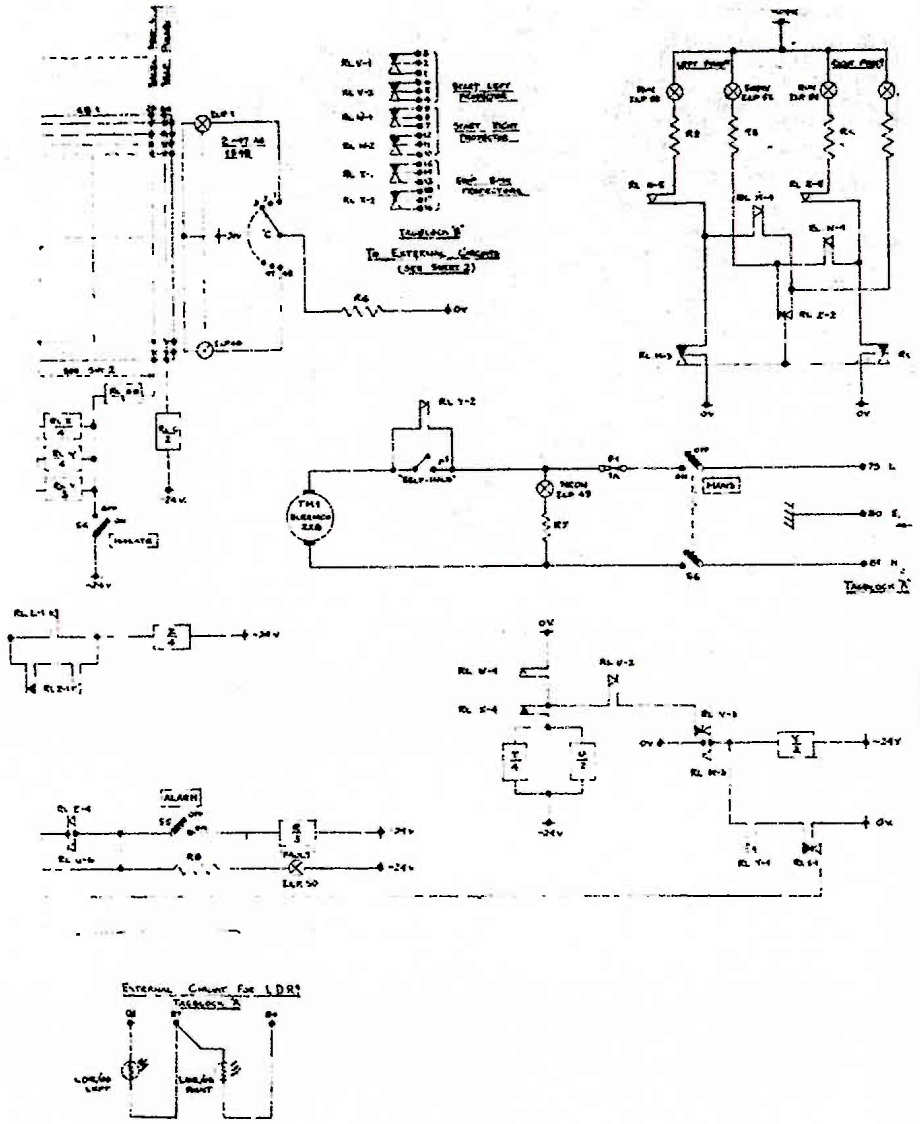
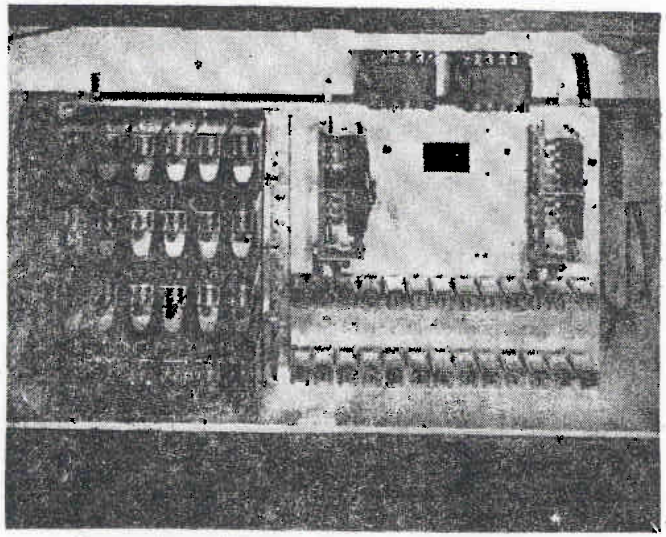


Fig. 5. Circuit of Cinematic MK.1. Film Presentation Instrument.

then opens.

The fifth micro-switch operates, RL.H energises via contacts RL.T-3. Contacts RL.H-1 and RL.H-2 provide the control for the external XENON LEFT or VIC. 8 FIRE SHUTTER SOLENOID. The micro-switch then opens.



Front view of Cinemation control console

The sixth micro-switch operates, RL.K energises via contacts RL.T-4. RL.M also operates via contacts RL.K-2 and self-holds via contacts RL.M-1 and RL.Q-1. Contacts RL.K-3 and RL.K-4 provide the control for the external PICTURE CHANGE-OVER circuit. Contacts RL.K-1 open, breaking the self-hold circuit of RL.Z, which de-energises. Contacts RL.Z-3 and RL.Z-4 provide the control for

THEATRE AUTOMATION

the external non-pulsed SOUND CHANGE-OVER circuits, i.e. operation 1207 Sound C/O Unit.

The left SHOW lamp is now lit via contacts RL.M-3 and RL.Z-2. Contacts RL.M-2 close and provide a path for the LEFT STOP ROLLER circuit such that if the film should break, RL.R energises, and switches on the ALARM. The micro-switch then opens.

The seventh micro-switch operates, this energises RL.P via contacts RL.V-1. Contacts RL.P-1 open and both relays associated with the right projector which have self-hold circuits de-energise, i.e. RL.G and RL.N, the right projector then stops. The micro-switch then opens.

The eighth micro-switch operates, this provides a check circuit such that if RL.Y, RL.E or RL.G have not de-energised, then RL.R can energise via either contacts RL.Y-3, RL.E-4 and RL.G-6. If RL.R does energise, it self-holds via contacts RL.R-1 and RL.X-3. The ALARM lamp is lit, and it can only be extinguished by turning the alarm switch to OFF. Contacts RL.R-2 and RL.R-3 provide the control for the external ALARM CIRCUITS.

The timer motor continues turning until the first micro-switches opens; the motor then stops. and is ready for its next cycle.

In the position illustrated contacts 4 and 5 are made and Ov. are changing capacitor C32 through R92. At half-hourly intervals moving contact 4 of microswitch will change over to contact 3 and discharge 50 uf capacitor C32 into relay coil RLAG.

It should be noted that the number appearing underneath the lettered relay identification refers to the number of contacts on that particular relay, so in this case we see that RLAG carries one set of contacts, and these appear as RLAG–1 associated with the uniselector operating coil. These contacts now close and apply Ov. to the uniselector coil which energises.

The first section of the uniselector UNI-1 is only concerned with the homing function, i.e. only 48 ways are used on a 50-way uniselector and positions 49 and 50 of this section are joined on to the interruptor contacts; therefore, when a pulse is received on position 48 the uniselector will home round to position No. 1.

The second section of the uniselector UNI-1B is associated with the 48 vertical miniature amber lamps which indicate the position of the uniselector as well as the row of holes which is being 'read' at that time.

The third section of the uniselector UNI-1C is associated with the actual 'reading' of the matrix and the operation of the miniature plug-in relays via the diode pins. It is necessary to use diodes in the pins to prevent 'sneak' circuits from occurring when many ON/OFF functions are programmed on the same row of holes in the matrix.

Note that relay RLAG can also be energised to operate the equipment by depressing the manual button.

Assume that the wiper contacts of the uniselector are at present on position No. 3 and a pulse is generated either by C32 discharging into RLAG coil or by the operation of the push button. Relay RLAG now energises and contacts RLAG-1 energise the uniselector coil which on de-energisation moves the three wiper arms on to position 4.

Contacts RL.BC close and operate as before. Contracts RL.R-1 ensure that all the projector relays are de-energised should there be a fault condition.

The method of operation is similar when it is required to change from the left to the right projector. This time RL.Z is energised via contacts RL.L-1, and it self-holds via contacts RL.K-1 and RL.Z-1. Also RL.W energises instead of RL.V. Therefore RL.T and RL.U are energised via contacts RL.W-4 and RL.X-4. They are self-held via contacts RL.X-4, RL.U-2 and RL.V-3.

When it is required to stop the projector from a film pulse, RL.X is momentarily energised. Contacts RL.X-3 break the self-hold circuit of any energised projector relays. Also RL T and RL.U are de-energised via contacts RL.X-4. If SELF PULSE is required, then RL.C is energised and self-holds via contacts RL.C-1, uniselector bank 'B' and any one of a continuous line of pegs in the SELF PULSE row. Contacts RL.C-2 close, and the action is then as described for MANUAL SELF-PULSE.

The Cinemation equipment supplied to a theater depends upon the requirements of each individual

theater. These various equipments are classified as Mark 1, Mark 2, Mark 3, Mark 4, Mark 5, and so on. Let us briefly list just what these various equipments consist of and what they will do.

MARK 1-- This is covered elsewhere in this book.

MARK 2-- This is covered elsewhere in the book.

MARK 3-- Main control unit housed in metal cabinet. Switch, indicator lamp and fuse panel. A Matrix Board providing thirty horizontal ways and forty-eight vertical ways.

Type PS-24 ex 24 volt Power Supply Unit to operate from A.C. mains supply 115-245 volts, 40-60 cycles Single Phase.

One Type 1207 Sound Change-Over Relay, Type 1205 Film Disc Relay Unit.

Two Type 1258/F 35mm Stop Rollers with brackets.

Two Type LDR/03 Light Detector Cells, and fifty Green Diode Pins.

The equipment listed above will automatically control the following functions:

1.---The starting, stopping and change-over of picture and sound between two standard 35 mm projectors and two carbon arcs or Xenon lamps. Optical sound only.

2.---The operation of No.1 projector lens turret if fitted to projectors, Cinemascope and wide screen.

3.---The operation of No.2 projection lens turret if fitted to projectors.

4.---The operation of masking to Cinemascope limit.

5.---The operation of masking to Wide Screen limit.

6.---The operation of masking to Television limit.

7.---The operation of masking to 70 mm limit.

8.---The operation of the tabs to open limit.

9.---The operation of the abs to close limit.

10.---The operation of the footlights to the up limit via motorized dimmer or electronsonic unit.

11.---The operation of the footlights to the down limit.

12.---The operation of spots to the up limit.

13.---The operation of spots to the down limit.

14.- -The operation of the house lights to the up limit.

15.---The operation of the house lights to the down limit

16.---The starting and stopping of the Non-Sync deck.

17.---The Switching of the sound from film to disc and vice versa.

18.---The facility for fading in and out of the Non-Sync sound if Type SF/2 Sound Fade Unit is installed.

19.---The sounding of a buzzer in the Manager's office.

20.---The provision of auto self pulse to continue sequences when projectors are stationary.

MARK 4 CINEMATION

The Mark 4 will automatically control the following functions:

1.---The starting and stopping and change-over of picture and sound between two 35 mm projectors and two carbon arcs or Xenon Lamps.

2.---The operation of the masking to 70mm limit.

3.---The operation of masking to Cinemascope limit.

4.---The operation of masking to Wide Screen limit.

5.---The operation of the tabs to open limit.

6.---The operation of tabs to the close limit.

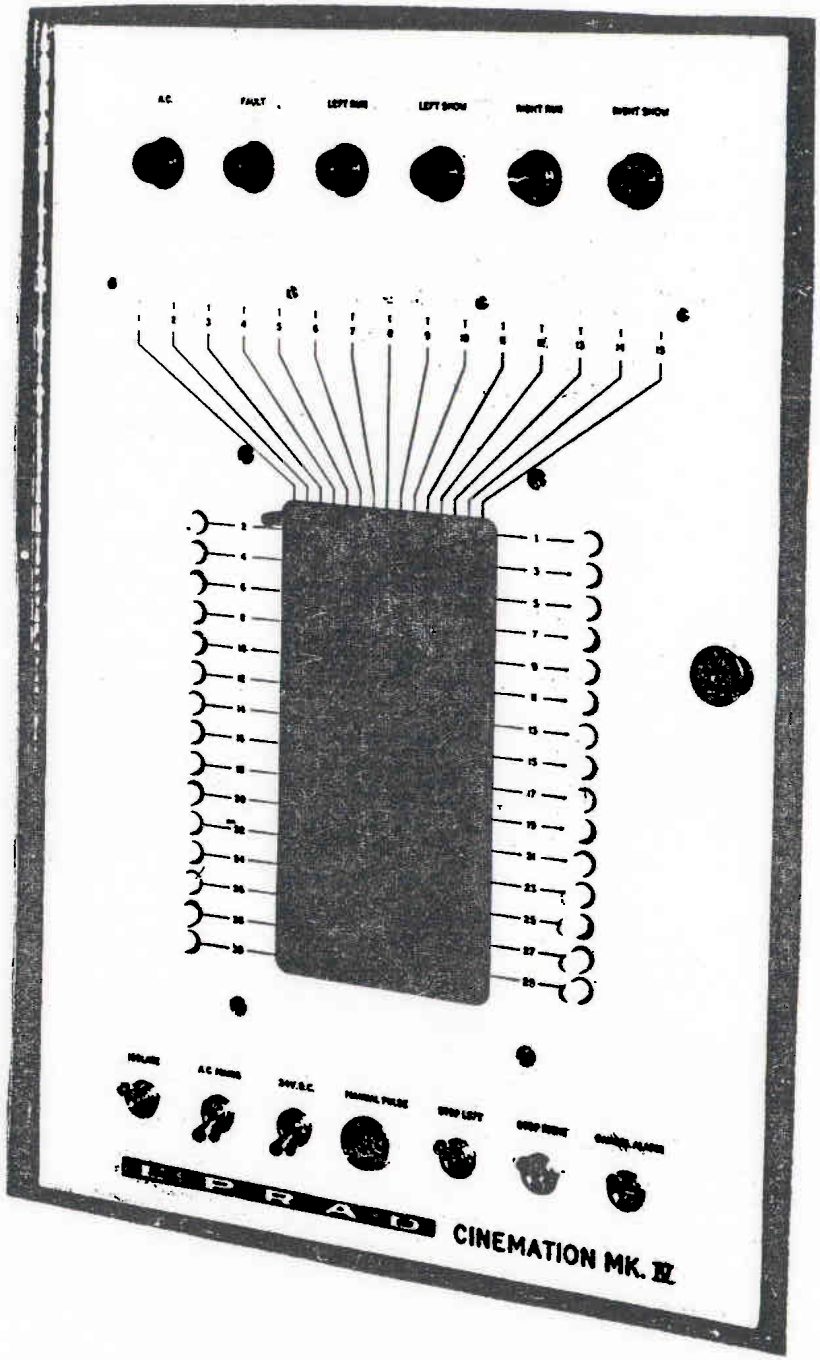
7.---The operation of the footlights to the up limit via motorized dimmer electronsonic unit.

8.---The operation of footlights to the down limit.

9.---The operation of the houselights to the up limit.

10.--The operation of the houselights to the down limit.

11.--The provision of auto self pulse to continue sequences when projectors are stationary.



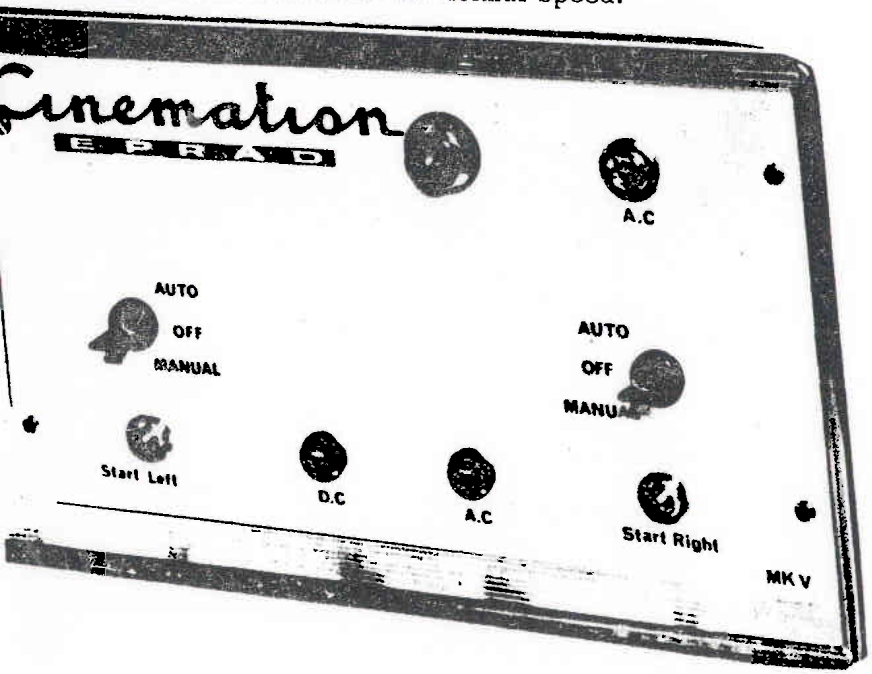
MARK 5 CINEMATION

The Mark 5 will automatically control the following functions:

1.---Starting and stopping and changing over both the picture and sound between two standard 35mm projectors.

2.---Switching on and off the illuminant (carbon arc or Xenon lamp).

3.---Automatically stopping the projector and extinguishing the arc lamp in the event of a film break or should the speed of the projector motor reduce to less than half its normal speed.



NATIONAL THEATER SUPPLY'S PROJECTION ELECTRONIC CONTROL

Here is what the system does –

1--- It ignites the Xenon or carbon lamp.

2--- It starts the soundhead motor.

3--- It raises the fire shutter.

4--- It dims out the auditorium lights.

5--- It opens the front curtain.

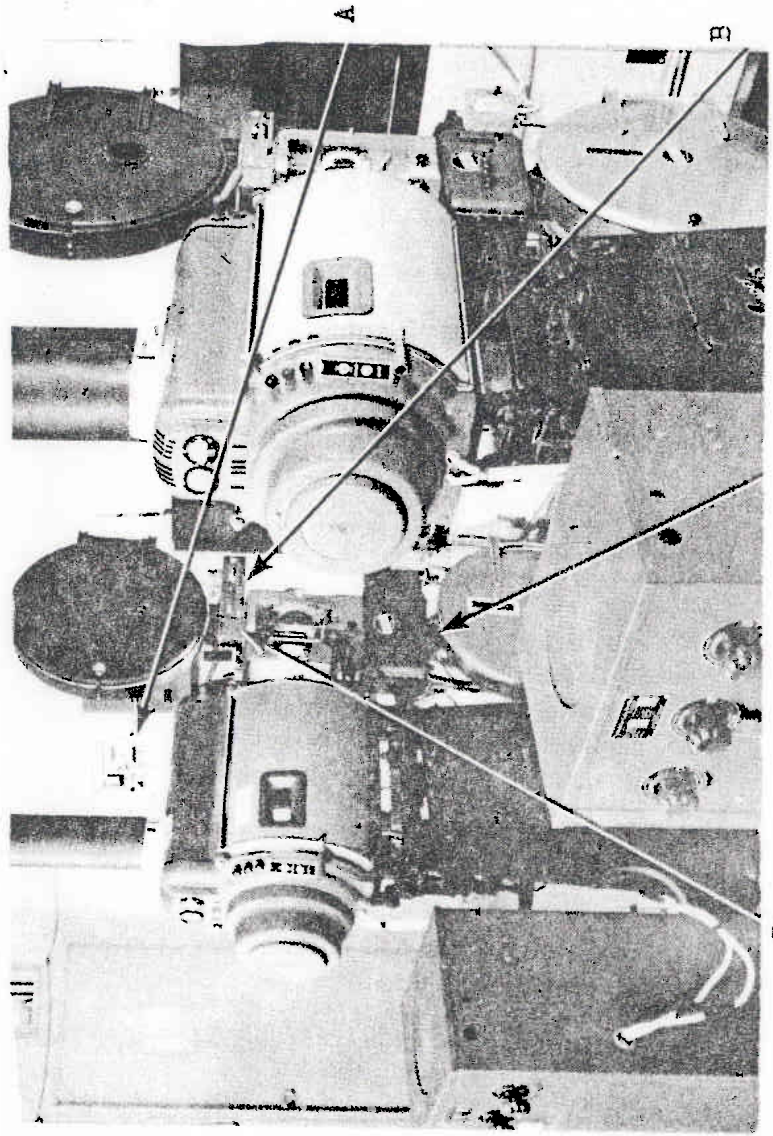
6--- It changes screen masking to proper ratio.

7--- It changes over to Projector #2 to repeat the cycle of Xenon or carbon arc auto strike, starting the soundhead motor, lifting the dowser and changing the screen masking, if required, as it shuts off Projector #1.

8--- It raises the auditorium lights and closes the front curtain at the completion of the show.

The start button can be remotely located anywhere in the theater.

Indicator lights for each automation and, or,



manual phase of operation show on Power Projector Module and Programmer Control Cabinet. Projectionist can tell system's position at a glance.

Uses dielectric capacitance for changeovers.

Every operational phase has manual override in case of emergency.

Unlimited selection of any type or combination of show, such as Cinemascope, Wide-screen or normal.

The system requires only one sensing tape for each reel, rather than many different tapes for each step in the operational sequence such as changeover, curtain control, lights, etc.

Can program up to two shows.

A.. as shown in illustration

Programmer Control Cabinet

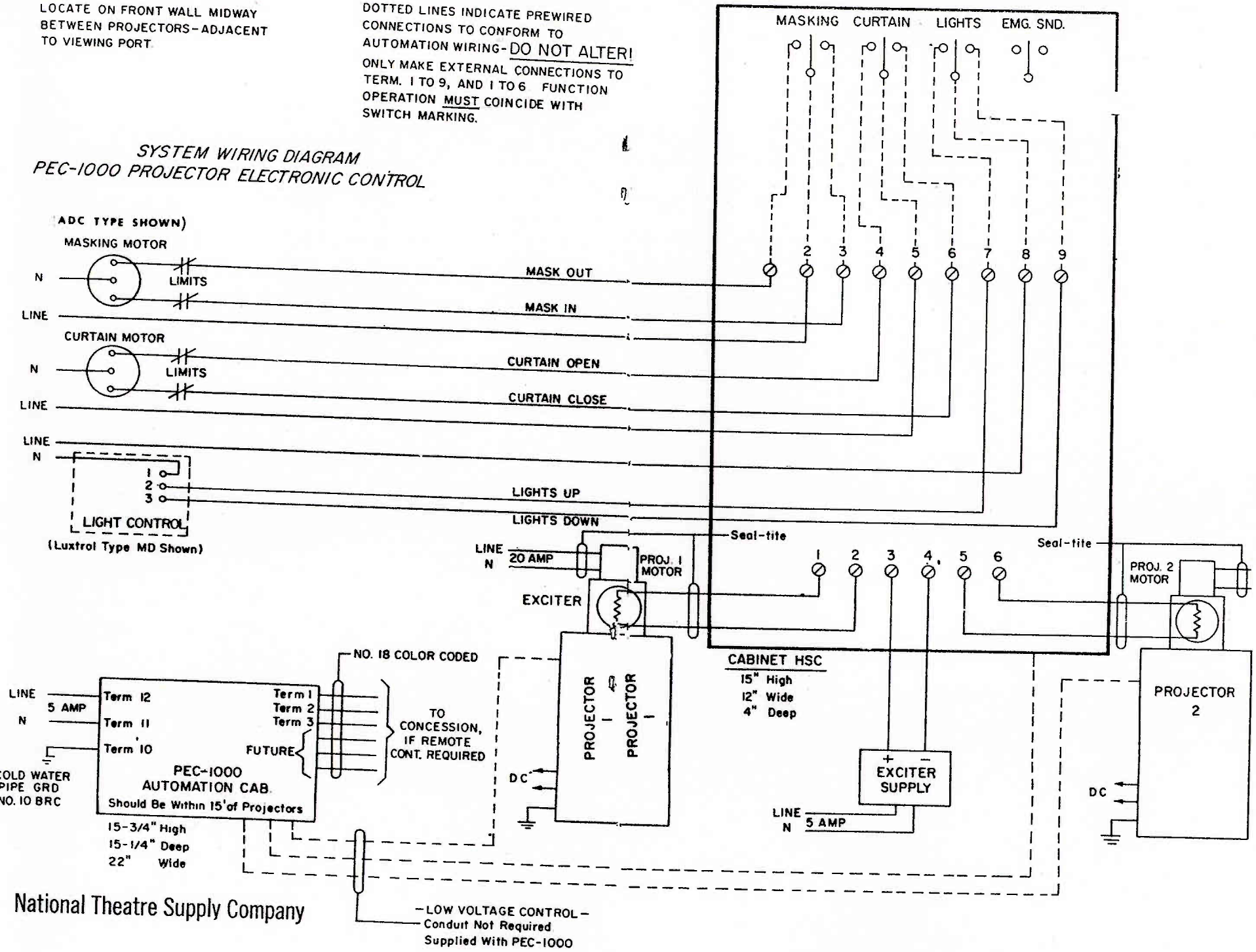
The electronic heart of the PEC 1000 system. Starts, changes over and stops the projector. Controls house lights, front curtain and masking screen. Activates with simple startbutton that can be remotely located anywhere in theatre. 6 pre-set position switches can program up to two complete shows. Available with optional intermission timer. Indicator lights provide immediate identification of operational stage. In case of emergency, system can go into manual operation. Designed with solid state electronics for greater reliability.

LOCATE ON FRONT WALL MIDWAY BETWEEN PROJECTORS - ADJACENT TO VIEWING PORT.

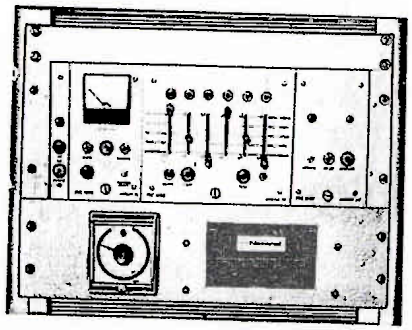
DOTTED LINES INDICATE PREWIRED CONNECTIONS TO CONFORM TO AUTOMATION WIRING - DO NOT ALTER!

ONLY MAKE EXTERNAL CONNECTIONS TO TERM. 1 TO 9, AND 1 TO 6 FUNCTION OPERATION MUST COINCIDE WITH SWITCH MARKING.

SYSTEM WIRING DIAGRAM
PEC-1000 PROJECTOR ELECTRONIC CONTROL



National Theatre Supply Company



B..

Projector Power Module

Operates projector and makes changeovers according to electronic commands from Programmer Control Cabinet. All factory-wired, plug-in connections are simple to install, maintain and replace. Plug-in connections are:

- to Xenon lamp (carbon arc strike can also be used)
- to soundhead motor switch
- to lower roller motor shutoff and "fail safe" device
- to changeover

C..

"Fail Safe" Device

Shuts off projector and lamphouse motor, automatically, after film passes through. Works at end of reel, or in event of film break, lost splice or other malfunction.

THEATRE AUTOMATION

D..

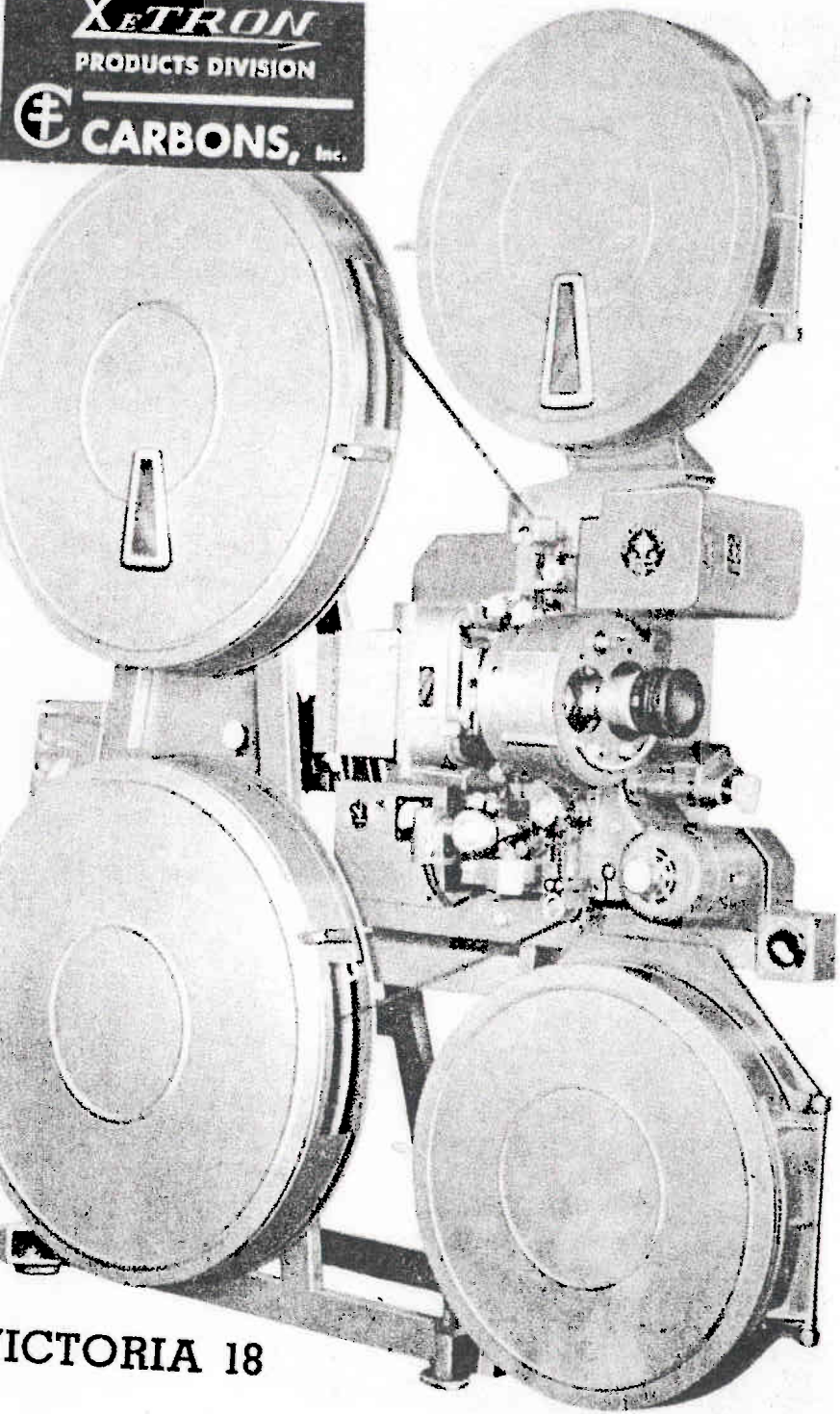
Film Sensing Module

Mounted between the upper magazine and the mechanism of each projector. Triggers action of the system by reliable dielectric capacitance. Sends electric signal to Programmer Control Cabinet to make changeover. Raises lights, etc. Only one strip of sensing tape (½" x ¼") for each reel of film is required.

SCH Module Cabinet

Provides sound changeover with pictures; connections for curtain motor and motorized dimmer.

XETRON
PRODUCTS DIVISION
CARBONS, Inc.



ICTORIA 18

CINEMECCANICA V–18 AUTOMATIC PROJECTOR

Cinemeccanica V–18 system which was conceived for use as a single projector device and has some unusual features. Basically, it is equipped with oversized magazines, 13,000 foot capacity, and the 35 mm. version adapts very easily to the automatic-remote control type of operation.

The light source is XENON 1600 or 2500 watt capacity depending upon the size of the screen which is to be used. Usually, this is 35 to 40 feet wide.

It has a double lens turret which is motorized for lens change and focus.

In connection with the available auxiliary equipment, it can provide the following automatic or remote controlled operations:

1---Ignition of Xenon lamp.

2---Starting of projector.

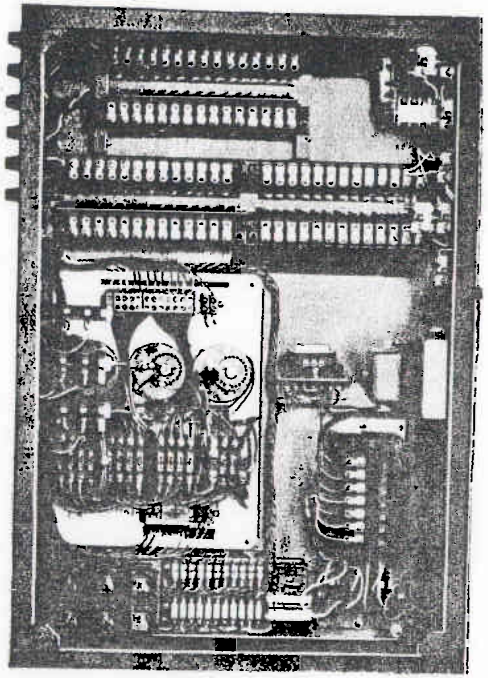
3---Operation of projector and lamphouse dousers.

4---Changeover of picture and sound.

5---Change of aperture plate and lens.

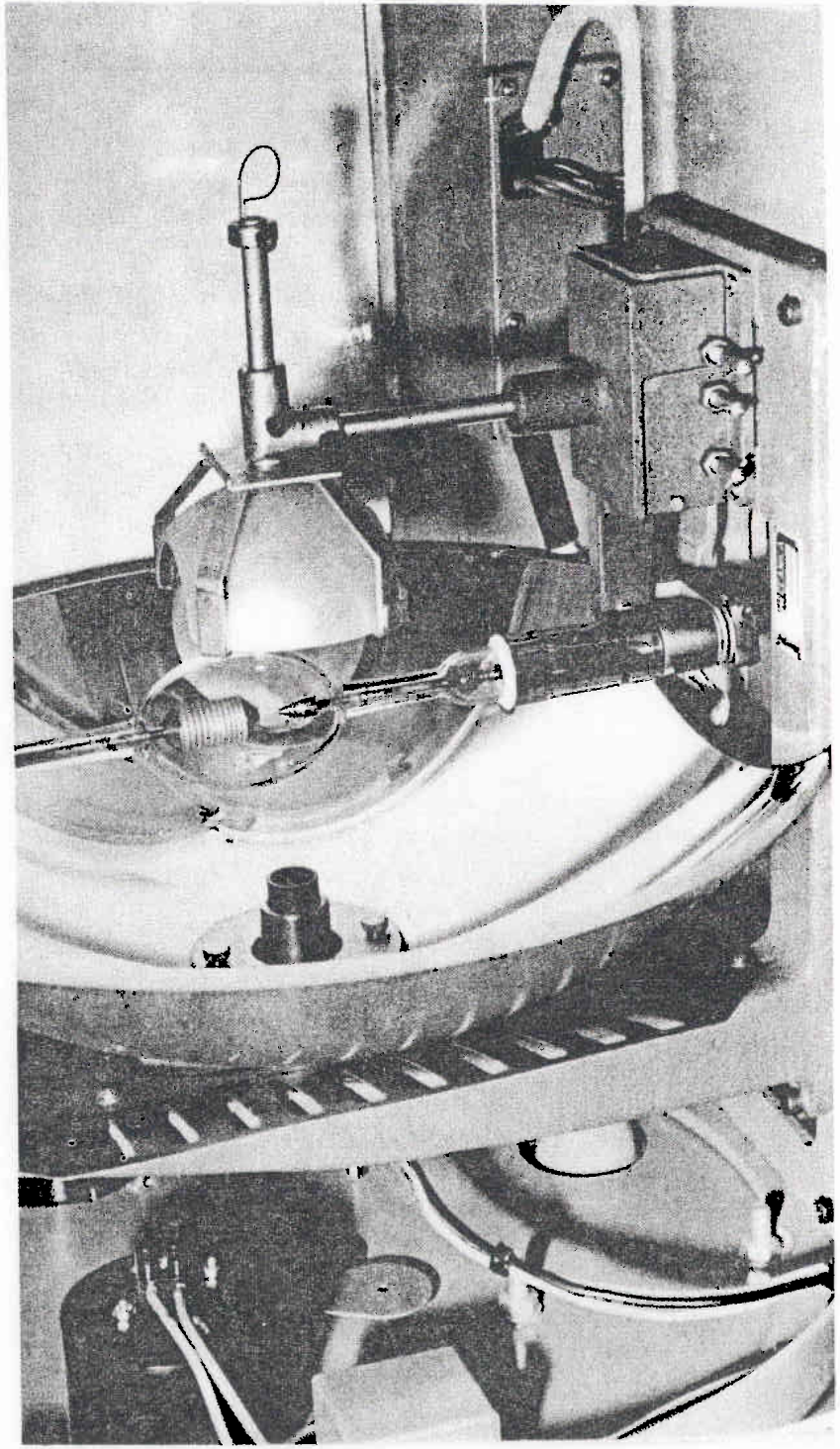
6---Remote focus, framing and volume control.

Normally the entire show is on one reel. It is never necessary for this reel to be lifted or carried, as the show is made up, rewound and taken apart on the machine. A seperate re-wind motor is used having a reversible clutch.



For normal operation, this same motor provides the take-up power. If desired regular 2,000 foot magazines can be added to the system in order to run trailers and short subjects while re-winding the main attraction on the same machine.

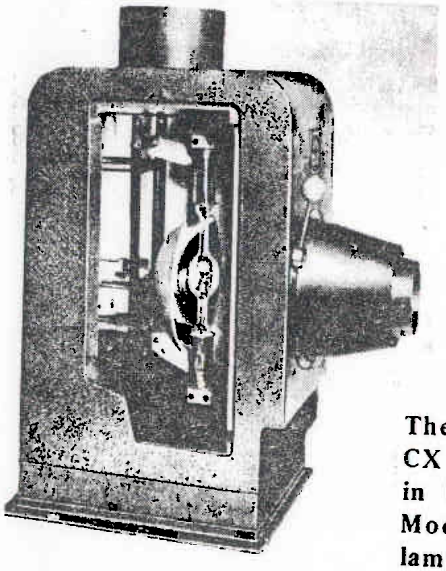
The motorized lens turret is mechanically linked to the aperture plate which is changed at the same



time. A tin foil tab cemented to the film provides the impulse for this change. The lens focus device is arranged in such a manner that only the lens being used will be focused from the remote point.

"Fail-safe" contacts are provided to turn off the equipment in case of a film break, loss of power or decrease in film speed. Operation of this circuit turns off the entire system and if desired, will turn on the house lights.

The duplication of controls can be provided at the remote point. To permit starting and stopping in this unattended manner, special devices automatically take up any slack in the film which could result from the heavy reel coasting to a stop.



CINEMECCANICA
CX-900
The newest addition to the CX Series lamphouses. Used in 16 & 35 mm installations, Moderate power in a compact lamphouse.

THE XENON BULB AND ITS APPLICATION FOR MOTION PICTURE PROJECTION

THEORY AND CONSTRUCTION OF THE XENON BULB

The name Xenon is derived from a Greek word meaning "little stranger" as the element is present in the atmosphere in such small concentrations. It is a rare gas origionally discovered on the sun by spectrographic methods and is extracted from our atmosphere. The Xenon bulb supplies us with a spectral output which is similar to natural daylight in character. It is very difficult to try to measure the actual color temperature as Xenon is not a black body and we can only say that the color temperature is similar to that of a black body of 5800 to 6000 degrees Kelvin. It has an excellent stability and it is the only known light source used for projection whereby the light output can be varied over a wide range without effecting the color temperature.

Ozone is created by the operation of most Xenon bulbs. This is accomplished by the action of the ultraviolet rays passing through the quartz envelope and changing the 02 factor of the air to 03. Ozone, in limited quantities, is actually used for air purification. However, in very dense amounts it can be injurious and can cause headache and a dryness of the throat. As it is a very active gas, it recombines

with the air immediately and has a very short life. As a Xenon bulb ages to a life of about 100 hours a very fine deposit, which is primarily tungsten, adheres to the inside of the quartz envelope creating a filter effect. This filtering effect actually limits the amount of ultraviolet passing through the quartz envelope and therefore less and less ozone is created as the bulb ages. At a point of approximately 100-200 hours this filter action is so effective there is very little ozone created. In recent years several companies have developed what is now referred to as the "Ozone Free" type of bulb. As ozone is created at approximately 2100 angstroms the engineers decided that if they could effectively put something in the quartz to eliminate these rays in

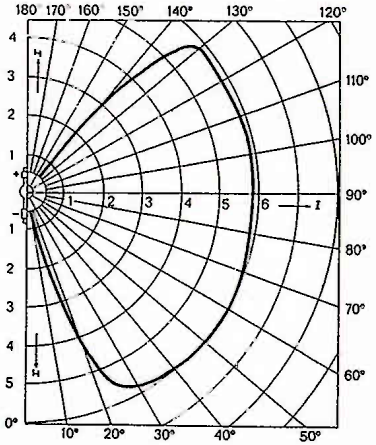


FIGURE A

Relative Light Intensity Distribution of XBO-1600 watt

the spectrum from reaching the outside air there would in effect be no ozone created. This is basically what has been done in the design of the ozone free type bulb. Some companies have taken the approach of actually mixing into the quartz a chemical which will act as a filter. Other companies have taken the approach of putting a coating on the inside of a quartz envelope. Of course in no way does this effect the visible light produced by the bulb.

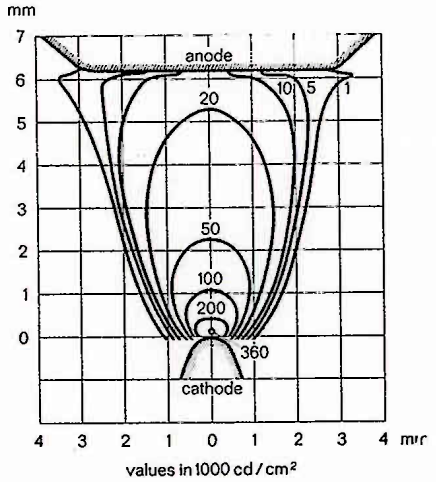
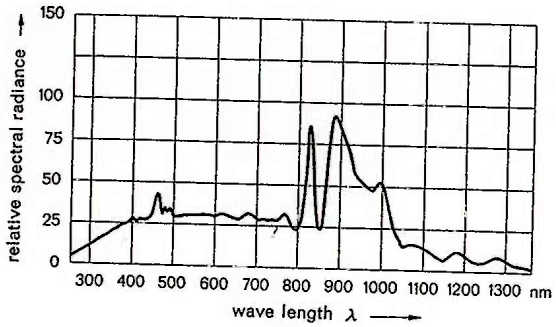


FIGURE B

Luminance Distribution in Arc of XBO-2500 watt at rated current

The construction of the Xenon bulb consists basically of two electrodes. A large anode at the top of the bulb and a smaller pointed cathode at the bottom

enclosed in an ellipsoidal shaped envelope filled with Xenon gas. This is a gaseous discharge type of light source with a main source of illumination being the plasma ball between the two electrodes and close to the cathode. The actual luminous distribution of the light between the two electrodes is shown in figure B. The quartz envelope is necessary to withstand the extreme temperature and the most difficult part of the manufacturing process is in the quartz to metal seal at each end. Some manufacturers prefer the use of a graded type seal and others desire to use a foil type seal. All of the lamps used in the motion picture industry come equipped with prefocus type bases so that the removal and installation of replacement bulbs is a very simple matter.



1 nm (nanometre) = 10 Å = 10^{-9} m

FIGURE C

Distribution of Relative Spectral Radiance of XBO-1600 watt

Due to a special property of the Xenon arc, that is, to absorb only a very small portion of its own radiation, it is possible to substantially increase overall illumination by super-imposing an inverted image of the arc, by use of an auxiliary reflector, back through the Xenon envelope to the main mirror.

$$\text{Ripple} = \frac{I_{max} - I_{min}}{I_{max}} \times 100\%$$

FIGURE D

This is peak to peak current ripple

Without the auxiliary reflector the forward radiation of the bulb is lost as it is not being focused on the aperture. By the addition of the auxiliary reflector it is possible to capture this radiation, direct it back to the main reflector, and increase overall luminous output by approximately 20%. It also provides a very important function of providing better distribution of the light over the screen, especially on the sides and in the corners. In order to obtain a very high brightness and luminous efficiency with a Xenon lamp it is filled with Xenon gas at a pressure of about eight atmospheres. When the bulb reaches normal operating temperature the pressure increases to approximately 20-25 atmospheres. This increase in pressure is very important to the stability of the arc as well as improving its spectral output. The design of the bulb is such that maximum safety of operation is obtained. Perhaps also of

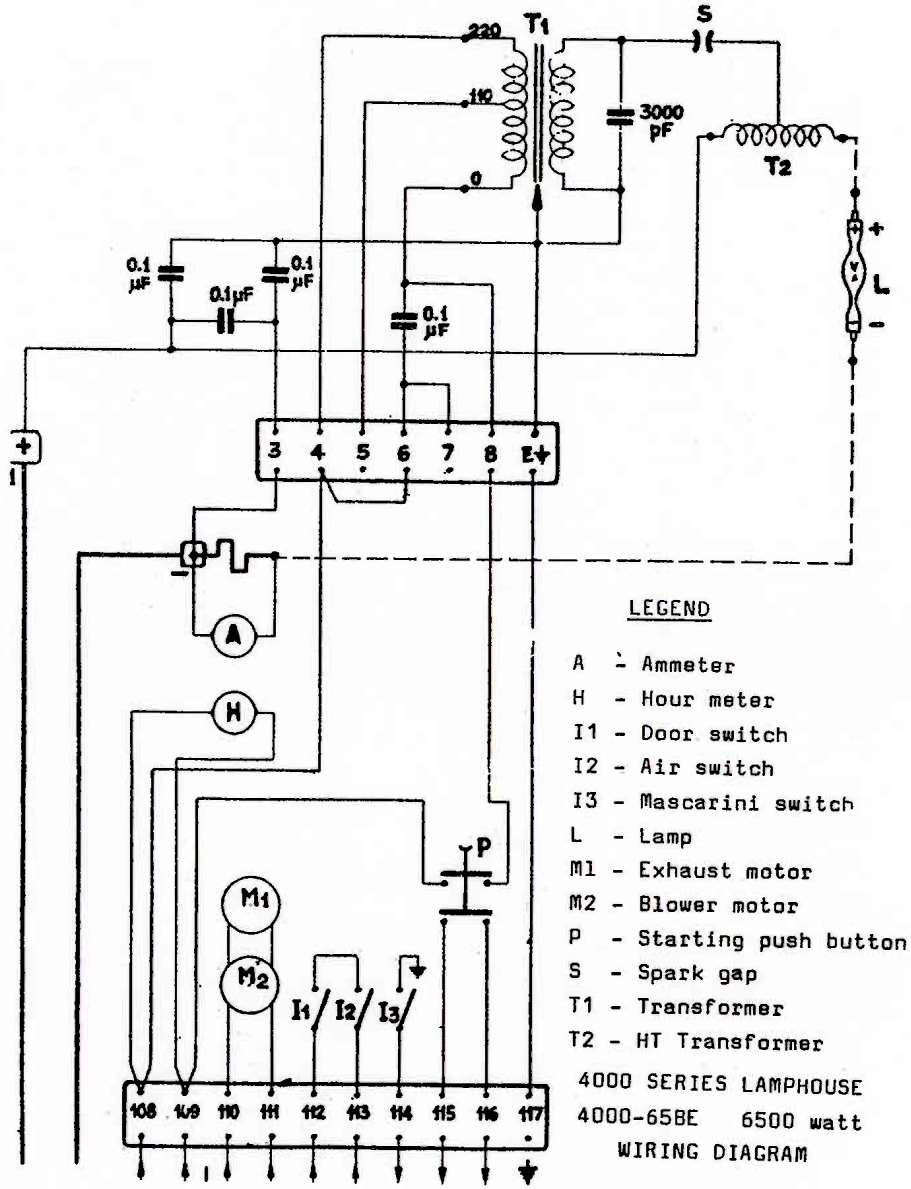
interest to the reader are the charts A and C showing the relative light intensity distribution, including the shadow effect of the electrodes or the polar distribution, of an XBO 1600 watt bulb and the distribution of the relative spectral radiance of an XBO 1600 watt bulb respectively.

There have been many other types of light sources tried for projection purposes but none seem to be as practical or as economical as Xenon. For instance, Xenon Mercury which is used in applications where a great amount of energy is desired in the ultra-violet region, cannot reproduce the red section of the spectrum and when used for projection purposes the reds appear to be predominantly brown on the screen. The blue output is unusually high which also reduces its value as a projection light source.

Equipment Required For Use With The Xenon Bulb

There are basically two major pieces of equipment which must be associated with the use of a Xenon bulb. They are the lamphouse in which the bulb is mounted and the power supply which delivers the necessary current.

The lamphouse is usually constructed of sheet metal or a casting which does lend itself to greater ridigidity in design. Usually included in a lamphouse are the mountings for the Xenon bulb, the starter or ignition device which supplies a very high voltage pulse across the electrodes, a reflector, preferably of the cold heat transmitting type, and an auxiliary reflector which is usually a front



LEGEND

A - Ammeter
H - Hour meter
I1 - Door switch
I2 - Air switch
I3 - Mascarini switch
L - Lamp
M1 - Exhaust motor
M2 - Blower motor
P - Starting push button
S - Spark gap
T1 - Transformer
T2 - HT Transformer

4000 SERIES LAMPHOUSE
4000-65BE 6500 watt
WIRING DIAGRAM

surface silver coated. Also included in the higher powered lamphouses are blowers and exhausters for increased ventilation from the lamphouse. In some cases special optics are desired such as a beam spreader which is used for 70 mm presentation to change the configuration of the light delivered to the aperture as more of a rectangular shape is required. This is usually removed for a 35 mm presentation. Please note the diagram which shows a typical Xenon starter and lamphouse wiring for Model #4000-65BE. As mentioned above the basic function of the starter is to provide a very high pulse of approximately 30-50,000 volts of high frequency energy across the electrodes. This ionizes the gas in the bulb, reduces the resistance across the gap and enables the initial current flow. As you will note, a primary voltage of either 110-220 volts is fed into the T1 transformer which thus has a secondary output of approximately 4000-5000 volts. This voltage is subsequently fed into the T2 transformer which has an output of 30-50,000 volts depending upon its size. This transformer is very unusual as the entire bulb current must flow thru the secondary as it is in series with the power supply bulb. This means considerable copper cross section must be used in the 95 to 170 ampere applications. The push button starter device simply controls and completes the AC imput to the T1 transformer.

The power supply used with the Xenon bulb must be capable of supplying an open circuit voltage of at least 80 volts for the proper ignition of the bulb. Immediately upon ignition this voltage must drop

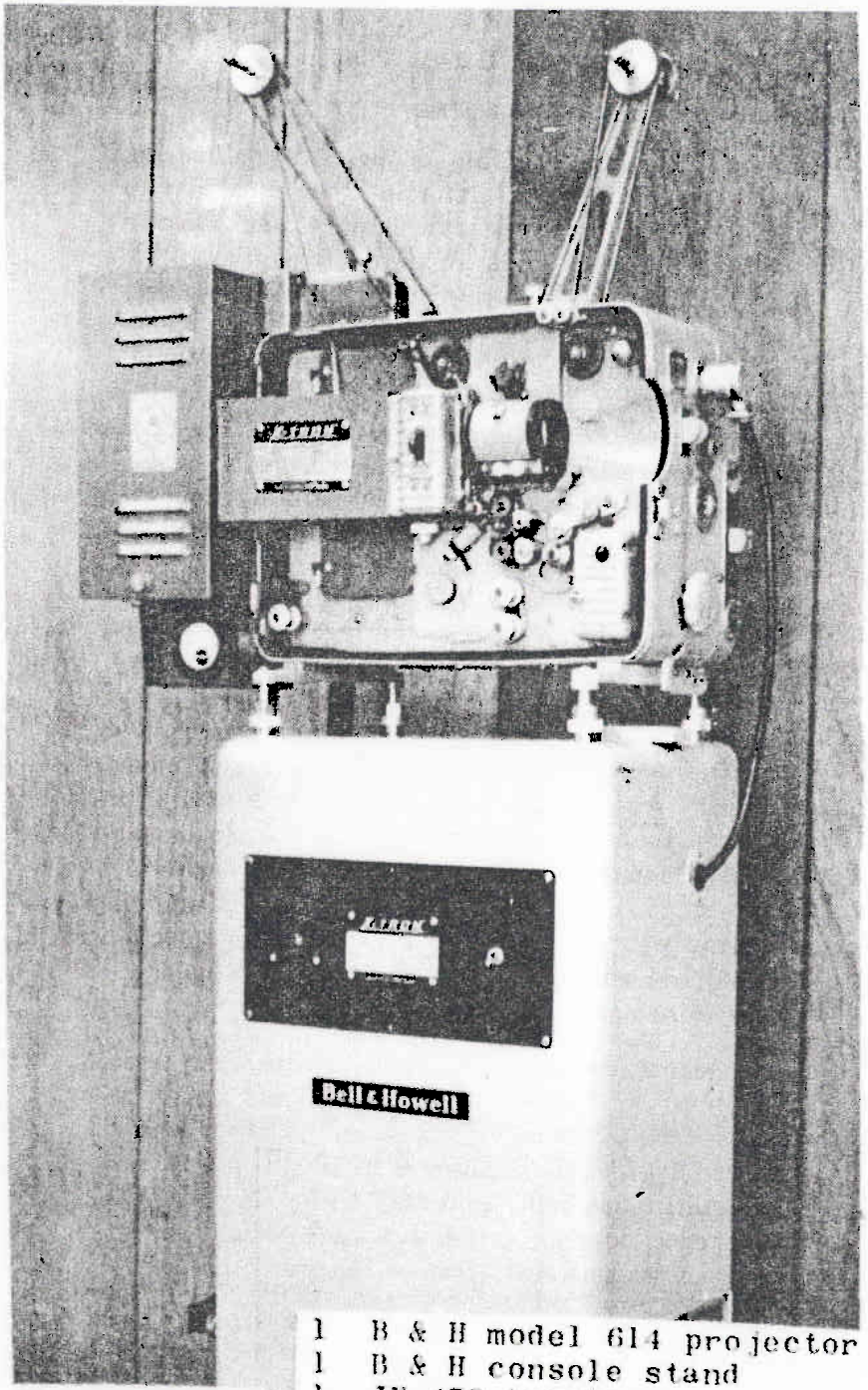
to an operating level of 20-40 volts depending upon the size of the Xenon bulb. Although some of the following requirements have been mentioned in the above text, we would like to completely outline the sequence of events that must take place to complete ignition of a Xenon bulb. First, the gas must be ionized by the high voltage across the electrodes. Second, power supply no load voltage must be approximately 80 volts to start the initial flow of current. Third, the power required for this initial current flow is usually stored in the output capacitor. Fourth is the need, either by a high reactance circuit or other means, to instantaneously reduce the output voltage to the nominal operating value of 20-40 volts. The power supply designer must control the important factors of current ripple (a formula for which is shown in figure D) and current surge of initial current flow. These factors have a direct effect on the life expectancy of any short arc Xenon bulb.

Also of interest to some people would be the fact that motor generator sets can readily be used as an ideal direct current source for the Xenon bulb. However, there are some requirements which must be met. First, it is recommended that the open circuit voltage of a motor generator set be at least 45-50 volts. To this we would have to add a special auxiliary unit (Xetron AG-X3L) which enables us to increase this open circuit voltage to a level necessary for igniting the bulb. In those motor generator sets which have an open circuit voltage of 80 plus volts it is usually not necessary to have to add this special additional auxiliary equipment.

It will be necessary to add some additional capacitance to facilitate the ignition of a bulb and to supply additional filtering. Third, it is usually necessary to obtain a ballast resistor for this particular generator which will enable it to drop the voltage low enough to reach the proper operating voltage of the Xenon bulb.

Installation and Operation

The original installation of any Xenon equipment is very important and enough time should be allowed to insure optimum results. Due to the fact that we are magnifying a very small point source of light at the tip of the cathode of the bulb, which in most cases will vary between .5 and 2.5mm in overall diameter, the Xenon light source is more critical in original setup than most other light sources. However, once this installation is properly completed, the Xenon light source needs very little attention for repeatable operation. Please keep in mind that there are no moving parts other than the hour meter which can wear out or become defective. Also, due to the fact that this is a point source of light the overall resolution of the picture presentation is very good, as theoretically the design of all optical systems favor the point source. Once a Xenon bulb is installed in its lamphouse enclosure it is possible to operate for many hours without the need for any adjustment or maintenance other than to turn it on and off. As with the carbon arc type of lamphouse, it is absolutely necessary that a proper flow of air be maintained around the Xenon bulb. This is necessary due to the heat that is generated



XeTRON

1 B & H model 614 projector
1 B & H console stand
1 JX-450 lamphouse
1 XS-450 power supply
1 XOF-600 watt bulb

by its operation. The flow of air also enables the use of an auxiliary reflector in close proximity to the Xenon bulb for the reimaging of the arc and increased light output. It is also very important that this air flow be properly designed as it is very possible to overcool a Xenon bulb which will cause instability of the arc, by a decrease of internal pressure, and a more rapid blackening of the inside of the quartz envelope. This blackening, which is normal over the long life of a Xenon bulb, is actually caused by the tungsten evaporating from the electrodes and being deposited on the inside of the quartz envelope, predominantly near the top. The proper cooling of the Xenon lamphouses can be accomplished by the use of the regular booth ventilation system. In some of the higher powered lamphouses this type of ventilation is assisted by a special blower duct system built into the lamphouse forcing air up from the bottom of the bulb. This can be further assisted in the highest power lamphouses by an exhauster system in the top of the lamphouse which then moves the air into the theatre ventilation system. This flow of air around the bulb and reflectors will deposit a certain amount of dust on these components and will require a routine maintenance as outlined in the instructions.

It is necessary that proper safety be observed when handling any Xenon bulbs. They should never be handled while hot and a lamphouse should never be opened until approximately 8 to 10 minutes after a Xenon bulb has been turned off. Before opening the lamphouse door the protective mask should be put on and worn until such time as the protective heavy

plastic jacket is installed on the bulb. We like to compare the handling of this Xenon bulb with that of the T.V. picture tube as both are somewhat similar in their handling characteristics and must be treated with reasonable caution. Many thousands of television picture tubes are handled every day by repair men throughout the country and although the T.V. tube is under vacuum and will implode, while the Xenon bulb is under pressure and will explode, a potential similar hazard does exist. Under no circumstances should the quartz part of the Xenon bulb be handled, as any finger marks left on the quartz envelope will be etched into the glass once the bulb is turned on. This means that there is a possibility of weakening of the quartz structure in this particular area.

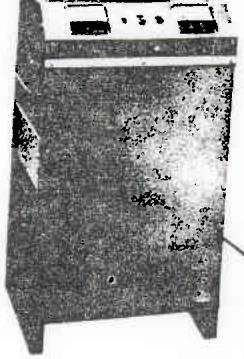
Most of the Xenon bulbs available on the market today, up to the 2500 watt size, can be installed at a projection angle as great as plus or minus 30 degrees. The maximum recommended angle of projection for the four thousand watt is plus or minus 15 degrees, and for the 6500 watt bulb this figure is plus or minus 10 degrees. The main reason for this requirement is due to the fact that there will be an accelerated blackening on one side of the quartz envelope in one concentrated area of the bulb directly above the arc. The reason for this is that a heat pocket is formed which results in uneven cooling of the quartz envelope.

Application

Based upon the use of moderate gain screens it has been our experience that the 450 watt lamphouses

can be used effectively on ten to twelve foot pictures, the 900 watt equipment on pictures up to 32-33 feet, the 2500 watt up to 42-43 feet, the 4KW up to 50 feet and the 6500 watt to 50-60 feet. Regarding the cost of operation of the Xenon arc Vs. Carbon arc we have found that the Xenon is usually a more economical operation up to and including the 1600 watt bulb. The 2500 watt Xenon bulb is approximately equal to the carbon arc and of course we are referring to cost per lumen output. We find that the 4000 and 6500 watt are definitely more expensive than the carbon arc and usually the decision to purchase such equipment must be motivated by the desire toward automation or to improve the repeatable quality of light that is possible with Xenon. The original cost of the high powered (anything over 2500 watts) Xenon or Carbon arc equipment must be considered as practically equal.

The warranty of most Xenon bulbs is 1500 hours for the 450, 900, and 1600 watt sizes. The warranty for the 2500 watt, 4000 watt and 6500 watt is 1000 hours based upon the bulb being used within the specifications as published by the bulb manufacturer. However, the average life of the lower wattage bulbs can be expected to exceed their warranty by 20 to 40%. It is recommended by most manufacturers of Xenon bulbs that the maximum current pulsation or current ripple must not exceed a value of 10% peak to peak. This can be achieved with most Xenon power supplies available on the market today. The degree of blackening in a Xenon bulb is influenced greatly by the magnitude of the current pulsation and by the number of starts on a bulb as well



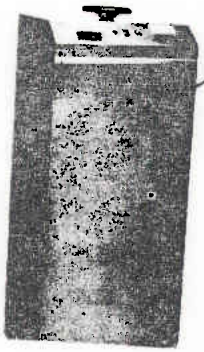
XeTRON

IREM N1 SERIES SINGLE PHASE 115/230V

MODEL	XENON LAMP CAPACITY	D.C. AMPERE RANGE	D.C. VOLTAGE RANGE	NO-LOAD Volts minimum	PEAK-TO-PEAK CURRENT RIPPLE	A.C. INPUT*	COOLING	NET WEIGHT Kg	NET WEIGHT lbs
N1-X30DM	450/600W	17-30	17-25	80	5%	1-phase	natural	63	139
N1-X50DM	900/1000W	30-50	18-28	80	6%	1-phase	natural	87	192
N1-X75DM	1600W	45-75	22-32	80	7%	1-phase	natural	109	241

* Other input voltages on special order. Some 50/60 Hz supplies in stock.

These are Silicon power supplies, mounted in a heavy duty cabinet, expressly designed to insure a good natural convection type of ventilation. Continuous output regulation by means of a small hand wheel which controls the transformer adjustable magnetic shunt. Our use of this type of regulation is original and is such as to give an excellent and noiseless operation. The power supplies are equipped with a specially designed transformer core section which makes the units perfectly balanced on the three phases and gives a low output current pulsation, thus insuring a long life of the lamp. The power supplies are equipped with a remote control switch, through which the units can be connected and disconnected from a remote point. Protection is insured by a thermostat which disconnects the power supply in case of overload for an extended time. A 220 V outlet is provided for input to the igniting device and to the lamp hour-meter instrument when required.



IREM N3 SERIES THREE PHASE 208/230V

MODEL	XENON LAMP CAPACITY	D.C. AMPERE RANGE	D.C. VOLTAGE RANGE	NO-LOAD Volts minimum	PEAK-TO-PEAK CURRENT RIPPLE	A.C. INPUT*	COOLING	NET WEIGHT Kg	NET WEIGHT lbs
N3-X50DM	900/1000W	30-55	18-28	80	7%	3-phase	natural	70	155
N3-X75DM	1600W	45-75	22-32	80	7%	3-phase	natural	85	188
N3-X75/95DM	1600W 2500W	45-95	22-37	95	7%	3-phase	natural	129	285
N3-X95/140DM	2500 4000	75-140	28-140	110	7%	3-phase	natural	150	340
N3-X160DM	6500W	85-160	35-45	120	7%	3-phase	natural	245	540
N3-X200DM	10,000W	100-200	38-50	120	7%	3-phase	natural	270	595

as the cooling which was mentioned earlier. When one reads of the bulb being warranted for 1500 hours of operation it is based on the prerequisite that the average operating time per start should be at least 20 minutes. It is also very important that the operation of the Xenon bulb should not be below the useful range of regulation as stated by the manufacturer or arc stability and shortening of lamp life will be effected. The manufacturers further advise us that it is not of any advantage to start a Xenon bulb at its minimum rating for every ignition and then increase it to the operating current.

In summary we would like to say that there is no question that the Xenon bulb is definitely a revolutionary new type of light source for the motion picture theatre. In our opinion it cannot help but become more popular in the future. The ease of operation and simplicity of the lamphouse design, the steady, repeatable light source all help to make this most attractive to many exhibitors who are building new theatres and renovating older theatres.

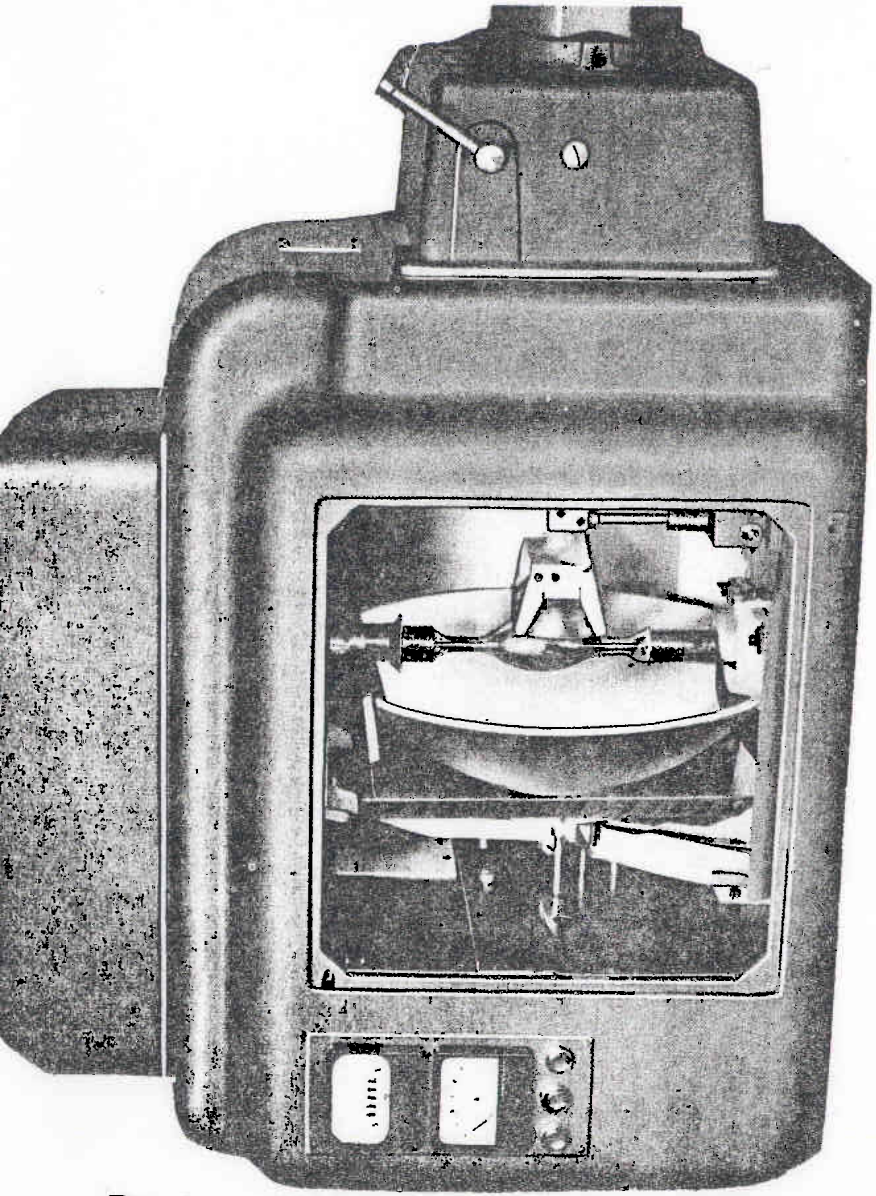


Fig. A 4,000 Watt High Pressure Xenon Lamp. Model XBO-4000W. Xenon Arc Lamps operate much in the same manner as Carbon Arc sources. A.D.C. arc is established between two diametrically opposed tungsten electrodes mounted in a Quartz glass envelope filled with gas Xenon.

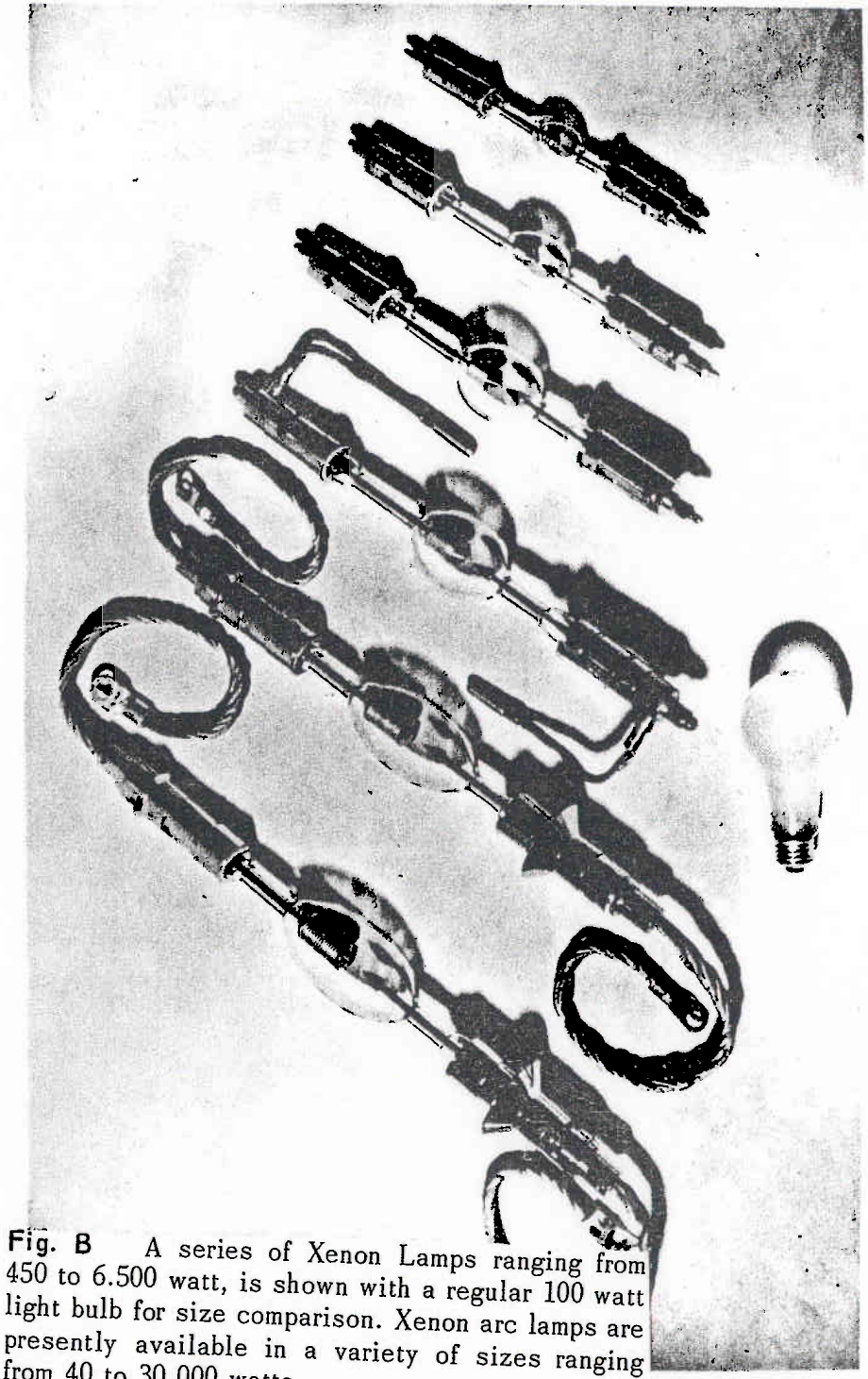


Fig. B A series of Xenon Lamps ranging from 450 to 6.500 watt, is shown with a regular 100 watt light bulb for size comparison. Xenon arc lamps are presently available in a variety of sizes ranging from 40 to 30,000 watts.

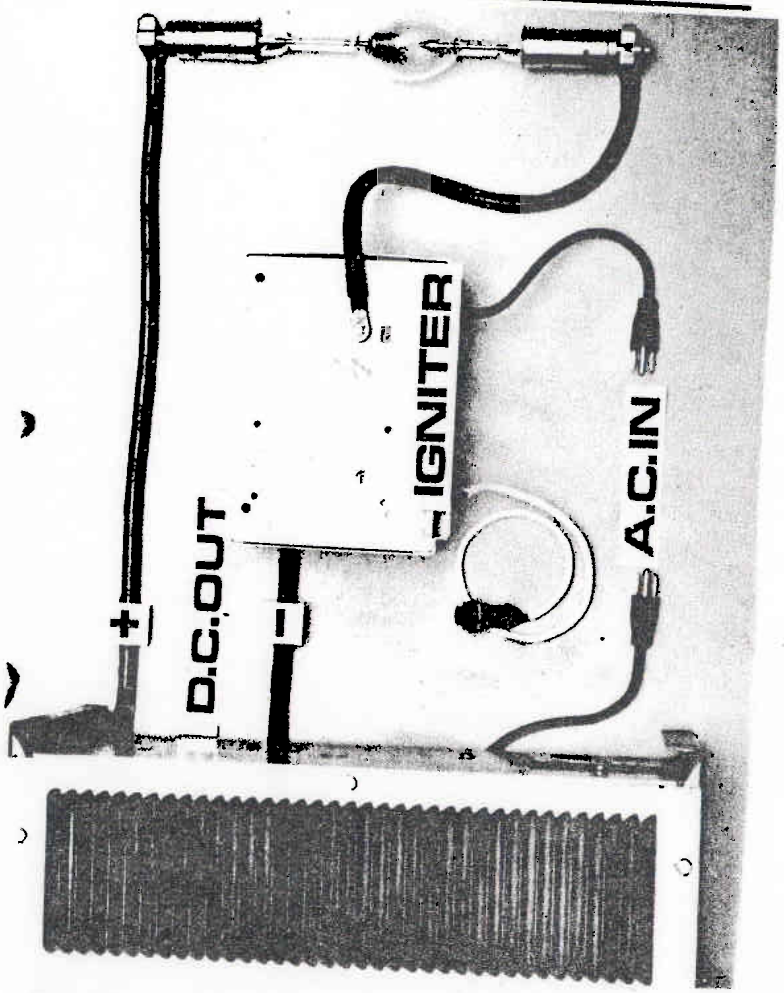


Fig. C. D.C. power from the power supply is fed to the Xenon Lamp through an igniter. A push button to momentarily activate the igniter is included. Xenon Short Arc Lamps usually are used in conjunction with a D.C. power supply. In order to ionize the Xenon gas, which is under several atmospheres of pressure, an igniter is to be used in addition to the D.C. power supply.

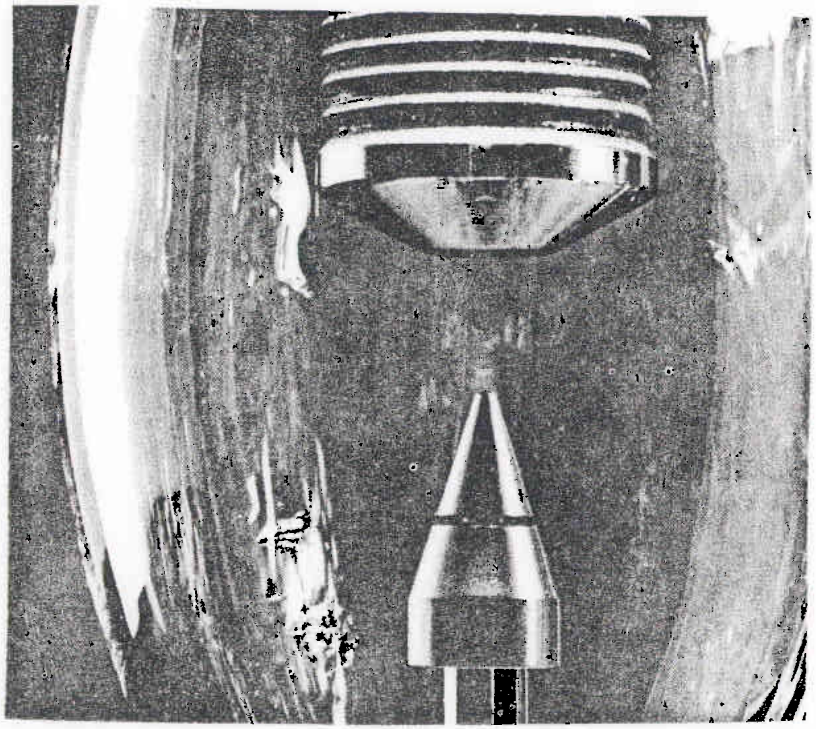


Fig. D Before ignition the Xenon Lamp has a very high electrical resistance.

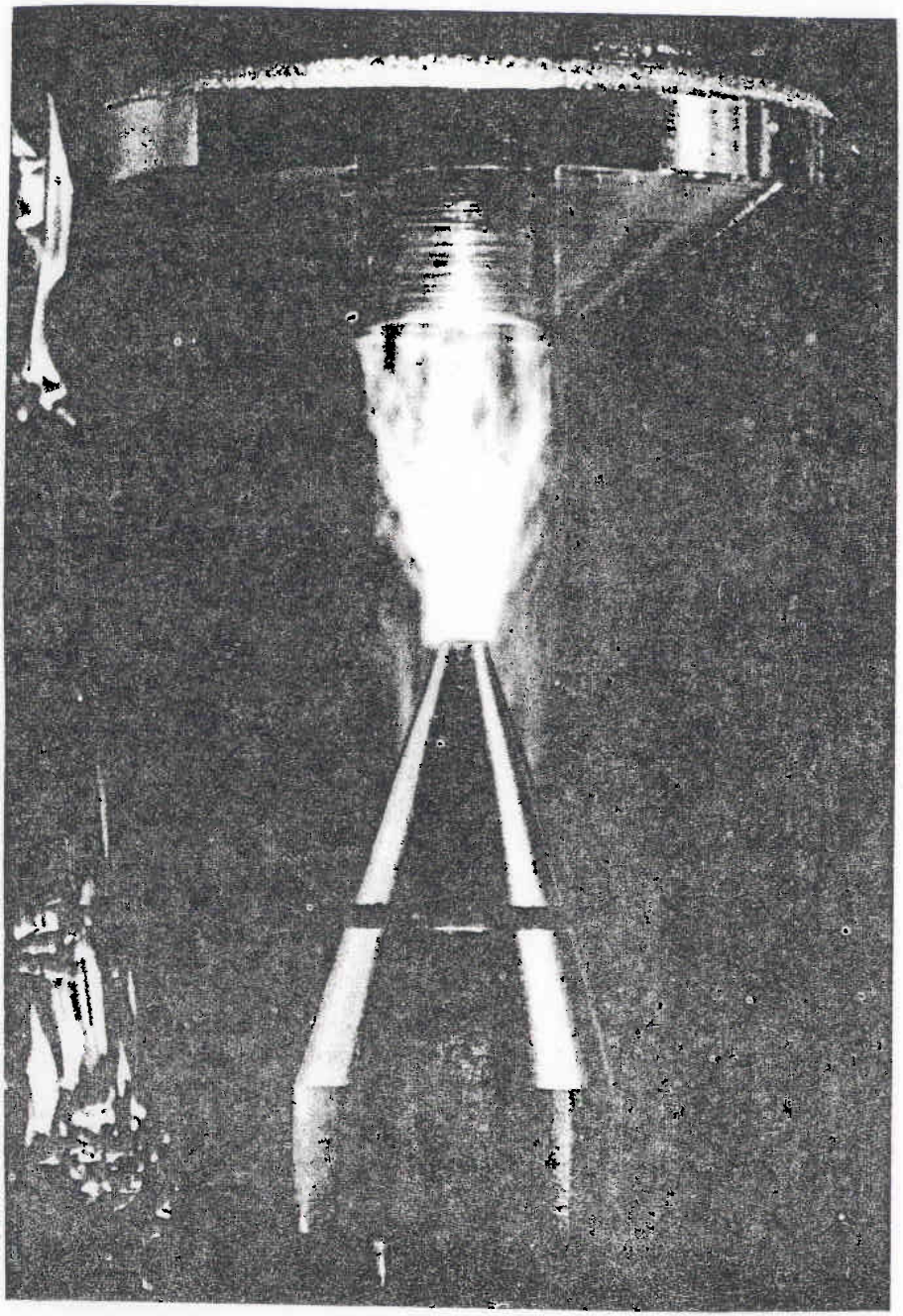


Fig. E A High voltage high frequency pulse from the igniter bridges the gap between electrodes, thus ionizing the xenon gas.

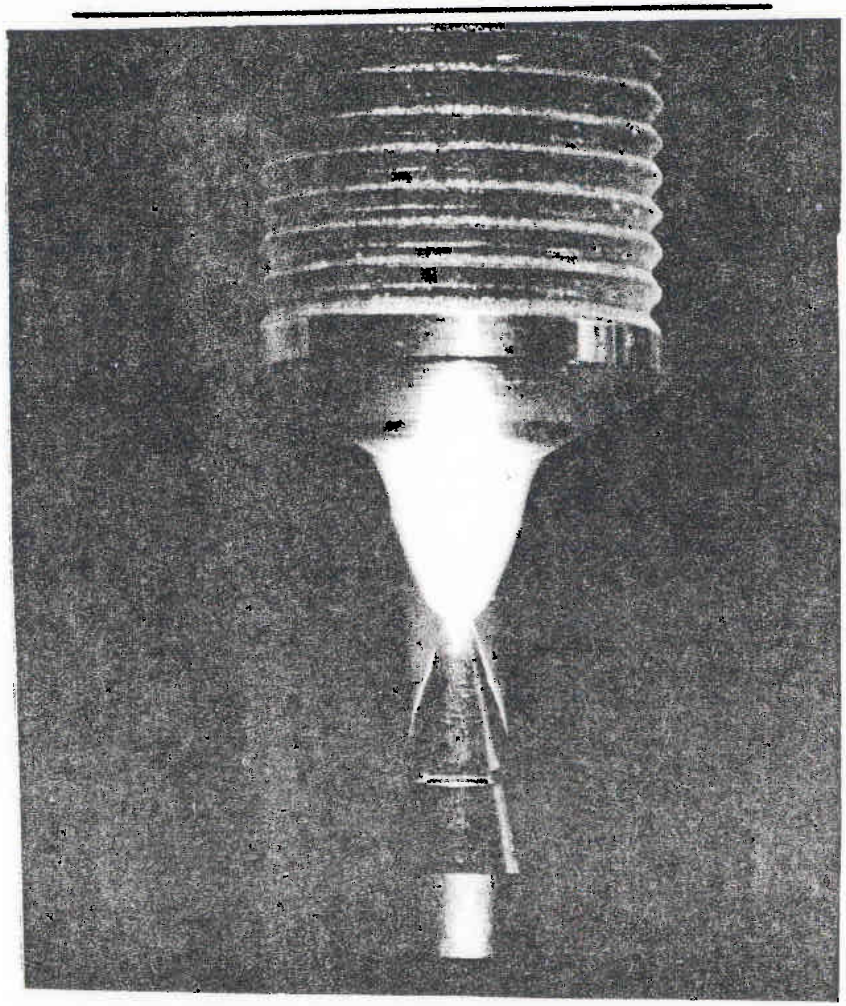


Fig. F This lowers the electrical resistance between the electrodes and provides a "conduction path" for the D.C. power, thus establishing a continuous arc, the brightness of which can be as high as that of the sun.

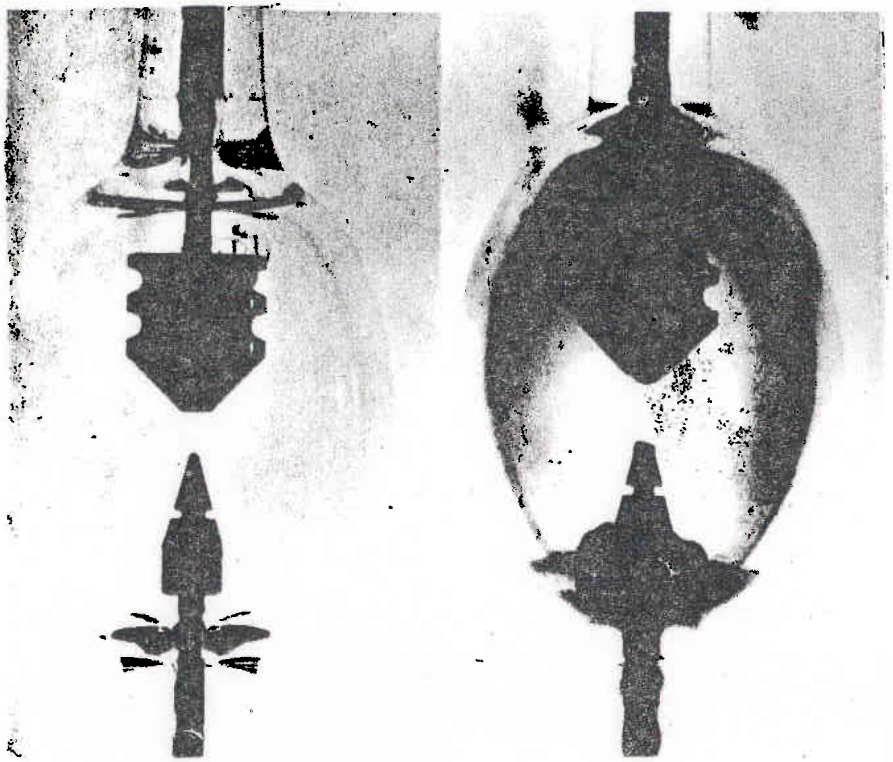


Fig. G A new Xenon Lamp vs an identical lamp, used for approximately 9,000 hours (27,000, 20 minute reels) in the Technicolor Screening Studio in Hollywood, California. Lamp life in excess of 4,000 or more hours is not uncommon.

The life of a Xenon lamp is extremely long and essentially only decided by miniscule amounts of tungsten "boiling" away from the electrodes. Some of this metal will condense on the relatively cool bulb-wall, thus producing a degree of bulb-wall blackening.

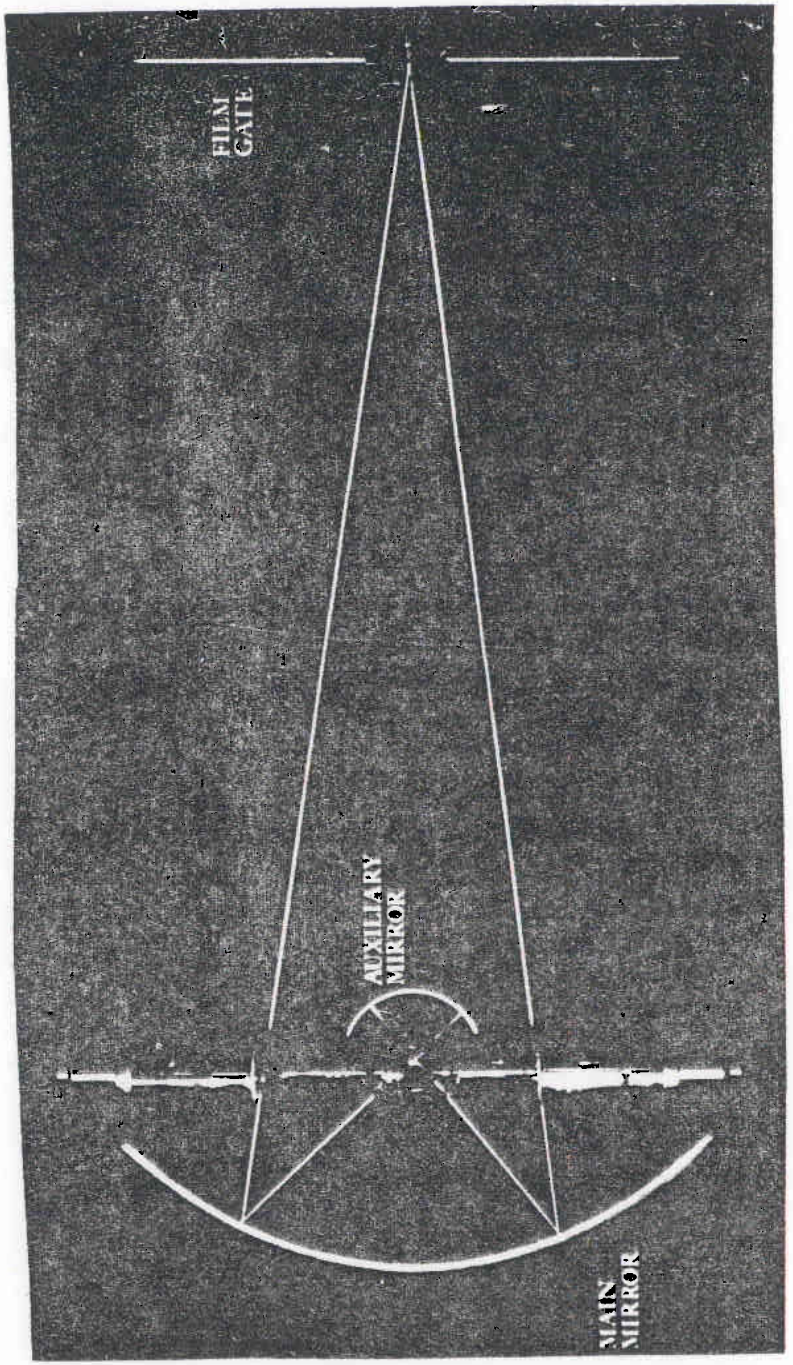


Fig. H An auxiliary mirror reimages the arc into itself, thus increasing the apparent arc brightness. The main mirror focuses the arc on the film gate.

The color of the light produced by the Xenon Arc is very close to that of natural sunlight. A true and very pleasing color reproduction is thus assured.

Xenon Arc Lamps can be installed in existing projection equipment and lamphouses. In case of a new installation, a specially designed lamphouse is usually installed.

Advantages of Xenon

1. Completely clean operation (no mirror pittings, for instance.)
2. Once lamp is installed no further adjustments are necessary.
3. Extremely high efficiency.
4. No or hardly any maintenance (no moving or driven parts.)
5. Entirely reliable operation.
6. Full output available seconds after lamp is turned on.
7. Economical when compared to Carbon Arcs.
8. Excellent color rendition.
9. Optically almost ideal size of luminous area.
10. Simple replacement with minimum adjustments.

HUGHES XENON XTL SYSTEM

The optical system utilizes a 7" elliptical mirror and a flat front surface dichroic mirror. All optical elements are coated for the highest efficiency possible in the visible color spectrum. The light output for the 500 watt system is 3000 lumens. The light output for the 1000 watt system is 6000 lumens. Either the 500 or 1000 watt xenon bulb may be used in the same illuminator.

The illuminator is of heavy aluminum construction for mounting on standard projector bases. All controls are located on the sides of the unit. Basic controls consist of:

(1) Lamp focus adjustments in each of three axis.
(2) Dowser.

Socket head type fittings are used on all mechanical controls and adjustments and access panels.

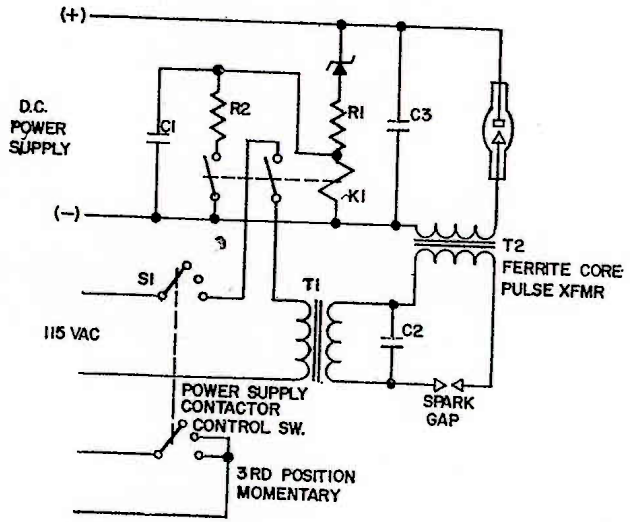
An air vent opening is provided in the side of the illuminator for an internal fan. Air is exhausted from the top.

Height - 16 inches; width - 11 inches.
Length 9 inches; weight - 50 pounds.
The illuminator is painted with a durable green.

The igniter is an integral part of the illuminator. It consists of an RF high voltage circuit. The ignition voltage is 30,000 volts. Special attention has been given to provide high voltage insulation on all com-

ponents. An automatic starting circuit is provided to de-energize the ignition circuit upon positive ignition of the xenon lamp.

An r-f automatic igniter is used to start the xenon lamp. It consists of a high-voltage step-up transformer, T1, a resonant pulsing circuit, a pulse transformer, T2, and automatic controls. Upon application of a-c power to the igniter, the control circuit is energized by a relay, R1. The step-up transformer



Igniter schematic.

increases the d-c line voltage to approximately 10,000 v, which is applied across a spark gap. When the spark gap breaks down, an r-f voltage is applied

to the pulse transformer, increasing the voltage across the lamp terminals to 50,000 v. Upon ignition, the d-c input voltage decreases from the high threshold voltage, 100 v, to the lamp operating voltage, de-energizing the relay, R1.

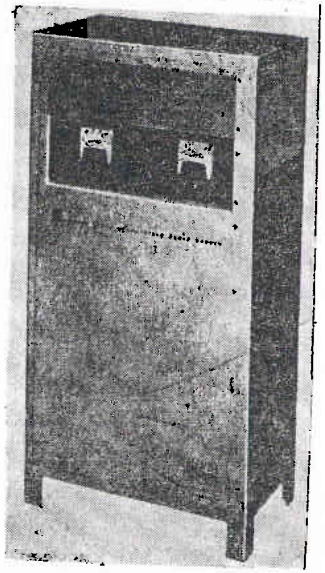
The igniter is installed in the illuminator housing with the terminal of the pulse transformer connected directly to the xenon lamp. All magnetic components are vacuum-impregnated or encapsulated for maximum insulation of the high voltage. A preset plug-in type of spark gap is used to control the maximum ignition voltage.

The power supply for the XTL500/1000 illuminator is a current regulated solid state design. Each element of the circuit maintains positive electrical control of the lamp during ignition and operating phases.

The output DC current is regulated in a closed loop system using silicon controlled rectifiers with a vernier adjustment, providing "finger tip" control of the output current. The unit is filtered to hold the DC current ripple to less than 3% peak to peak. A seperate power supply built into the unit furnishes the necessary threshold voltage for ignition to the igniter.

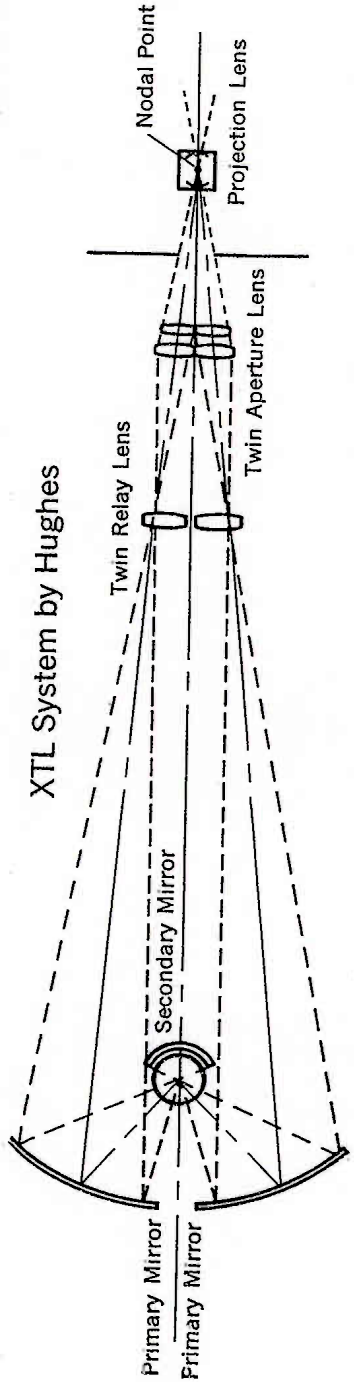
The Hughes XTL is unique in that it uses a split primary mirror to obtain uniformity and efficiency unattainable in single primary mirror systems. The beams reflected from the primary mirrors pass through a dual relay system and are merged at the film plane. The arc image is formed at the nodal point of the

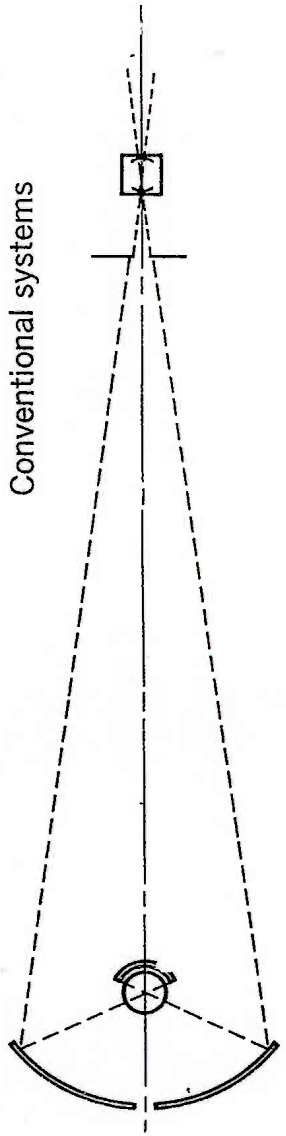
projection lens rather than at the film plane. This eliminates the need for "flies eye" or other types of diffusers employed in other units. These diffusers are inherently inefficient and reduce the output of



the lamp by many lumens.

The rugged cast aluminum illuminator housing features clean, functional styling with controls and metering grouped on one side for maximum ease in operation. The only optical adjustments necessary are motions for centering the xenon bulb when replacement is necessary. These adjustments are located on the side below the door and can be operated while viewing the arc image on the screen provided.





XTL500/1000 INSTALLATION DATA

Wattage	Model No. Illuminator including igniter)	Model No. Constant Current Power Supply	Input Voltages* 60 Cycles* 3 Phase	1 Phase	Accurrent
500/1000	XTL500/1000	900R25T	208/230	—	5
			416/460		3
500/1000	XTL500/1000	900R25S	—	115/230	20/10

With standard adapter the XTL Illuminator is readily adapted to the Simplex XL, Century and Phillips projectors which represent over 95% of existing installations.

2. The twin beam system provides more uniformity of light through the aperture and projector lens system eliminating "hot spots" on the screen.
3. For maximum film protection infra-red transmitting ("cold") mirrors are used in all sizes.
4. Safety interlocks are provided so that projectionist cannot be endangered.
5. Screen brightness remains constant because the mirror does not get dirty.
6. Screen brightness remains constant because lamp stays in fixed position, not rotated like carbon arc.
7. Uninterrupted performance – no carbons to replace.
8. Immediate illumination.
9. The projectionist can devote full effort to sound level, focus, framing and film handling in general.
10. Mirrors are not unevenly heated due to carbon and copper splatter. Breakage and coating damage are virtually nil.
11. Small package allows comfortable booth arrangements.

HUGHES XTL XENON SYSTEM - POWER SUPPLIES

The Hughes Solid State Xenon lamp and D.C. power supplies are constant current regulated with Silicon Controlled Rectifiers, while the Xenon lamp can be operated from an unregulated direct current source, the preferred method is a constant current D.C. source which provides longer bulb life, absolute control of its output wattage resulting in improved screen light.

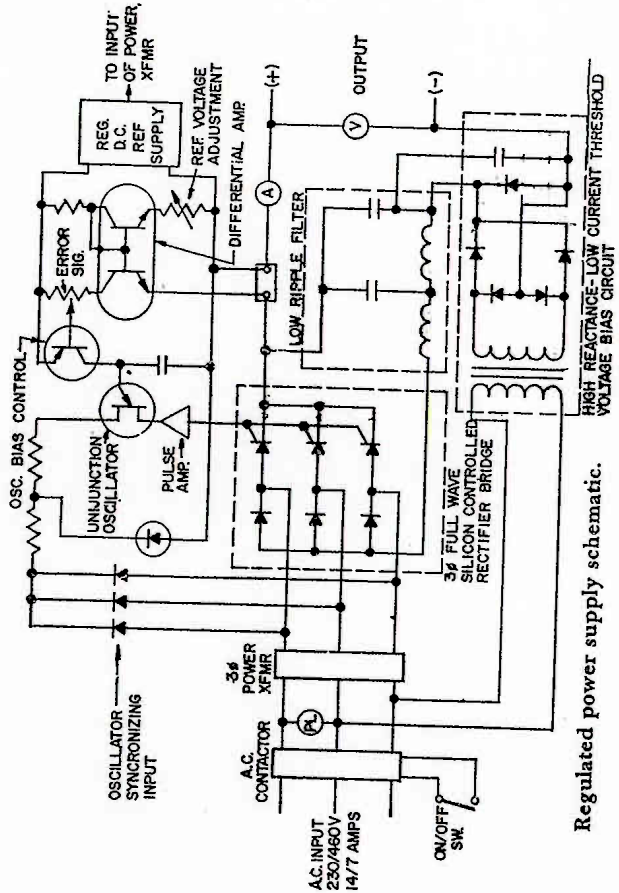
The Hughes solid state power supply does precisely this, providing an output current that remains constant within Plus/Minus 1% of a set value irrespective of input line variations of Plus/Minus 10% and modulation frequencies not to exceed 0.5 cps.

Extreme care has been given in the design to hold the DC output current ripple to less than 5% (peak) at the bulb with balanced input lines.

The unit is cooled by natural draft. All components are operated many times below their normal rating further assuring almost indefinite life. Efficiency of units is in excess of 78%.

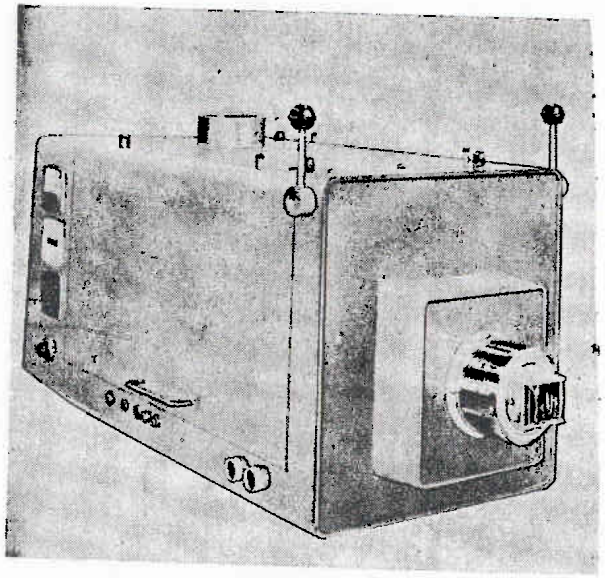
With the "transistor" regulator which controls the silicon controlled rectifiers employed in the design,

"finger tip" adjustment either at the rectifier itself or on the operating side of the illuminator housing is available, providing vernier adjustment of the output current from 50 to 110% of the rating of the xenon lamp. The operator has full control of the light output for various differences in film, its color or light density.



Regulated power supply schematic.

A small auxiliary power supply is built into the unit to provide an open circuit voltage of 100 to 140 volts, low current output, for the starting voltage of the igniter. A continuous operating voltage of 25-35 volts is provided by the main rectifiers with a current capability up to 110% of the rating of the 2500



2,500-w xenon illuminator

watt bulb. (Other values apply for 1600 and 5000 watt bulbs.)

All Hughes constant current power supplies are designed for dual input, whether for 3 phase or 1 phase. Example: 208/230 volt 3 phase, 230/460 volt 3 phase, or 115/230 volts single phase, all for 60 cycles input.

With natural convection cooling, a very small amount of foreign particles collect in the power supply itself. Periodically, inspection should be made by removing the front panel. Service to any component in the unit can be done by removing the front or the two side panels.

The igniter is an integral part of illuminator housing. The Hughes design incorporates a protective circuit which eliminates sound system interference. Safety interlock switches are provided to prevent operation of the illuminator when the back panel or the side doors are open. Provision is included to bypass these protective devices for service and inspection.

The model 5000R41T 5000 watt power supply is available only for three phase input. It is furnished with a cooling system. Dimensions 28''W. x 42''H. x 15''D.

Quotations From the Press Around The World About CAMERON BOOKS . .

UNITED STATES

AMERICAN CINEMATOGRAPHER, Hollywood (Organ of the A. S. C.)—"For years the Cameron books have been recognised in Hollywood as the standard authority on sound projection and sound reproduction. The Cameron books are used in all departments of all the major studios. The best books available."

INTERNATIONAL PROJECTIONIST, New York, N. Y.—"Cameron is master of them all when it comes to publishing a real book for projectionists. There is no other book that can compare with it, and it is easily seen why it is now the oldest publication in the industry. We recommend Cameron's book to the craft, as the best book available and a worthy investment."

MOTION PICTURE HERALD, New York, N. Y.—"It is obvious that Cameron has a vast store of knowledge on the subject of sound motion pictures and knows how to impart this knowledge to others."

FILM DAILY, New York, N. Y.—"The Cameron book is the best book published on sound motion pictures. The fact that it his been used throughout the English speaking world for over 30 years bears out its claim to being the STANDARD AUTHORITY. The entire motion picture industry in the United States has depended upon the book from the early days of motion pictures."

ENGLAND

PROJECTIONISTS JOURNAL, London (Guild of British Kinema Projectionists)—"Cameron's books are a projection asset. To those requiring a complete and authentic treatise of Projection, we thoroughly recommend James R. Cameron's books. Mr. Cameron, whose books are world renowned, deals with every phase of our profession. The books are as complete from the theoretical point of view as one could desire. Valuable hints are given that usually only can be obtained from first hand knowledge and practical experience."

KINEMATOGRAPH WEEKLY, London—"The Cameron books on motion pictures have long been held in high esteem in this country. While comprehensive, they are easily understood. We unreservedly recommend the Cameron book to all interested in sound motion pictures."

THE NATION and ATHENAEUM, London—"Cameron's book on Motion Pictures is a portly work which provides a complete education in the technique of sound films, from the first elements of electrical knowledge to the details of recording and projection. A book for which we should be grateful."

THE CINEMA, London—"Cameron's book is a remarkably comprehensive and authoritive text, surveys the whole field of modern equipment, and modern day practice—it is as lucid as it is practical."

AUSTRALIA—

PHOTO-REVIEW, Sydney—"Cameron is well known for his technical manuals, which have for a great many years been accepted as authoritative and standard, every detail of theory, technique and apparatus is fully covered. We most highly recommend the book."

SOUTH AFRICA—

ELECTRICAL TIMES, Capetown—"Cameron's books on motion pictures are used by all branches of the movie industry in South Africa, they have given satisfaction for many, many years."

CANADA—

CANADIAN MOTION PICTURE DIGEST—"It is no surprise that the Cameron books are looked upon as the Standard Authority. A reading of these books convinces any member of the craft, that the books are complete, and written so they can be easily understood."

DEPARTMENT OF LABOR, Harrisburg, Pa.:
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