

# Film-Tech

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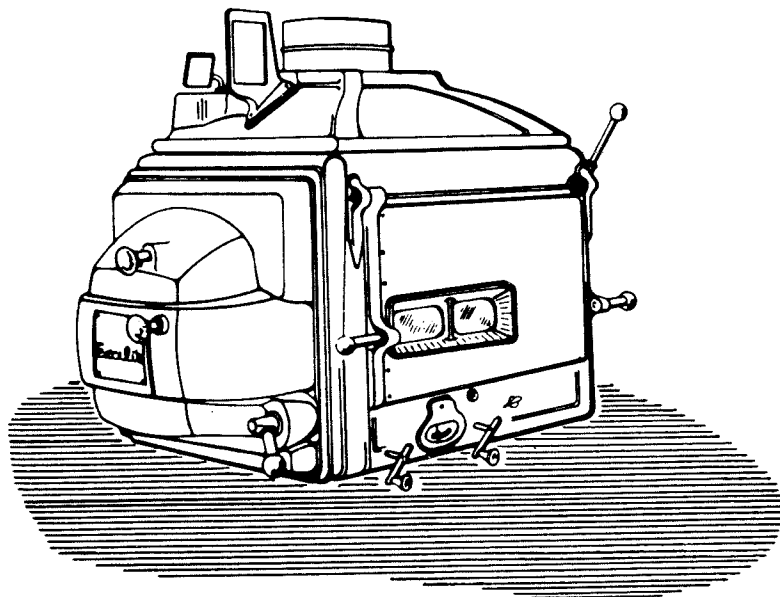
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THE EXCELITE HIGH INTENSITY  
PROJECTION ARC LAMP

#135

90145  
EVL-WIRE, POS & NEG  
HEADS



THE STRONG ELECTRIC CORP.  
87 CITY PARK AVE., TOLEDO 2, OHIO

## PREFACE

THIS IS A REFLECTOR TYPE direct current angle trim high intensity projection arc lamp for use on 35 mm projectors.

THE ELECTRICAL CAPACITY of this type of lamp is 75 to 135 amperes with corresponding arc voltages of 50 to 70 volts.

FOR INFORMATION REGARDING CARBON TRIM and current range of this new lamp, refer to the yellow tag fastened to the positive head. Further identification and information as to conversion to other carbon trim and current ranges can be found by consulting the table on plate 1211.

THE POWER SOURCE for this lamp shall be a generator or rectifier designed for angle trim motion picture arc service, and shall have a no load voltage at least 15 volts above the arc voltage as shown on plate 1211.

THE POSITION OF THE POSITIVE CRATER in reference to the burner is automatically controlled by a position sensing element which controls the speeds of the positive and negative feed motors. A constant white screen light is maintained once the burner has been focused to the reflector.

SET THE CURRENT AND FEED RATE SELECTOR at the approximate positive burning rate desired. The slower the burning rate selected, the lower the arc current will be. See plate 1102 which presents information regarding the approximate burning rates of positives at various currents.

THE CURRENT AND FEED RATE SELECTOR controls only the arc current or burning rate desired and should not be used in an attempt to control the position of the carbons on the arc imager screen.

IF THE CARBONS "OVERFEED", or the crater positioning indicator light stays out all the time, or the arc gap becomes too short, THE POWER TO THE ARC IS TOO LOW FOR THE BURNING RATE SELECTED AND THE POWER SUPPLY MUST BE INCREASED.

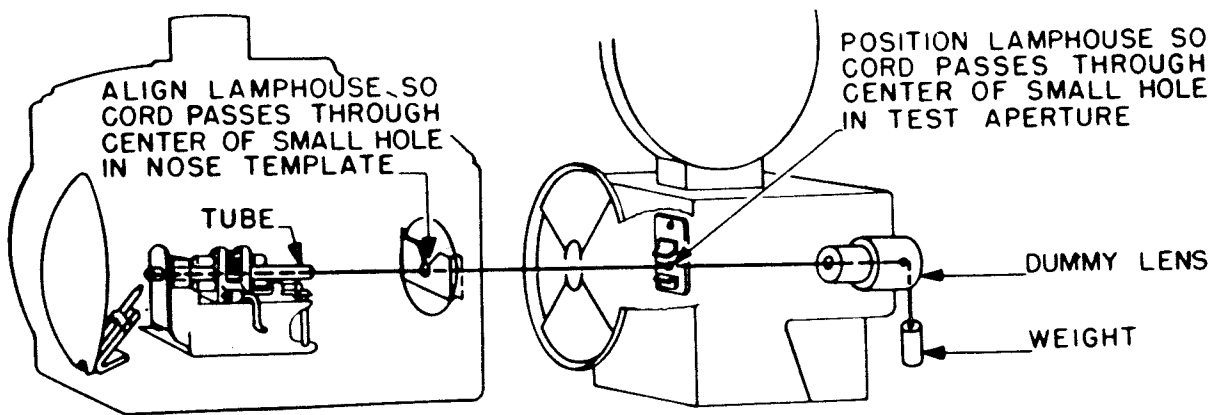
IF THE CARBONS "UNDERFEED", or the crater positioning indicator light stays on all the time, or the arc gap becomes too long, THE POWER TO THE ARC IS TOO HIGH FOR THE BURNING RATE SELECTED AND THE POWER SUPPLY MUST BE DECREASED.

IN CASE TROUBLE is experienced with operation of lamp, refer to trouble section of this instruction book. Please feel free to correspond with the factory regarding any specific problem of operation.

## SETTING UP

SET THE LAMP on the projector so that the center of the reflector is approximately 36-1/2" from the film line. When using the 11 mm regular or 10 mm Hitex carbons it is possible to reduce this distance to 35 inches if the greatest center brilliancy is desired. In this case it may be necessary to remove the light entrance cone from the rear of the projector. A light cone for the lamphouse is included with each lamp to be used if desired.

THE KEEL PLATE of the lamphouse contains 8 tapped holes 5/16" diameter 18 thread. Use the four 5/16-18 hex head cap screws (shipped with the lamp in a cloth bag) and fasten the lamp to the lamphouse table by placing the cap screws up through the holes in the lamphouse table and on through the lamp keel plate. Secure for the time being only tight enough to prevent the lamp from sliding endwise on the projector base while aligning the lamphouse.



ONE ALIGNING KIT NUMBER 23481 is supplied with each pair of lamphouses to provide an accurate and reliable method of locating the lamphouse on the projector base, so that the ultimate in optical efficiency and screen illumination can be obtained.

AS A RESULT OF the careful use of this tool, the lamphouse will be aligned so that its optical axis is in line with both the center of the aperture and the center of the lens.

PROP THE FIRE SHUTTER OPEN, open change-over dowser and turn projector mechanism by hand so that shutter blades are clear.

THE PROJECTOR LENS should now be removed and the tube with the cord attached, passed through the lens holder and into the lamphouse. The tube should be clamped in the positive carbon contacts and drive roller assembly exactly as illustrated.

PLACE THE DUMMY LENS in the projector and locate the test aperture as shown. The test aperture is held by closing the projector film gate.

TENTATIVELY POSITION THE LAMP so that the cord passes through the center of the hole in the test aperture.

THEN INSERT THE NOSE TEMPLATE in the lamphouse nose and further position the lamp sideways or up and down so that the cord passes exactly through the centers of the holes in both the test aperture and nose template.

IT MAY BE NECESSARY ON SOME TYPES of projector bases to make use of shim washers either at the front or rear or at both ends of the lamphouse base to bring the lamphouse to the correct alignment with the projector optical system.

~~THE DRAFT STACK is designed to fit an 8" diameter pipe. Under no circumstances should the volume of air removed through the lamphouse stack be less than 50 cubic feet per minute for currents up to 105 amperes nor less than 150 cubic feet per minute for currents of 110-135 amperes. If the volume of air removed exceeds 250 cubic feet per minute the stability of the arc will be affected.~~

SEE PLATE 1261

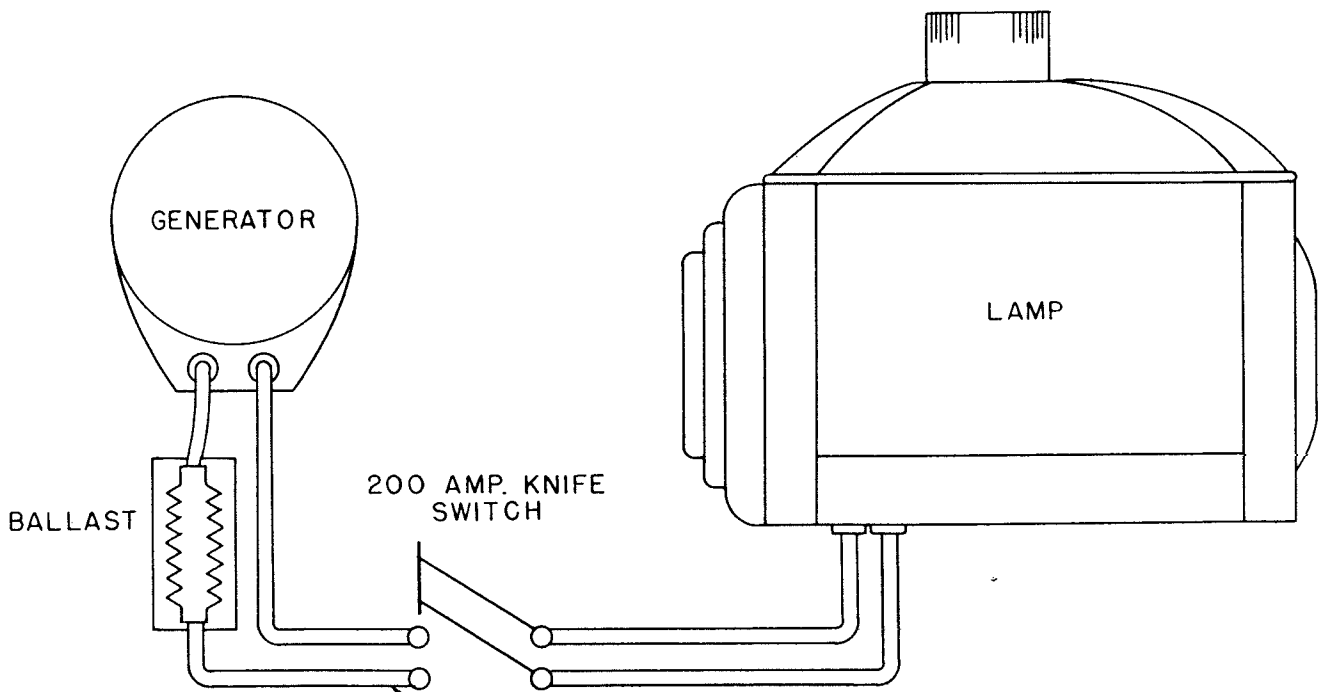
CONSULT THE YELLOW TAG fastened to the positive head of the arc lamp for the proper carbon trim and current range that this lamp was equipped for at the factory. Information as to other carbon trims and current ranges can be found by consulting the table on plate 1211. Instructions for converting to other carbon trim are given on plates 1218 and 1219.

IF A GENERATOR is to be used as the power supply, it should be rated at 75 volts minimum to burn the lamp from 75 to 100 amperes, and rated at 85 volts minimum to burn from 100 to 135 amperes. The ballast rheostat should be of sufficient capacity to drop the generator voltage to the required arc voltage for a particular carbon as shown on plate 1211.

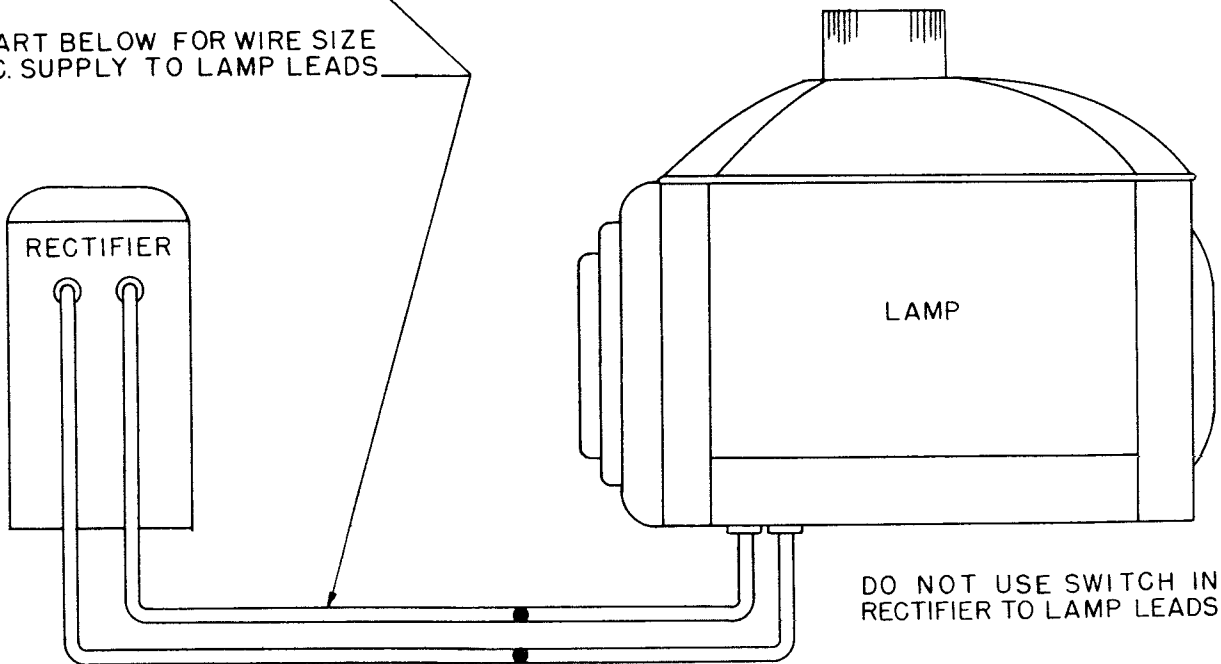
CONNECT THE LAMPHOUSE arc supply leads to the power supply connections through the table switch to the generator or directly to the rectifier as the case may be. (See Installation Diagram, Plate 1137). CAUTION: If a rectifier is used, the direct current or arc circuit must be connected directly from the rectifier to the lamphouse with no fuse or switch in this circuit.

THE CORRECT WIRE SIZE between lamphouse and power supply will vary from installation to installation depending on the amount of current to be burned. (See Installation Diagram, Plate 1137.)

INSTALLATION DIAGRAM  
NUMBER 1137



SEE CHART BELOW FOR WIRE SIZE  
FROM D.C. SUPPLY TO LAMP LEADS



FOR CURRENTS FROM

75 TO 90 AMPERES  
90 TO 110 AMPERES  
110 TO 135 AMPERES

FOR RUNS UNDER  
15 FEET  
USE WIRE SIZE

# 3 RH  
# 2 RH  
# 1 RH

FOR RUNS OVER  
15 FEET  
USE WIRE SIZE

# 2 RH  
# 1 RH  
# 0 RH

## INSTALLATION INSTRUCTIONS FOR LAMPS EQUIPPED WITH WATER COOLED HEADS

LAMPS EQUIPPED WITH WATER COOLED HEADS are designed for use with a water recirculating unit and must not be attached directly to the local water supply.

IF EITHER A CENTURY, OR NATIONAL "AQUAFLOW" water recirculating unit is presently used in your installation for cooling the projector aperture, it may also be used to cool the positive head. Make certain however that the water hoses are connected so that the water is pumped from the circulator through the aperture first, then to the positive head, and then returned to the tank.

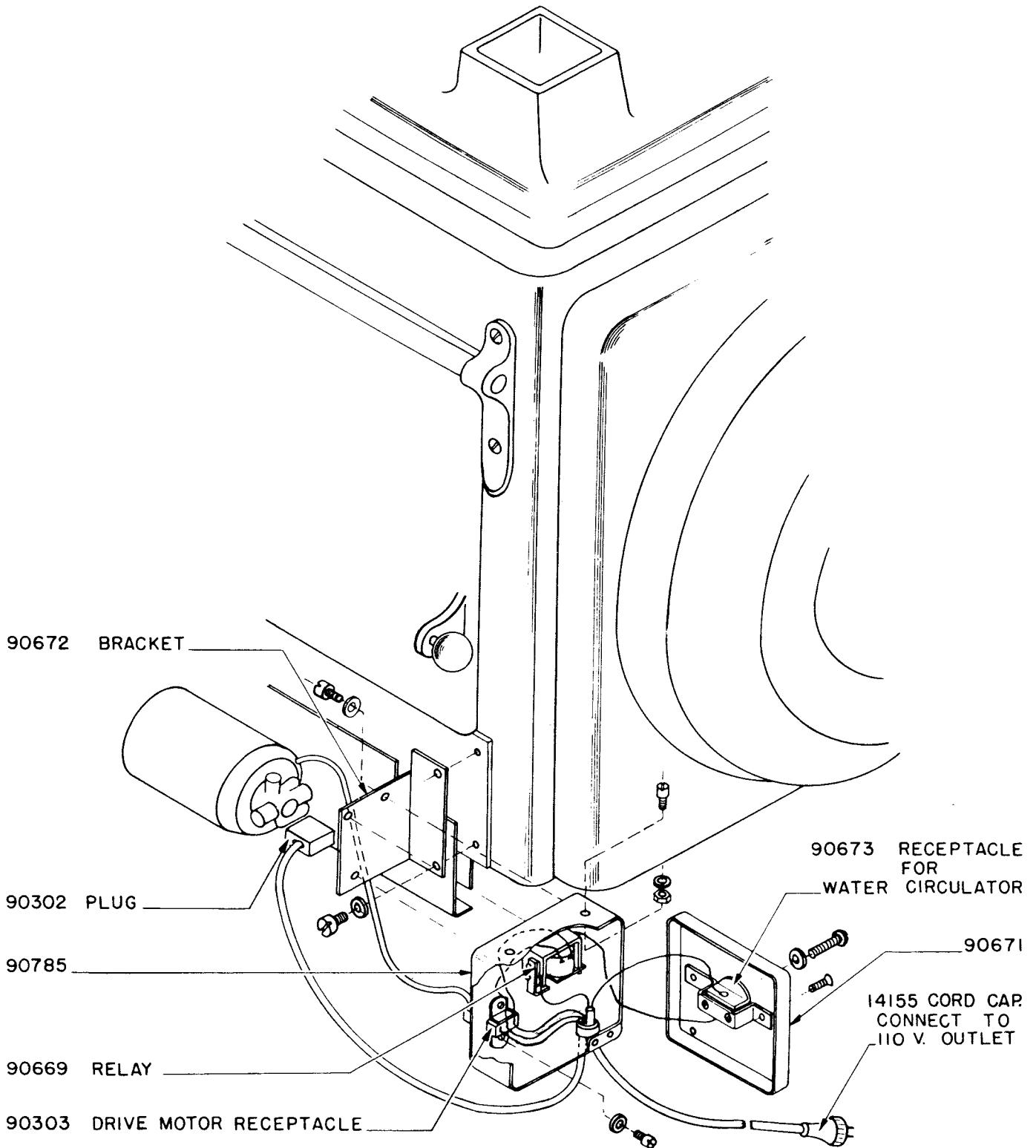
CAUTION: ONE CIRCULATOR MUST BE USED FOR EACH LAMP. If a circulator is not presently in use it will be necessary to order one for each lamp. Water recirculating units are available from the factory under part number 23479.

TO TEST FOR PROPER WATER CIRCULATION, connect one of the hoses from the water cooled head to the "feed" connector of the water recirculating unit, or to the return hose of the water cooled projector aperture, depending on the installation. Next, connect the electrical supply cord from the water recirculator to any 110 volt outlet. Turn the water recirculator motor on and catch a small amount of water with the "return" hose. A solid steady flow of water is an indication of proper water circulation. If above test is satisfactory, secure "return" hose to circulating unit with hose clamp #90663.

THE ELECTRICAL SUPPLY CORD from the water circulator is then connected to receptacle 90673 in the relay box and relay cord cap 14155 is connected to any 110 volt outlet.

TO PREVENT THE POSITIVE HEAD from becoming clogged due to rust, add one (1) pound of rust inhibitor to the water system every year. Rust inhibitor is available from the factory in (1) pound lots under part number 23098.

PLATE 1274





## SPECIAL BULLETIN

TO: All Users of Excelite and Excelite 135 Projection Arc Lamps.

FROM: The Strong Electric Corporation

SUBJECT: Preliminary Information on lamphouse draft requirements for National Excelite & Excelite 135 rotating high intensity reflector Type lamps burning 75-135 amperes.

The general increase of arc currents in the last year in theatres with large screen light requirements has necessitated a careful review of the exhaust draft capabilities of lamphouse ventilation systems. An exhaust system that was adequate for smaller lamps or lower currents fails at higher currents.

Suprex or copper coated carbon type lamps could be adequately ventilated by small fans of 50-150 cu. ft/minute capacity as their total heat dissipation was in the order of only 2 Kilowatts.

Rotating high intensity type arcs burning up to 105 amperes dissipated a maximum of 6 Kilowatts and could be adequately ventilated by a medium size fan of the centrifugal type.

However, with the increase of currents to 110 and 135 ampere ranges with power dissipation up to 9-1/2 Kilowatts, experience has shown that special attention must be paid to all details of the fan installation if proper removal of fumes & products of combustion is to be accomplished along with proper cooling of the reflector, and lamphouse.

Furthermore experience in numerous theatres, backed by exhaustive laboratory tests has shown that discoloration of the silver backing and fracture of reflectors from heat differentials in the reflector are both a function of the temperature of the reflector. Complete absence of reflector failure by discoloration and fracture have been obtained by proper ventilation of the lamphouse at these high currents.

The factory strongly recommends that the special reflector ventilating kit, part #55984, be installed on all lamps that were not factory equipped with this device and which have raised their arc current to over 100 amperes. These kits are available through your theatre supply dealers.

For currents of 110-135 amperes it is absolutely essential to have a minimum air velocity through the eight inch chimney opening of the lamphouse of at least 700 lineal feet per minute. This velocity can generally be assured by constructing the exhaust ventilation system, according to figure I using 8" dia. pipe or an equivalent duct size all the way from lamphouse to fan to outside atmosphere.

Fans should be of the centrifugal type with an eight inch diameter intake opening. There are several good fans of this type available such as American Blower Model 80-H or Dayton Blower Model 7-C-038.

Flow of air and balance between lamps should be regulated by installing a suitable by-pass in each line as shown in figure I.

As a guide to determine if a theatre's present air system is capable of meeting the minimum requirement for the ranges of 75-105 amperes or 110-135 amperes, two gauges are enclosed in an envelope attached to this instruction.

Select the gauge corresponding to the amperage you intend to use and follow the instructions for use printed on the gauge.

The gauge indicates only that the draft is meeting the minimum standard required. The maximum draft that can be used for any particular amperage is determined by the stability of the arc flame.

The by-pass opening in each lamp chimney duct should be opened a little at a time if necessary with the arc burning until any unsteadiness of the flame at the crater is eliminated. Do not however open the by-pass to such an extent that the draft gauge for the current you are using will not remain held up into the chimney.

Do not attempt to reduce the air flow by restricting the full 8-inch pipe opening, either by the use of a damper or by the use of smaller pipe. Remove lamphouse damper entirely and reduce air flow by the use of the by-pass only.

Any questions regarding your particular lamphouse exhaust system should be addressed to the factory.

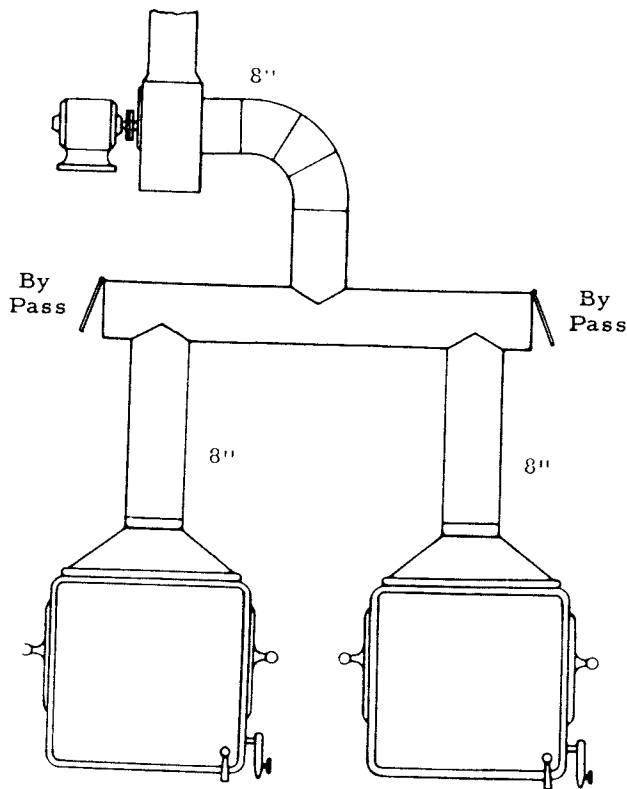


Figure I

## INSTRUCTIONS FOR INSTALLING HEAT FILTER OR BLOWER ASSY.

IN ORDER TO PREVENT DAMAGE TO THE FILTER, do not make installation or allow heat filter glass to be placed in light beam until the lamp has been aligned with the projector; the burner is operating correctly at the desired burning rate; and the light has been correctly focused on the screen for maximum brightness. If the lamp is operated without the spot being properly focused on the aperture, to obtain maximum screen brightness, a hotspot on the filter may result with consequent damage to the coating.

THE LAMPS THAT HAVE HAD THE HEAT FILTER FACTORY INSTALLED will need only the Blower & Motor Assembly installed as instructed in paragraph (3) below. CAUTION: Do not attempt to operate the lamp with the Heat Filter in place unless the Blower & Motor Assembly is attached and electrically connected.

TO INSTALL THE COMPLETE HEAT FILTER AND BLOWER & MOTOR ASSEMBLY (KIT 90808), follow instructions in the order listed below.

(1) REMOVE THE NOSE RING CASTING from the forward end of the lamp by removing its 8 attaching screws. Discard the casting and screws.

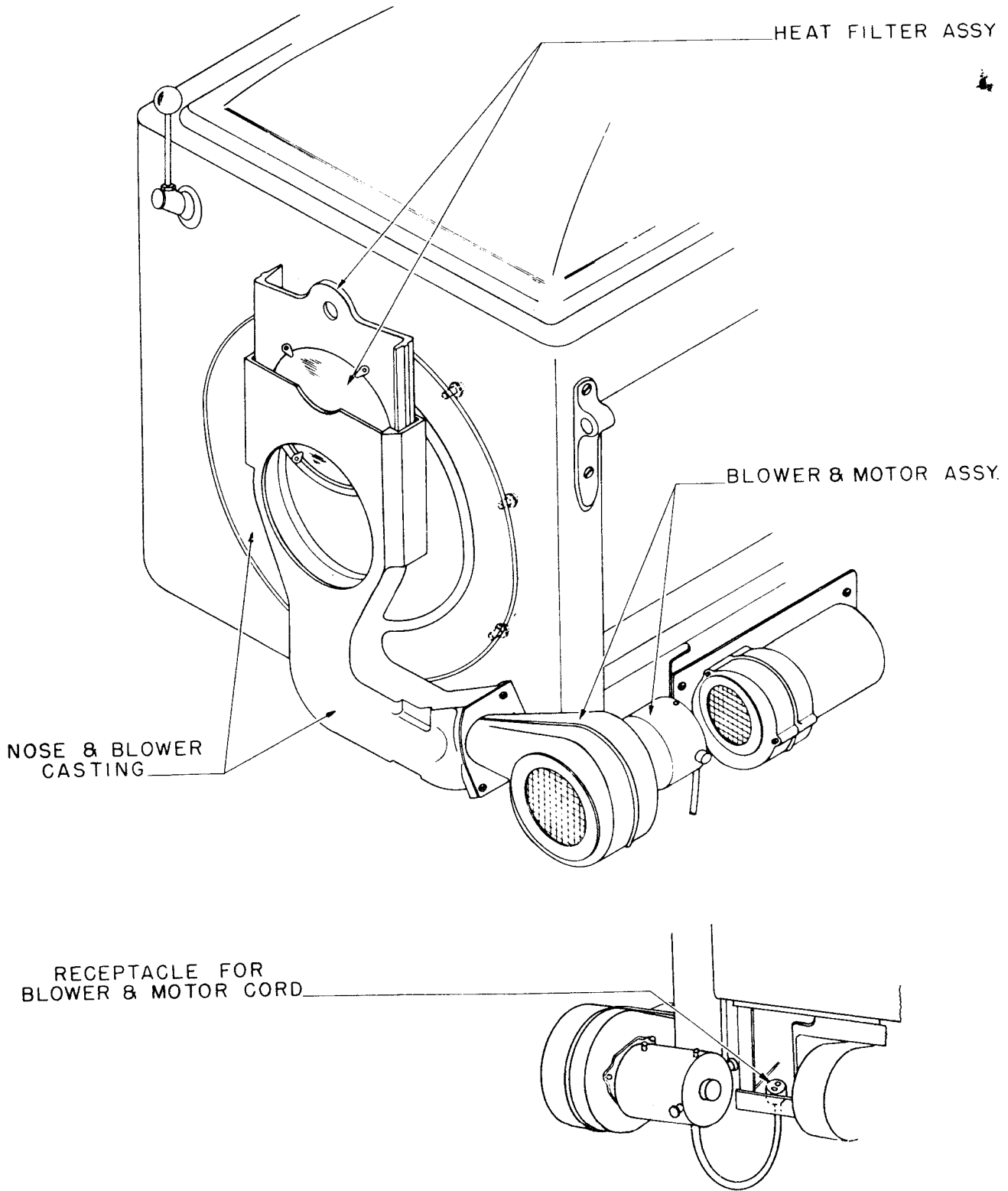
(2) ATTACH THE NOSE & BLOWER CASTING as shown in the figure on the opposite side of this page. Use the 8 #10-24 x 1/4" Fillister Hd. screws (part #377) furnished in this kit to secure the assembly.

(3) ATTACH THE BLOWER & MOTOR ASSEMBLY as shown in the illustration, and secure with the #10-24 x 5/16" Fillister head screws (part #379) furnished. Plug the cord of the blower and motor assembly into the receptacle located under the front end motor side corner of the lamphouse.

IF THE FILTER GLASS IS EVER REMOVED, it must be reinstalled in the Heat Filter Assembly so that the reflective coated surface marked either "XX" or by the manufacturer's trade mark, faces towards the carbon arc.

TO CLEAN THE COATED SURFACE of the filter glass, brush lightly with a piece of dry cotton. Repeat the process several times, but use a clean piece of dry cotton each time. In no event should any cleaning compound or liquid be used on the coated surface.

PLATE 1209



AS THE LIFE OF THE FILTERS can be lengthened by proper care, it is necessary to avoid using anything but a dry piece of cotton to clean the coated side. Cleaning compounds or liquids should not be used under any circumstances.

IF THE FILTER GLASS is removed from the holder frame for any reason, care must be taken in replacing so that the coated side is inserted toward the arc and that the frame is not tightened in such a way as to cause the filter to break when expanded from the heat.

IN ORDER TO PREVENT DAMAGE to the filter, do not make installation in the lamp until the light has been focused on the screen for maximum brightness inasmuch as you will be likely to get a hot spot on the filter with an out of focus condition.

WHEN RETRIMMING THE LAMP and upon striking the arc, be sure to properly position the positive carbon crater to the crater reference wire before opening the dowsers and causing the heat filter to be inserted in the light beam.

A YELLOW OR BROWNISH OVERALL CAST to the projected picture indicates that the position of the arc is too close to the reflector.

A STEEL BLUE TINT TO THE PROJECTED PICTURE indicates that the arc is too far from the reflector.

REFLECTOR TILT ADJUSTMENT for vertical and horizontal centering of the spot on the aperture is by means of the two knobs on the back door of the lamphouse.

DAILY OPERATION OF THE LAMP requires adjusting the lamp feed cranks only when the arc is struck. If it is necessary to adjust the lamp feed cranks during the remainder of the burn, it indicates improper functioning or adjustment and the TROUBLE SECTION should be consulted.

TO PROJECT BLACK AND WHITE FIRST RUN OR "GREEN" PRINTS, when operating above 82 amperes with the 9 mm positive carbon, or above 95 amperes with the 10 mm carbon, the use of a heat filter is usually needed to prevent embossing or buckling of the film.

HOWEVER THE AMOUNT OF HEAT that the film will actually stand depends on type and condition of film, type of projector, and conditions peculiar to each installation.

WITH THE 16-1/2" REFLECTOR LAMP, SECOND RUN black and white, or first run dye image color prints can in some cases tolerate as high as 85-90 amperes with the 9 mm positive carbon, 95-100 amperes with the 10mm carbon or 110-115 amperes with the 11mm without too much difficulty from heat.

18" REFLECTOR LAMPS are factory equipped with a 5-1/2" diameter dichroic heat filter which reflects unwanted portions of energy back into the lamphouse instead of letting this energy pass through to heat the film.

THE HEAT FILTER HOLDER is easily removable from the beam and it may be possible to remove it when projecting dye image color prints under certain conditions thereby gaining approximately 8% light.

MANUFACTURERS OF THESE HEAT FILTERS will not guarantee them, first because they are made of glass, and secondly because the coating is extremely delicate. They say however, that under normal operating conditions the life expectancy is from 6 to 8 months.

WHILE THERE IS NO GUARANTEE WHATSOEVER on the filters, they can be recoated by the factory at a nominal price. The factory cannot however accept broken filters.

## OPERATION

TRIM THE LAMP through its back door opening. Raise the positive carbon drive rollers by swinging the carbon release handle to its upright position, then insert the butt end of the positive carbon through the hole in the positive heat baffle and continue to push the carbon on through the carbon contacts and through the drive rollers until the tip of the cratered end of the carbon is in line with the crater reference wire.

TRIM THE NEGATIVE by first cranking the carbon carriage all the way back. Place the carbon in the negative jaw, with its butt end resting against the stop, and tighten the negative clamp screw firmly to secure the carbon. Use only the screw driver type wrench furnished to tighten this clamping screw.

SET THE CURRENT AND FEED RATE SELECTOR at approximately the burning rate desired. This selector dial is calibrated in inches per hour (burning rate) of the positive carbon. Use the outside scale of values if a 216:1 ratio positive motor is used, and the inside scale of values if a 300:1 ratio positive motor is used. See table on plate 1102 for arc currents at various burning rates. A burning rate should be selected that will use the carbons most economically and with the smallest stubs for the size reels being used.

TO MAKE PRELIMINARY ADJUSTMENTS on operation of lamp, turn the power "ON" and strike the arc by cranking the negative carbon feed handle. As soon as the arc strikes, back off very quickly and adjust the position of the negative carbon so the arc gap is approximately equal to the diameter of the negative carbon.

AFTER THE ARC HAS SETTLED DOWN, which will require a minute or two of burning, use the positive manual carbon feed crank to bring the position of the positive carbon tip even with the crater reference line as projected on the arc imager screen. It may be necessary to readjust the position of the negative carbon to again obtain a gap equal to the negative diameter.

TO CRANK THE POSITIVE CARBON forward or back it is necessary to push in while turning the positive carbon feed crank.

ALLOW THE LAMP TO OPERATE for ten minutes without any further adjustments of the controls or manual carbon feed cranks.

AT THE END OF THIS TRIAL PERIOD turn the lamp off and check the length of arc gap using a negative carbon as a gauge. The carbon should just pass between the positive and negative carbons.

IF THE ARC GAP IS TOO SHORT, increase the power supply by raising the rectifier output. If generator or commercial D.C. is in use, decrease line ballast by throwing in additional switches or connecting additional links so as to reduce the voltage drop across the ballast.

IF THE ARC GAP IS TOO LONG, decrease the power supply by lowering rectifier output. If generator or commercial D.C. is in use, increase line ballast by pulling out switches or disconnecting links so as to increase the voltage drop across the ballast.

AFTER THE CORRECT POWER SETTING is thus obtained as determined by the length of arc gap, no further adjustment of the power supply will be necessary unless indicated as follows:

THE CRATER POSITIONING INDICATOR LIGHT is located on the control panel just above and to the right of the positive manual carbon feed crank. Depending on whether the light is "ON" or "OFF", the positive carbon is being fed at a faster or slower rate than selected. When this light flashes "ON" and "OFF" at least twice a minute, it is an indication that the automatic positioning control is functioning properly, and the power supply is set correctly.

IF THE CRATER POSITIONING INDICATOR LIGHT remains "OFF" for long periods, or if the arc gap becomes too short, or carbons overfeed, THE POWER TO THE ARC IS TOO LOW FOR THE BURNING RATE SELECTED AND THE POWER SUPPLY MUST BE INCREASED.

IF THE CRATER POSITIONING INDICATOR LIGHT remains "ON" for long periods, or if the arc gap becomes too long, or carbons underfeed, THE POWER TO THE ARC IS TOO HIGH FOR THE BURNING RATE SELECTED AND THE POWER SUPPLY MUST BE DECREASED.

THE ARC IMAGER WIRE, mounted on the negative jaw indicates the approximate position of the positive carbon crater. This wire has no effect whatsoever on the automatic positioning system and is used only as a reference guide for the setting of the positive carbon when the arc is struck. If this wire becomes bent it will indicate a false setting of the positive carbon. Refer to ADJUSTMENT SECTION to reset the arc imager wire to the proper position.

THE LIGHT ON THE PICTURE APERTURE CAN BE FOCUSED by means of the arc focus adjustment knob, (see plate 1101) which is conveniently located at the lower forward end of the lamphouse. CAUTION: The projector must be kept running all the while the light is being focused to prevent overheating of the mechanism and lens.

TURNING THE ARC FOCUS ADJUSTMENT KNOB moves the entire burner mechanism towards or away from the reflector. In this way the reflector alignment is not changed and the stable burning of the arc is not disturbed while focusing.



BURNING RATE CHARTS

9 MM POS.

BURNING RATE	AMPS	NEG
13" HR	75	5/16
15" HR	80	5/16
19" HR	85	5/16
23" HR	90	11/32

10 MM (REG.) POS.

BURNING RATE	AMPS	NEG
13" HR	90	11/32
16 1/2" HR	95	11/32
19" HR	100	11/32
23 1/2" HR	105	11/32

10 MM-HITEX-POS.

BURNING RATE	AMPS	NEG
15" HR	115	3/8
17" HR	120	3/8
20" HR	125	3/8
25" HR	130	7/16
32" HR	135	7/16

11 MM POS.

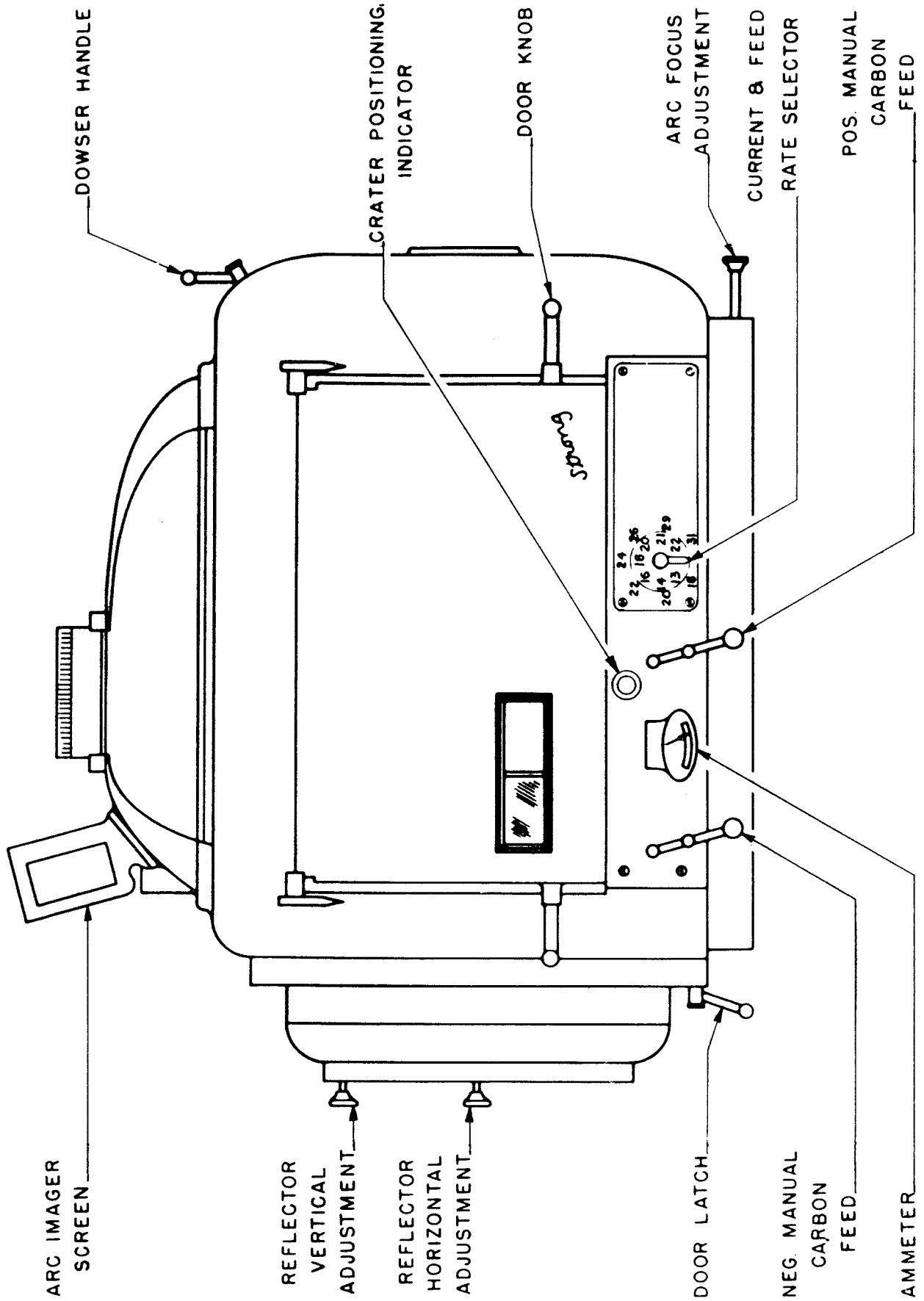
BURNING RATE	AMPS	NEG
14" HR	110	3/8
17" HR	115	3/8
22" HR	120	3/8

CARBON TRIM AND  
CURRENT RANGE CHART

ARC AMPERAGES	ARC VOLTS	CARBONS		POSITIVE MOTOR	POSITIVE DRIVE ROLLER ASSY.	NEGATIVE LEAD SCREW	POSITIVE CONTACTS	LUMENS TO SCREEN - NO SHUTTER - NO FILTER.	
		POS.	NEG.					F20 COATED LENS - 16-12" REFLECTOR	F17 COATED LENS - 18" REFLECTOR
75-85	50-57	9 MM	5/16	300:1 (3-D)	9-10 MM (REGULAR)	5 THR. LEAD (REGULAR)	9 MM	15,700 TO 19,500	18,100 TO 22,500
82-90	54-60	9 MM	11/32 SEE NOTE-1 BELOW	216:1	9-10 MM (REGULAR)	5 THR. LEAD (REGULAR)	9 MM	18,300 TO 21,000	21,100 TO 24,200
90-100	56-62	10 MM	11/32	300:1 (3-D)	9-10 MM (REGULAR)	5 THR. LEAD (REGULAR)	10 MM	16,000 TO 20,000	18,400 TO 23,000
97-105	61-64	10 MM	11/32	216:1	9-10 MM (REGULAR)	5 THR. LEAD (REGULAR)	10 MM	18,200 TO 21,500	21,000 TO 24,800
110-120	59-65	11 MM	3/8	300:1 (3-D) SEE NOTE-2 BELOW	11 MM	6 1/4 THR. LEAD	11 MM	18,000 TO 22,000	20,700 TO 25,300
115-124	59-65	11 MM	3/8	216:1	11 MM	6 1/4 THR LEAD	11 MM	20,500 TO 23,500	23,600 TO 27,000
124-135	62-70	10 MM HITEX	7/16 SEE NOTE-3 BELOW	216:1	9-10 MM (REGULAR)	6 1/4 THR. LEAD	10 MM	22,400 TO 25,500	25,800 TO 30,000

NOTE-1. USE A 5/16 NEGATIVE WHEN BURNING 82-85 AMPS.  
 NOTE-2. A 216:1 POSITIVE MOTOR CAN BE USED FROM 117-120 AMPS.  
 NOTE-3. DO NOT USE A HEAVY DUTY CORED 3/16 X 9 NEGATIVE CARBON

SIDE VIEW  
(OPERATING SIDE)



SIDE VIEW  
(MOTOR SIDE)

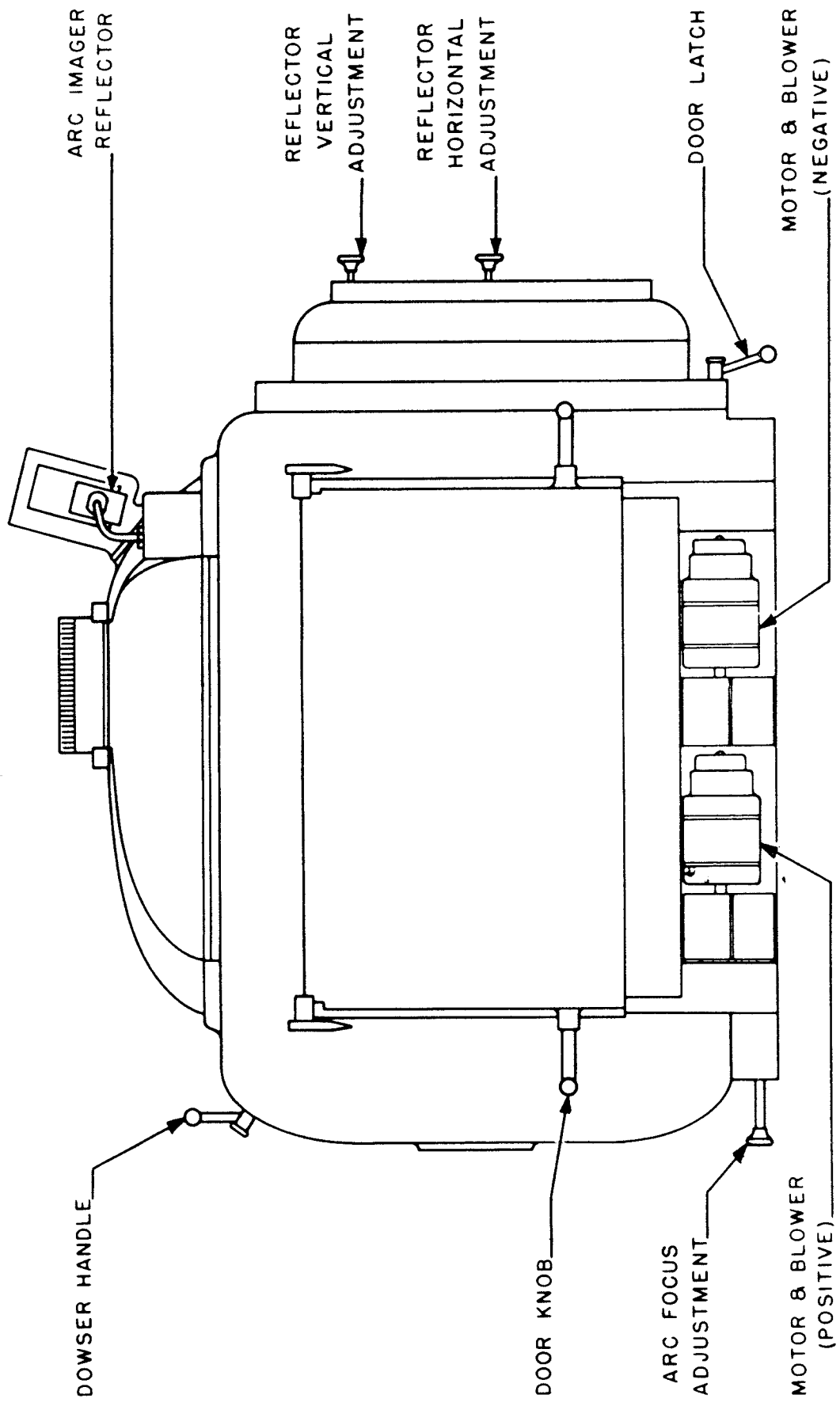
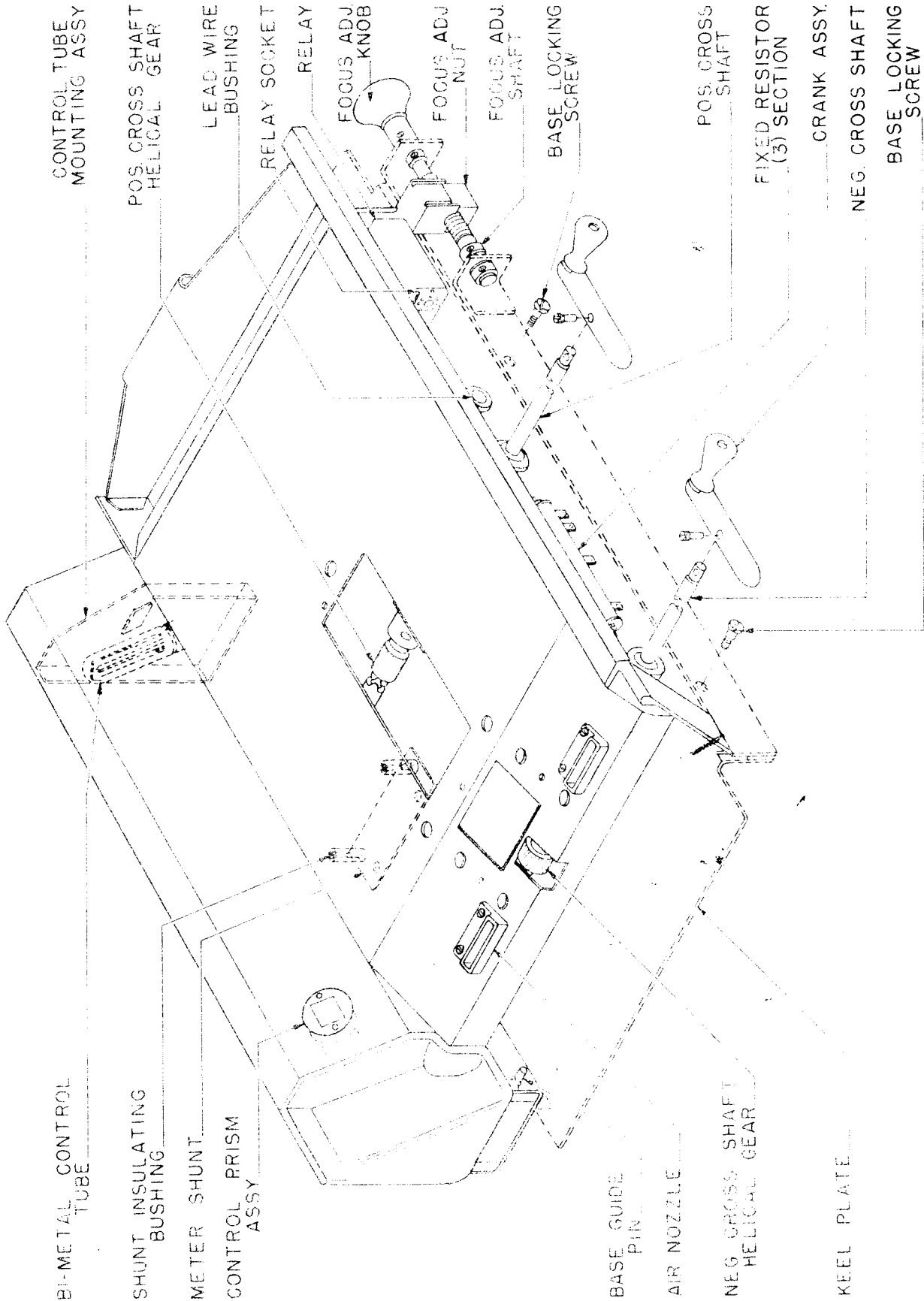


PLATE 1212



BI-METAL CONTROL  
TUBE

SHUNT INSULATING  
BUSHING

METER SHUNT

CONTROL PRISM  
ASSY

BASE GUIDE  
PIN

AIR NOZZLE

NEG. CROSS SHAFT  
HELICAL GEAR

KEEL PLATE

CONTROL TUBE  
MOUNTING ASSY

POS. CROSS SHAFT  
HELICAL GEAR

LEAD WIRE  
BUSHING

RELAY SOCKET  
RELAY

FOCUS ADJ.  
KNOB

FOCUS ADJ.  
NUF

FOCUS ADJ.  
SHAFT

BASE LOCKING  
SCREW

POS. CROSS  
SHAFT

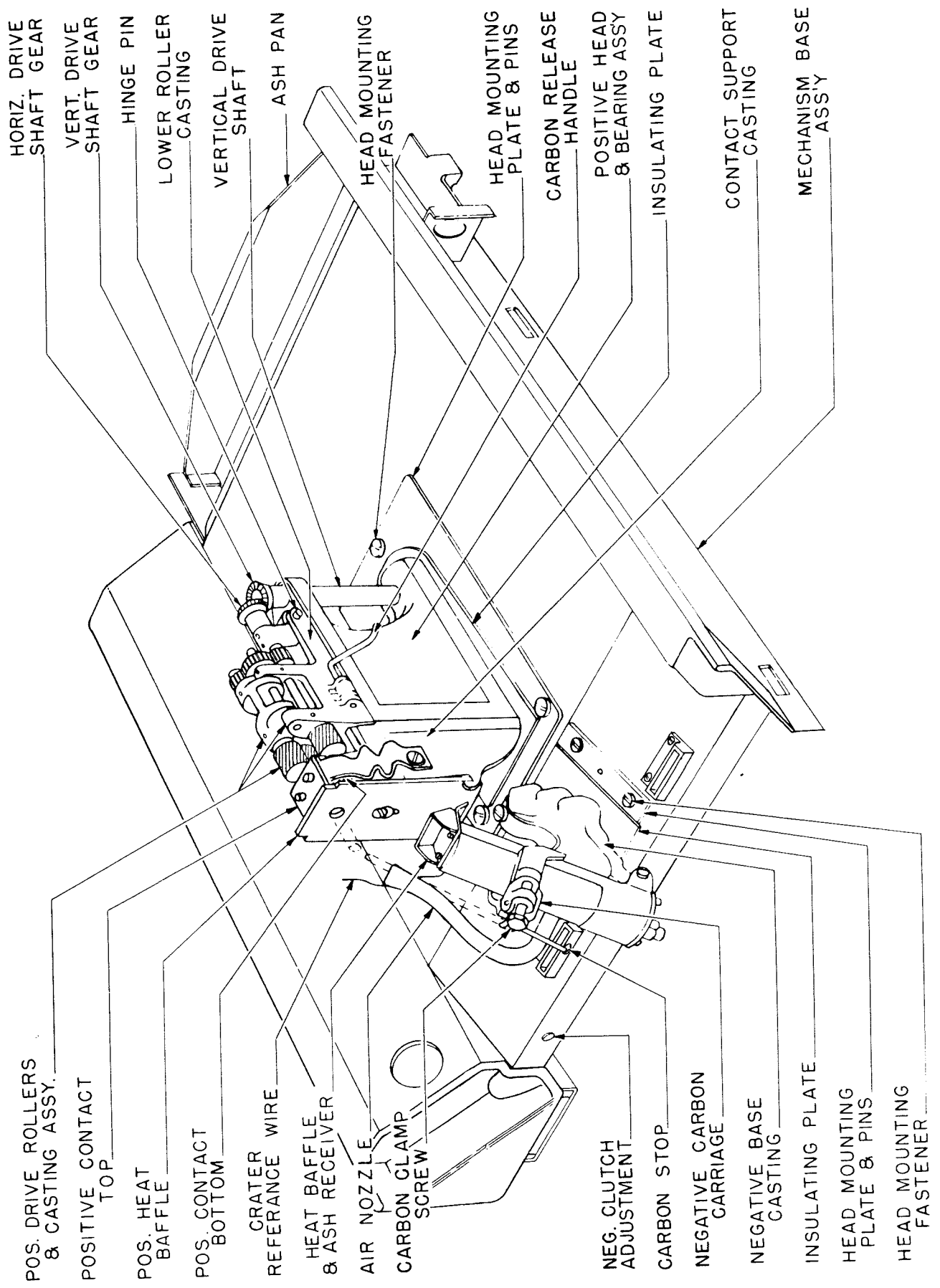
FIXED RESISTOR  
(3) SECTION

CRANK ASSY.

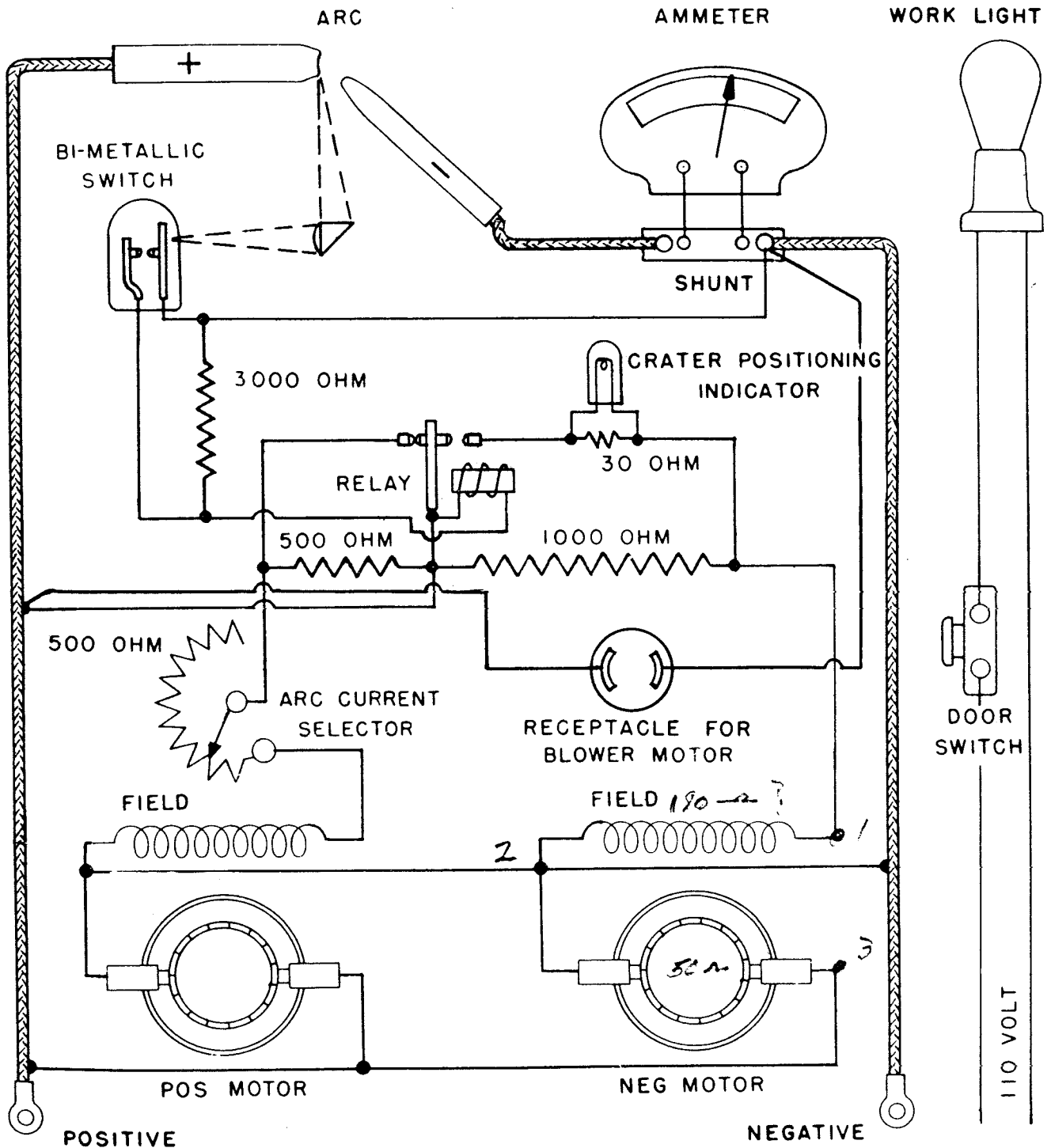
NEG. CROSS SHAFT

BASE LOCKING  
SCREW

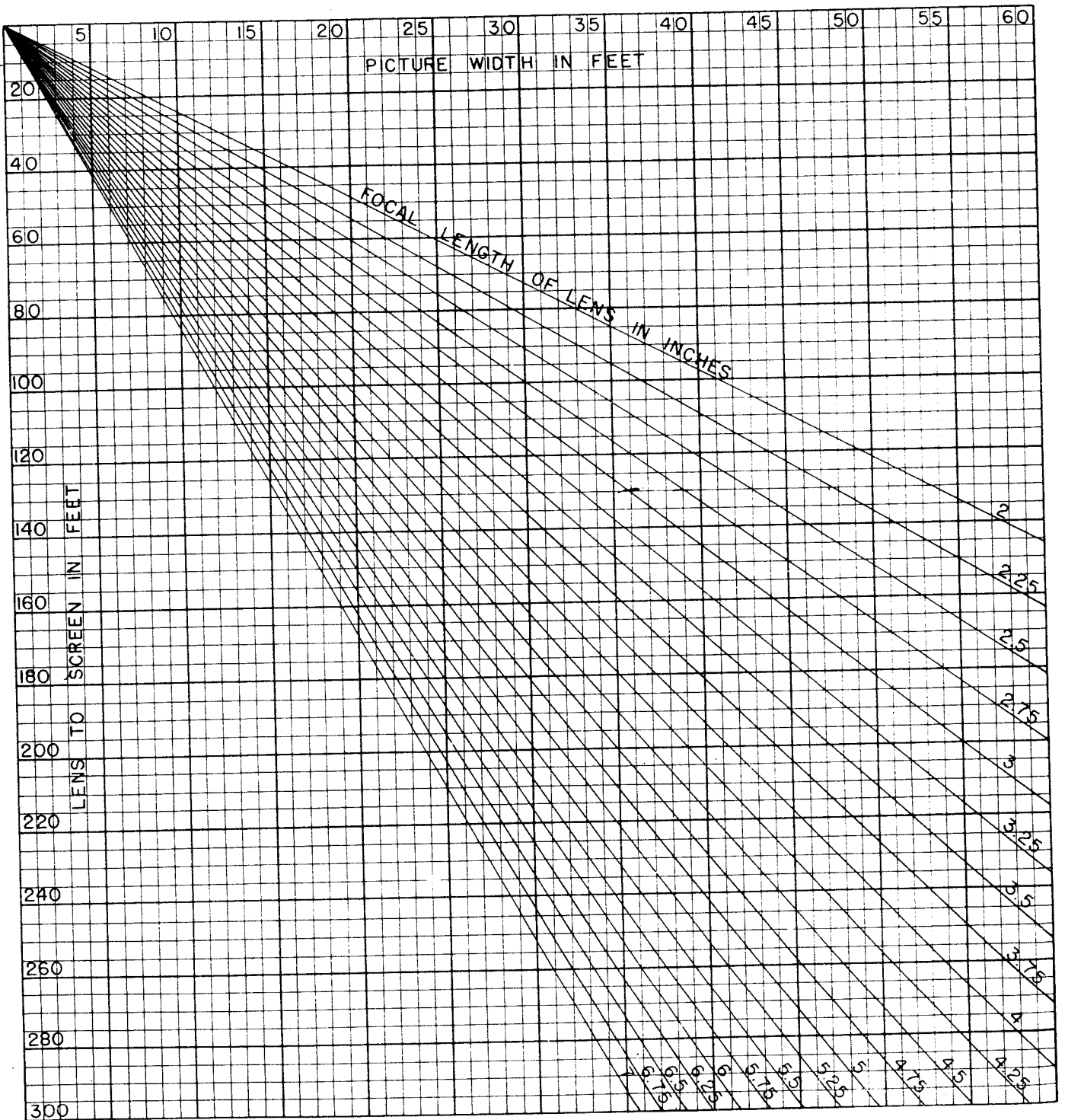
PLATE 1213



WIRING DIAGRAM  
NUMBER 1214



PROJECTION TABLE  
FOR .825 X .600 APERTURE





## MAINTENANCE

LUBRICATION OF THE POSITIVE AND NEGATIVE HEAD feed mechanism requires just a drop or two of the Strong heat resistant lubricant, every week after the initial breaking in period.

DURING THIS INITIAL BREAKING IN PERIOD, of the first three or four days on a new lamp, both the positive and negative heads should be lubricated once a day.

THE POSITIVE HEAD AND DRIVER ROLLER ASSEMBLY contain a total of ten drilled oil holes. One oil hole is located at each end of every horizontal shaft bearing in the drive roller assembly. One oil hole is located in the idler gear hub on the shaft which does not turn and one oil hole is located in the top bearing of the vertical drive shaft.

THE NEGATIVE HEAD ASSEMBLY contains a total of 5 drilled oil holes. The negative idler gear bearing located at the extreme lower rear end of the negative carbon carriage guide casting should be lubricated occasionally.

THIS STRONG HIGH TEMPERATURE LUBRICANT contains a heavy metallic powder which tends to settle out of solution while standing. Accordingly the can must be shaken vigorously before using.

CAKING OF THE METALLIC POWDER may clog the positive carbon drive roller mechanism, after several months of operation, as indicated when the manual carbon feed handle cranks hard.

TO FLUSH OUT ANY LUBRICANT which has caked in the positive carbon drive roller mechanism, it is most convenient to remove the drive roller unit, then while spinning the drive rollers, immerse the complete assembly in a can of kerosene.

TO REMOVE THE POSITIVE DRIVE ROLLER ASSEMBLY as a unit, pull out the one hinge pin, which holds this assembly in place.

GRAPHITIZED OIL or grease is not suitable as a lubricant for any part of this lamp.

THE MOTOR GEARBOX and the ball bearings in the motors are factory lubricated, then sealed to retain the grease and keep out any dirt. The lubricant should be changed every two years. This special grease is available from the factory and can be ordered under part number 23067 for the motor gearbox, and part number 23068 for the ball bearings.

THE STEEL GEARS which run against bakelite gears and the crank shafts which run in ball bearings require no lubrication.

CLEANING THE REFLECTOR SHOULD become a daily habit as even the small amount of white soot which accumulates on the reflector in a day, if allowed to remain, will start to scum the reflector and will become difficult, if not impossible to remove.

FOR THIS DAILY CLEANING of the reflector the use of a soft dry cloth is all that is necessary.

ANY ACCUMULATION OF WHITE SCUM on the reflector which cannot be removed with the cloth, should be cleaned from the surface by using a small pad of steel wool. The reflector can be polished vigorously with the steel wool without harming the surface.

CARBON AND COPPER PARTICLES which may occasionally adhere to the reflector surface may be scraped off with a flexible razor blade so that these specks will not hinder polishing.

THE POSITIVE CARBON CONTACTS are machined from solid silver and should occasionally be lifted for inspection and removal of carbon dust accumulations.

THE CLEANING BRUSH which is furnished with each arc lamp should be used daily on the silver carbon contacts to keep them free from carbon dust.

THE CONTACT SURFACES OF THE CARBON CONTACTS should not be filed or sanded to brighten them under any circumstances. Oxides of silver are excellent electrical conductors and should not be removed from the contact surfaces. Occasionally, check the guide rods of the upper carbon contact to make sure they move freely. Clean the guide rods with number 400 emery cloth if necessary.

## ADJUSTMENTS

### ARC IMAGER WIRE

WHEN THE CRATER POSITIONING INDICATOR LIGHT is flashing ON & OFF (Proper Cycling) the tip of the positive carbon will protrude approximately 1-1/8" from the positive silver contacts. At the instant the indicator light flashes OFF, turn the lamp off and bend the arc imager wire so the tip of the positive carbon, the arc imager wire, and the slot in the door prism cover box are in alignment when sighted from the operators side of the lamp.

### BI-METAL TUBE

IF THE CRATER POSITIONING INDICATOR light does not flash ON or OFF when the edge of the positive crater is approximately 1-1/8" from the silver contacts, it is possible the Bi-Metal Tube is out of adjustment. See plate 1138 for instructions in adjusting the Bi-Metal tube.

### HEIGHT OF BI-METAL TUBE

THE TOP OF THE PROJECTED POSITIVE CARBON IMAGE should be 1/16" below the top of the slit in the bi-metal tube. (See inset plate 1138) If the tube is too low, loosen the bi-metal tube clamp band and raise the bi-metal tube enough to allow the positive carbon image to fall on the tube properly.

### SHEAR PIN

EACH LAMP is shipped with six extra shear pins. The shear pin is used in securing the Horizontal Drive Shaft Gear to the Horizontal Drive shaft of the Positive head. A broken shear pin can easily be removed with a pair of pliers and a new shear pin inserted in its place. Clean and lubricate the drive roller mechanism according to the instructions in the "MAINTENANCE" section to avoid damage to the replacement shear pin.

### AIR TUBE ALIGNMENT

THE AIR TUBE, when adjusted properly, will direct a stream of air just above the arc. To adjust the air tube to the proper position, first loosen the filister head screw and the set screw that is used to secure the air tube in the negative head. Then run a positive carbon out beyond the air tube. Using the positive carbon as a guide, adjust the air tube so the positive carbon passes over the center of the top of the air tube. The top of the air tube should also be about 3/16" below the bottom of the positive carbon. Then tighten the set screw and the filister head screw.

## SIDEWAYS ALIGNMENT OF NEGATIVE HEAD

THE NEGATIVE HEAD, WHEN IN CORRECT SIDEWAYS ALIGNMENT should direct the negative carbon to the exact center of the positive carbon. If it is mis-aligned sideways, it should be realigned so as to prevent the positive and negative flames from separating.

Loosen the fasteners of the negative head and remove the negative head from the base pan. Then just loosen the screws on the bottom side of the negative head assembly and replace the negative head on the base pan. With the screws just loosened, the negative head can be moved sideways to bring it into proper alignment. After the negative head is realigned, remove it once more and moderately tighten the screws on the bottom plate. Before attempting this adjustment however, be sure to have spare lava bushings (part No. 1086-C) on hand. They are used for insulating the negative head from the base pan and are very fragile. The lamp should not be operated without them. Should alignment be impossible, it may in rare cases be necessary to file the holes in the head mounting plate to give clearance to the lava bushings.

## CURRENT CONTROL RELAY

A CHECK TO SEE IF THE CURRENT CONTROL RELAY is operating properly can be made by removing the Bi-Metal tube and inserting a jumper wire diagonally across the tube socket contacts. Then, while the lamp is operating, the crater positioning indicator light should go on when the wire is inserted and off when the wire is removed.

## NEGATIVE FEED CLUTCH

SLIPPING OF THE NEGATIVE FEED CLUTCH can be corrected by inserting a screw driver in the slot of the negative clutch adjusting nut #90423 (see plate 1226) and turning the negative crank counterclockwise. Access to the clutch adjusting nut is accomplished by opening the rear door of the lamp and removing the plug in the end of the base pan to the left of the negative head.

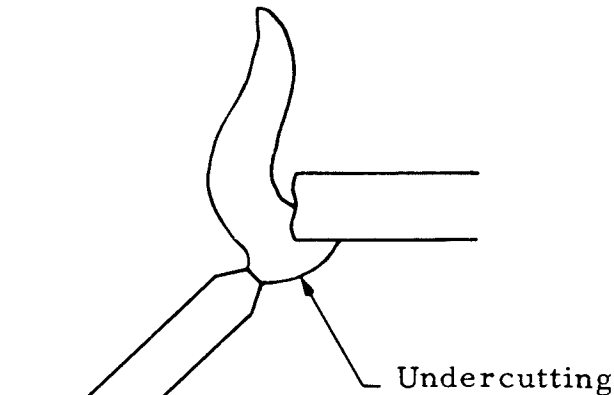
## POSITIVE MOTOR REALIGNMENT

REALIGN THE POSITIVE MOTOR by just loosening the 3 screws used to secure the positive motor gear head assembly to the motor body. Then tap the positive motor gear head with a fibre or rubber hammer until the positive crank will turn with no indication of binding. Tighten the three screws to again secure the gear head.

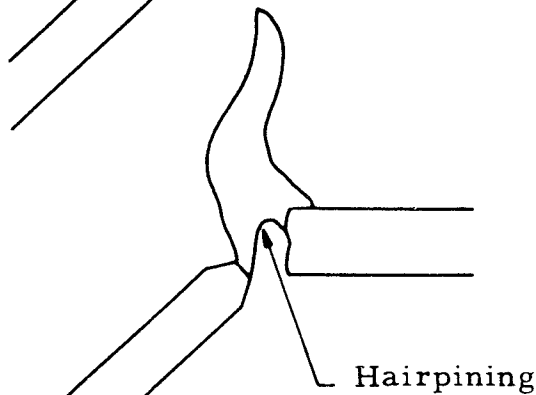
## NEGATIVE CARBON ADJUSTMENT

IF THE CURRENT SURGES MORE THAN 5 AMPERES, or the crater is persistently crooked, it is quite probable that the negative carbon is not adjusted to the proper angle.

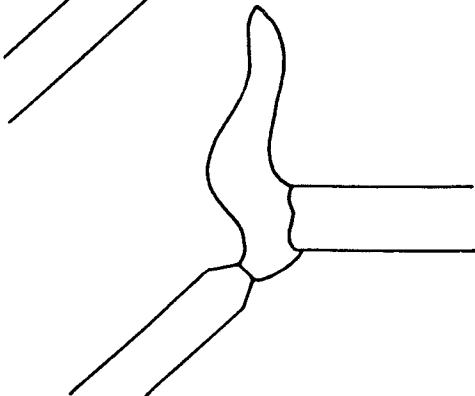
CHANGEOVERS FROM ONE SIZE CARBON TRIM to another will necessitate a slight adjustment of the negative carbon.



"UNDERCUTTING" of the arc flame is caused when the negative carbon is adjusted too low. Raise the negative carbon by turning the turnbuckle nut of the adjusting rod counter-clockwise.

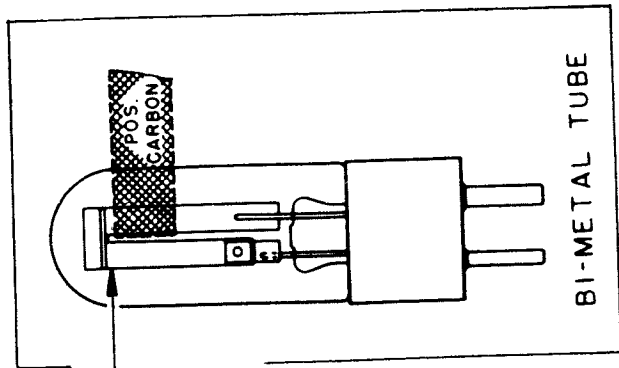
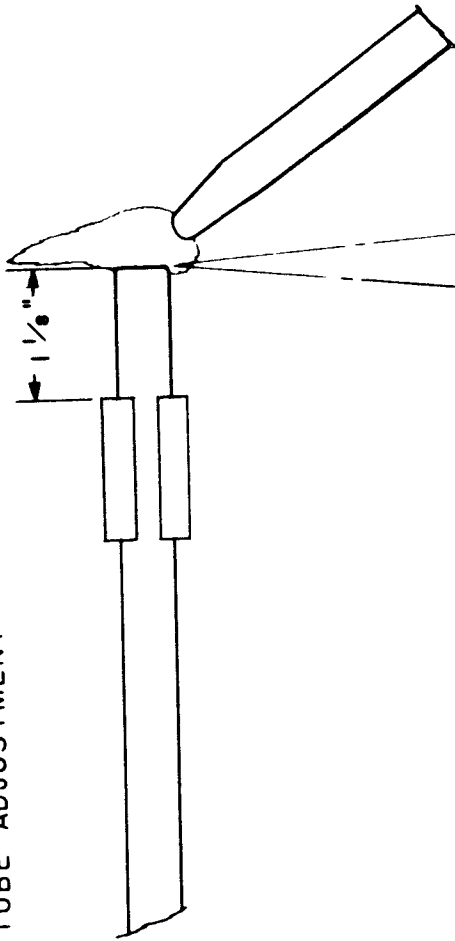


"HAIRPINING" of the arc flame is caused when the negative carbon is adjusted too high. Lower the negative carbon by turning the turnbuckle nut of the adjusting rod clockwise.

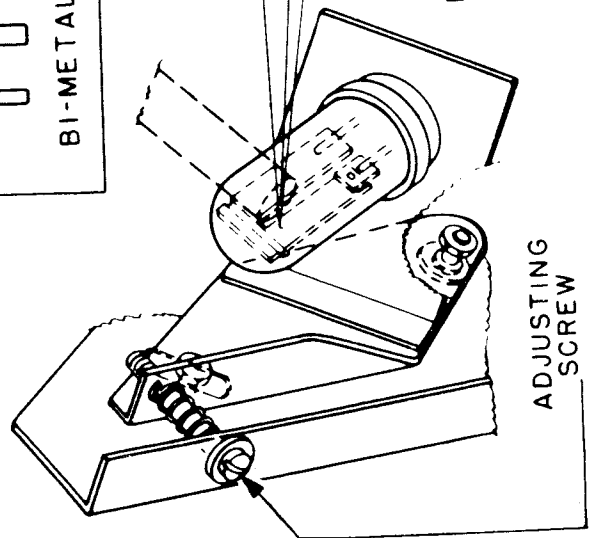


THE ARC FLAME will take on this appearance, with maybe just a slight undercutting when the negative carbon is adjusted to the proper angle.

BI-METAL TUBE ADJUSTMENT



$\frac{1}{16}$ "  
DISTANCE FROM TOP  
OF PROJECTED CAR-  
BON TO TOP OF SLIT  
IN BI-METAL TUBE.



ADJUSTING  
SCREW

REMOVE THE COVER PANEL FROM MOTOR SIDE OF THE LAMP. TURN ADJUSTING SCREW, WHILE LAMP IS BURNING, SO THAT TIP OF POSITIVE CARBON IMAGE IS AT SLOT IN BI-METAL TUBE WHEN THE POSITIVE CARBON PROTRUDES  $\frac{1}{8}$ " FROM POSITIVE SILVER CONTACTS.

*Turn screw clockwise to move arc closer to mirror*

TROUBLE CHART

<u>TROUBLE</u>	<u>PROBABLE CAUSE</u>	<u>REMEDY *</u>
1. Series of rapid flashes of crater positioning indicator light or cycles of "on" - "off" operation of from 2 seconds to 40 seconds duration.	Normal operation	Normal operation
2. Crater Positioning indicator light flashes in 1-1/2 to 3 minute cycles.	Normal except when these long cycles continue 10 minutes or more.	If continues see #3 below.
3. Crater Positioning Indicator light flashes 2-3 minute intervals for 10 minutes or more.	Wrong carbon trim combination.	See Plate 1211 for correct combinations.
	Wrong negative lead screw.	See Plate 1211 for information.
	Power supply not correctly adjusted see #4 or #5 below.	Adjust power supply in accordance with #4 or #5 below.
	Bi-Metal Tube at incorrect height.	See ADJUSTMENT section of instruction book.
4. Crater Positioning Indicator light remains OFF all the time.	Defective Bi-Metal tube.	Replace Bi-Metal tube.
	Power Supply to Arc Lamp is adjusted too low.	Increase power supply by raising rectifier output. If generator or commercial D. C. is in use, decrease line ballast by throwing in additional links.

\* All references are to instruction book.

TROUBLE	PROBABLE CAUSE	REMEDY
5. Crater Positioning Indicator light remains ON all the time.	Power Supply to Arc Lamp is adjusted too HIGH.	Decrease power supply by lowering rectifier output. If generator or commercial D. C. is in use, increase line ballast by pulling out switches or disconnecting links.
6. Arc Gap too Short	Power Supply too Low	Increase power supply (See #4)
7. Arc Gap too Long	Power Supply too High	Decrease power supply. (See #5)
8. Positive Carbon feeding too fast. Crater Positioning Indicator light remains OFF.	Power Supply too LOW	Increase power supply. (See #4)
9. Positive Carbon not feeding fast enough - Crater Positioning Indicator light remains ON.	Power Supply too High	Decrease power supply. (See #5)
10. Positive carbon not feeding fast enough - Crater Positioning Indicator light remains OFF.	Positive carbon referenced at incorrect location because Arc Imager Wire is bent out of correct position.	Reset the Arc Imager Wire -(See adjustment Section).
	Improper setting of Bi-Metal positive position sensing tube.	Adjust Bi-Metal tube (See plate 1138).
	Pilot light burned out.	Replace with new pilot light and check #9 above.
	Defective Bi-Metal tube.	Replace Bi-Metal tube



TROUBLE  
10. (Cont'd)

PROBABLE CAUSE

REMEDY

Current control RELAY  
not working properly.

Check RELAY - (See  
Adjustment Section).

11.  
Positive carbon feeding  
too fast Crater Position-  
ing Indicator light remains  
ON.

Positive carbon refer-  
enced at incorrect loca-  
tion because Arc Imager  
Wire is bent out of prop-  
er position.

Reset the Arc Imager  
Wire - (See Adjustment  
Section).

Improper setting of Bi-  
Metal positive position  
sensing tube.

Adjust Bi-Metal tube.  
(See plate 1138).

Defective Bi-Metal tube.

Replace Bi-Metal tube.

Current control RELAY  
not working properly.

Check RELAY - (See  
Adjustment Section).

12.  
Crater Positioning Indi-  
cator light flashes ON  
and OFF when carbon  
crater is held at distance  
other than approximately  
1-1/8" from the positive  
silver contacts.

Improper setting of Bi-  
Metal positive position  
sensing tube.

Adjust Bi-Metal tube.  
(See plate 1138).

13.  
Light does not flash ON  
when tip of positive car-  
bon is moved slightly be-  
hind (away from negative)  
reference wire on arc im-  
ager, or flash OFF when  
positive carbon is moved  
slightly ahead of reference  
wire as seen on arc imager.

Positive carbon refer-  
enced at incorrect loca-  
tion because Arc Imager  
wire is bent out of cor-  
rect position.

Reset arc imager wire  
(See Adjustment Sec-  
tion).

Improper setting of bi-  
metal positive carbon  
position sensing tube.

Adjust bi-metal tube  
(See Plate 1138).

Defective bi-metal tube.

Replace bi-metal tube.

Current control relay  
not working properly

Check relay. (See  
Adjustment Section).

TROUBLE	PROBABLE CAUSE	REMEDY
14. Improper Feeding or failure of Positive Carbon to Feed.	Carbon release handle not engaged.	Engage carbon release handle.
	Motor plug disconnected	Plug in motor plug.
	Lack of lubrication in Positive cluster.	Refer to Lubrication in Maintenance Section.
	Silver contact frozen.	Insert screw driver between upper and lower contacts and pry apart. (See maintenance section).
	Wrong size positive contacts in use.	Replace with correct contacts. See chart on plate 1211.
	Worn motor brushes	Replace if worn.
	Defective or burned out motor	Replace positive motor.
15. Improper Negative Feeding or Failure of negative carbon to feed.	Shear Pin in Horizontal Drive Shaft broken.	Replace with new shear pin. (See plate 1151).
	Motor plug disconnected	Plug in motor.
	Lack of Lubrication of lead screw and guide rod.	Refer to Lubrication in Maintenance section.
	Wrong size lead screw.	Replace with correct lead screw. See Chart on plate 1211
	Wrong size negative carbon.	See plate 1102 for proper negative to use with various positives and currents.
	Worn motor brushes	Replace if worn.
Defective or burned out motor.	Replace negative motor.	

TROUBLE 15. (Cont'd)	PROBABLE CAUSE	REMEDY
	Damaged Helical Gear in negative head.	Replace Helical Gear.
	Negative Feed Clutch Slipping.	See Adjustment Section.
16. Current surges up and down five amperes or more.	Angle of Negative Carbon improperly set.	See plate 1153).
	Incorrect Power Supply Setting	See "Operation" for setting the power supply.
	Improper power supply characteristics.	Refer to generator requirements in "Setting UP" section.
17. Carbide tip on negative carbon.	Arc Gap too Short	See TROUBLE #6
18. Excessive penciling of the negative carbon (over 1" copper burnt off).	Wrong negative carbon.	See plate 1102), for proper negative to use with various positives and currents.
19. Undercutting or Hair-pinning of Arc flame.	Incorrect angle of negative angle.	See carbon alignment on plate 1153.
20. Fanning or splitting of Tail Flame.	Sideways miss-alignment of negative carbon.	See adjustment section.
	Air tube is bent out of position and directing the aid improperly.	See Adjustment section.
	Excessive Stack draft.	Cut down the stack draft by means of the damper. (See setting up instructions)

TROUBLE	PROBABLE CAUSE	REMEDY
21. Insufficient Illumination or Discoloration on Screen.	Amperage too low for selected carbon trim; or wrong carbon trim.	Refer to Carbon Com- bination Chart for cor- rect carbon trim and corresponding amper- ages. See plate 1102.
	Lamphouse improper- ly aligned.	See "Setting UP" sec- tion in this instruction book for proper align- ment.
	Lamp improperly Focused.	See "Operation" sec- tion.
	Carbon Miss-Alignment	See carbon alignment on plate 1153.
	Obstruction in light path	File out the aperture heat baffle in the pro- jector to clear the beam.
22. Excessive Sooting of Reflector.	Insufficient stack draft.	Increase stack veloc- ity. (See setting up Instructions)
	Air tube is bent out of position and directing the air improperly.	See Adjustment section
	Motor fans full of dirt.	Remove and clean.
23. Scum on the reflector	Improper cleaning.	See Maintenance Secti for daily care of the r flector.
24. Positive crank sticks in after manual feed adjustment.	Positive motor out of line	See adjustment section
25. Positive carbon stubs too long resulting in waste of carbons.	Current and burning rate selector not set to utilize carbons to best extent.	Raise or lower burn- ing rate selector to fit needs. (See plate 11

## CONVERSION TO OTHER CARBON COMBINATIONS OR CURRENT RANGES

THE TABLE ON PLATE 1211 presents information regarding the illumination, arc power requirements, and parts required to burn any of the carbon trims now available for this lamp.

THE NECESSARY PARTS REQUIRED TO BURN these carbon trims can be supplied for field installation.

### POSITIVE MOTOR

THE 300:1 RATIO OR SO CALLED "3-D" MOTOR can be identified by the blue mark placed on the "cycles" blank as well as by the notation of the ratio on the motor nameplate. The 216:1 ratio or regular positive motor has the ratio stamped on the motor nameplate.

TO CHANGE THE POSITIVE CARBON DRIVE MOTOR, simply remove the three mounting screws on the motor base plate. Then pull out the three wire plug connection and the motor and blower assembly can be removed as a unit. Attach the replacement motor and blower assembly and secure with the three mounting screws. Replace the three wire plug connection.

### POSITIVE CARBON DRIVE ROLLER ASSEMBLY

THE 11 MM POSITIVE CARBON DRIVE ROLLER assembly can be used only for the 11 mm carbon and is identified by the numeral "11" stamped on the rollers. The combination 9-10mm positive drive rollers are not stamped.

TO CHANGE THE POSITIVE CARBON DRIVE ROLLER ASSEMBLY, remove the hinge pin (see plate 1213) and lift off the assembly. Attach the replacement assembly and secure with the hinge pin.

### NEGATIVE LEAD SCREW

THE 5 THREAD NEGATIVE LEAD SCREW can be used only for 9 or 10 mm regular carbons, and arc amperages below 110. The 6-1/4 thread lead screw is needed for any arc amperage above 110. The 6-1/4 thread lead screws are stamped 6-1/4 on the end of the shaft under the drip catcher. The 5 thread screws are not stamped. The lead screws can also be identified by counting the turns of the negative crank. The 5 thread negative lead screw will take 8 to 9 complete revolutions of the crank handle to run the negative carbon carriage its complete length of travel. The 6-1/4 thread negative lead screw will require 10-3/4 to 12 revolutions of the crank.

FOR INSTRUCTIONS IN REMOVING AND REPLACING the negative lead screw see Service Bulletin 240-90000 contained in this Booklet, beginning on plate 1220.

### POSITIVE CONTACTS

THE POSITIVE CONTACTS are identified by the numerals "9", "10", or "11" stamped on the side of the contacts.

TO CHANGE POSITIVE CONTACTS, remove the rod top end plate, #90579, (see plate 1198). Remove the ends of the top contact shunts from the side of the support casting and lift off top contact. Unscrew the bottom contact from the contact support casting. Wrap a piece of fine emery cloth around a block of wood and lightly rub the top surface of the contact support casting a few times to clean the table. If the top surface of the contact support casting is badly pitted or burned so that a good connection to tower contact will not be obtained, replace with a new contact support casting. Attach the replacement bottom contact and secure with the two attaching screws. Place the new top contact over the guide rods making sure the insulating washers are in place or according to plate 1198. Secure with the rod top end plate and attach the ends of the top contact shunts to the sides of the support casting.

## SERVICE BULLETIN

240-90000

8-53

INSTRUCTIONS FOR REMOVING AND REPLACING the Lead Screw and Ball Assembly and Lead Screw Collar in the Negative Head Unit Assembly. The 6-1/4 thread per inch negative lead screw is needed for any arc amperage above 110. It can be installed in any negative head with the screw type negative carbon clamp. For older heads with the cam type negative carbon clamp it will be necessary to obtain a complete new negative head. The 5 thread per inch negative lead screw can be used only with 9 or 10 mm regular carbons, and arc amperages below 110.

LOOSEN THE FOUR HEAD MOUNTING FASTENERS that secure the negative head unit assembly to the mechanism base assembly and remove the casting.

DETACH THE NEGATIVE LEAD WIRE from the casting.

DETACH THE NEGATIVE RIBBON #90505 (see plate 1100) and the top attaching screw of the upper adjusting rod #90507 from the negative guide casting #90498.

CAUTION - IMPORTANT. Before executing the next step you will observe that there may be one or two washers on one or both sides of fibre gear #90970. These washers are used to center the fibre gear with the lead screw helical gear. When you remove the negative head guide casting pivot pin #90500, these washers will be released. Remember the number of washers (they will vary in number) on each side of this fibre gear, so when it is replaced, the washers will appear exactly as they did before they were removed.

REMOVE ONE WIRE SNAP RING #90516 and slip out the negative head guide casting pivot pin #90500. This will release the negative guide casting from the negative head base casting #90499.

REMOVE SCREW #256 and washer #830 used to secure the negative head driving dog #90504. You will observe the driving dog is tapped. Insert a 6-32 machine screw in the driving dog and grasp the head of the screw with pliers and remove the driving dog.

REMOVE SET SCREW #90133 that attaches the lead screw and ball assembly to the lead screw helical gear #90219 and remove the lead screw and lead screw collar.

## REPLACEMENT

INSERT THE REPLACEMENT LEAD SCREW AND LEAD SCREW COLLAR and attach it to the lead screw helical gear with set screw #90133.

ADJUST SET SCREW #17319 until snug against lead screw thrust ball. Then loosen screw 1/8 turn and lock. This will give the lead screw the correct amount of end play.

REPLACE THE NEGATIVE HEAD DRIVING DOG to the negative carbon carriage and secure with screw #256 and washer #830.

REATTACH THE GUIDE CASTING to the head base casting by means of the pivot pin. Make certain that the washers on either side of the fibre helical gear are placed exactly as they were before they were removed. Secure with the snap ring.

REATTACH THE UPPER ADJUSTING ROD AND NEGATIVE RIBBON.

MOVE THE CARBON CARRIAGE BACK AND FORTH several times by turning the fibre gear by hand to make sure all parts have been fitted properly.

PLACE A FEW DROPS OF STRONG HEAT RESISTANT LUBRICANT on the lead screw, on the two guide rods, and in the oil holes in the guide casting. Then once again run the carbon carriage back and forth several times to make sure the above mentioned parts are properly lubricated.

REATTACH THE NEGATIVE LEAD WIRE.

REATTACH THE NEGATIVE HEAD UNIT ASSEMBLY to the mechanism base assembly.

## READJUSTMENT OF ARC IMAGER WIRE

The Arc Imager Wire, mounted on the negative jaw indicates the approximate position of the positive carbon crater. This wire has no effect whatsoever on the automatic positioning system and is used only as a reference guide for the setting of the positive carbon when the arc is struck. Therefore, if this wire becomes bent it will indicate a false setting of the positive carbon. Proper position of this wire is indicated when the shadow of the wire, as projected on the arc imager screen, is just at the tip of the positive carbon when the automatic crater positioning control light is flashing ON and OFF. The position of the wire then should be approximately 1-1/8" from the silver contacts of the positive jaw.



SERVICE BULLETIN

235-90000

10-23-50

TO REMOVE THE MECHANISM BASE ASSEMBLY, disconnect the white asbestos direct current supply leads running into the lamphouse at supply end of the leads.

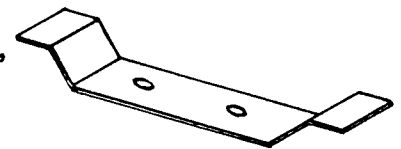
TAKE OFF THE MOTOR COVER PANEL located immediately above the motors on the off side of the lamp by removing the four screws.

REMOVE BOTH NEGATIVE AND POSITIVE MOTOR AND BLOWER assemblies by taking out the three mounting screws on each motor base plate. Then pull out the three wire plug connection and the motor and blower assembly can be removed.

THE POSITIVE FEED HEAD ASSEMBLY can next be conveniently removed by rotating 1/4 turn each, the three hold down screwdriver head mounting fasteners (see plate 1213). Lift the head up so that the lower gear drive is above the base hole, then lay the complete head down on its side on the base pan, with its carbon drive roller end facing the off side of the lamphouse, so that the lower most screw number 508 (see plate 1198) can be removed to disconnect the positive lead wire.

LOOSEN THE INSTRUMENT PANEL, #90397 by removing the four #1307 screws (see plate 1222 or 1229). Slide this instrument panel outward as far as it will go before it hits the manual feed cranks.

REMOVE THE TWO LIGHT BAFFLE PLATES, the shapes of which are here roughly sketched, one baffle being located at each end of the mechanism base inside the lamphouse.



BOTH NEGATIVE AND POSITIVE MANUAL CARBON FEED cranks part number 90955 (see plate 1224) are next taken off by removing set screws part number 90134, and then without disconnecting any wires, the instrument panel is set on the mechanism base, crosswise to and within the lamphouse.

NEXT REMOVE THE TWO BASE LOCKING SCREWS, part number 90389 (see plate 1224). These two locking screws are located on the operator's side of the lamp underneath the instrument panel and near the positive and negative crank shafts.

REMOVE THE BASE GUIDE PINS, part number 90387 (see plate 1224). These pins are on the non-operating side of the lamp and are located under the motor and blower mounting plates, which have already been removed.

One pin is located at each end of the mechanism base and they are easily removed with a pair of pliers.

THE COMPLETE MECHANISM BASE ASSEMBLY can then be lifted up and removed through the lamphouse door on the operating side of the lamp.

CLEAN ALL COPPER DRIPPINGS OUT OF THE GROOVE in the lamphouse keel plate, (see plate 1212), located on the operator's side so that the mechanism base guide edge will seat properly when it is engaged. ←

INSERT THE COMPLETE MECHANISM BASE through the operator's side door of the lamphouse and lower it into position making sure that the mechanism base guide edge is properly entered into the groove in the lamphouse keel plate on the operator's side. Also the focus adjusting nut, part number 90254 (see plate 1224) fits into the sheet metal retainer on the mechanism base.

INSERT THE BASE GUIDE PINS, part number 90387 and tap lightly into place so that their ends are flush with the side of the mechanism base upon which the motors are mounted.

INSERT AND TIGHTEN THE TWO BASE LOCKING SCREWS, part number 90389 (see plate 1224).

NEXT INSTALL THE TWO LIGHT BAFFLES, one at each end of the mechanism base, using the long screws for the front baffle.

THE INSTRUMENT PANEL, part number 90397 is next installed using the four 1307 screws. The positive and negative manual feed handles can then be fastened on their shafts.

THE POSITIVE FEED HEAD ASSEMBLY is next installed. Lay the complete head down on its side on the base pan, with its carbon drive roller end facing the non-operating side of the lamphouse, so that the screw, 508, can be inserted to secure the positive lead wire. Tighten this screw snugly.

NOW INSTALL THE POSITIVE HEAD in its upright operating position, engaging the dowel pins in their respective holes, and tightening it down by rotating for 1/4 turn each, the three hold down screwdriver head mounting fasteners (see plate 1213).

RE-INSTALL BOTH POSITIVE AND NEGATIVE MOTOR AND BLOWER assemblies, by engaging the dowel pins into their respective holes and securing each by the three screws. It may be necessary to rotate the positive or negative manual feed cranks to properly seat the motor shafts onto their respective drives. Insert the three conductor plugs into the receptacles.

INSTALL THE MOTOR COVER PANEL located immediately above the motors, using the four screws, and reconnect DC supply leads.

## INSTRUCTIONS FOR ATTACHING WATER COOLED HEAD ASSEMBLY

Kit 90797 for 9 mm Carbons  
Kit 90798 for 10 mm Carbons  
Kit 90799 for 11 mm Carbons

THE NEW WATER COOLED HEADS are designed for use with a water recirculating unit and must not be attached directly to the local water supply. If either a Century, or National "Aquaflow" water recirculating unit is presently used in your installation for cooling the projector aperture, it may also be used to cool the positive head. Make certain however that the water hoses are connected so that the water is pumped from the circulator through the aperture first, then to the positive head, and then returned to the tank. CAUTION: One circulator must be used for each lamp. If a circulator is not presently in use it will be necessary to order one for each lamp. Water recirculating units are available from the factory under part number 23479.

BEFORE ATTEMPTING TO CONVERT to the new water cooled positive head, observe the bottom side of the lamphouse (from motor side of lamp) to see if there are two holes containing welsh plugs located about 8-1/4" from the front edge of the burner pan (bottom side). See plate 1272. These two holes are the entrance openings for the two water hoses contained in kit.

IF YOUR LAMP DOES NOT CONTAIN THESE TWO HOLES it will be necessary to drill them in the base pan with a size #17/32 drill. Drill so the center of the first hole is about 8-1/4" from the front edge of the burner pan (bottom side), and in line with the arc lead bushings, as shown on plate 1272. Drill second hole one inch to rear of first hole drilled.

REMOVE THE POSITIVE HEAD ASSEMBLY by rotating 1/4" turn each, the three hold down screwdriver headmounting fasteners. Lift the head up so that the lower gear drive is above the base hole and lay the complete head down on its side on the base pan. Disconnect the positive lead wire by removing the lowermost screw #508. (See Plate 1273. Location of screw #508 is same on old and new positive head.) Remove the positive jaw and support casting from the positive feed head assy. by removing the two attaching screws, #508 and #513 and lockwashers, #876. Retain screws and lockwashers.

ATTACH THE NEW WATER COOLED POSITIVE HEAD to the positive casting assembly and secure with attaching screws and lockwashers previously removed.

LOOSEN THE FASTENERS OF THE NEGATIVE HEAD ASSEMBLY and lay the complete head down on its side on the base pan. (Negative head is removed only for greater convenience when attaching water hoses.)

REMOVE THE POSITIVE MOTOR AND BLOWER ASSEMBLY by taking out the three mounting screws on the motor base plate. Pull out the three wire plug connection and the motor and blower assembly can be removed.

INSERT THE TWO WATER HOSES (from bottom side of lamp) through the two hose entrance openings in the burner pan and push them through the air chamber and around the flange of the positive head opening before bringing the ends of the hoses up through the positive head opening as shown on plate 1272.

NOW RUN THE POSITIVE LEAD through the positive casting assembly and connect (between copper tubes) to the lowermost screw on the new positive head. Connect the ends of the hoses to the copper tubing in the positive head and secure with hose clamps #90663 contained in kit. These hose clamps will be very close or may even touch one of the positive head mounting screws; this cannot cause any electrical trouble, however care should be taken so the clamps do not touch the flange of the burner pan.

TO TEST FOR PROPER WATER CIRCULATION, connect one of the hoses from the water cooled head to the "feed" connector of the water recirculating unit, or to the return hose of the water cooled projector aperture, depending on the installation. Next, connect the electrical supply cord from the water recirculator to any 110 volt outlet. Turn the water recirculator motor on and catch a small amount of water with the "return" hose. A solid steady flow of water is an indication of proper water circulation. If above test is satisfactory, secure "return" hose to circulating unit with hose clamp #90663.

TO PREVENT THE POSITIVE HEAD FROM BECOMING CLOGGED due to rust, add one (1) pound of rust inhibitor to the water system every year. Rust inhibitor is available from the factory in one (1) pound lots under part number 23098.

REPLACE THE COMPLETE POSITIVE HEAD ASSEMBLY to the base pan and secure by means of the head mounting fasteners. Be sure that the slack is taken out of the positive lead wire so that it will not rub on the drive gear on the positive cross shaft.

RE-INSTALL THE POSITIVE MOTOR AND BLOWER ASSEMBLY, by engaging the dowel pins into their respective holes and secure the assembly with the three screws. It may be necessary to rotate the positive manual feed crank to properly seat the motor shaft onto the positive drive. Insert the three conductor plug into its receptacle.

REATTACH THE NEGATIVE HEAD to the base pan.

REMOVE THE SET SCREW that secures the carbon release handle to the Positive Drive Rollers and casting assembly and remove the handle. Replace with the handle enclosed in kit and secure with the same set screw.

SO THE LAMP CANNOT BE OPERATED WITHOUT THE WATER flowing through the positive head, a relay has been included in the kit. Attach relay bracket 90672 to the lamphouse with the same two screws that presently secure the side panel (motor side) to the lamphouse. (See plate 1274). Now attach the relay box to the relay bracket with attaching screws furnished. Next, remove the three pronged plug of the negative motor from its receptacle and in its place attach relay plug 90302 as shown on plate 1274. Connect the negative motor plug then to receptacle 90303 in the relay box. The electrical supply cord from the water circulator is connected to receptacle 90673 in the relay box and relay cord cap 14155 is connected to any 110 volt outlet.

#### CAUTION - IMPORTANT

BEFORE INSERTING THE POSITIVE CARBON make sure that proper contact is made between upper and lower carbon contacts. The flexible tubing can be bent slightly to allow the entire surface of the upper contact to touch the entire surface of the lower contact.

PLATE 1272

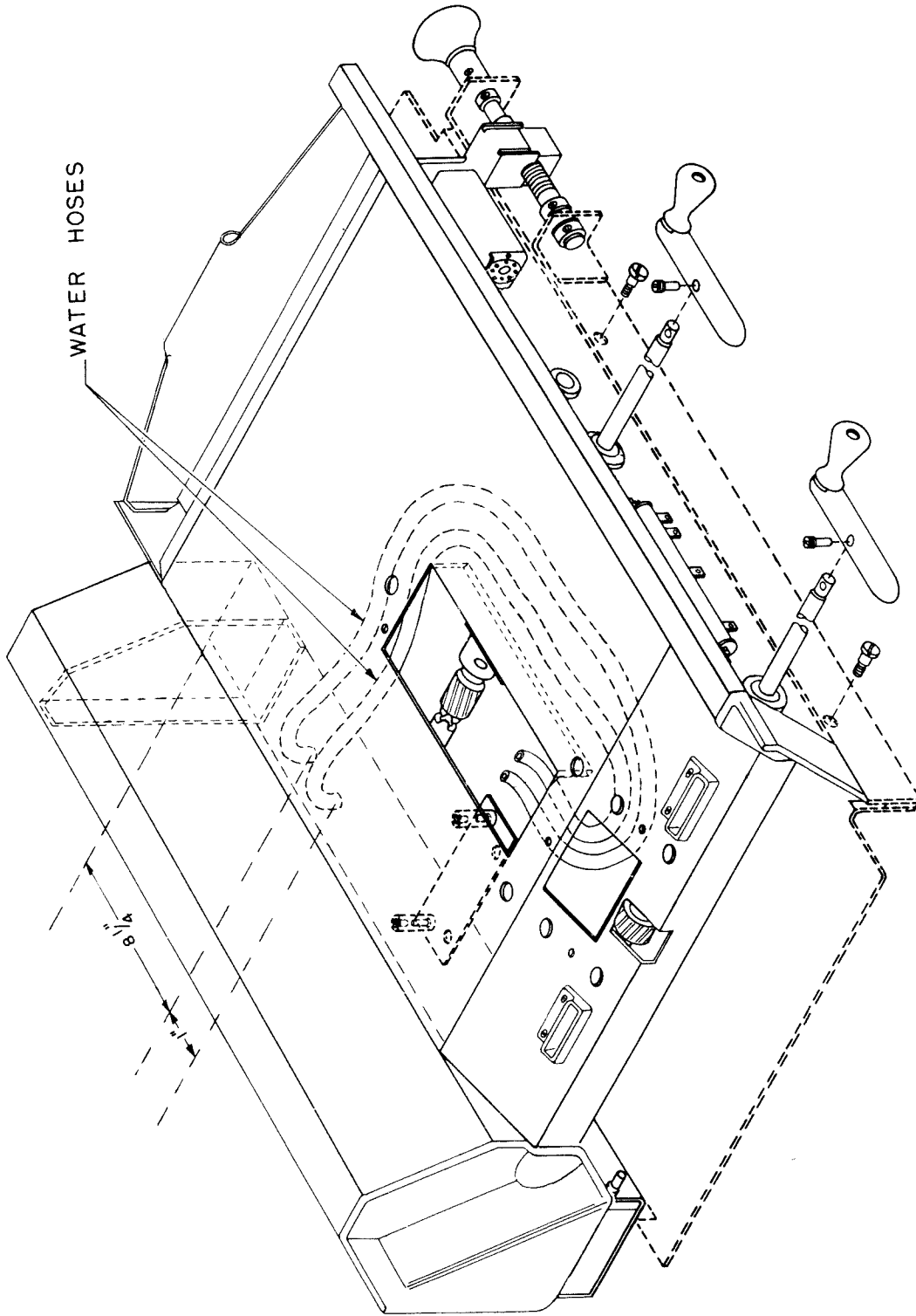
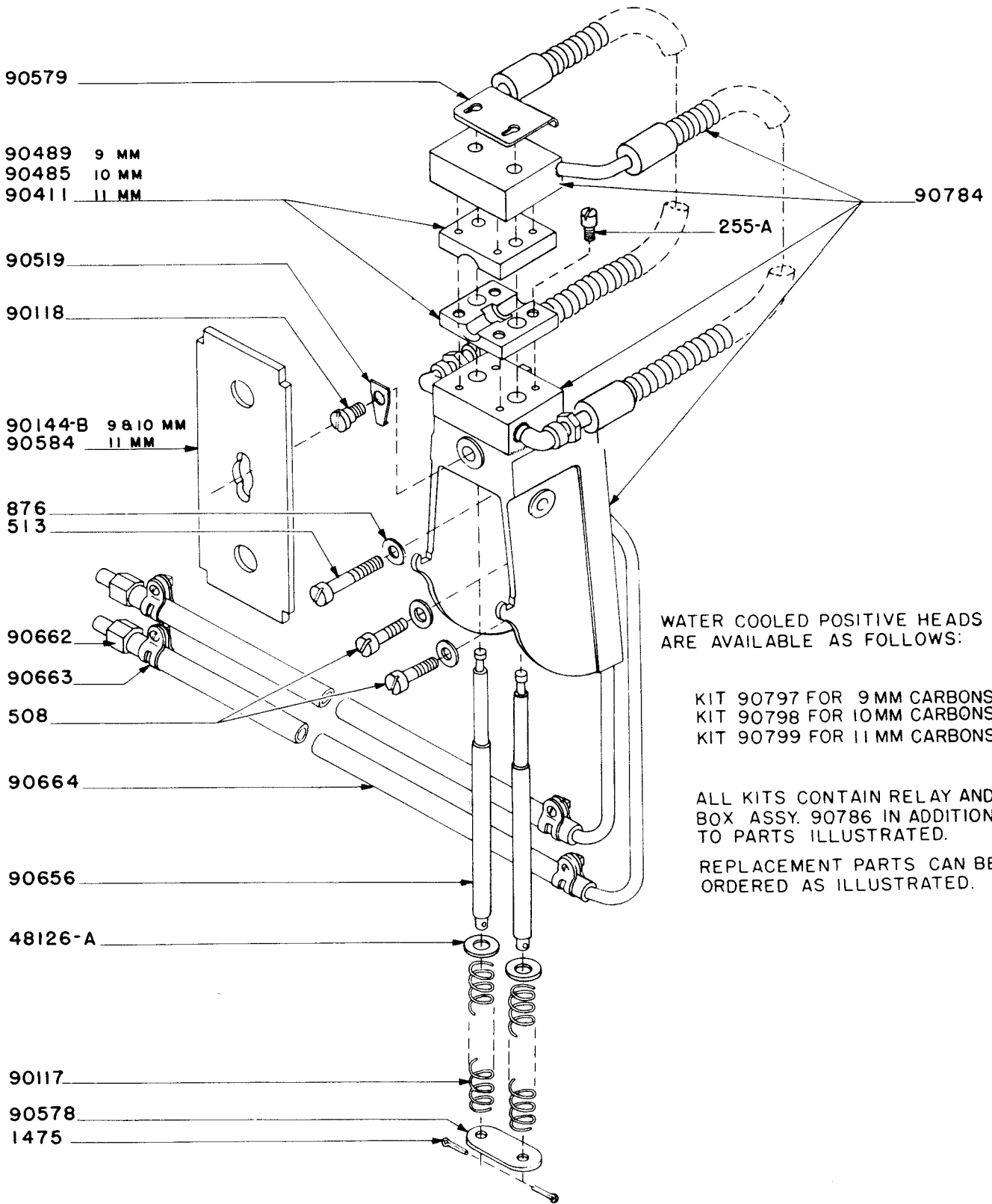


PLATE 1273



WATER COOLED POSITIVE HEADS  
ARE AVAILABLE AS FOLLOWS:

- KIT 90797 FOR 9 MM CARBONS
- KIT 90798 FOR 10MM CARBONS
- KIT 90799 FOR 11 MM CARBONS

ALL KITS CONTAIN RELAY AND  
BOX ASSY. 90786 IN ADDITION  
TO PARTS ILLUSTRATED.

REPLACEMENT PARTS CAN BE  
ORDERED AS ILLUSTRATED.

PLATE 1274

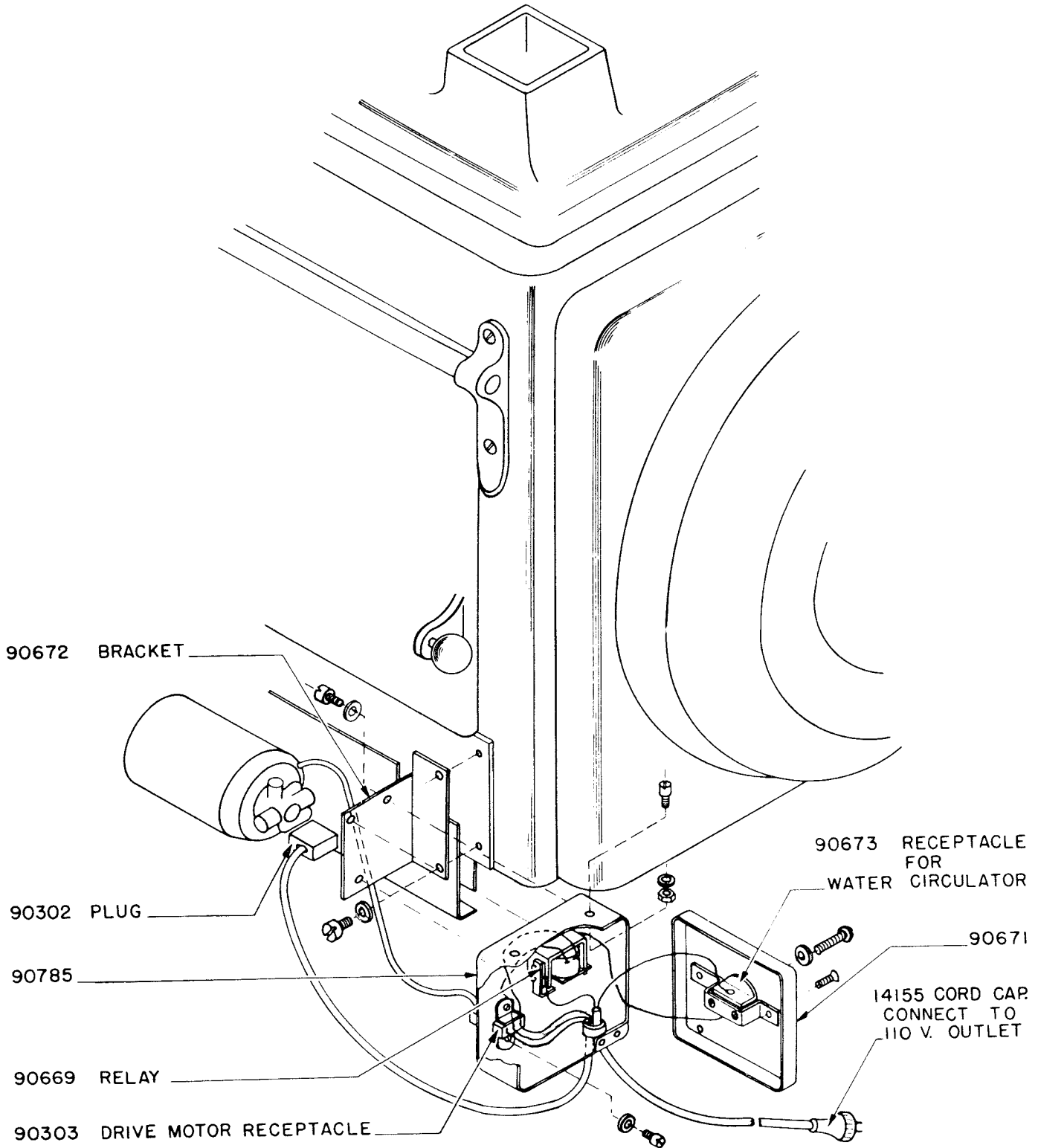




PLATE 1232

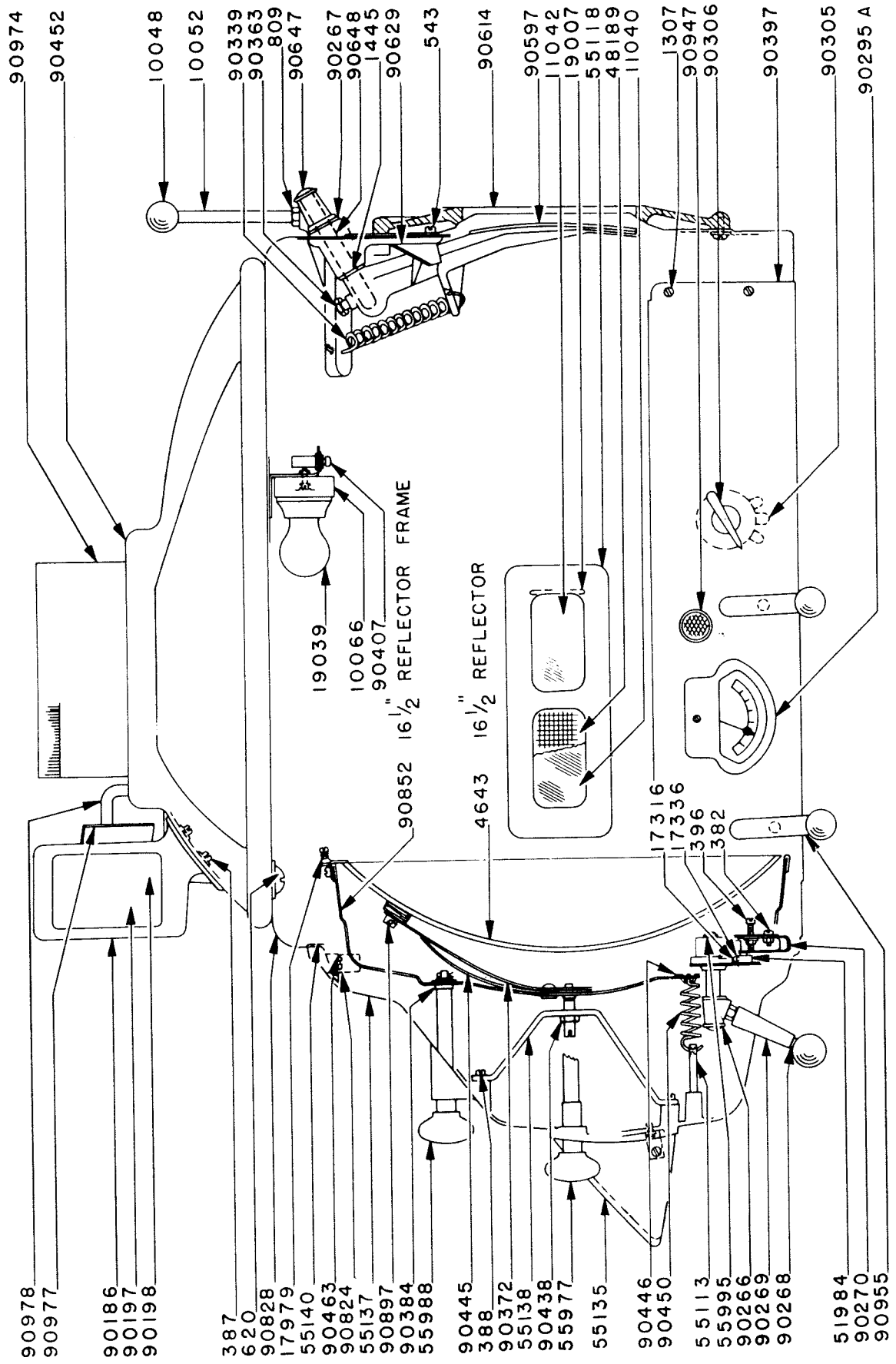


PLATE 1233

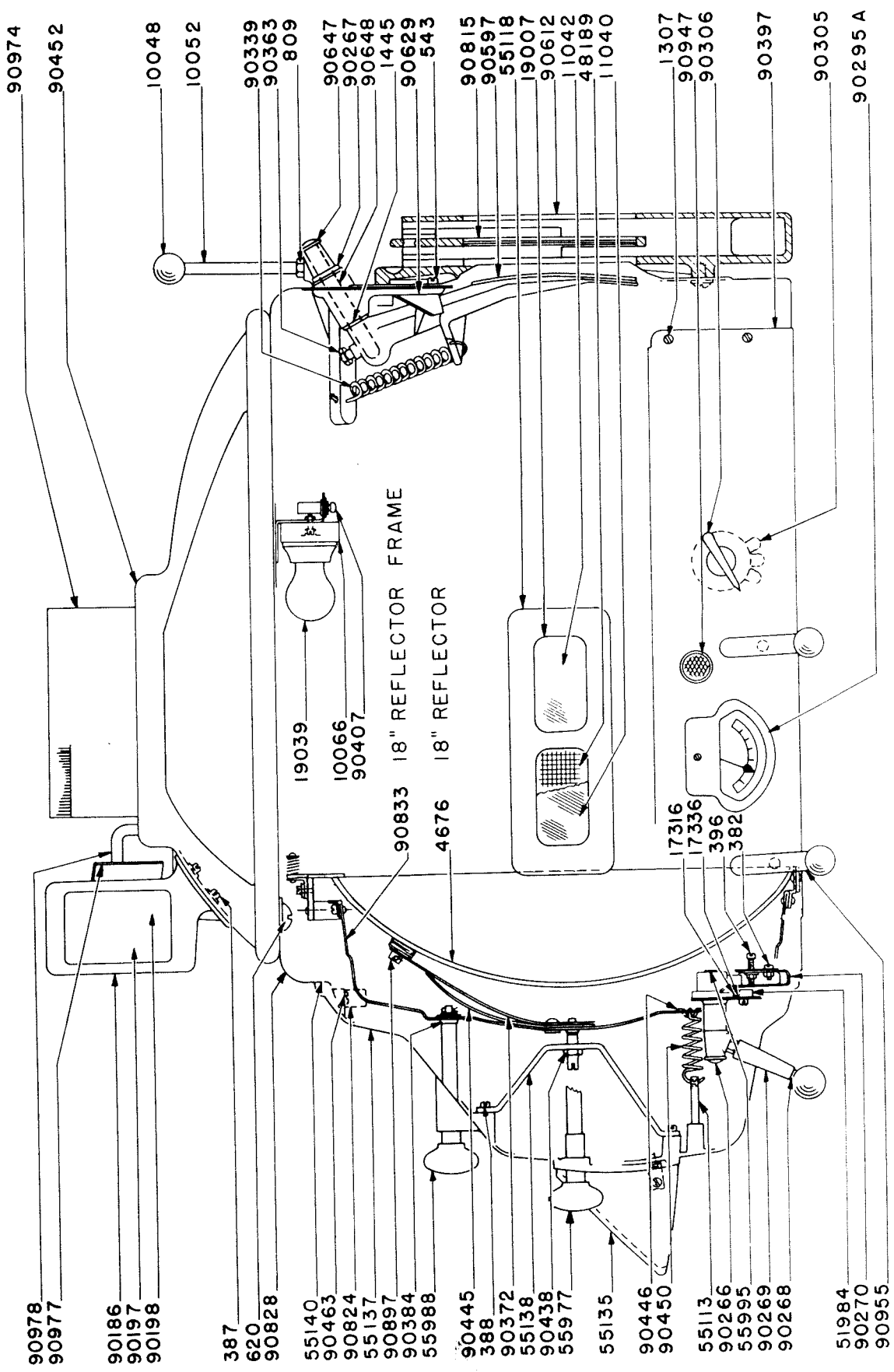


PLATE 1223

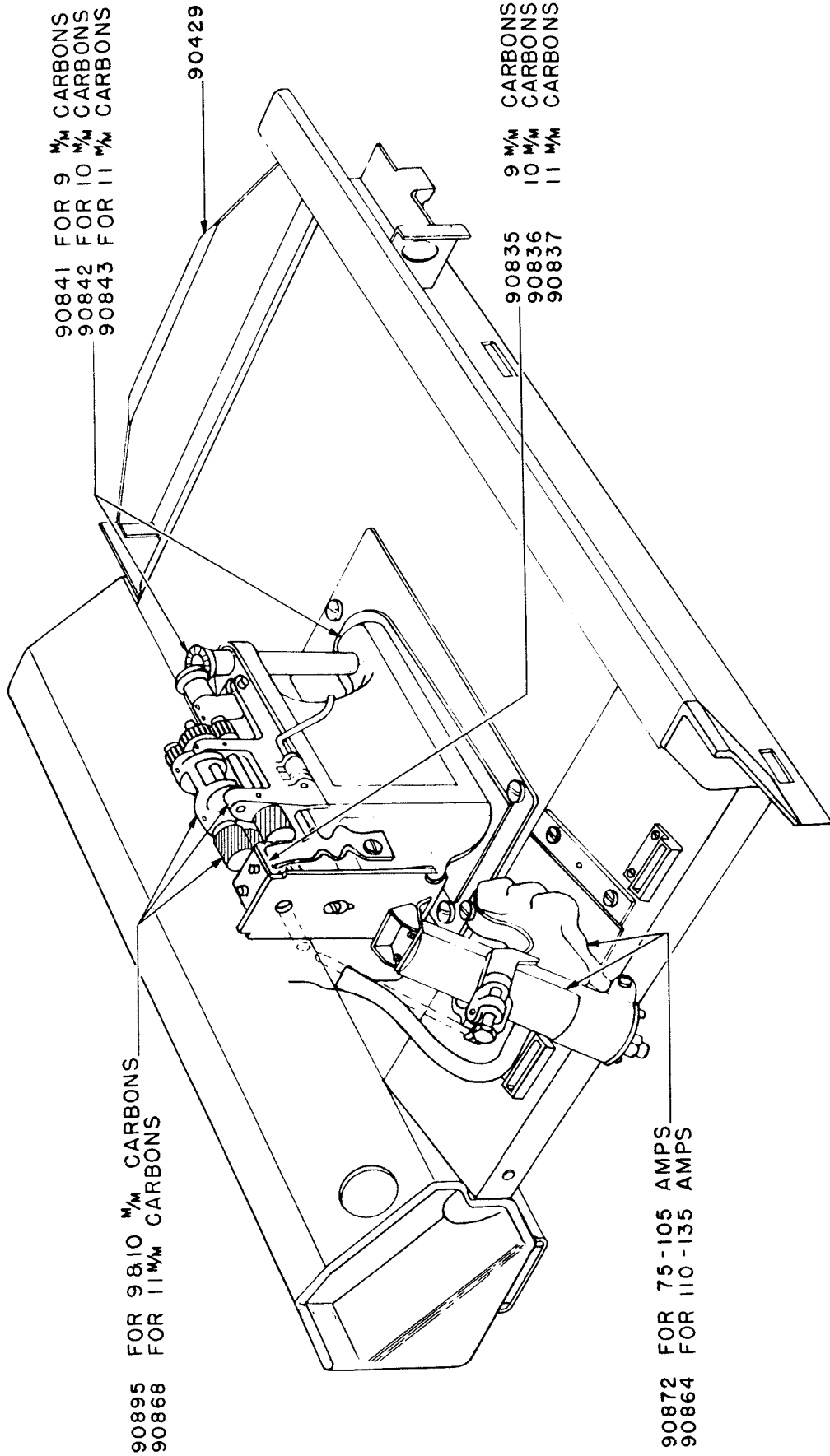


PLATE 1224

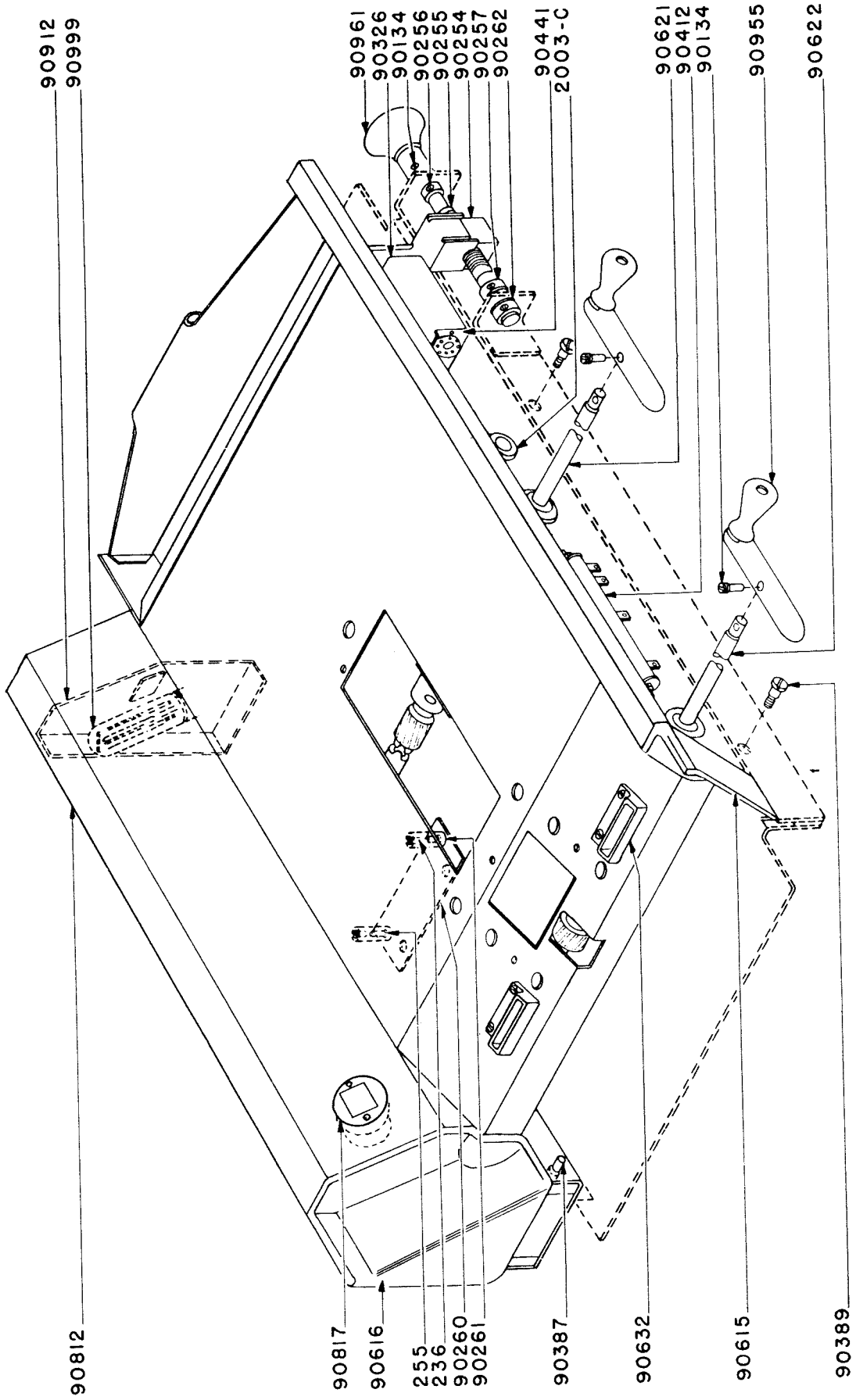
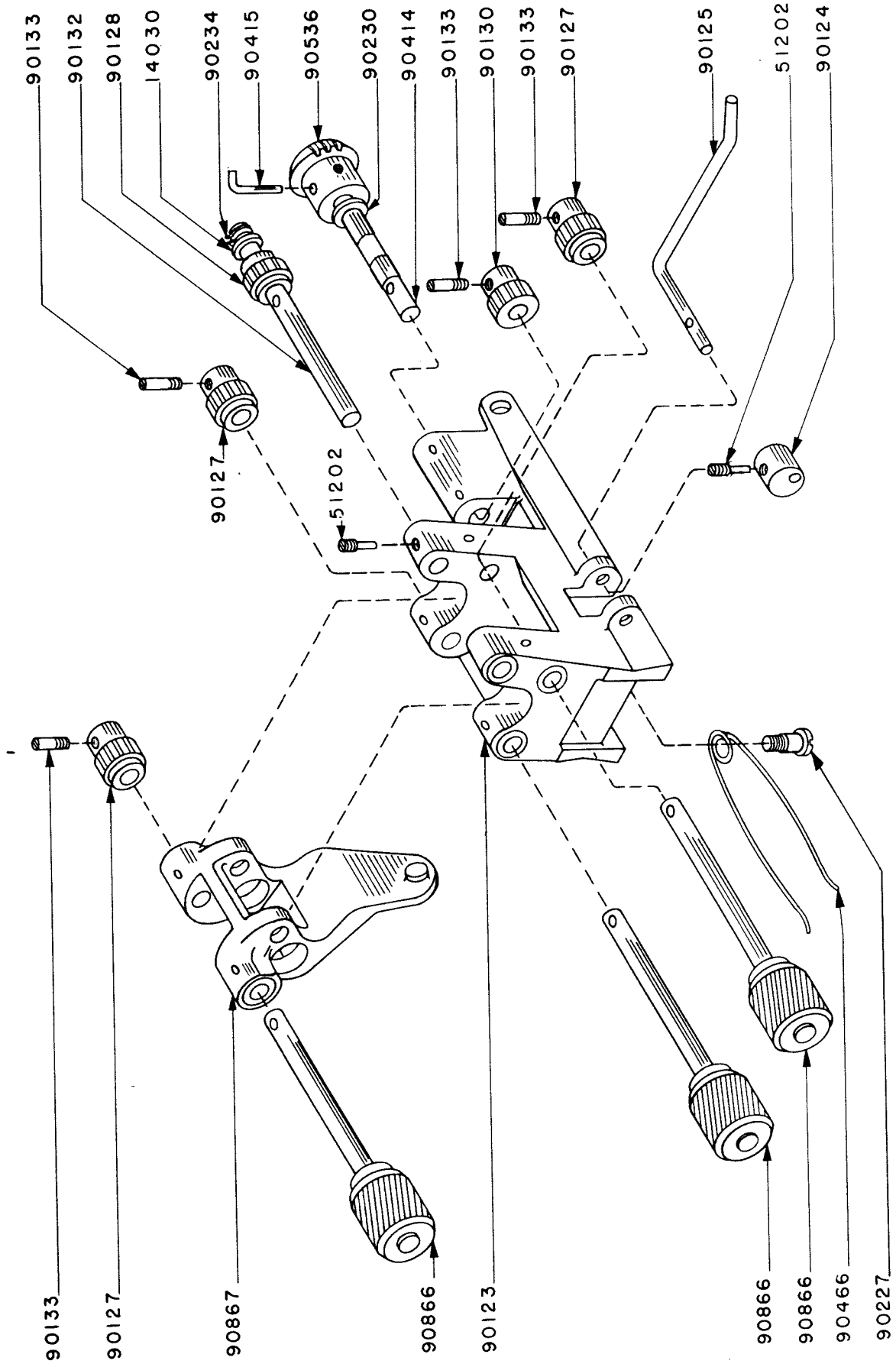


PLATE 1049



DECIMALS OF AN INCH  
FOR EACH 64 TH  
WITH MILLIMETER EQUIVALENTS

Frac- tion	$\frac{1}{64}$ ths	Decimal	Milli- meters
	1	.015625	0.397
$\frac{1}{32}$	2	.03125	0.794
	3	.046875	1.191
$\frac{1}{16}$	4	.0625	1.588
	5	.078125	1.984
$\frac{3}{32}$	6	.09375	2.381
	7	.109375	2.778
$\frac{1}{8}$	8	.125	3.175
	9	.140625	3.572
$\frac{5}{32}$	10	.15625	3.969
	11	.171875	4.366
$\frac{3}{16}$	12	.1875	4.763
	13	.203125	5.159
$\frac{7}{32}$	14	.21875	5.556
	15	.234375	5.953
$\frac{1}{4}$	16	.250	6.350
	17	.265625	6.747
$\frac{9}{32}$	18	.28125	7.144
	19	.296875	7.541
$\frac{5}{16}$	20	.3125	7.938
	21	.328125	8.334
$\frac{11}{32}$	22	.34375	8.731
	23	.359375	9.128
$\frac{3}{8}$	24	.375	9.525
	25	.390625	9.922
$\frac{13}{32}$	26	.40625	10.319
	27	.421875	10.716
$\frac{7}{16}$	28	.4375	11.113
	29	.453125	11.509
$\frac{15}{32}$	30	.46875	11.906
	31	.484375	12.303
$\frac{1}{2}$	32	.500	12.700

Frac- tion	$\frac{1}{64}$ ths	Decimal	Milli- meters
	33	.515625	13.097
$\frac{17}{32}$	34	.53125	13.494
	35	.546875	13.891
$\frac{9}{16}$	36	.5625	14.288
	37	.578125	14.684
$\frac{19}{32}$	38	.59375	15.081
	39	.609375	15.478
$\frac{5}{8}$	40	.625	15.875
	41	.640625	16.272
$\frac{21}{32}$	42	.65625	16.669
	43	.671875	17.066
$\frac{11}{16}$	44	.6875	17.463
	45	.703125	17.859
$\frac{23}{32}$	46	.71875	18.256
	47	.734375	18.653
$\frac{3}{4}$	48	.750	19.050
	49	.765625	19.447
$\frac{25}{32}$	50	.78125	19.844
	51	.796875	20.241
$\frac{13}{16}$	52	.8125	20.638
	53	.828125	21.034
$\frac{27}{32}$	54	.84375	21.431
	55	.859375	21.828
$\frac{7}{8}$	56	.875	22.225
	57	.890625	22.622
$\frac{29}{32}$	58	.90625	23.019
	59	.921875	23.416
$\frac{15}{16}$	60	.9375	23.813
	61	.953125	24.209
$\frac{31}{32}$	62	.96875	24.606
	63	.984375	25.003
1	64	1.000	25.400

PLATE 803

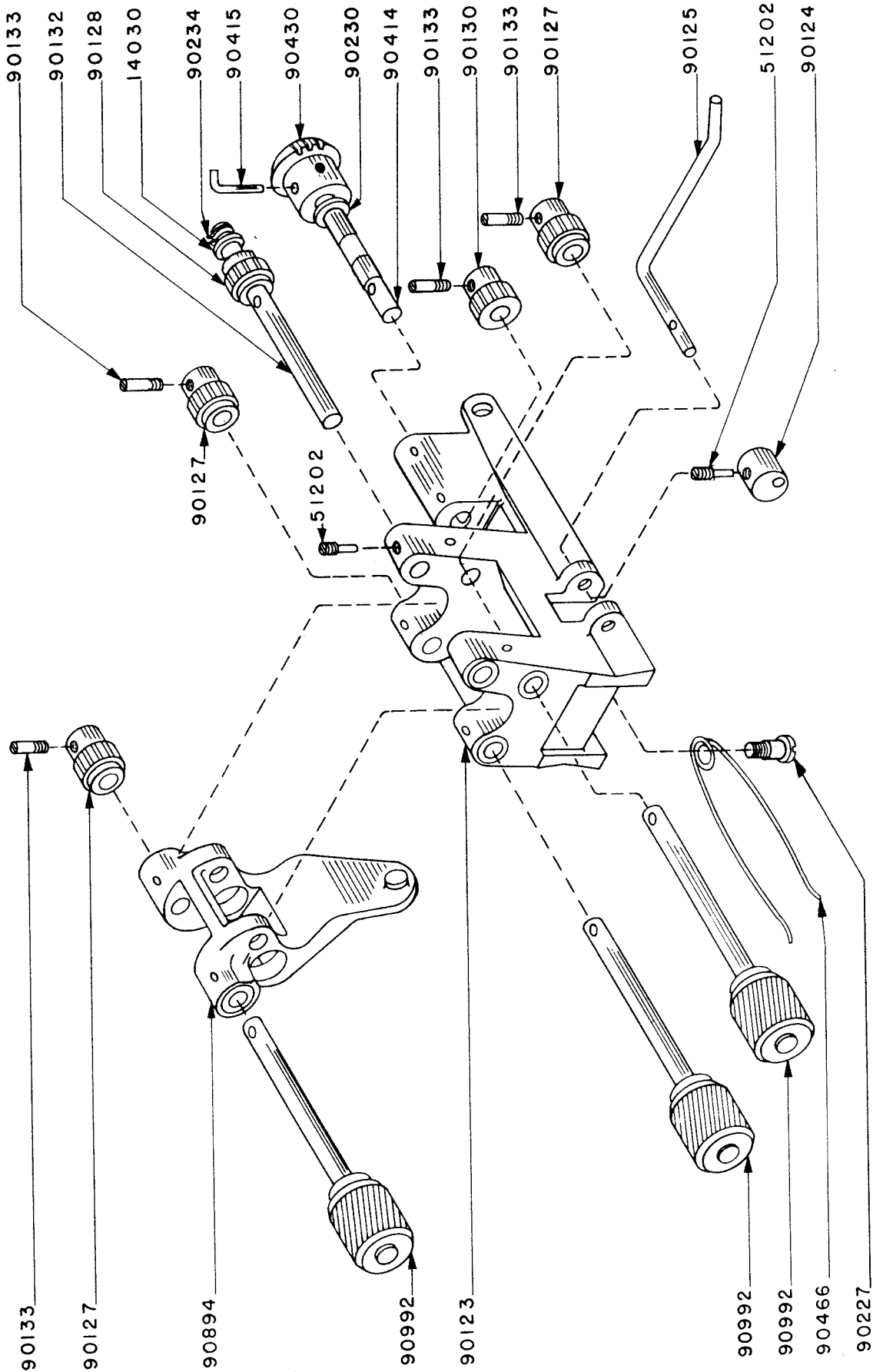


PLATE 1225

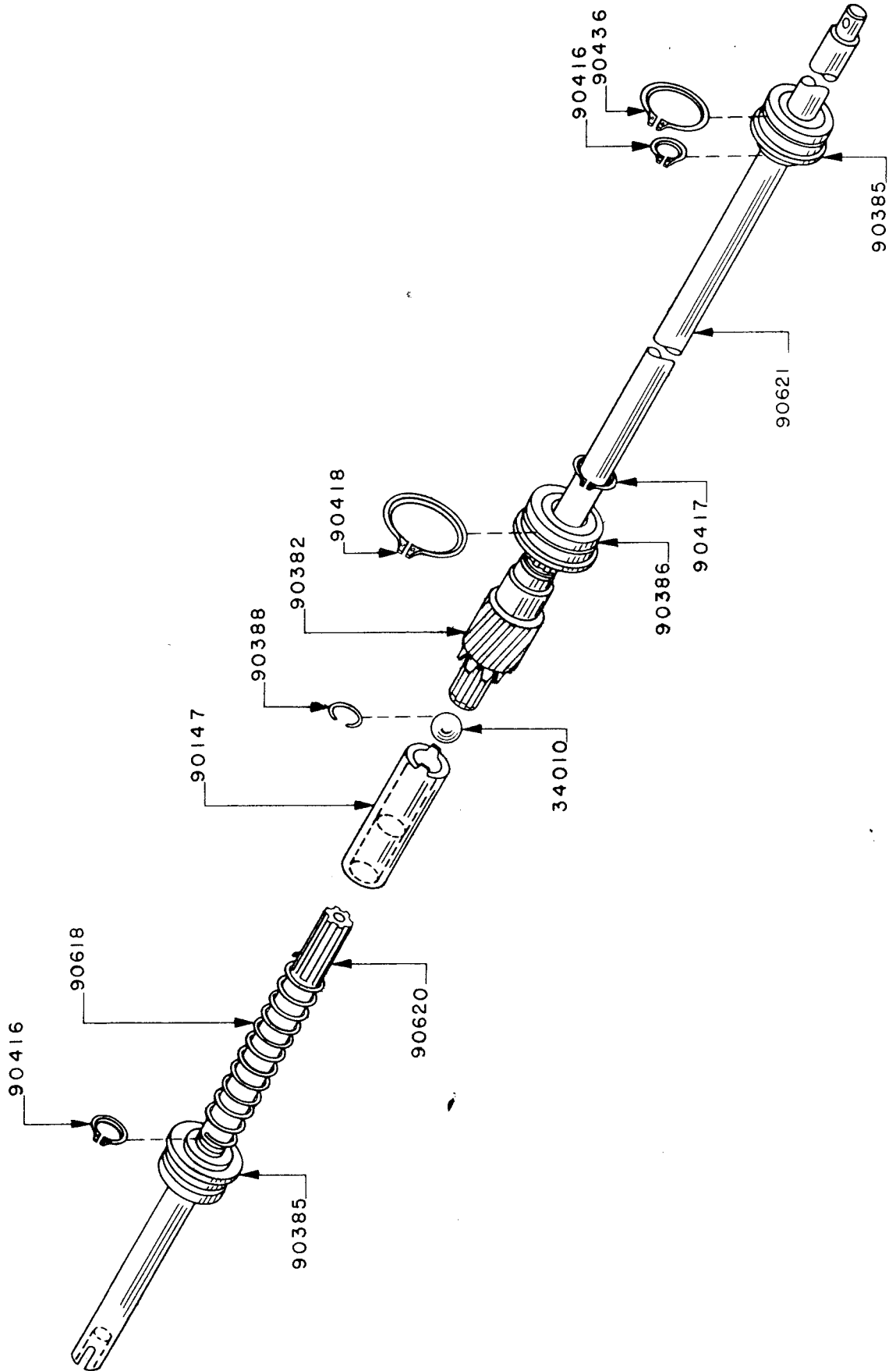




PLATE 1030

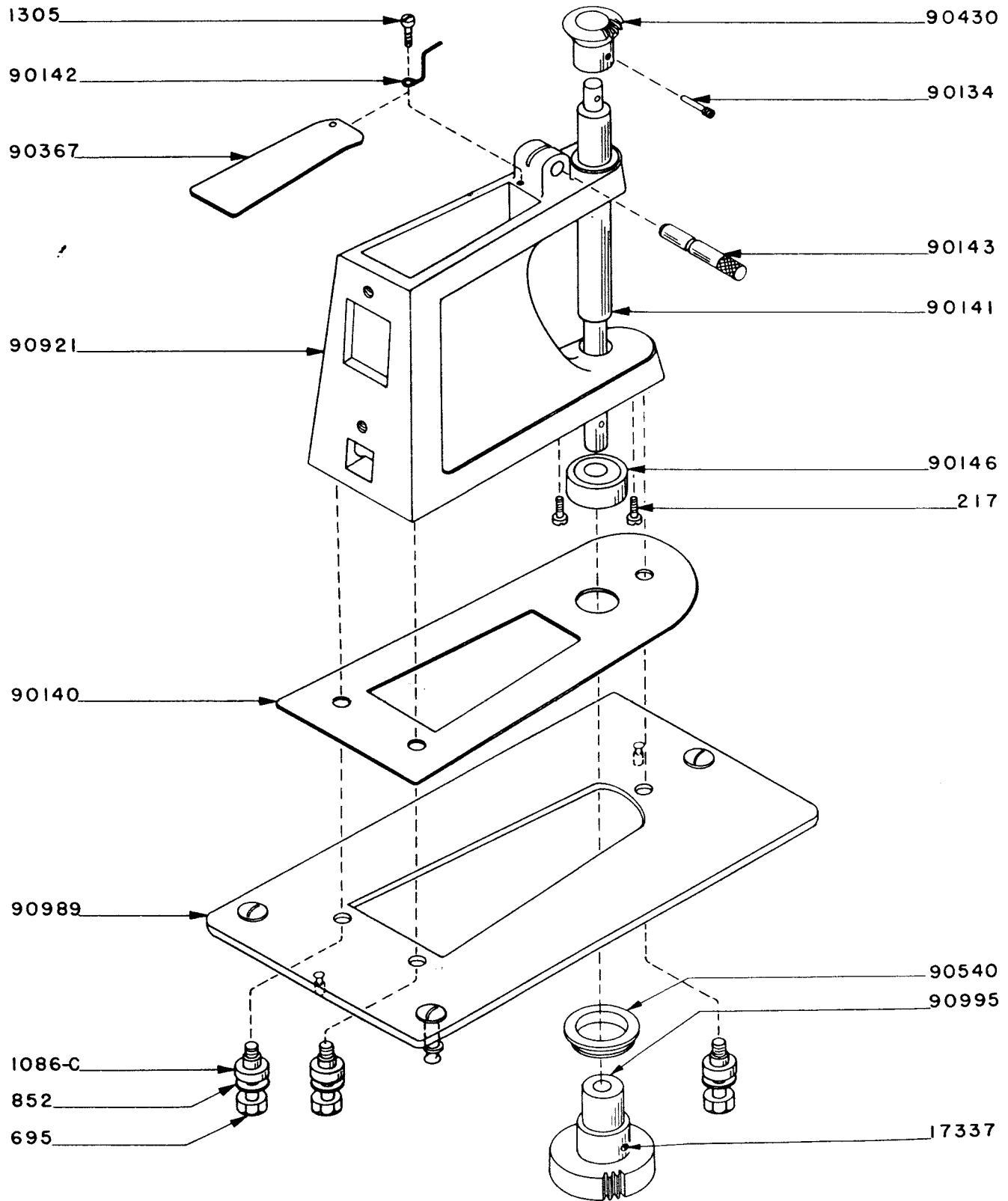
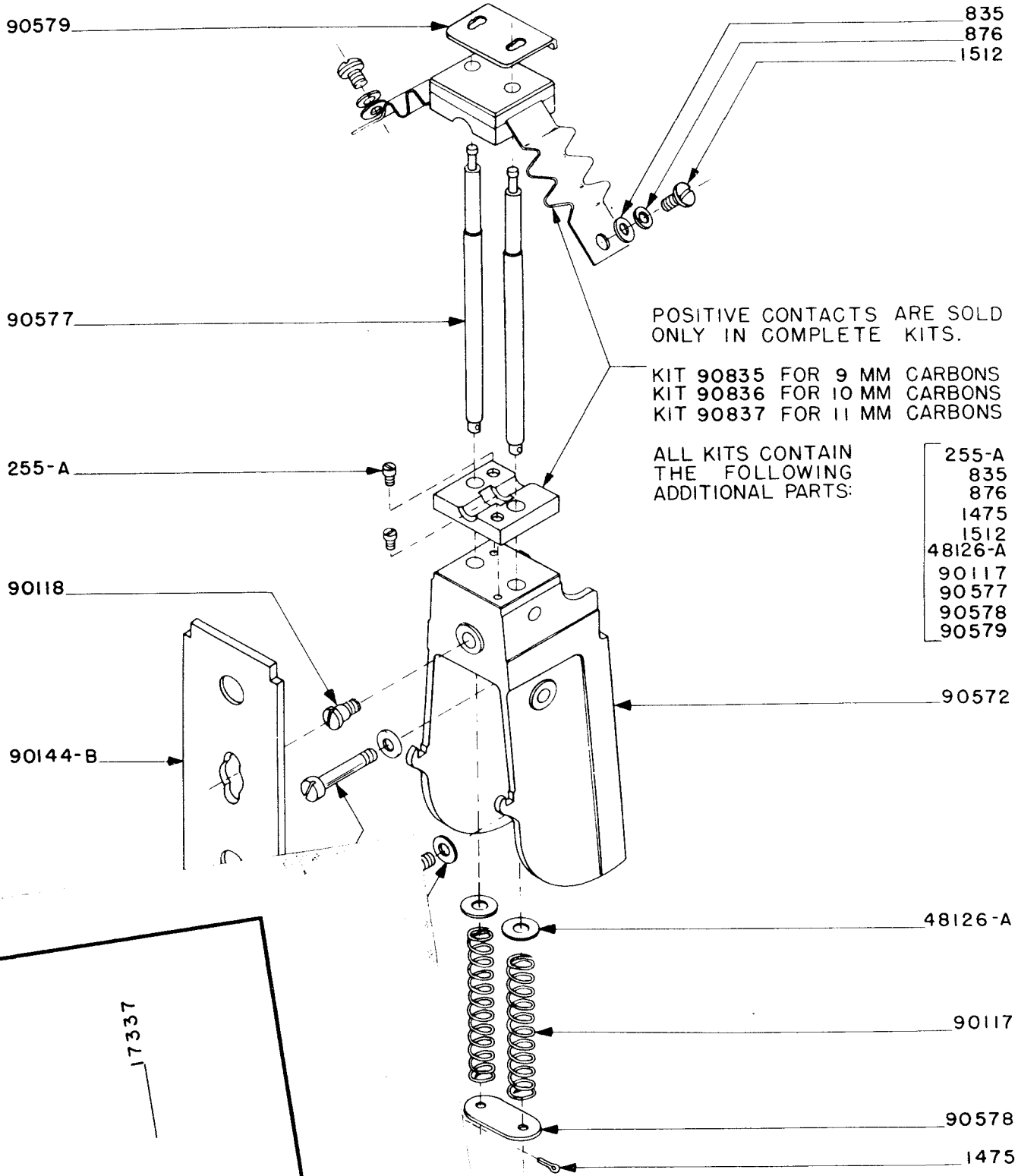


PLATE 1198



POSITIVE CONTACTS ARE SOLD ONLY IN COMPLETE KITS.

KIT 90835 FOR 9 MM CARBONS  
 KIT 90836 FOR 10 MM CARBONS  
 KIT 90837 FOR 11 MM CARBONS

ALL KITS CONTAIN THE FOLLOWING ADDITIONAL PARTS:

- 255-A
- 835
- 876
- 1475
- 1512
- 48126-A
- 90117
- 90577
- 90578
- 90579

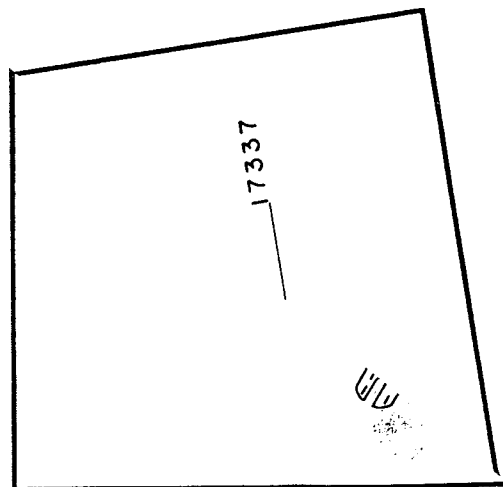
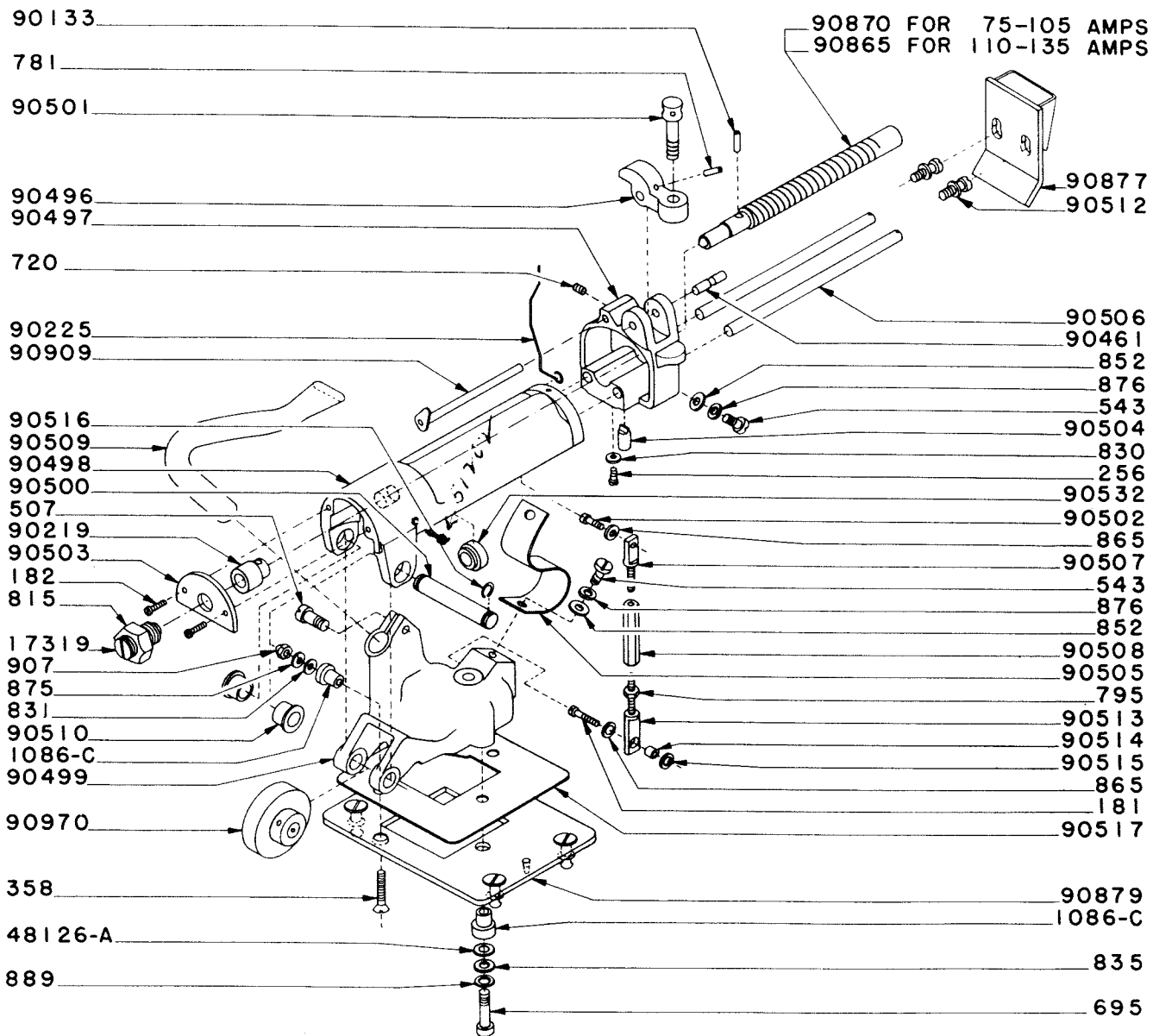


PLATE 1100





181 Screw - #6-32 x 3/8" Fil. Hd.  
182 Screw - #6-32 x 7/16" Fil. Hd.  
217 Screw - #8-32 x 5/16" Rd. Hd.  
236 Screw - #8-32 x 5/16" Flat Hd.  
255 Screw - #8-32 x 5/16" Fil. Hd.  
255-A Screw - #8-32 x 5/16" Fil. Hd., Stainless Steel  
256 Screw - #8-32 x 3/8" Fil. Hd.  
358 Screw - #10-24 x 1" Flat Hd.  
377 Screw - #10-24 x 1/4" Fil. Hd.  
379 Screw - #10-24 x 5/16" Fil. Hd.  
382 Screw - #10-32 x 3/8" Fil. Hd.  
387 Screw - #10-24 x 5/8" Fil. Hd.  
388 Screw - #10-32 x 5/8" Fil. Hd.  
396 Screw - #10-32 x 1-1/8" Fil. Hd.  
507 Screw - 1/4-20 x 1/2" Fil. Hd.  
508 Screw - 1/4-20 x 5/8" Fil. Hd.  
513 Screw - 1/4-20 x 1-1/4" Fil. Hd.  
543 Screw - 1/4-20 x 3/8" Oval Bd. Hd.  
620 Screw - 3/8-16 x 1/2" Rd. Hd.  
695 Screw - 1/4-20 x 1" Hex Hd.  
720 Screw - Set, #10-32 x 3/16" Headless Cup Point  
781 Screw - Set, #8-32 x 1/4" Allen Hd., Cup Pt.  
795 Nut - #8-32 Hex  
809 Nut - Jam, 3/8-16  
815 Nut - Jam, 1/2-20  
830 Washer - #8 Brass  
831 Washer - #10 Flat  
835 Washer - 1/4" Flat  
852 Washer - 1/4" Flat  
865 Washer - #6 Std. Steel  
875 L'Washer - 3/16" Split  
876 Washer - Lock, 1/4" Split  
907 Nut - #10-24 Acorn (brass)  
1086-C Bushing - Lava  
1211 Terminal - Kleigl, #4  
1254 Terminal - Sherman, #24  
1305 Screw - #6-32 x 1/4" Bd. Hd.  
1307 Screw - #10-32 x 3/8" Bd. Hd.  
1445 Washer - Spring, Shakeproof  
1475 Pin - Cotter, 1/16" dia. x 3/8" long  
1512 Screw - 1/4-20 x 5/16 Binding Hd.  
2003-C Bushing - Lead Wires  
4643 Reflector - 16-1/2" diameter  
4676 Reflector - 18" diameter  
10048 Knob - Black  
10052 Shaft - Dowser Handle  
10066 Receptacle - Work Light  
10074-B Washer-Splined, Neg. Cross Shaft

11040	Glass - Window
11042	Glass - Window
11119	Clamp - Wire
11138-A	Terminal - #40 Sherman, Shunt
14030	Washer
14069	Ring - Retaining, Prism Cover Glass
14155	Cap - Cord, Work Light
14569	Nut - Lock, Work Light Switch
15010	Spring - Mounting, Control Tube Adj.
17014	Connector and Nut - BX
17119	Ring - Shoat #2
17316	Ball - Steel, Rear Door Latch
17319	Screw - Set
17336	Spring - Ball Tension, Rear Door
17337	Screw - Set
17979	Trigger - Release, Reflector Assy.
19007	Clip - Retaining, Imager Screen
19039	Bulb - Work Light
23046	Brush - Cleaning, Carbon Contact
23066	Lubricant - Positive & Negative Heads
23067	Lubricant - Gear Box, Bodine Motors
23068	Lubricant - Bearings, Bodine Motors
23085	Cone - Light
23086	Extension - Light Cone
23481	Kit - Aligning, Lamp
32042	Door Latch (see 90604 for striker)
34010	Ball-Steel, Positive Coupling (see #90987)
48126	Washer - Fibreglass (with spring #90117)
48126-A	Washer - Fibreglass
48189	Screen - Window Glass
51202	Screw - Set
51984	Ball - Retaining Block Assy., Rear Door
53163	Plug - Button, Dot
55113	Stud, Ref. Tension Spring Anchor
55118	Window Frame Casting
55129	Nameplate
55135	Air Intake Casting
55136	Clip - Air Intake Casting
55137	Rear Door Casting
55138	Pivot Bracket
55140	Light Seal, Rear Door
55977	Control Knob and Shaft Assy., Ref. (long)
55979	Door Assy., Right Hand (complete)
55980	Rear Door Assy.
55995	Shaft and Roller Assy., Rear Door Latch
56271	Wrench - Negative Head
90103	Impeller - Blower (Drive Motors)
90117-A	Spring - Pressure, Contact

90118 Screw - Shoulder  
 90123 Roller Casting - Positive, Lower  
 90124 Cam - Release, Positive Carbon  
 90125 Handle - Release, Positive Carbon  
 90127 Gear - Spur, Roller (32P. 20T.)  
 90128 Gear - Spur, Idler (32P. 24T.)  
 90129 Resistor - Control Tube (3000 Ohm)  
 90130 Gear - Spur, Driver (32P. 20T.)  
 90132 Shaft - Gear, Idler  
 90133 Screw - Set  
 90134 Screw - Set  
 90140-A Plate - Insulating, Positive  
 90141 Shaft - Drive, Vertical  
 90142 Spring - Hinge Pin  
 90143 Pin - Hinge *φ 11 MM*  
 90144-B Baffle - Heat, Positive 9 & 10 MM (see ~~90584 for 11 MM~~)  
 90145 Lug - Wire, Positive & Negative Heads  
 90146 Bearing - Ball, Vertical Drive Shaft  
 90147 Coupling - Positive Cross Shaft (see 90987)  
 90156 Collar - Negative Cross Shaft  
 90161 Housing - Blower, Motor Side (Drive Motor)  
 90162 Housing - Blower, With Screen (Drive Motor)  
 90182 Pin - Hinge, Side Doors  
 90186 Frame - Imager, Arc  
 90196 Reflector - Image  
 90197 Glass - Arc Image Screen  
 90198 Paper - Arc Image  
 90205 Socket - Tube, Control  
 90210 Wires - Lead (shunt to meter)  
 90219 Gear - Helical, Lead Screw  
 90225 Wire - Arc Imager  
 90227 Screw - Shoulder  
 90230 Washer - Helical Gear, Negative  
 90234 Ring - Retaining  
 90239 Gear - Helical, Negative Driver  
 90254 Nut - Adjusting, Focus  
 90255 Shaft - Adjusting, Focus  
 90256 Collar - Locking (7/16" I. D.)  
 90257 Collar - Locking (5/8" I. D.)  
 90260 Shunt - Ammeter  
 90261 Bushing - Insulating, Shunt  
 90262 Washer - Thrust, Focus Adjusting  
 90266 Hub - Handle, Rear Door  
 90267 Washer - Fibre, Rear Door & Douser  
 90268 Shaft - Handle, Rear Door  
 90269 Handle - Rear Door  
 90270 Spring - Latch, Rear Door  
 90295-A Ammeter

90302 Plug - Drive Motor Connection (Male)  
 90303 Receptacle - Drive Motor Connection (Female)  
 90305 Rheostat  
 90306 Knob - Rheostat  
 90308 Body - Indicating Light (see 90947)  
 90309 Bezel - Indicating Light (see 90947)  
 90310 Bulb - Indicating Light  
 90311 Bracket - Support, Side Doors  
 90324 Damper - 8 inch  
 90326 Relay (see 90910)  
 90339 Spring - Dowser  
 90358 Filter Glass - Image Beam  
 90363 Screw - Set, Dowser  
 90367 Baffle - Air, Positive Head  
 90372 Spring - Steadying, Reflector (see 90445)  
 90374 Countershaft - Negative Cluster  
 90375 Gear - Spur, Negative Countershaft  
 90376 Gear & Shaft - Negative Motor  
 90378 Gear - Clutch, Negative Fibre (sold only with bushing 90559)  
 90382 Gear - Helical, Positive Driver (20P. 13T.)  
 90383 Bearing - Ball, Negative Countershaft  
 90384 Bearing - Ball, Reflector Adjusting Rods  
 90385 Bearing - Ball, Positive & Negative Cross Shafts  
 90386 Bearing - Ball, Positive Cross Shaft  
 90387 Pin - Guide, Base  
 90388 Ring - Retaining (see 90987)  
 90389 Screw - Locking, Base  
 90396 Light Seal - Front Mechanism Base  
 90397 Panel - Instrument  
 90398 Panel - Cover, Motor Side  
 90407 Switch & Cord - Work Light  
 90412 Resistor - 3 Section  
 90414 Shaft - Horizontal Drive, Positive Carbon  
 90415 Pin - Shear, Horizontal Drive Shaft  
 90416 Ring - Retaining  
 90416-A Ring - Retaining  
 90417 Ring - Retaining  
 90418 Ring - Retaining  
 90422 Sleeve - Negative Clutch Adjustment  
 90423 Nut - Negative Clutch Adjustment  
 90429 Pan - Ash  
 90430 Gear - Drive, Positive Head (straight bevel)  
 90432 Ring - Retaining  
 90436 Ring - Retaining  
 90437 Rod - Adjusting, Reflector Frame  
 90438 Screw - Pivot, Reflector Frame  
 90441 Socket - Octal Relay  
 90445 Spring - Booster



90446 Retainer - Spring, Ref. Tension (In reflector frame)  
 90450 Spring - Tension, Reflector  
 90452 Top Casting - Lamphouse  
 90455 Cap - Brush, Bodine  
 90461 Shaft - Roller, Negative Carbon Release  
 90463 Screw - Mounting, Friction Stay  
 90466 Spring - Pressure, Carbon Drive Roller  
 90474 Cover Glass, Prism Holder  
 90482 Chain - Instrument Panel  
 90483 Insulation - Panel Chain  
 90490 Motor - Negative (sold only as 90881)  
 90491 Motor - Positive (216:1) (sold only as 90882)  
 90492 Brush - Motor, Bodine (3/16" x 1/4" x 3/4")  
 90493 Spring - Motor Brush, Bodine  
 90494 Holder - Motor Brush, Bodine  
 90496 Clamp - Carbon, Negative Jaw  
 90497 Carriage - Carbon, Negative Jaw  
 90498 Guide Casting - Negative  
 90499 Base Casting - Negative Head  
 90500 Pin - Pivot, Guide Casting, Neg. Hd.  
 90501 Screw - Set, Carbon Clamp  
 90502 Screw - Adjusting Stud  
 90503 Plate - Thrust, Negative Head  
 90504 Driving Dog - Negative  
 90505 Ribbon - Negative  
 90506 Rod - Guide, Negative Head  
 90507 Rod - Adjusting, Upper  
 90508 Nut - Turnbuckle, Negative Head  
 90509 Duct - Air, Negative Head  
 90510 Bushing - Insulating, Neg. Head Pivot Pin  
 90512 Screw - Retaining, Neg. Head Heat Shield  
 90513 Screw - Adjusting, Lower  
 90514 Bushing - Insulating, Adjusting Stud  
 90515 Washer - Insulating, Adjusting Stud  
 90516 Ring - Snap, Wire  
 90517-A Plate - Insulating, Negative Jaw  
 90524 Tube - Insulating (For Positive Crank Stem)  
 90532 Collar - Negative Head  
 90536 Bevel Drive Gear (for 11 MM carbon)  
 90539 Glass - Heat Filter  
 90540 Insulator - Helical Gear, Positive Driven  
 90553 Plate - Instruction, Instrument Panel  
 90554 Plate - Name, Instrument Panel  
 90559 Bushing - Gear, Clutch Negative  
 90572 Casting - Support, Positive Jaw  
 90577 Rod - Contact  
 90578 Plate - Rod End, Bottom  
 90579 Plate - Rod End, Top

~~90584~~ Shield.- Heat (for 11mm only)  
 90597 Dowser  
 90603 Shaft - Door Handle  
 90604 Striker (see 32042 for latch)  
 90605 Cap - Cord (Blower, Heat Filter)  
 90606 Seal - Light, Rear  
 90608 Cover Box - Door Prism  
 90610 Clip, Heat Filter  
 90611 Frame, Heat Filter  
 90612 Nose & Blower, Casting  
 90614 Nose Ring Casting  
 90615 End Cover - (Operator Side)  
 90616 End Cover - (Motor Side)  
 90618 Spring - Cross Shaft, Positive  
 90619 Spacer - Negative Cross Shaft  
 90620 Shaft - Cross, Positive (short)  
 90621 Shaft - Cross, Positive (long)  
 90622 Shaft - Cross, Negative  
 90627 Spring - Negative Clutch  
 90628 Receptacle (Blower, Heat Filter)  
 90629 Bracket Casting - Dowser  
 90631 Plug Button, Motor Side Panel  
 90632 Air Nozzle (Base Pan)  
 90640 Brush - Motor (Heat Filter)  
 90647 Hub - Dowser Handle  
 90648 Shaft - Dowser  
 90808 Heat Filter & Blower Assy. (Complete Kit)  
 90810 Cable Assembly - Wiring, Base  
 90812 Mechanism Base Assy. - Welded (sold only as 90813)  
 90813 Mechanism Base Unit Assembly  
 90814 Motor & Blower Assy. - Heat Filter (see #90640 for  
 motor brush)  
 90815 Heat Filter Assembly (see #~~90558~~ for Glass only)  
 90817 Control Prism Assy. *90538*  
 90819 Prism Assy. - Arc Imager  
 90824 Stay - Friction, Rear Door  
 90827 Door Assy. - Left Hand Complete  
 90828 Lamphouse Assy. - Welded (not sold separately)  
 90830 Dowser Assembly - Complete  
 90833 Reflector Frame Assy. (18" Reflector)  
 90835 Kit - Positive Contacts, for 9mm carbons  
 90836 Kit - Positive Contacts, for 10mm carbons  
 90837 Kit - Positive Contacts, for 11mm carbons  
 90841 Positive Head Assy. - 9 mm  
 90842 Positive Head Assy. - 10 mm  
 90843 Positive Head Assy. - 11 mm  
 90852 Reflector Frame Assy. (16-1/2" Reflector)  
 90864 Negative Head Unit Assy. (Complete with 6-1/4" lead screw)

90865 Ball & Neg. Lead Screw Assy. (6-1/4 thread)  
 90866 Carbon Drive Assy. - 11 mm(Sold only as assembly #90868)  
 90867 Carbon Release & Bearing Assy. (11mm)  
 90868 Drive Rollers & Casting Assy. -Positive, Complete (11mm)✓  
 90870 Lead Screw & Ball Assy. - Negative, 5 thread  
 90871 Motor & Mounting Unit Assy. - Positive 300:1  
 90872 Negative Head Unit Assy. - Complete (5 thread lead screw)  
 90877-A Heat Shield Assy. - Negative Head ✓  
 90879 Mounting Plate Assy. - Negative Head  
 90881 Motor Unit Assy. - Negative (with mounting plate)  
 90882 Motor & Unit Mounting Assy. -Positive, 216:1  
 90894 Roller Casting & Bearings - Upper, Positive Hd., 9-10 mm  
 90895 Drive Rollers & Casting Assy-Positive Carbon, 9-10mm  
 90897 Reflector Rest Button Assy. - Asbestos  
 90898 Positive Lead & Feed Wire Assy.  
 90899 Negative Jaw Wire Assy.  
 90900 Negative Lead Wire Assy.  
 90909 Carbon Trim Rest Assembly  
 90910 Relay & Mounting Lug Assy.  
 90912 Mounting Brkt. Assy. - Control Tube  
 90921 Positive Head & Bearing Assy. (see 90841, 90842 or 90843)  
 90947 Indicating Light Body & Bezel Assy.  
 90955 Ball Crank Assembly  
 90961 Knob & Insert Assy. - Focus Adjusting  
 90970 Helical Gear Assy. - Negative  
 90974 Inner Hood Assy. - Lamphouse  
 90976 Imager Casting & Screen Assy.  
 90977 Imager Reflector Holder Assy.  
 90978 Support Assy. - Imager Reflector Holder  
 90979 Image Reflector Unit Assy.  
 90987 Coupling Assembly - Positive Cross Shaft  
 90989 Mounting Plate & Pins - Positive Head  
 (Sold only in 90841, 90842 or 90843)  
 90992 Roller Assy - Drive, Positive Carbon  
 (9-10 mm) (Sold only in 90895)  
 90995 Gear and Hub - Positive Driven  
 90999 Control Tube Assembly

## PARTS LIST

All the prices are quoted f.o.b. Toledo and are subject to change without notice.

When ordering parts be sure to advise the serial numbers and the model of lamps in addition to the name of the parts wanted and how shipment is to be made.

There will be a minimum charge of one dollar on any one invoice and a service charge sufficient to cover the cost of handling on all merchandise returned to us for credit.