Instructions

FOR PROJECTION EQUIPMENT

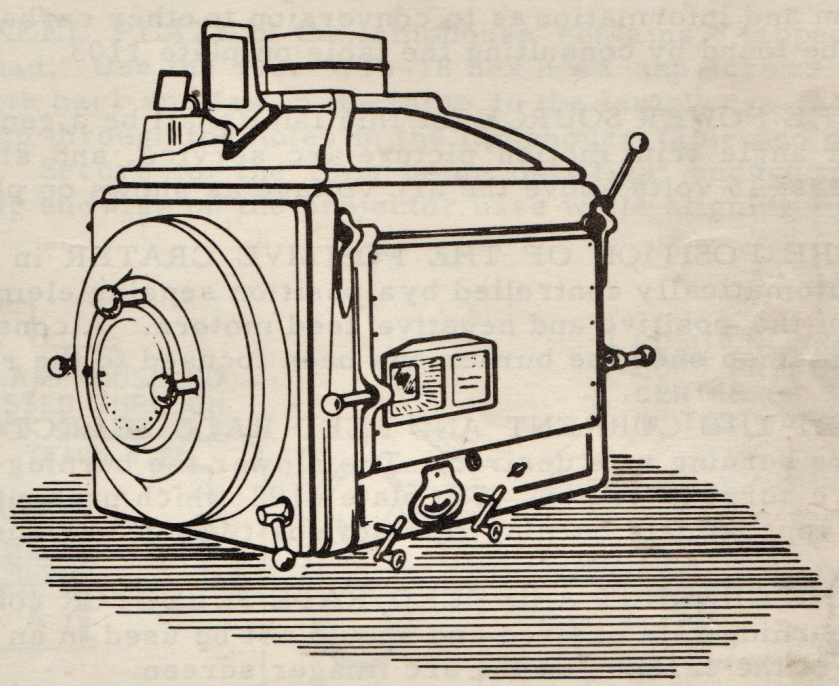
Type

90000
90001
90002
5-54

THE STRONG ELECTRIC CORP.
602 CITY PARK AVE., TOLEDO, OHIO

THE STRONG HIGH INTENSITY

PROJECTION ARC LAMP



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 1103.

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 1103.

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.

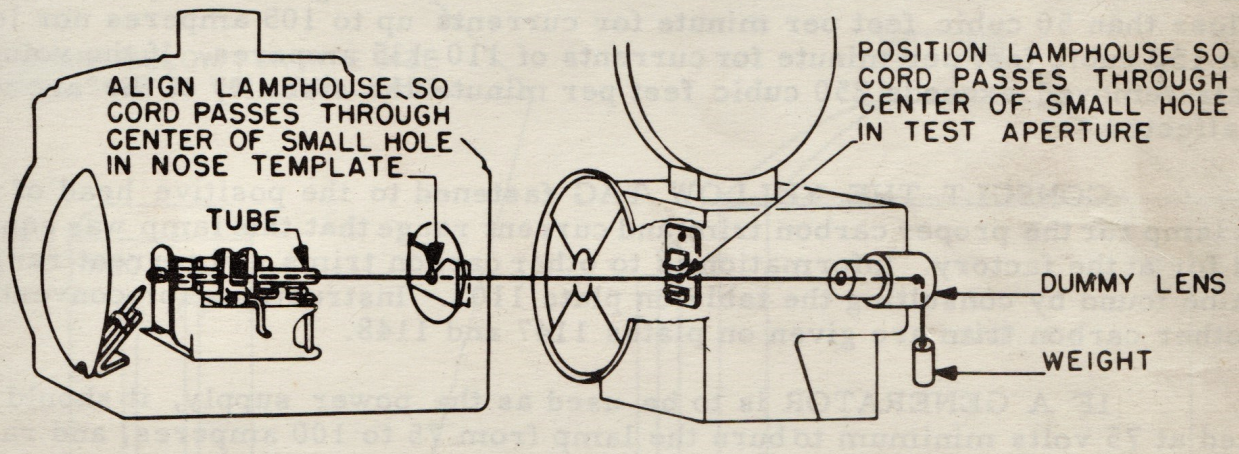
IF THE CARBONS "UNDERFEED", or the crater positioning indicator light stays on all the time, or the arc gap becomes too long, THE POWER TO THE ARC IS TOO HIGH FOR THE BURNING RATE SELECTED AND THE POWER SUPPLY MUST BE DECREASED.

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. If necessary this distance can be varied either way 1/2" so that the lamphouse light cone will fit tightly against the light entrance opening on the projector. A light cone extension is included with each lamp and can be used if necessary, depending on each particular installation.

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.

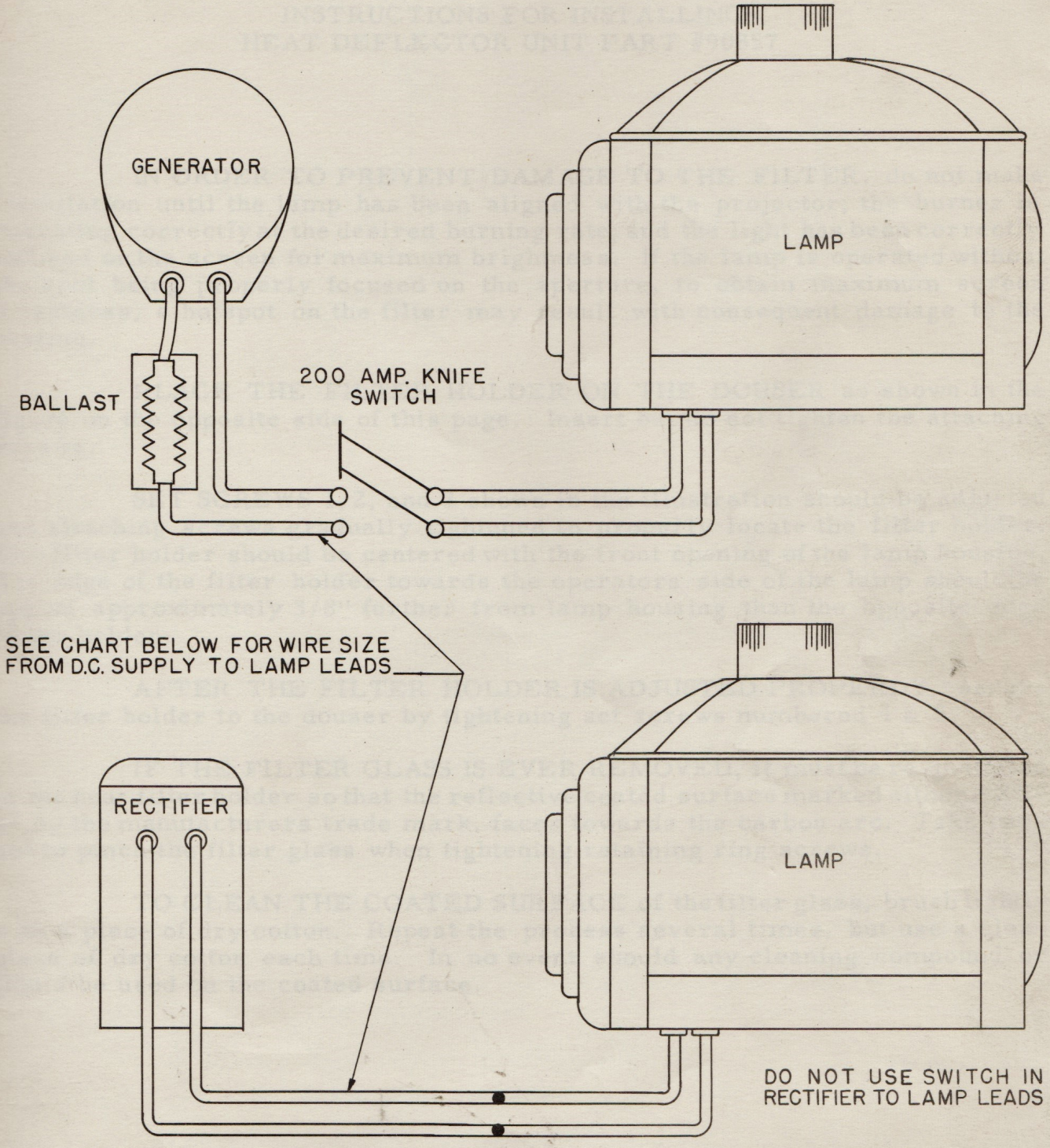
CONSULT THE YELLOW TAG fastened to the positive head of the arc lamp for the proper carbon trim and current range that this lamp was equipped for at the factory. Information as to other carbon trims and current ranges can be found by consulting the table on plate 1103. Instructions for converting to other carbon trim are given on plates 1147 and 1148.

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 1103.

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



FOR CURRENTS FROM	FOR RUNS UNDER 15 FEET USE WIRE SIZE	FOR RUNS OVER 15 FEET USE WIRE SIZE
75 TO 90 AMPERES	# 3 RH	# 2 RH
90 TO 110 AMPERES	# 2 RH	# 1 RH
110 TO 135 AMPERES	# 1 RH	# 0 RH

INSTRUCTIONS FOR INSTALLING HEAT DEFLECTOR UNIT PART #90857

IN ORDER TO PREVENT DAMAGE TO THE FILTER, do not make installation 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.

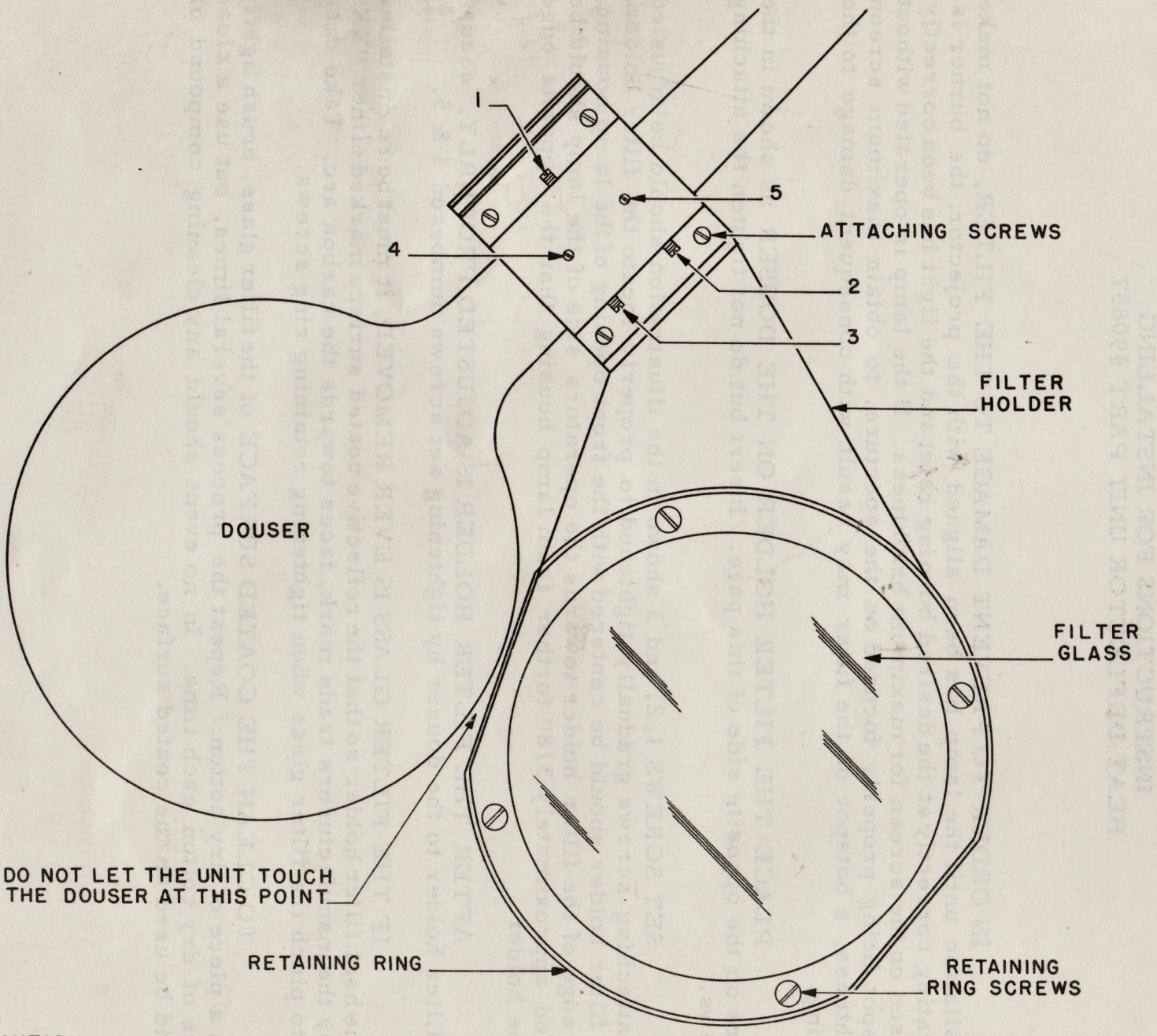
PLACE THE FILTER HOLDER ON THE DOUSER as shown in the figure on the opposite side of this page. Insert but do not tighten the attaching screws.

SET SCREWS 1, 2, and 3 shown in the illustration should be adjusted and attaching screws gradually tightened to properly locate the filter holder. The filter holder should be centered with the front opening of the lamp housing. The edge of the filter holder towards the operators side of the lamp should be angled approximately 3/8" further from lamp housing than the opposite edge of the holder.

AFTER THE FILTER HOLDER IS ADJUSTED PROPERLY, secure the filter holder to the douser by tightening set screws numbered 4 & 5.

IF THE FILTER GLASS IS EVER REMOVED, it must be re-installed in the heat filter holder so that the reflective coated surface marked either "XX" or by the manufacturers trade mark, faces towards the carbon arc. Take care not to pinch the filter glass when tightening retaining ring screws.

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.



CAUTION

DO NOT TOUCH FILTER GLASS WITH FINGERS

Plate 1131

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. F2.0 COATED LENS
		POS.	NEG.					
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
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
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
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
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
115-127	55-64	10 MM HITEX	3/8	300:1 (3-D)	9-10 MM (REGULAR)	6 1/4 THR LEAD	10 MM	20,000 TO 23,000
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

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 7/16 X 9 NEGATIVE CARBON

Plete 1103

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.

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.

THE PROJECTION OF SECOND RUN black and white, or dye image color prints can in some cases tolerate as high as 85-90 amperes with the 9 mm positive carbon or 95-100 amperes with the 10 mm carbon without too much difficulty from heat.

ANY OF THE 11 mm regular or the 10 mm Hitex carbons will require the use of a heat removing device.

LAMPS WITH RATINGS above 110 amperes 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.

FOR OTHER RATINGS DICHORIC HEAT DEFLECTOR UNITS are available from the factory, and attach easily to the dowser of the lamp.

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.

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 dowser and causing the heat filter to be inserted in the light beam.

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. F2.0 COATED LENS
		POS.	NEG.					
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
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
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
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
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
115-127	55-64	10 MM HITEX	3/8	300:1 (3-D)	9-10 MM (REGULAR)	6 1/4 THR LEAD	10 MM	20,000 TO 23,000
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

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 7/16 X 9 NEGATIVE CARBON

Plate 1103

SIDE VIEW
(OPERATING SIDE)

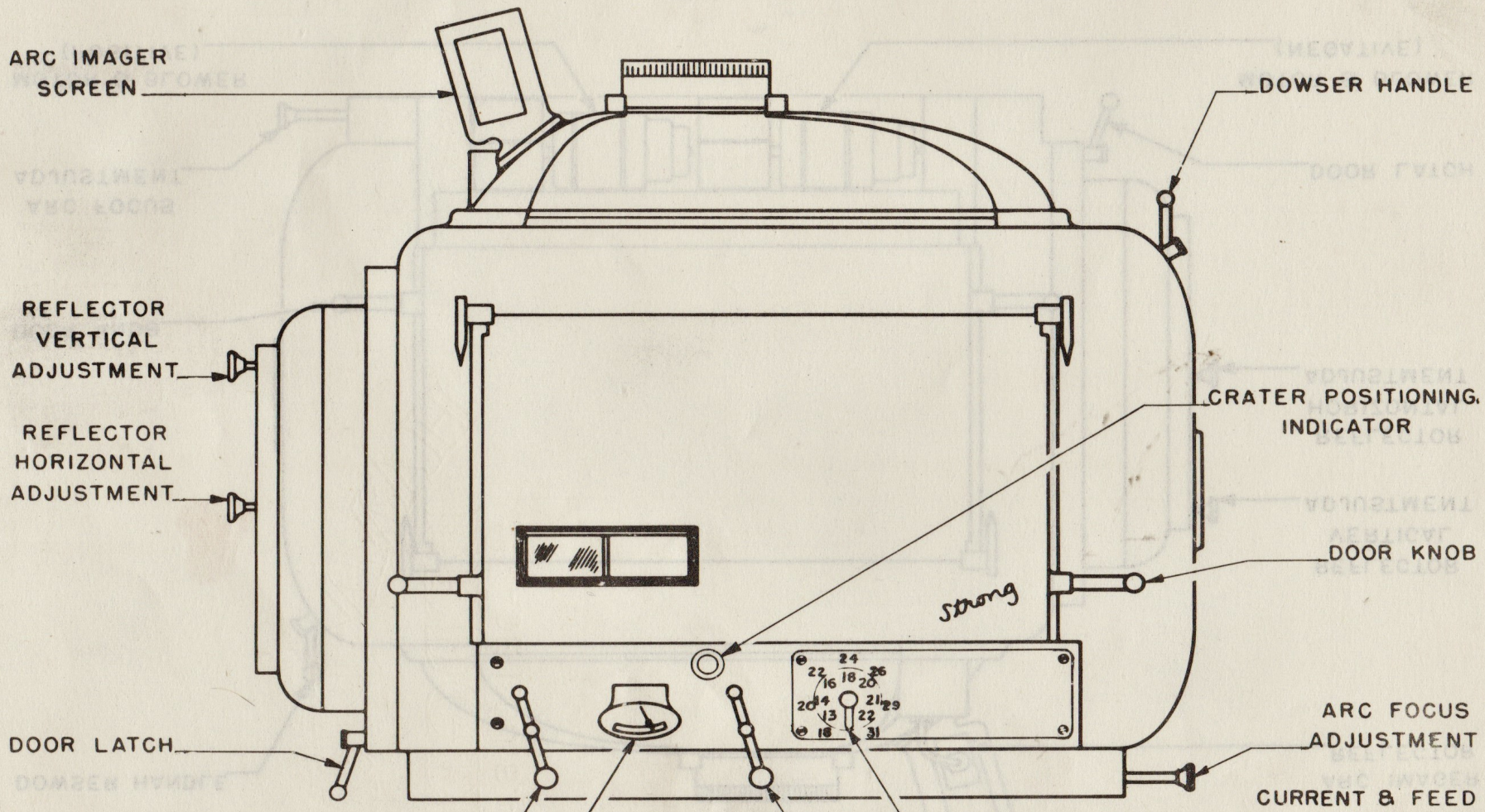


Plate 1101

SIDE VIEW
(MOTOR SIDE)

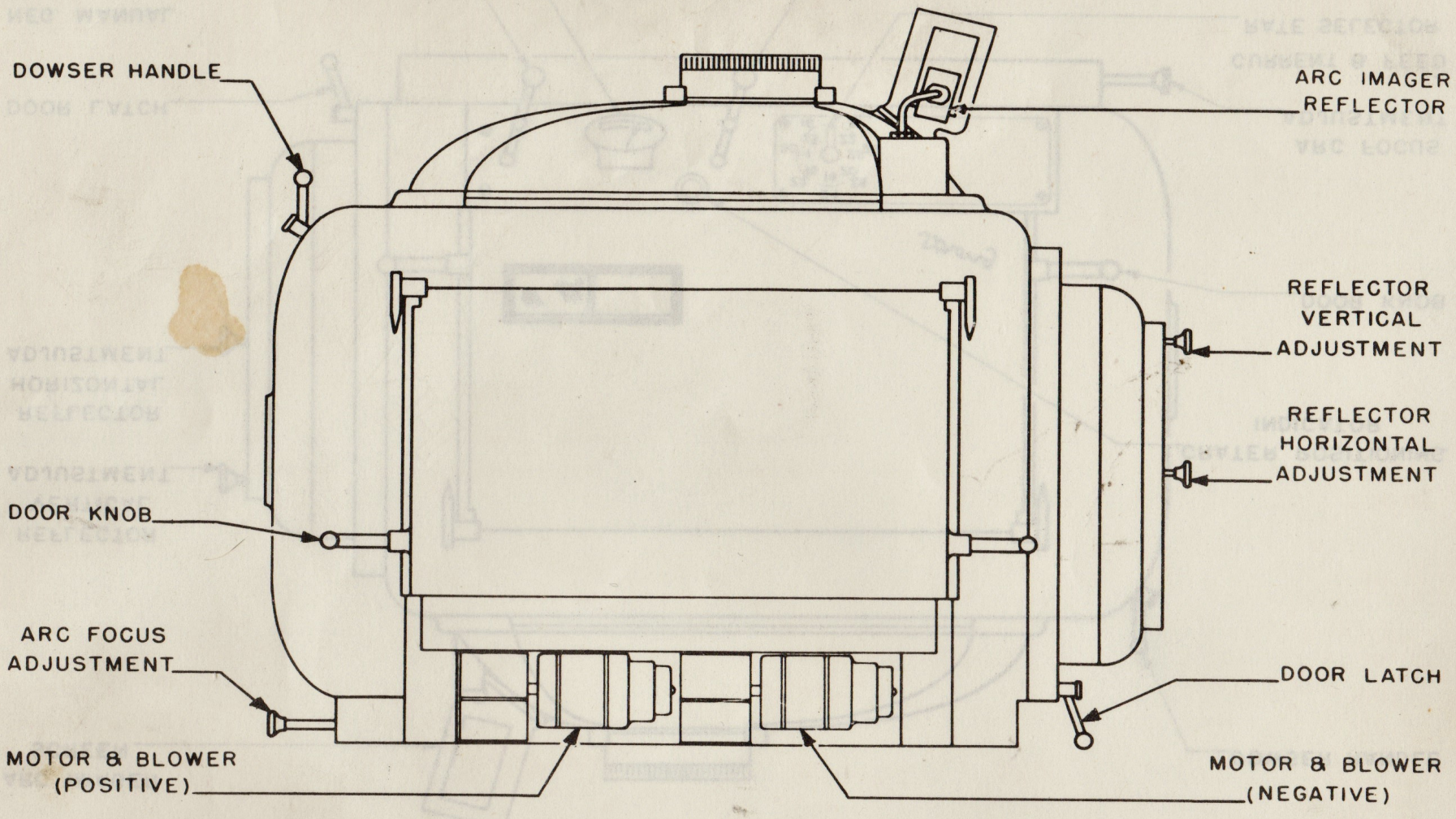


Plate 772

PLATE 1051

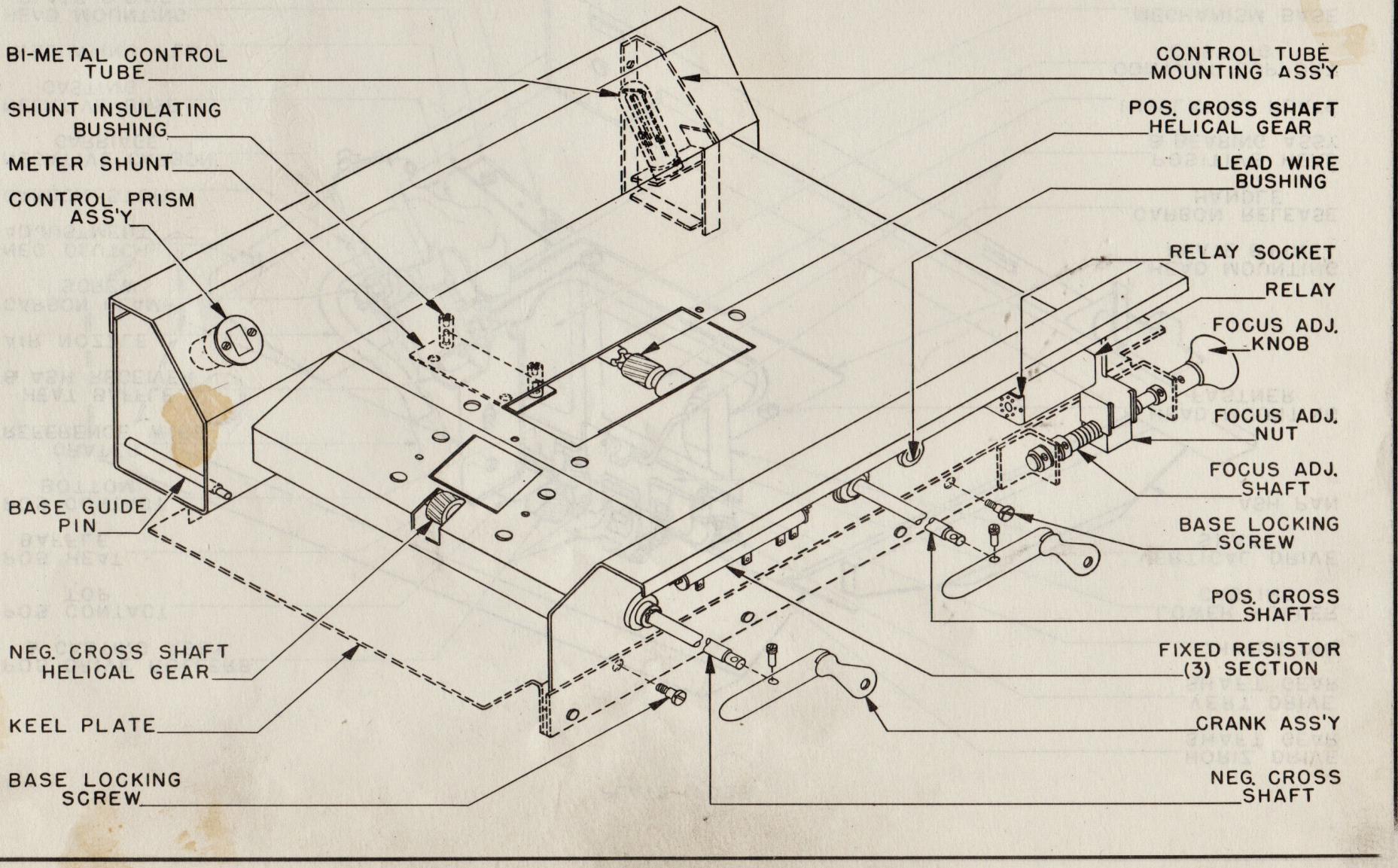

BI-METAL CONTROL TUBE
SHUNT INSULATING BUSHING
METER SHUNT
CONTROL PRISM ASS'Y
BASE GUIDE PIN
NEG. CROSS SHAFT HELICAL GEAR
KEEL PLATE
BASE LOCKING SCREW
CONTROL TUBE MOUNTING ASS'Y
POS. CROSS SHAFT HELICAL GEAR
LEAD WIRE BUSHING
RELAY SOCKET
RELAY
FOCUS ADJ. KNOB
FOCUS ADJ. NUT
FOCUS ADJ. SHAFT
BASE LOCKING SCREW
POS. CROSS SHAFT
FIXED RESISTOR (3) SECTION
CRANK ASS'Y
NEG. CROSS SHAFT

PLATE 1098

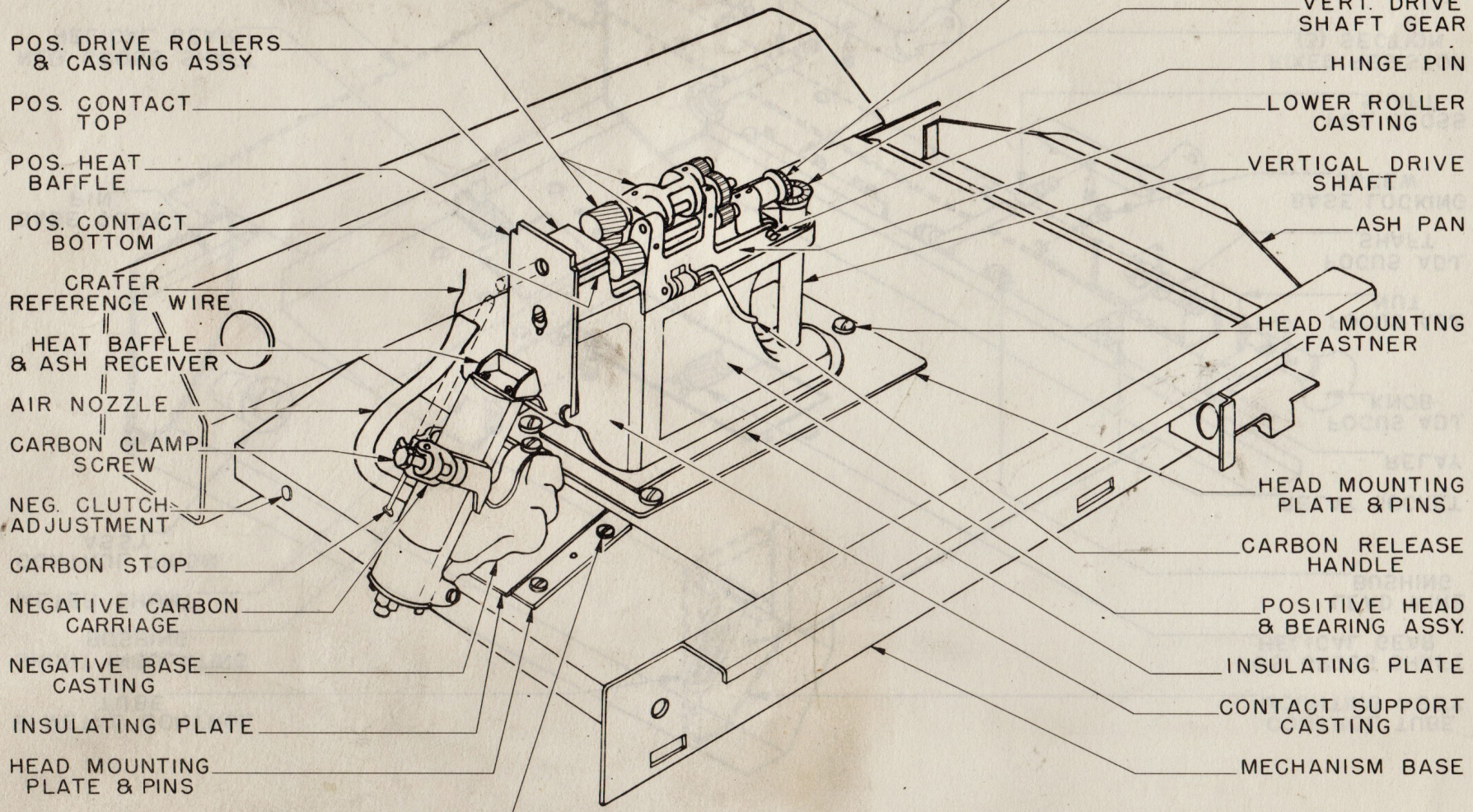


Plate 1098

WIRING DIAGRAM
NUMBER 1050

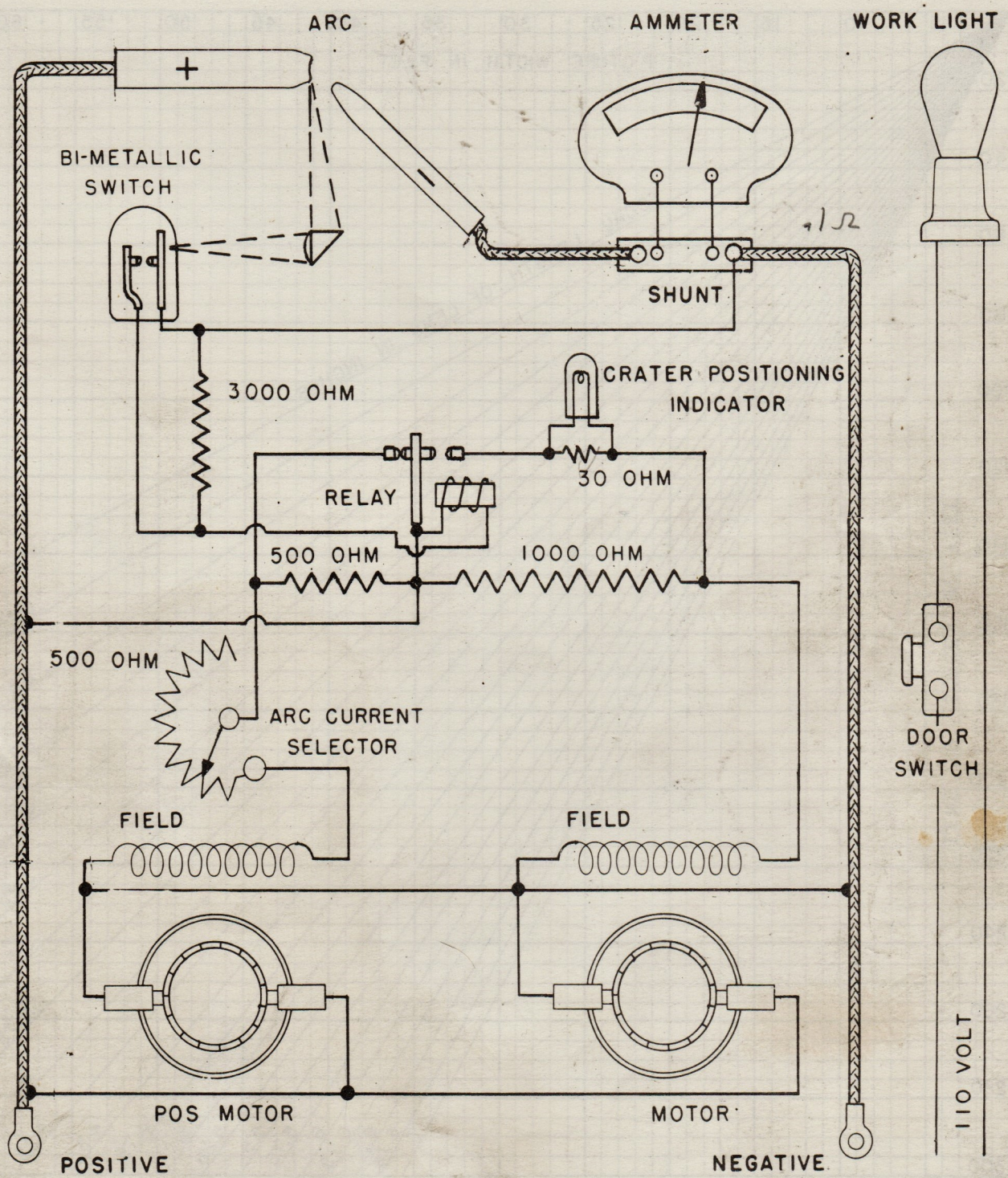
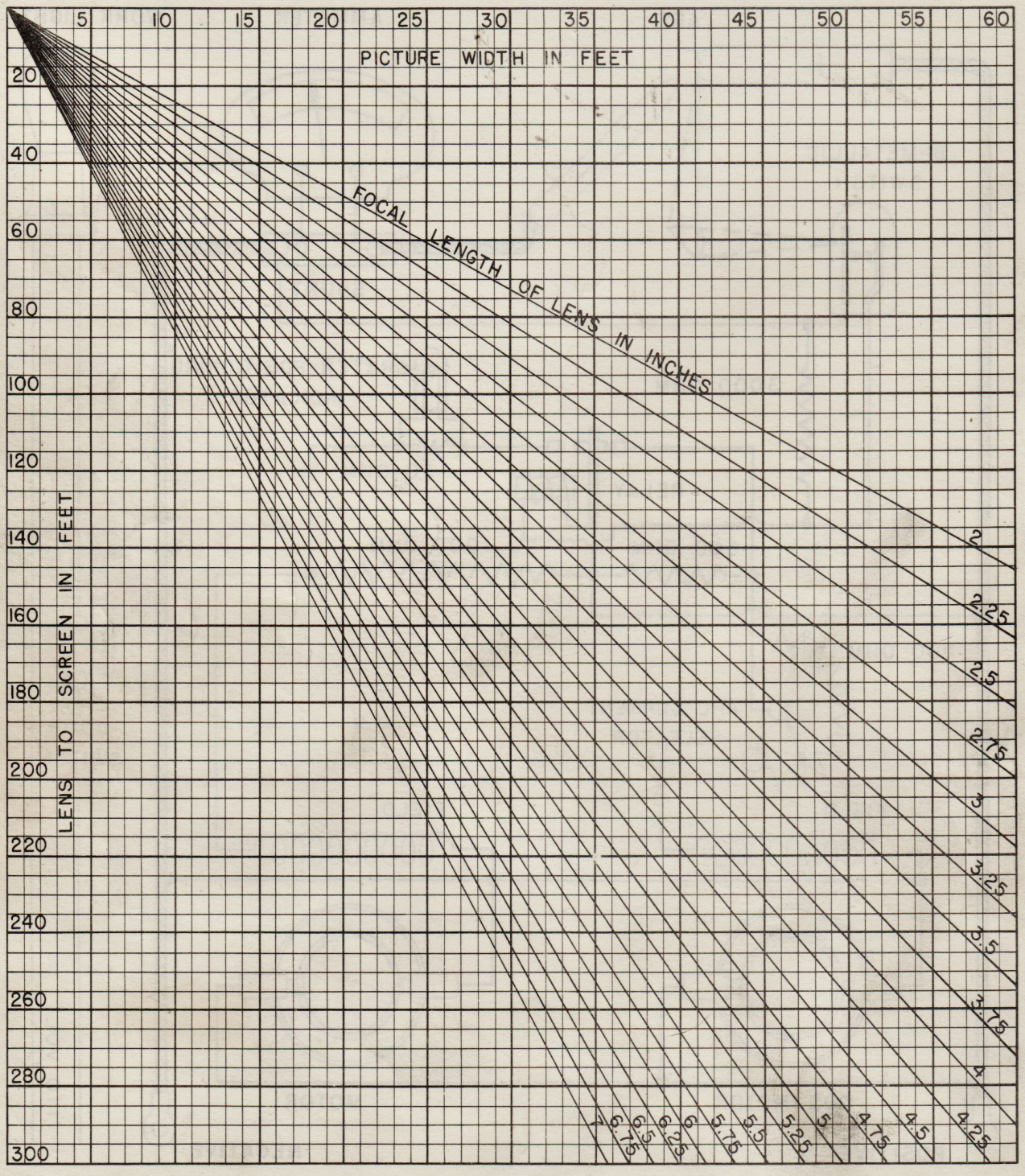


Plate 1050

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 795) 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.

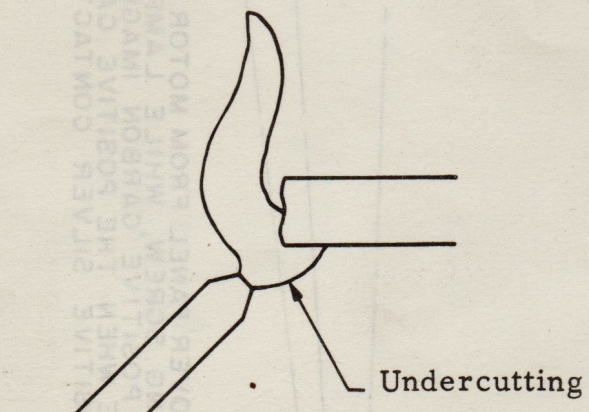
POSITIVE MOTOR REALIGNMENT

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.

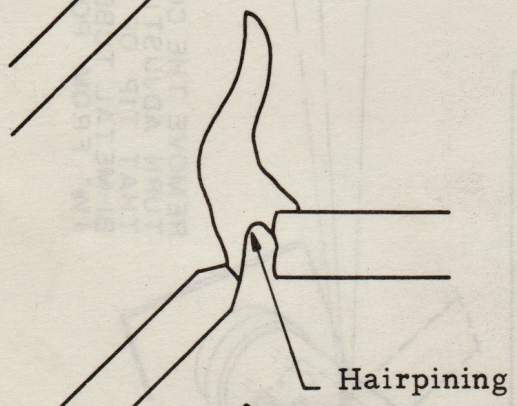
NEGATIVE CARBON ADJUSTMENT

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.

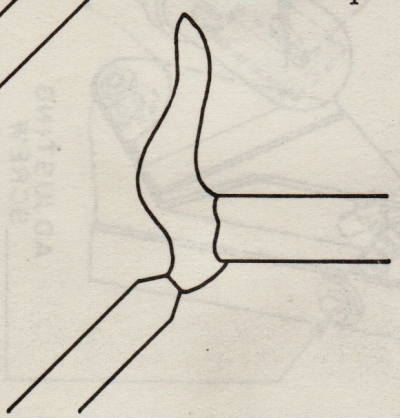
CHANGEOVERS FROM ONE SIZE CARBON TRIM to another will necessitate a slight adjustment of the negative carbon.



"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.

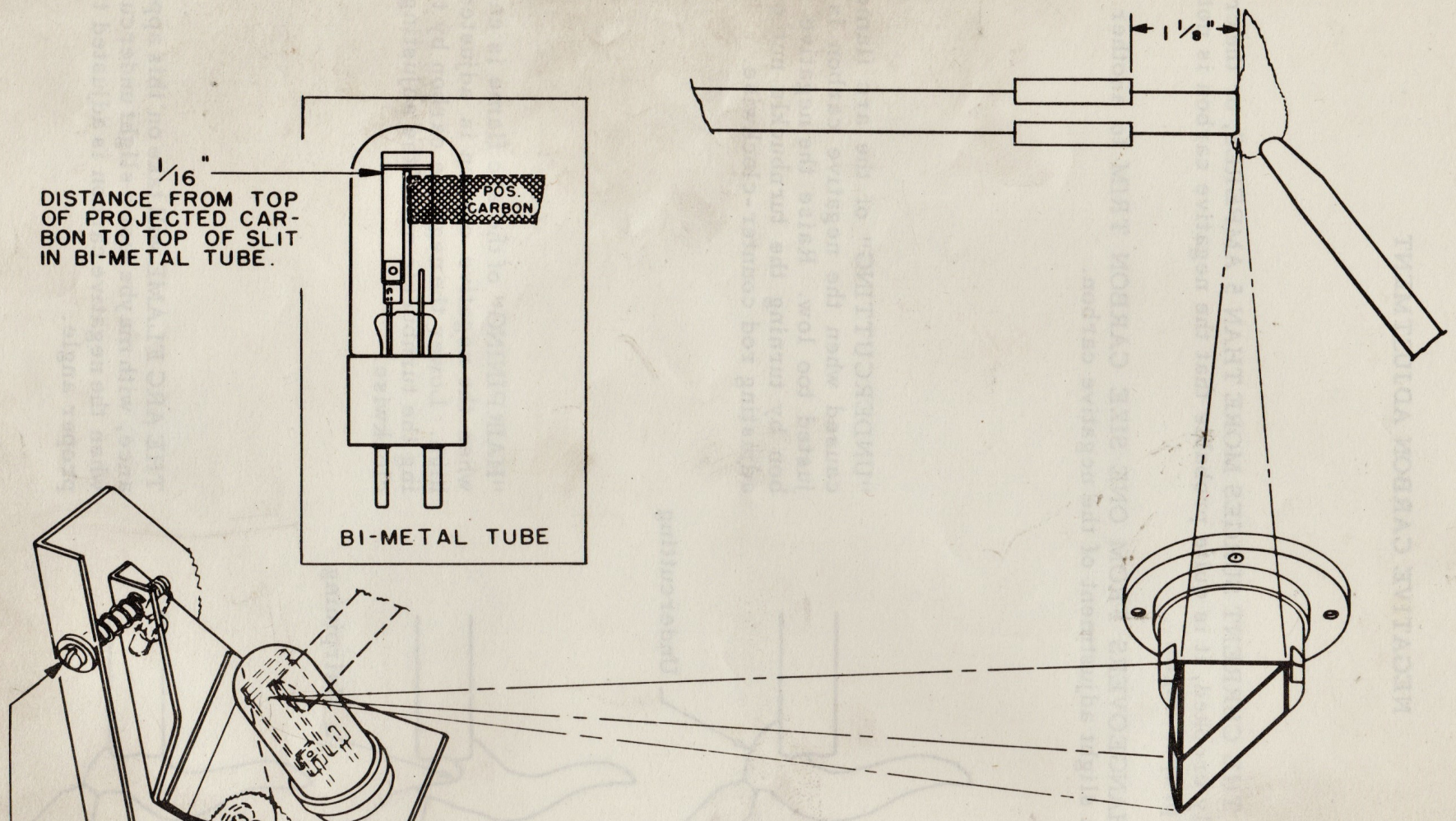


"HAIRPINING" of the arc flame is caused when the negative carbon is adjusted too high. Lower the negative carbon by turning the turnbuckle nut of the adjusting rod clockwise.



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



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 1⅛" FROM POSITIVE SILVER CONTACTS.

Plate 1138

TROUBLE CHART

TROUBLE	PROBABLE CAUSE	REMEDY *
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 1103 for correct combinations.
	Wrong negative lead screw.	See Plate 1103 for information.
	Power supply not correctly adjusted see #4 or #5 below.	Adjust power supply in accordance with E4 or #5 below.
	Bi-Metal Tube at incorrect height.	See ADJUSTMENT section of instruction book.
	Defective Bi-Metal tube.	Replace Bi-Metal tube.
4. Crater Positioning Indicator light remains OFF all the time.	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 ouf 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	PROBABLE CAUSE	REMEDY
10. (Cont'd)	Current control RELAY not working properly.	Check RELAY - (See Adjustment Section).
11. Positive carbon feeding too fast Crater Positioning Indicator light remains ON.	Positive carbon referenced at incorrect location because Arc Imager Wire is bent out of proper 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 Indicator 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 carbon is moved slightly behind (away from negative) reference wire on arc imager, or flash OFF when positive carbon is moved slightly ahead of reference wire as seen on arc imager.	Positive carbon referenced at incorrect location because Arc Imager wire is bent out of correct position.	Reset arc imager wire (See Adjustment Section).
	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 1103.
	Worn motor brushes	Replace if worn.
	Defective or burned out motor	Replace positive motor.
	Shear Pin in Horizontal Drive Shaft broken.	Replace with new shear pin. (See plate 1151).
15. Improper Negative Feeding or Failure of negative carbon to feed.	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 1103.
	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	PROBABLE CAUSE	REMEDY
15. (Cont'd)		
	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 Combination Chart for correct carbon trim and corresponding amperages. See plate 1102.
	Lamphouse improperly aligned.	See "Setting UP" section in this instruction book for proper alignment.
	Lamp improperly Focused.	See "Operation" section.
	Carbon Miss-Alignment	See carbon alignment on plate 1153.
	Obstruction in light path	File out the aperture heat baffle in the projector to clear the beam.
22. Excessive Sooting of Reflector.	Insufficient stack draft.	Increase stack velocity. (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 Section for daily care of the reflector.
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 burning rate selector to fit needs. (See plate 1102)

CONVERSION TO OTHER CARBON COMBINATIONS OR CURRENT RANGES

THE TABLE ON PLATE 1103 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 9-10 mm positive drive rollers are not stamped.

TO CHANGE THE POSITIVE CARBON DRIVE ROLLER ASSEMBLY, remove the hinge pin (see plate 787) 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 1149.

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, it is necessary first, to remove the positive head by loosening the 4 head mounting fasteners. Next, detach the positive lead wire from the head. Remove the nuts, washers, ribbon and pressure springs from the positive slide rods. (See plate 997). Lift the top contact off, being careful not to lose the insulating washers. Unscrew the bottom contact from the contact support casting. Wrap a piece of fine emery cloth around a flat block of wood and lightly rub the contact support table a few times to clean the table. Attach the replacement bottom contact and secure with the two attaching screws. Replace the top contact and attach and secure the nuts, washers, ribbon & pressure springs. Reattach the positive lead to the head and secure the head to the base pan by tightening the four head mounting fasteners.

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 952) 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.

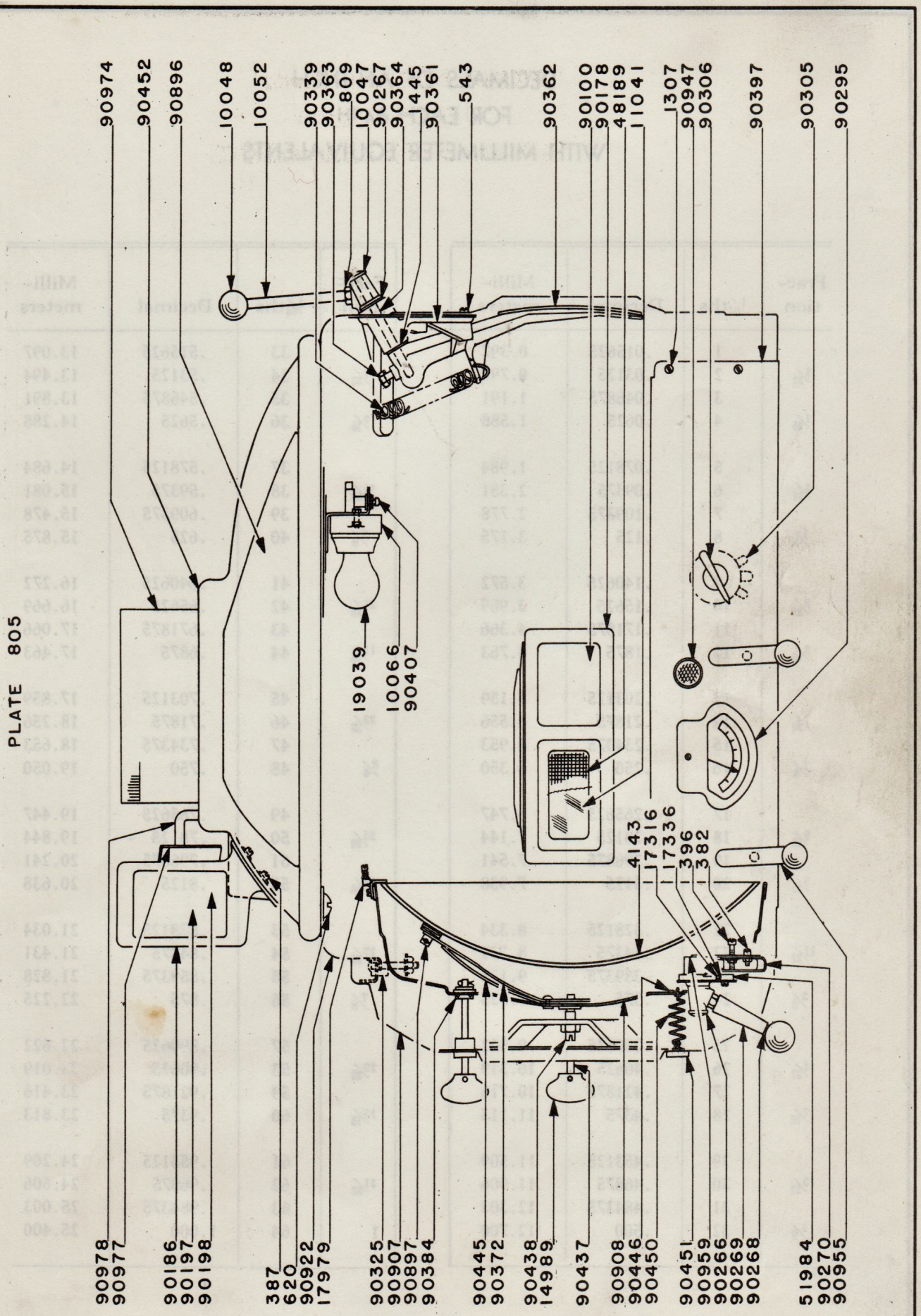


PLATE 805
90974
90452
90896
10048
10052
90339
90363
809
10047
90267
90364
1445
90361
543
90362
90100
90178
48189
11041
1307
90947
90306
90397
90305
90295
19039
10066
90407
4143
17316
17336
396
382
90978
90977
90186
90197
90198
387
620
90922
17979
90325
90907
90897
90384
90445
90372
90438
14989
90437
90908
90446
90450
90451
90959
90266
90269
90268
51984
90270
90955

DECIMALS OF AN INCH
FOR EACH 64TH
WITH MILLIMETER EQUIVALENTS

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

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

PLATE 1099

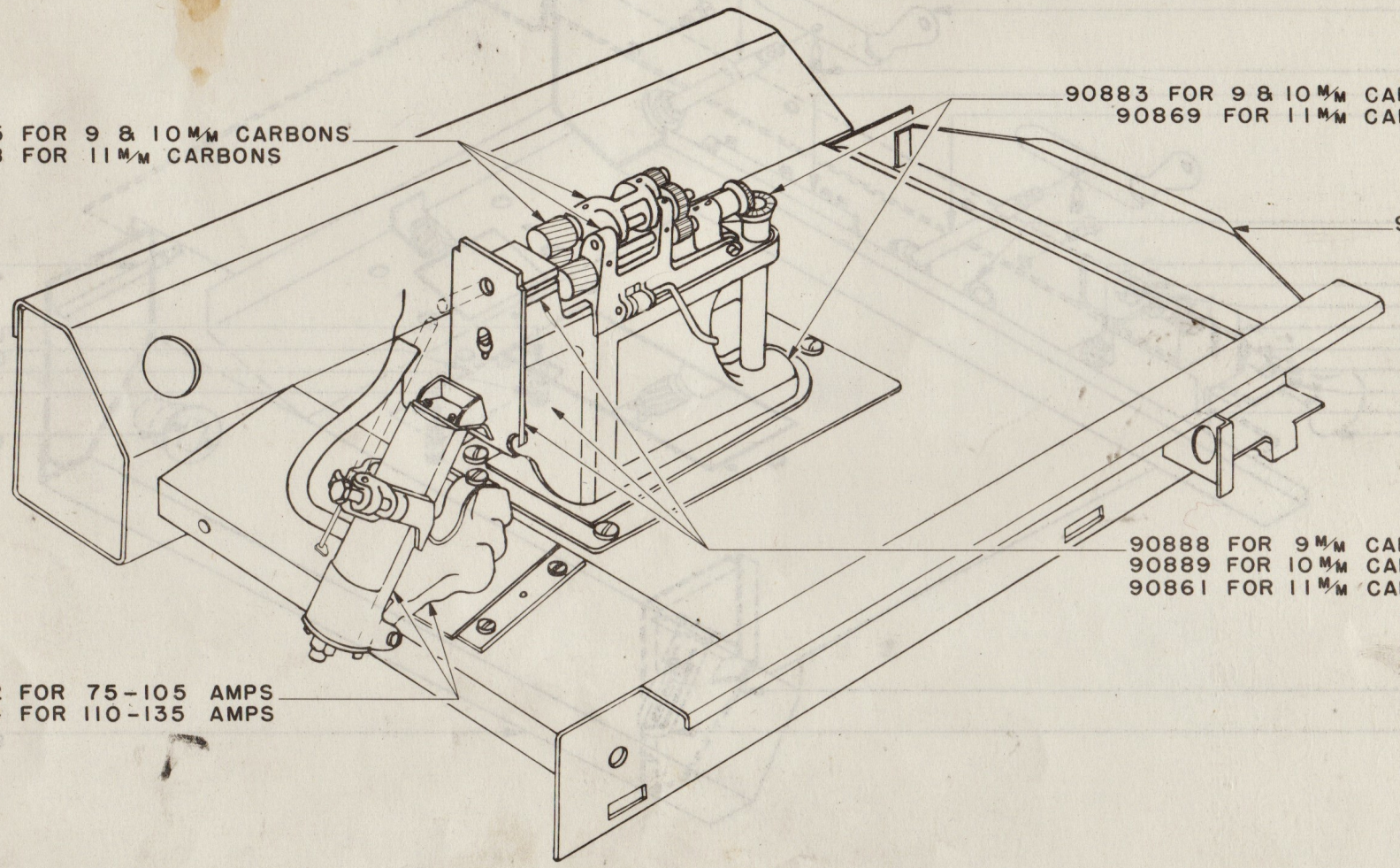


Plate 1099

PLATE 1052

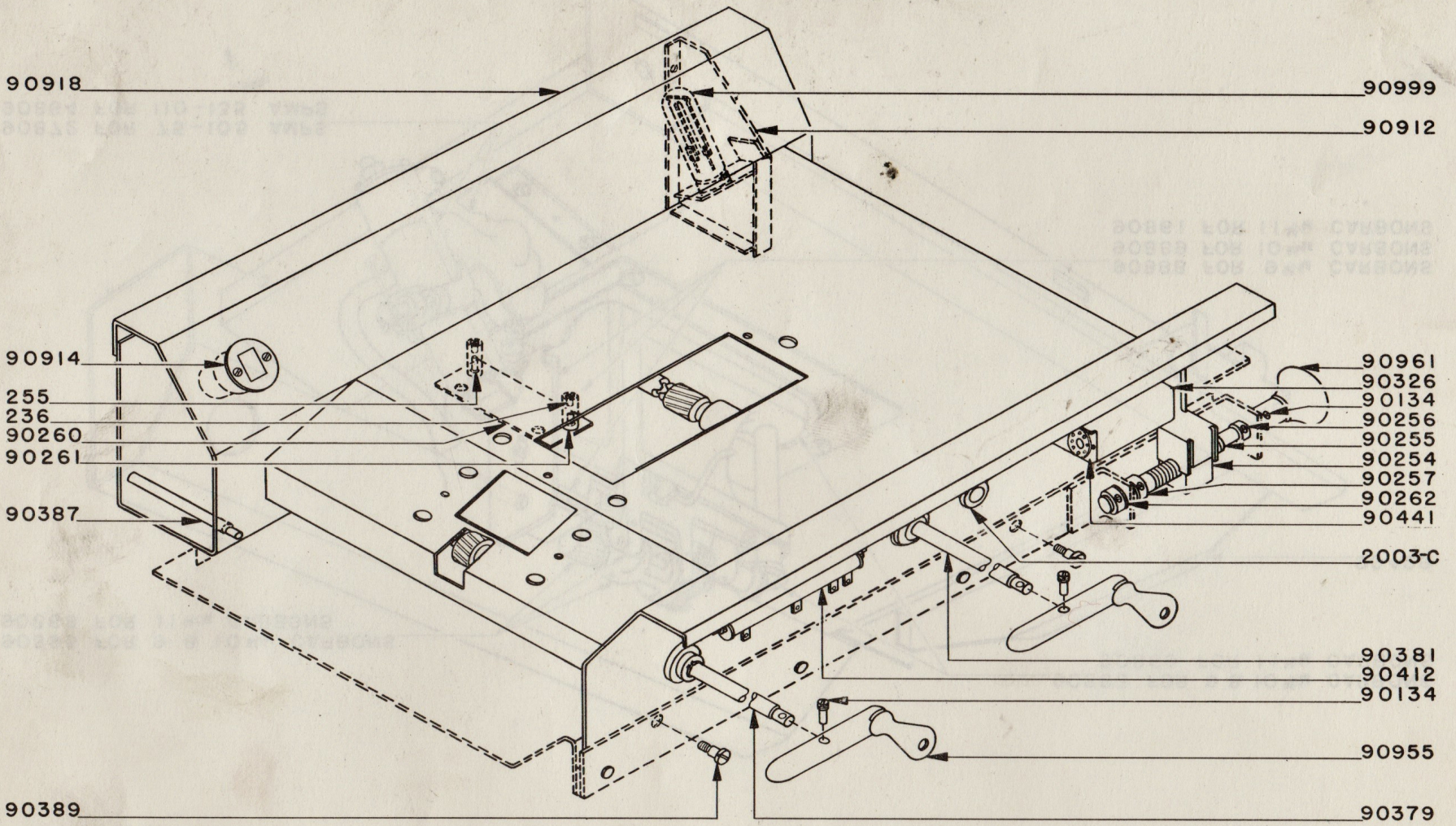

90918
90914
255
236
90260
90261
90387
90389
90999
90912
90961
90326
90134
90256
90255
90254
90257
90262
90441
2003-C
90381
90412
90134
90955
90379

PLATE 803

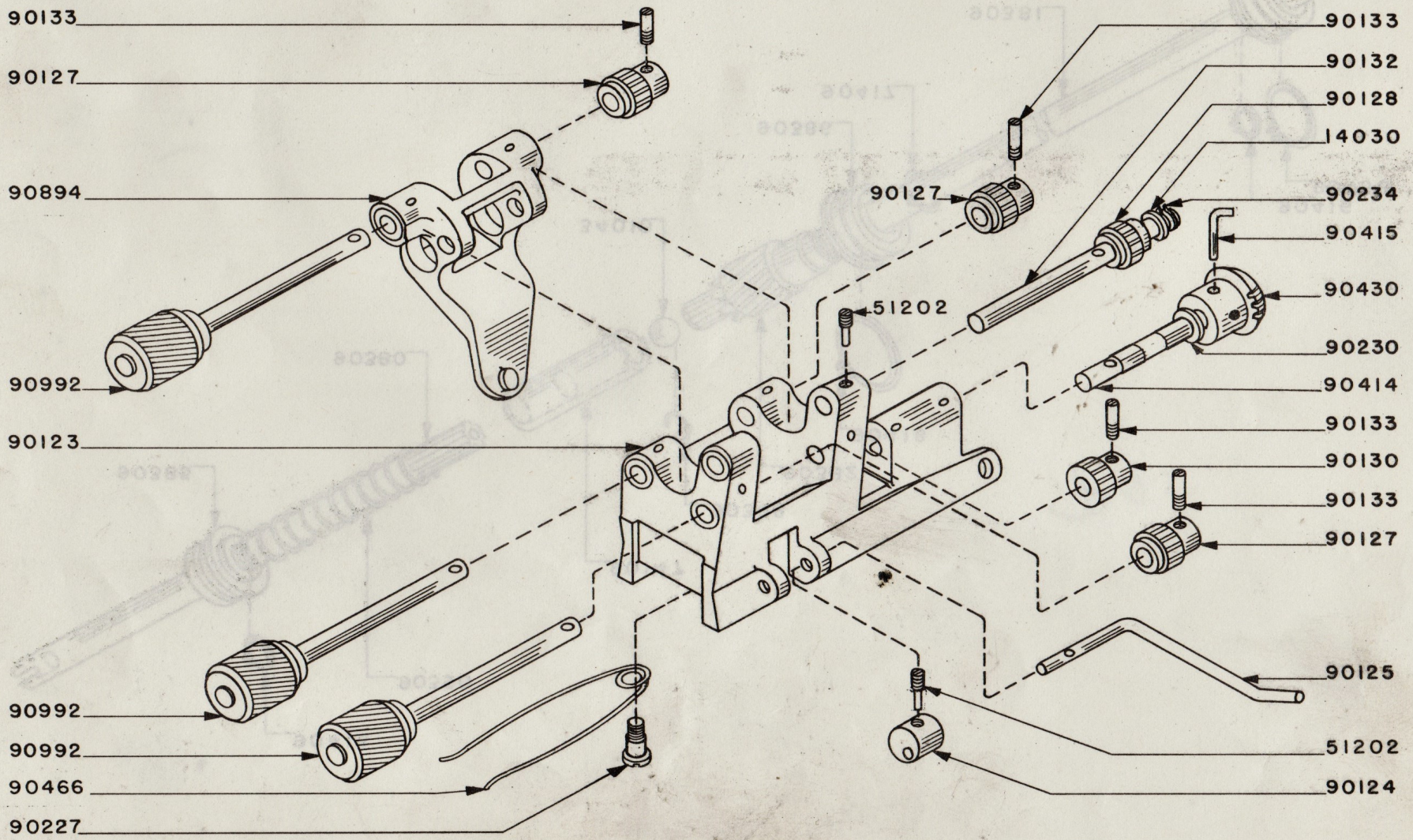

90133
90127
90894
90992
90123
90992
90992
90466
90227
90133
90132
90128
14030
90127
90234
90415
90430
51202
90230
90414
90133
90130
90133
90127
90125
51202
90124

PLATE 793

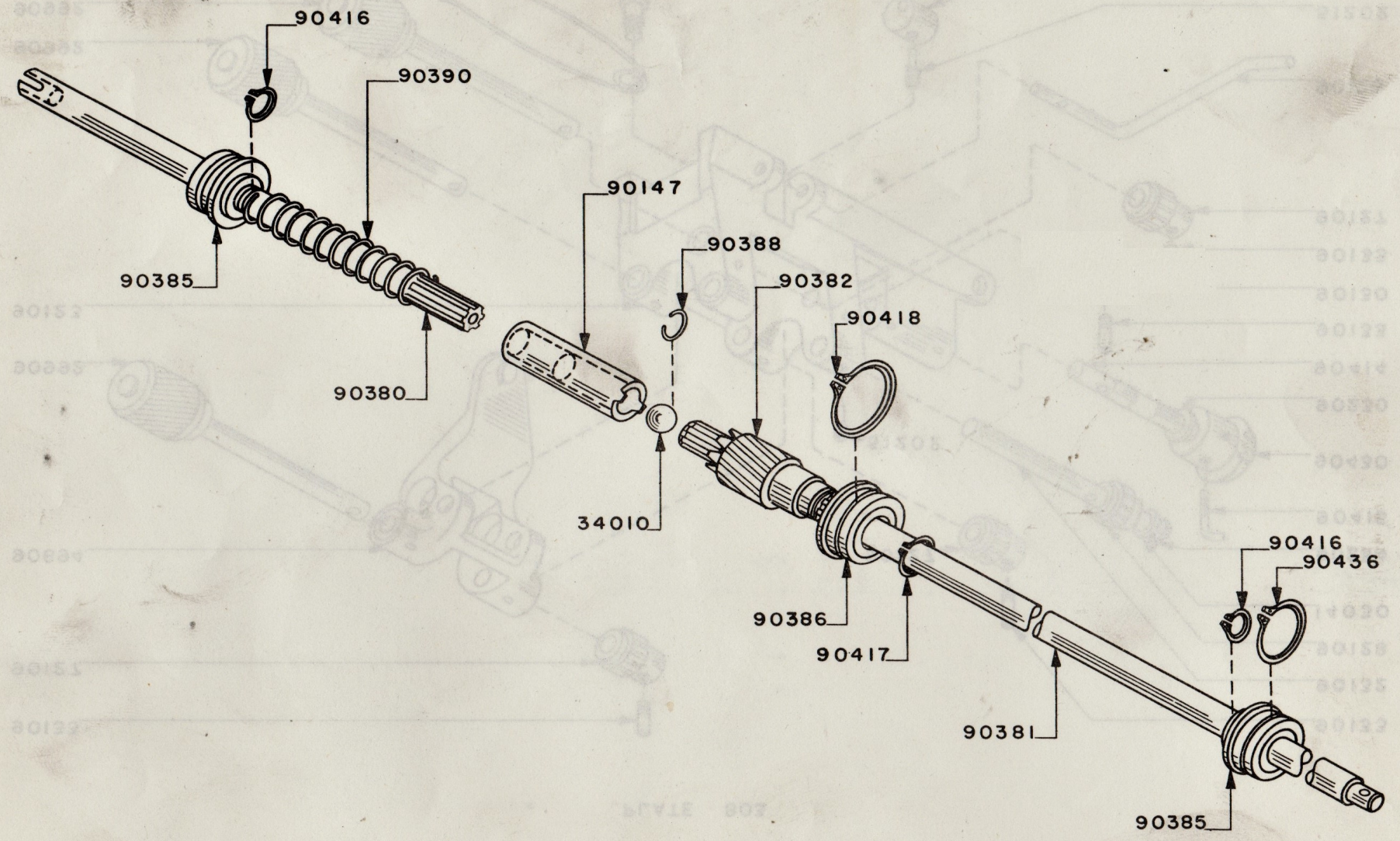


Plate 793

PLATE 1049

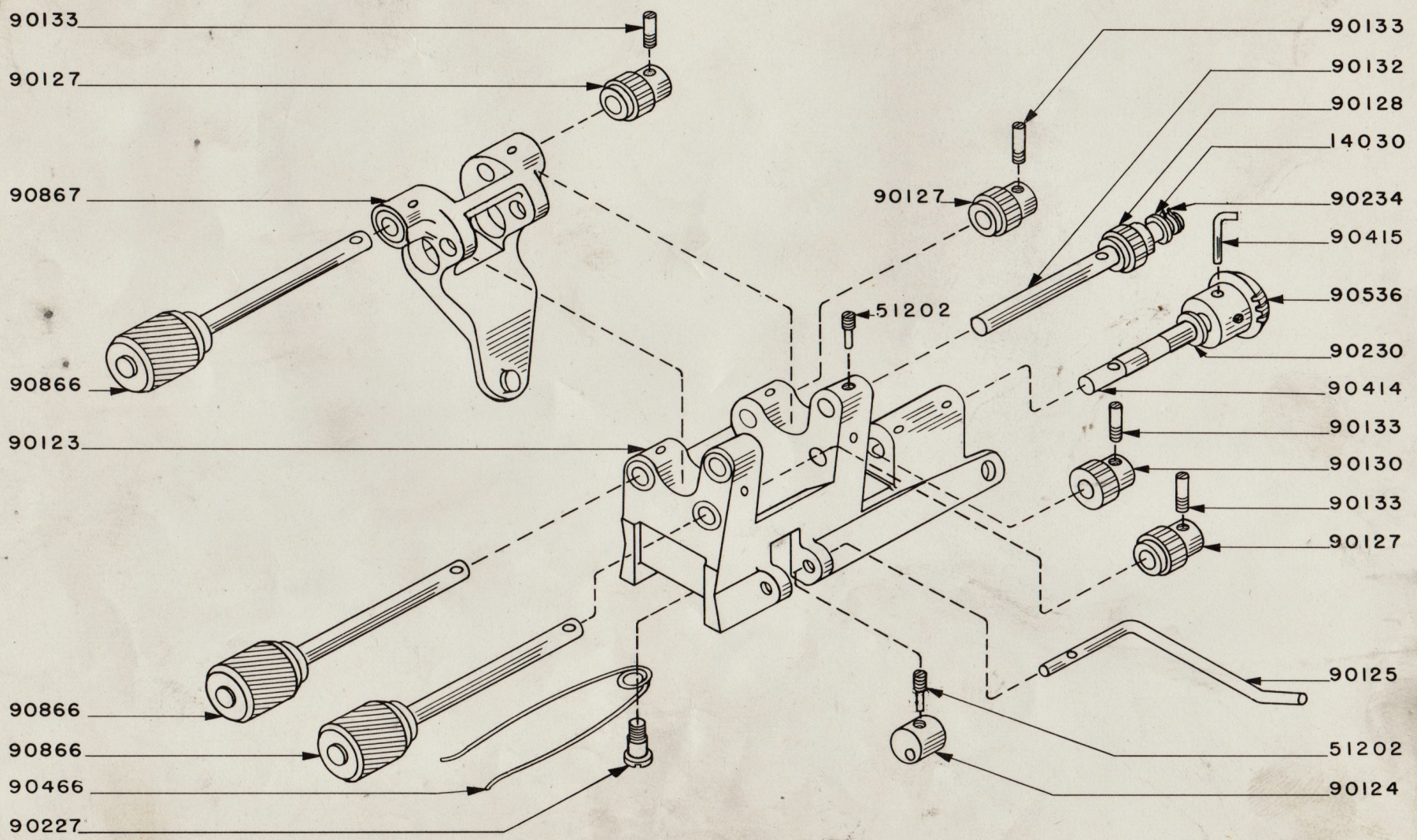


Plate 1049

PLATE 1030

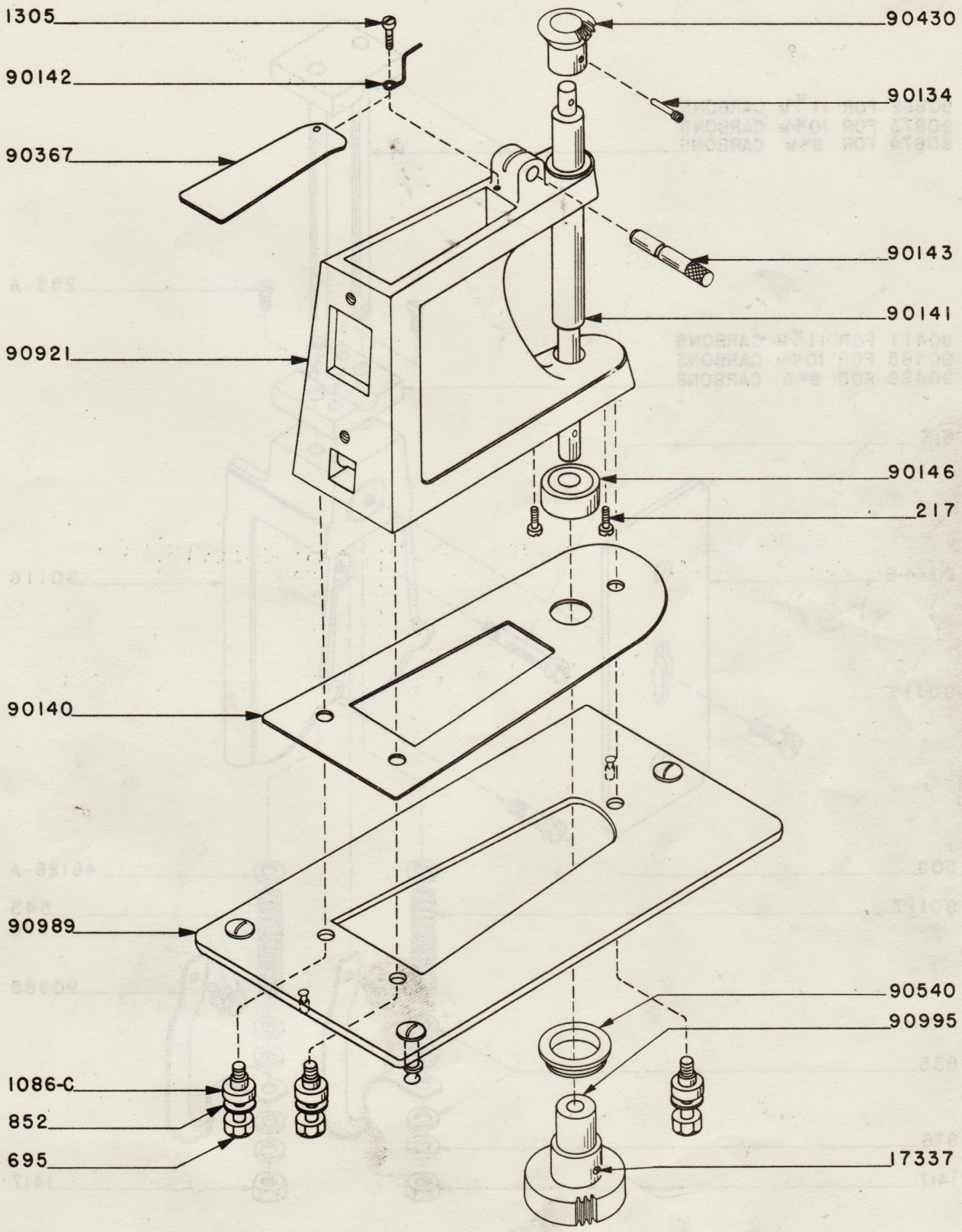

1305
90142
90367
90430
90134
90143
90141
90921
90146
217
90140
90989
90540
90995
1086-C
852
695
17337

PLATE 997

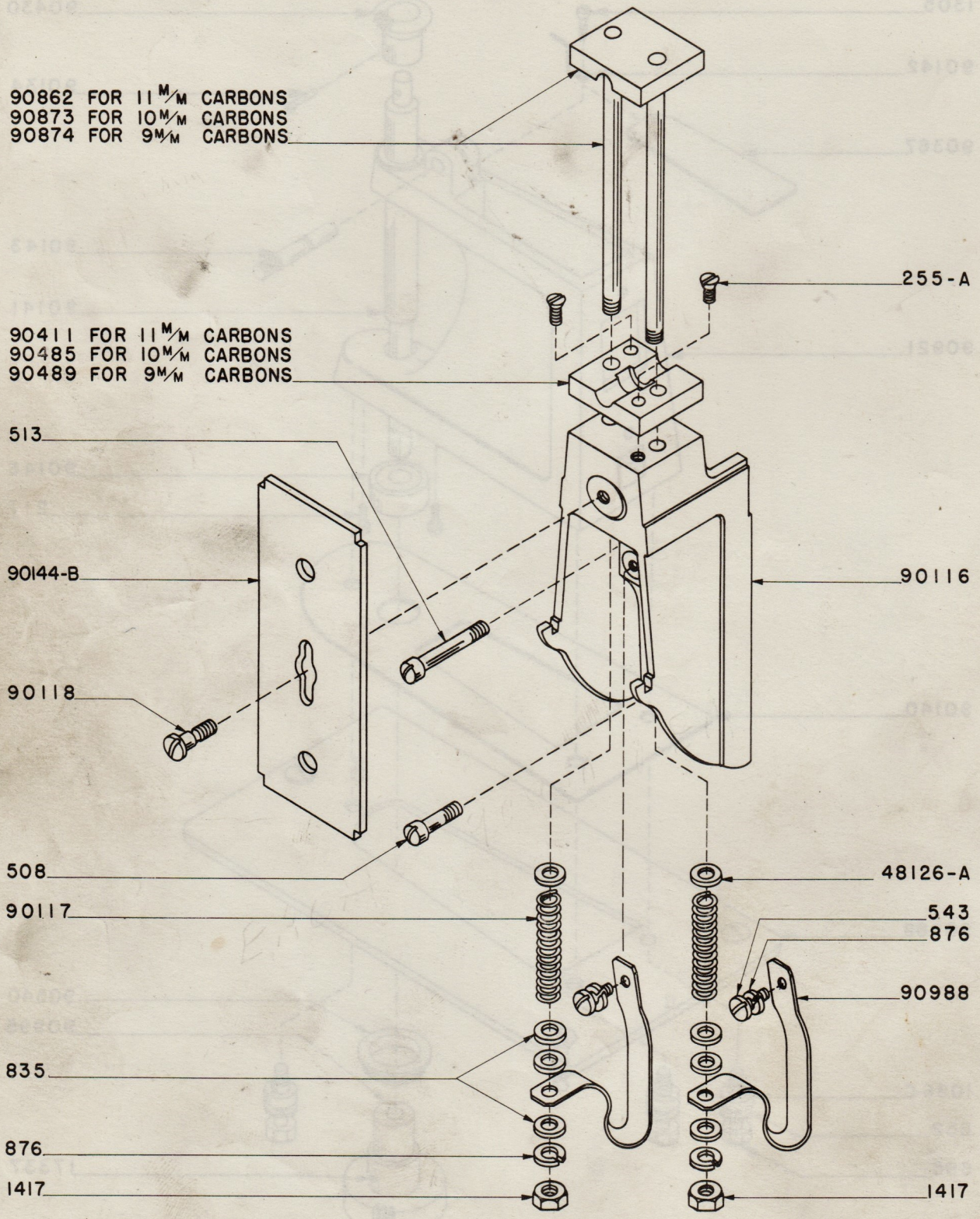
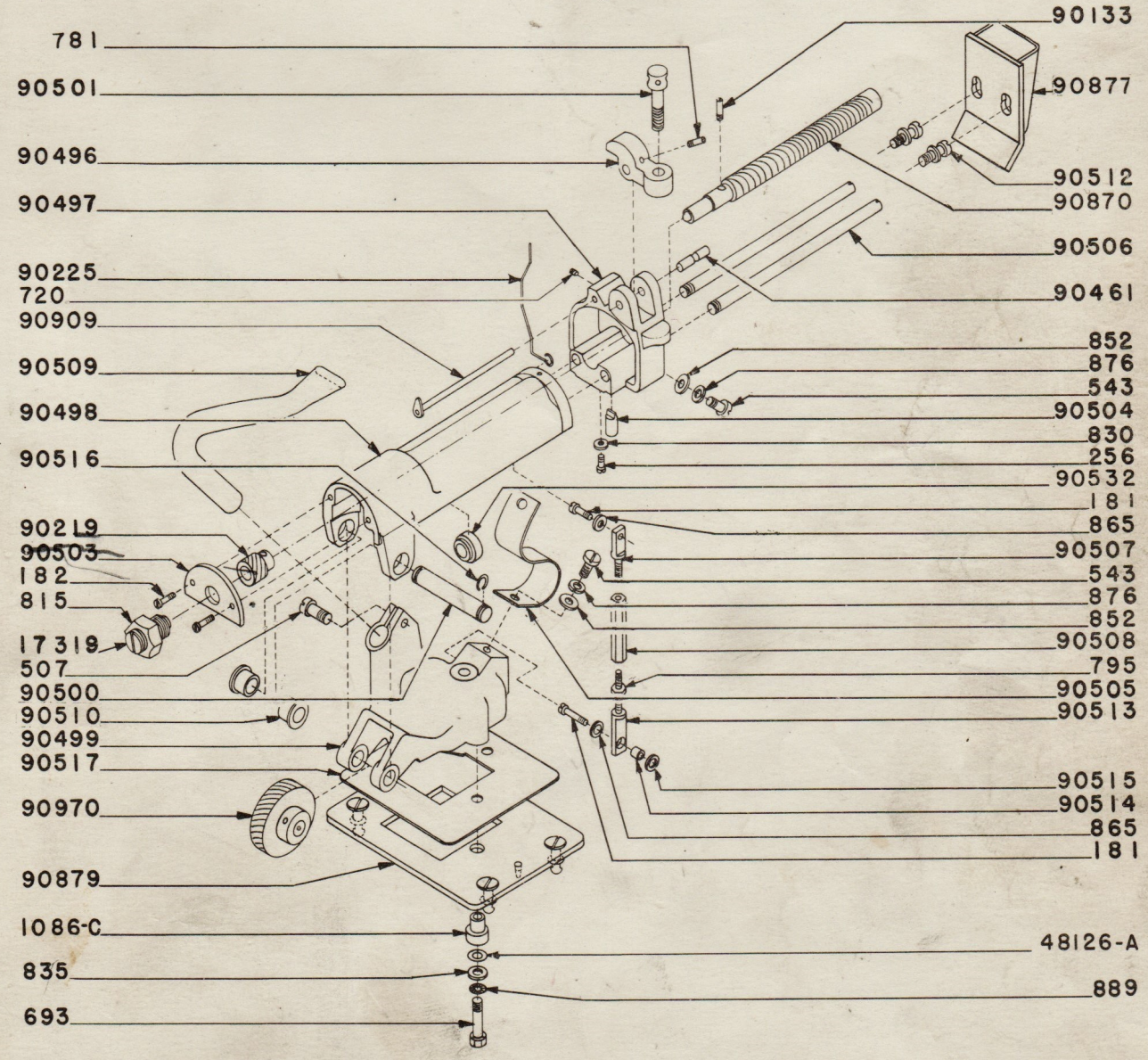

90862 FOR 11 M/M CARBONS
90873 FOR 10 M/M CARBONS
90874 FOR 9 M/M CARBONS
90411 FOR 11 M/M CARBONS
90485 FOR 10 M/M CARBONS
90489 FOR 9 M/M CARBONS
255-A
513
90144-B
90116
90118
508
48126-A
90117
543
876
90988
835
876
1417
1417

PLATE 1046


781
90501
90496
90497
90225
720
90909
90509
90498
90516
90219
90503
182
815
17319
507
90500
90510
90499
90517
90970
90879
1086-C
835
693
90133
90877
90512
90870
90506
90461
852
876
543
90504
830
256
90532
181
865
90507
543
876
852
90508
795
90505
90513
90515
90514
865
181
48126-A
889

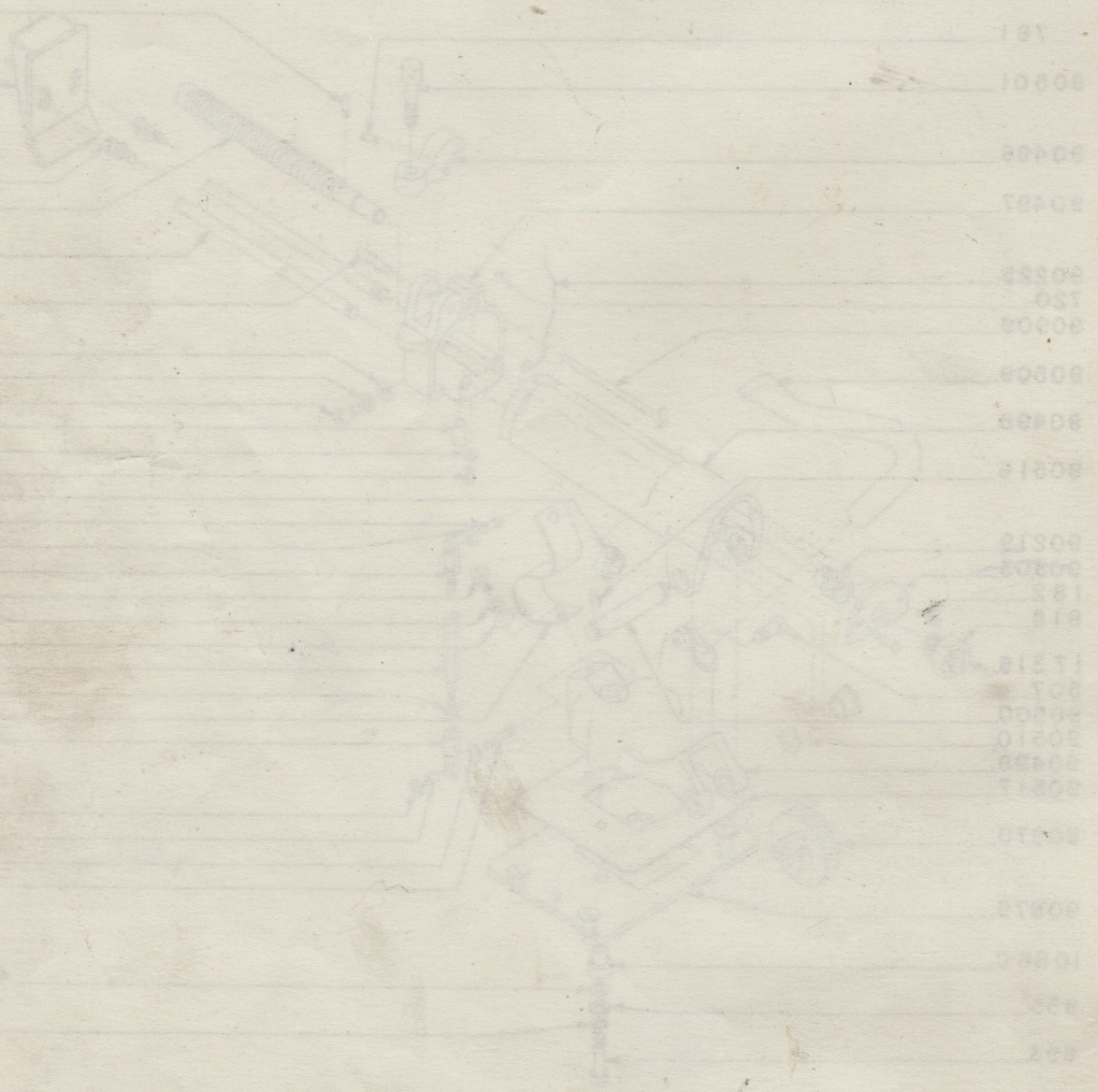


PLATE 1048

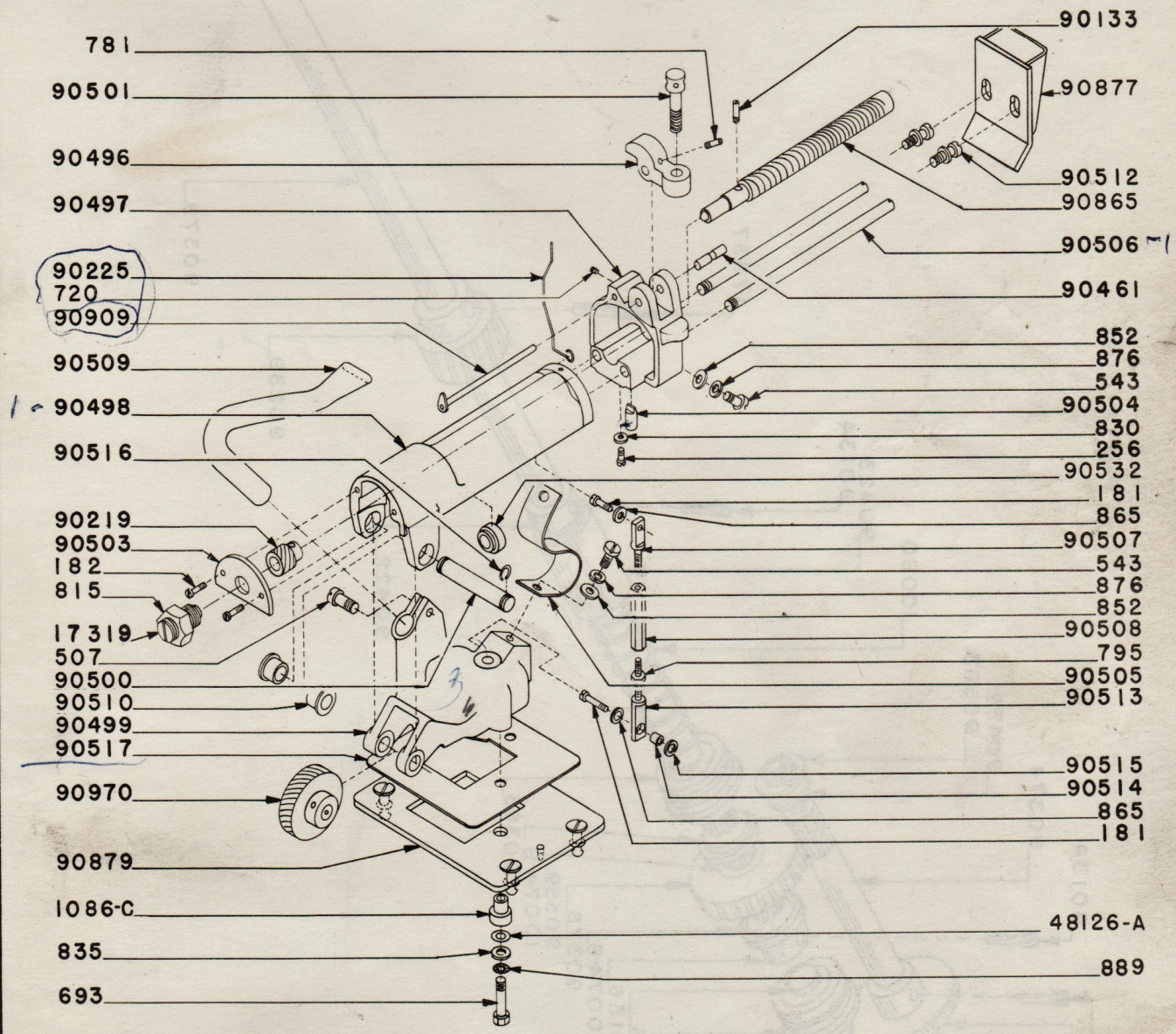
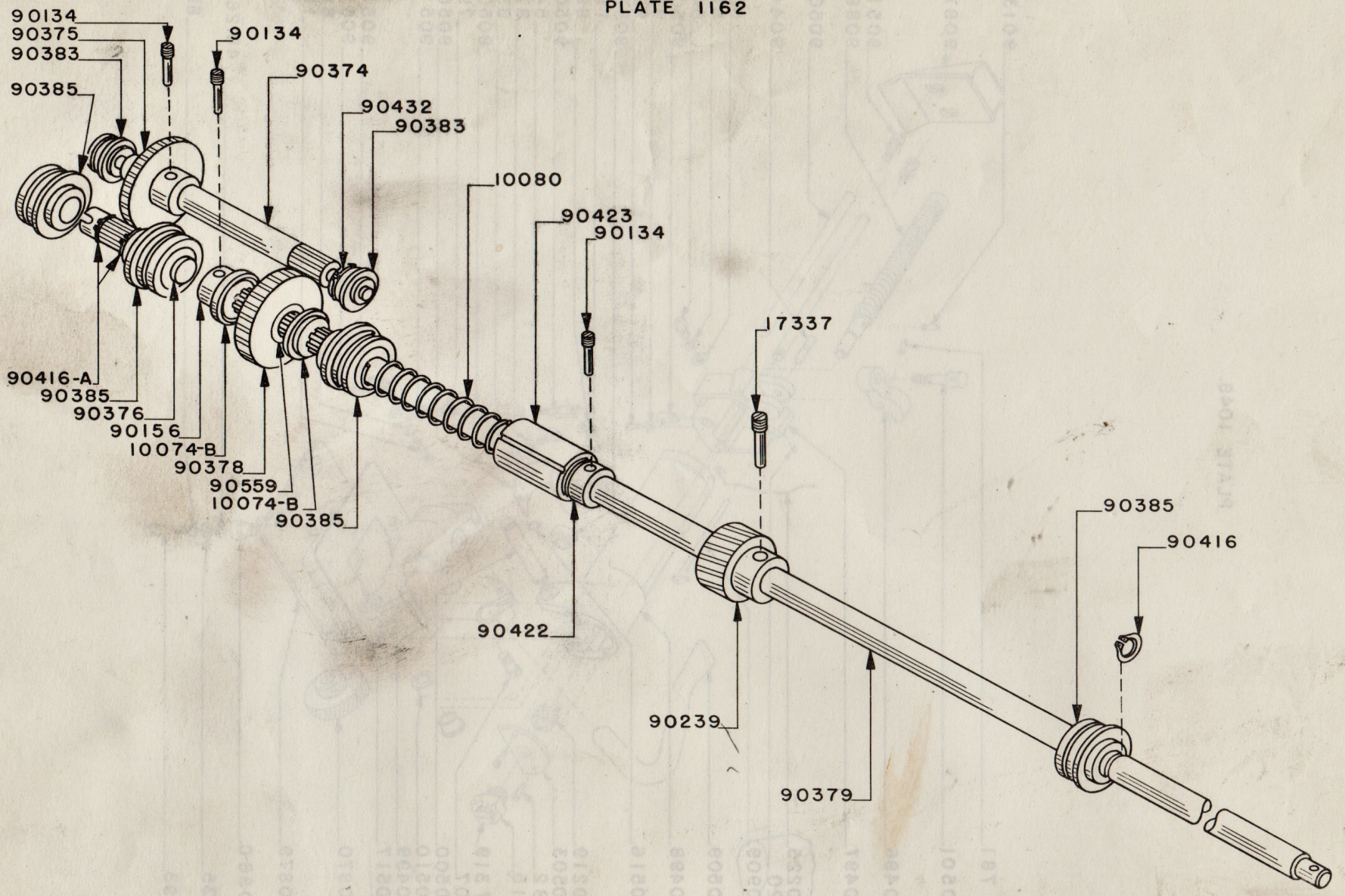

781
90501
90496
90497
90225
720
90909
90509
90498
90516
90219
90503
182
815
17319
507
90500
90510
90499
90517
90970
90879
1086-C
835
693
90133
90877
90512
90865
90506
90461
852
876
543
90504
830
256
90532
181
865
90507
543
876
852
90508
795
90505
90513
90515
90514
865
181
48126-A
889

PLATE 1162


90134
90375
90383
90385
90134
90374
90432
90383
10080
90423
90134
17337
90416-A
90385
90376
90156
10074-B
90378
90559
10074-B
90385
90422
90239
90379
90385
90416

181	Screw - #6-32 x 3/8" Fil. Hd.
182	Screw - #6-32 x 7/16" Fil. Hd.
216-A	Screw - #8-32 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.
382	Screw - #10-32 x 3/8" Fil. Hd.
387	Screw - #10-24 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.
691	Screw - #8-32 x 7/16" Fil. Hd.
695	Screw - 1/4-20 x 1" Hex Hed.
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 - 3/8-16 Jam
815	Nut - 1/2-20 Hex, Jam
830	Washer - #8 Brass
835	Washer - 1/4" Flat
852	Washer - 1/4" Flat
865	Washer - #6 Std. Steel
876	Washer - Lock, 1/4" Split
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.
1417	Nut - 1/4-20 Hex, Half (Brass)
1445	Washer - Spring, Shakeproof
2003-C	Bushing - Lead Wires
4143	Reflector - 16-1/2" diameter
10047	Hub - Dowser Handle
10048	Knob - Black
10052	Shaft - Douser Handle
10066	Receptacle - Work Light
10074-B	Washer - Splined, Neg. Cross Shaft
10080	Spring - Negative Clutch
11041	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
14989	Knob-Control, Assy. (Reflector)
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
19037	Latch-Door, Right Hand
19038	Latch-Door, Left Hand
19039	Bulb-Work Light
23034	Extension-Light Cone
23037	Cone-Light
23046	Brush-Cleaning, Carbon Contact
23059	Insignia-Door
23066	Lubricant-Positive & Negative Heads
23067	Lubricant-Gear Box, Bodine Motors
23068	Lubricant-Bearings, Bodine Motors
23481	Kit-Aligning, Lamp
34010	Ball-Steel, Positive Coupling (See also #90987)
48126-A	Washer-Fibreglass
48189	Screen-Window Glass
51202	Screw-Set
51984	Ball-Retaining Block Assy., Rear Door
53163	Plug-Button, Dot
56271	Wrench-Negative Head
90100	Plate-Name & Data, Side Door
90103	Impeller-Blower
90105	Plate-Name, Rear Door
90116	Support Casting-Contact
90117	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	Plate-Insulating, Positive
90141	Shaft-Drive, Vertical

90142	Spring - Hinge Pin
90143	Pin - Hinge
90144-B	Baffle-Heat, Positive
90145	Lug-Wire, Positive & Negative Heads
90146	Bearing-Ball, Vertical Drive Shaft
90147	Coupling-Positive Cross Shaft (see also #90987)
90156	Collar-Negative Cross Shaft
90161	Housing-Blower, Motor Side
90162	Housing-Blower, With Screen
90178	Window Frame Casting
90179	Shaft-Handle, Side Door
90180	Handle - Side Door
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	Ammeter
90302	Plug-Motor Connection (Male)
90303	Receptacle-Motor Connection (Female)
90305	Rheostat
90306	Knob-Rheostat
90308	Body-Indicating Light (also see 90947)
90309	Bezel-Indicating Light (also see 90947)
90310	Bulb-Indicating Light
90311	Bracket-Support, Side Doors
90324	Damper - 8 inch
90325	Stay-Friction, Rear Door

90326	Relay (also see 90910)
90339	Spring-Dowser
90357	Cover Box - Door Prism
90358	Filter Glass - Image Beam
90361	Bracket Casting - Dowser
90362	Dowser
90363	Screw-Set, Dowser
90364	Shaft-Dowser
90367	Baffle-Air, Positive Head
90372	Spring-Steadying, Reflector (also 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)
90379	Shaft-Cross, Negative
90380	Shaft-Cross, Positive (short)
90381	Shaft-Cross, Positive (long)
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 (also see #90987)
90389	Screw-Locking, Base
90390	Spring-Cross Shaft, Positive
90396	Light Seal-Front, Mechanism Base
90397	Panel - Instrument
90398	Panel-Cover, Motor Side
90407	Switch & Cord - Work Light
90411	Contact-Bottom, Positive Head (11 MM) (Sold only as #90863)
90412	Resistor - 3 Section
90414	Shaft-Horizontal Drive, Positive Carbon
90415	Pin-Shear, Horizontal Drive Shaft
90416	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, Ref. Steadying (also see #90372)
90446	Retainer-Spring, Ref. Tension (In reflector frame)

90448	Shield-Light, Rear
90450	Spring-Tension, Reflector
90451	Button-Anchor, Reflector Tension Spring
90452	Top Casting-Lamphouse
90455	Cap-Brush, Bodine
90461	Shaft-Roller, Negative Carbon Release
90463	Screw-Mounting, Friction Stem
90466	Spring-Pressure, Carbon Drive Roller
90474	Cover-Glass, Prism Holder
90482	Chain-Instrument Panel
90483	Insulation-Panel Chain
90485	Contact-Bottom, Positive (10 MM) (sold only in 90887)
90489	Contact-Bottom, Positive (9 MM) (sold only in 90886)
90490	Motor-Negative (Sold only as 90881)
90491	Motor-Positive (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. Head
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	Plate-Insulating, Negative Jaw
90524	Tube-Insulating (for Positive Crank Stem)
90530	Motor-Positive (Sold only as 90871)
90532	Collar-Negative Head
90536	Gear-Drive, Bevel (11 MM)
90539	Glass - Heat Filter
90540	Insulator-Helical Gear, Positive Driven
90542	Nameplate- Side Door
90543	Nameplate - Rear Door
90544	Cloth - Refinishing, Contact

90547	Tool - Refinishing, Contact
90550	Bracket - Clamping, Heat Filter Assy. to Douser
90552	Gasket - Heat Filter
90857	Heat Filter & Glass Assembly
90858	Retaining Ring Assy. - Heat Filter
90859	Support Brkt. Assy. - Heat Filter
90860	Heat Filter Assy. - Less Glass
90861	Jaw & Support Casting Assy. - 11 MM
90862	Top Contact & Rod Assy. - 11 MM (Sold only as 90863)
90863	Bottom & Top Contact & Rod Assy. - 11 MM
90864	Negative Head Unit Assy. - Complete (with 6-1/4" Lead Screw)
90865	Ball & Neg. Lead Screw Assy. (6-1/4)
90866	Carbon Drive Assembly - 11 MM (Sold only as assembly #90868)
90867	Carbon Release & Bearing Assy.
90868	Drive Rollers & Casting Assy. - Positive, Complete (11 MM)
90869	Positive Head Assy. - Complete (For 11 MM carbons)
90870	Lead Screw & Ball Assy. - Negative, 5 thread
90871	Motor & Mounting Unit Assy. - Positive, 300:1
90872	Negative Head Unit Assy. - Complete
90873	Positive Contact & Rod Assy. - Top, 10 MM(Sold only in 90887)
90874	Positive Contact & Rod Assy. - Top, 9 MM (Sold only in 90886)
90877	Heat Shield Assy. - Negative Head
90878	Cable Assembly - Wiring
90879	Mounting Plate Assy. - Negative Head
90881	Motor Unit Assy. - Negative (with mounting plate)
90882	Motor & Unit Mounting Assy. - Positive, 216:1
90883	Positive Head Assy. - Complete (for 9 & 10 mm carbons)
90886	Contacts & Rod Assembly - 9 MM
90887	Contacts & Rod Assembly - 10 MM
90888	Contact Support Casting & Contacts Assy. - 9 MM
90889	Contact Support Casting & Contacts Assy. - 10 MM
90894	Roller Casting & Bearings - Upper, Positive Hd., 9-10 MM
90895	Drive Rollers & Casting Assy. - Positive Carbon, 9-10 MM
90896	Top Casting Assembly - Complete
90897	Reflector Rest Button Assy. - Asbestos
90898	Positive Lead & Feed Wire Assy.
90899	Negative Jaw Wire Assy.
90900	Negative Lead Wire Assy.
90902	Dowser Assembly - Complete
90907	Rear Door Assembly - Welded
90908	Reflector Frame Assembly
90909	Carbon Trim Rest Assembly
90910	Relay & Mounting Lug Assy.
90911	Mechanism Base Unit Assy.
90912	Mounting Brkt. Assy. - Control Tube
90914	Control Prism Assy.
90918	Mechanism Base Assy. - Welded (Sold only as 90911)
90921	Positive Head & Bearing Assy. (Also see 90869)

90448	Shield-Light, Rear
90450	Spring-Tension, Reflector
90451	Button-Anchor, Reflector Tension Spring
90452	Top Casting-Lamphouse
90455	Cap-Brush, Bodine
90461	Shaft-Roller, Negative Carbon Release
90463	Screw-Mounting, Friction Stem
90466	Spring-Pressure, Carbon Drive Roller
90474	Cover-Glass, Prism Holder
90482	Chain-Instrument Panel
90483	Insulation-Panel Chain
90485	Contact-Bottom, Positive (10 MM) (sold only in 90887)
90489	Contact-Bottom, Positive (9 MM) (sold only in 90886)
90490	Motor-Negative (Sold only as 90881)
90491	Motor-Positive (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. Head
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	Plate-Insulating, Negative Jaw
90524	Tube-Insulating (for Positive Crank Stem)
90530	Motor-Positive (Sold only as 90871)
90532	Collar-Negative Head
90536	Gear-Drive, Bevel (11 MM)
90539	Glass - Heat Filter
90540	Insulator-Helical Gear, Positive Driven
90542	Nameplate- Side Door
90543	Nameplate - Rear Door
90544	Cloth - Refinishing, Contact

90922	Lamphouse Frame Assy. - Welded (Not sold separately)
90931	Prism Assembly- Arc Imager
90947	Indicating Light Body & Bezel Assy.
90955	Ball Crank Assembly
90959	Shaft & Roller Assy. -Latch, Rear Door
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.
90980	Door Assy. - Left Hand (complete)
90981	Door Assy. - Right Hand (complete)
90987	Coupling Assembly - Positive Cross Shaft
90988	Ribbon Assembly - Positive Head
90989	Mounting Plate & Pins - Positive Head (sold only as 90869)
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.