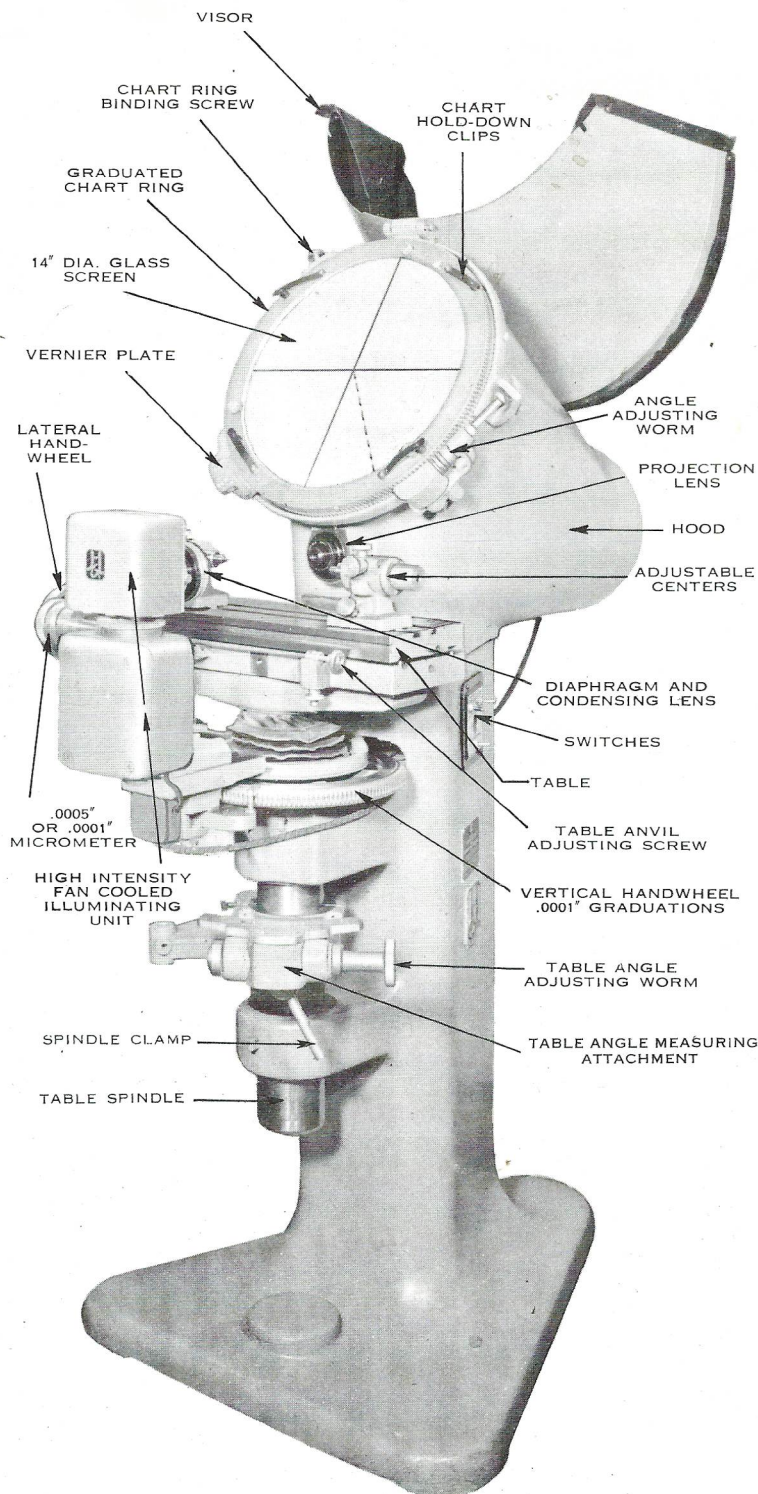


SETTING UP AND OPERATING INSTRUCTIONS FOR PC-14 OPTICAL COMPARATORS



**For Serial No.
E9367 and up**

JONES & LAMSON

*Machine Tool Craftsmen
Since 1835*



JONES & LAMSON MACHINE CO., Springfield, Vt., U.S.A.

OPTICAL COMPARATOR DIV.

The Jones & Lamson Pedestal Comparator and Measuring Machine is designed for use under ordinary shop lighting conditions in any part of the shop where it is convenient to gage the work, and where a light socket is available. It is desirable, however, when the Comparator is used continuously over long periods of time, that the operator face no light stronger than that illuminating the chart, and that there be no strong light behind the operator to dim the chart shadow. The Comparator is equipped with a transformer or resistor for the particular voltage and frequency specified when the machine is ordered, and must not be used on any other voltage or frequency.

TO GET THE BEST RESULTS WITH YOUR COMPARATOR

1. The light beam should be properly adjusted. See pages 6 and 7.
2. Keep the lens systems for a particular comparator with the machine at all times. The comparator has been set for these systems. Lens systems are not interchangeable between comparators. See page 7.
3. Check magnifications frequently. See page 7.
4. Do not tamper with the lens systems or condenser lenses. Only the external surfaces will require cleaning. Use alcohol and absorbent cotton.
5. Take proper care of the mirror. See pages 5 and 10.
6. Be sure that the screen is properly adjusted. See page 7.
7. When setting magnifications for various power lenses use the pin sizes recommended on page 7.
8. Use proper charts. Use clear overlay charts over the frosted glass screen in the machine. Use frosted overlay charts over the clear glass screen in the machine, the frosted surface of the overlay chart should be away from the operator.
9. Use soap and water to clean glass screens and overlay charts.
10. The horizontal centerline on the screen must be parallel with the table top.
11. The lens system must have sufficient magnifications to distinguish the tolerances on the part being inspected.
12. Keep table top clean and free from burrs. Wipe frequently to remove grit.
13. Keep the table guide bracket shoe in proper adjustment.
14. Keep vertical spindle of table free from gumming residue, and well oiled, to prevent its sticking in the close fitting bearings. See page 5.
15. Do not move the machine without removing top table slide, otherwise ball dents may occur in vees.
16. Where there is excessive vibration, mount the Comparator on rubber pads or a cork base. See page 5.
17. When projecting flat objects, position the face to be projected toward the projection lens. Position the cutting face of taps or hobs toward the projection lens. See page 8.
18. When measuring angles of parts held between centers, make certain that centers are in axial alignment, that is to say, parallel with the table top. See page 10.
19. Remove oil film from parts having a very high reflecting surface before projecting.
20. Parts to be reflected should be mounted with graining marks vertical to the table top. Be sure to remove diaphragm from the projection lens before reflecting. See page 10 and 11.

Fig. 1
Table Assembly

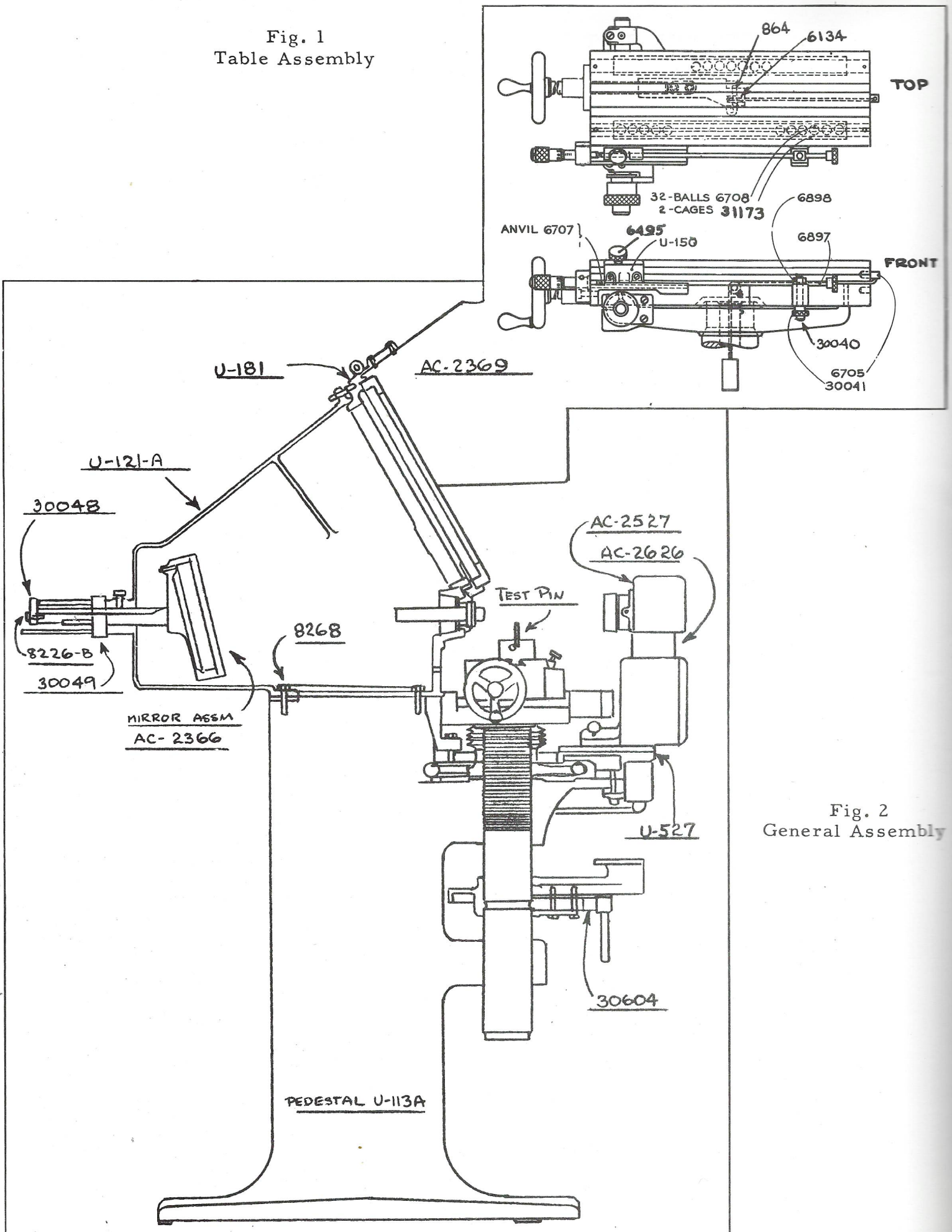


Fig. 2
General Assembly

SETTING UP INSTRUCTIONS

Set the pedestal, which has a three-point bearing, on a reasonably flat and solid foundation. If the machine is to be used where there is considerable vibration, it should be mounted on rubber pads or a cork base to prevent movement of the image on the screen.

Completely remove rust resisting compound from all surfaces. Special care should be taken to clean the table spindle before the table is adjusted vertically. Do not loosen any of the component parts of the machine while removing the rust resisting compound unless these are movable parts used in the operation of the equipment.

NOTE: Failure to follow the above suggestions may result in misalignment of the machine which will, of course, cause inaccuracies in measurement.

ASSEMBLE HOOD & MIRROR

Mount the hood U-121-A on the pedestal and fasten it securely with the three cap screws 8268, Fig. 2. Place the triangular board in the bottom of the hood to prevent dust from getting into the hood. Assemble the visor AC-2369 onto the lower chart ring U-181 with the hinge pin.

The mirror assembly should be carefully unwrapped and mirror cover removed. CAUTION: Do not touch face of mirror as the coating is on the outer surface. We can supply a solution called "Mir-O-Len" for cleaning the mirror when necessary. This solution should be used according to the instructions printed on the bottle.

Remove the stop block 30048, Fig. 2 and 3, from the end of the mirror shaft. Inspect the mirror assembly to make certain that the front surface of the mirror is securely located against the three pads on the front of the mirror cell, and place the mirror assembly into position as shown in Fig. 2. Slide the stop

collar assembly 30049 onto the shaft and fasten the stop block 30048 into position with the cap screw 8226B. Fig. 2 and 3.

TABLE ASSEMBLY

The Pedestal Comparator can be equipped with a table having 4" of travel or one having 8" of travel.

To assemble the table with 4" travel refer to Fig. 1. Lower counterweight through table bed into spindle. Install pulley and shaft 6134 and 864 in table bed and insert anchor 6705 in end of table bed. Screw micrometer thimble in place. Place the balls and cages on the table bed and carefully lay the table in place. The top of the table must be level.

Remove the anchor 6705 from the lower slide and put it in the hole in the top slide, as shown in Fig. 1. The anvil block U-150 may now be assembled. It is held in place with the hook clamp 6495. Insert the adjusting rod 6897 through the clamps 6898 and 30040 and screw it into the anvil block U-150 until it contacts the sliding anvil 6707.

The table having 8" travel is shipped assembled.

Place the chart ring in the lower Chart Ring U-181. Install the glass screen in place with the frosted surface toward the operator. Screw lens bushing B into hood casting U-121-A. (Fig. 5). Place lamphouse pedestal and lamphouse assemblies A-C-2626 and A-C-2627 on lamphouse pedestal bracket U-527 (Fig. 2).

Insert lamp (which has a vertical filament) into lamp socket and place chimney over same. Install condensing lens F in lamphouse. (Fig. 4).

Connect the switch cord to a convenient light socket. (Caution: Make sure the line voltage and current are as specified on the voltage rating plate; otherwise, the transformer may be burned out.)

Turn on the switch.

TO ADJUST LIGHT BEAM

It is important that the light beam be adjusted central with the axis of the projection lens in order to secure the proper screen illumination.

Screw the light aligning diaphragm A into the lens bushing B, in the lens opening of the hood. Fig. 5.

The left side of the lamphouse bracket C is aligned with a scribed line on the supporting bracket E and locked with Screw D. Check this location. Figs. 4 and 5.

Remove the condensing lens assembly (F) from the lamphouse. An image of the lamp filament will appear upon the screen. Adjust screws (G) to centralize this image with the vertical center line on the screen. Fig. 4 and 5.

Replace the condensing lens assembly and close the iris diaphragm (H). Loosen binding screw (I) and swivel the lamphouse left or right until an image of the lamp filament is seen on the face of the light aligning diaphragm (A). To bring this image into sharp focus, move the condensing lens assembly in or out. Centralize the image vertically with the

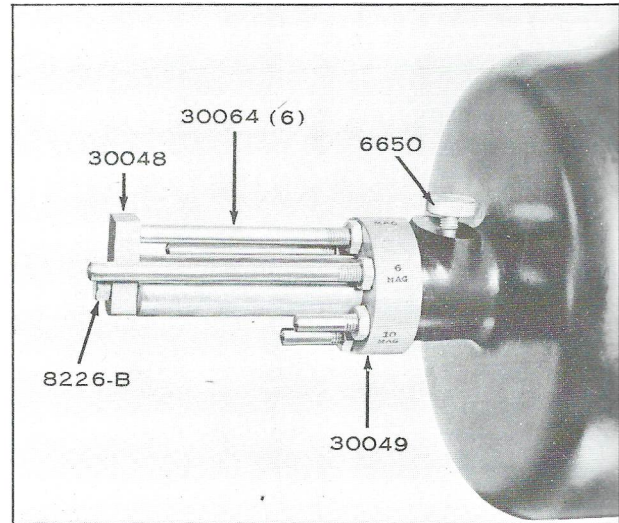


Fig. 3 Mirror Shaft and Stops

hole in the center of diaphragm (A). This is done by raising or lowering the bulb with eccentric (J) which is held in place by binding screw (K). Fig. 4 and 5.

Move the condensing lens in or out until a small lighted circle appears on the screen. Swivel the lamphouse left or right to centralize the lighted circle with the vertical center line on the screen. Lock the lamphouse in place with binding screw (I). Partially open the iris diaphragm.

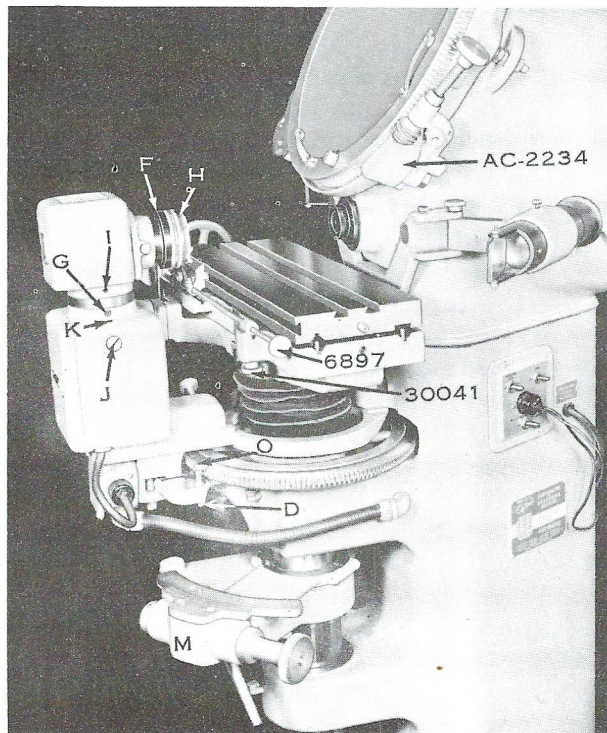


Fig. 4

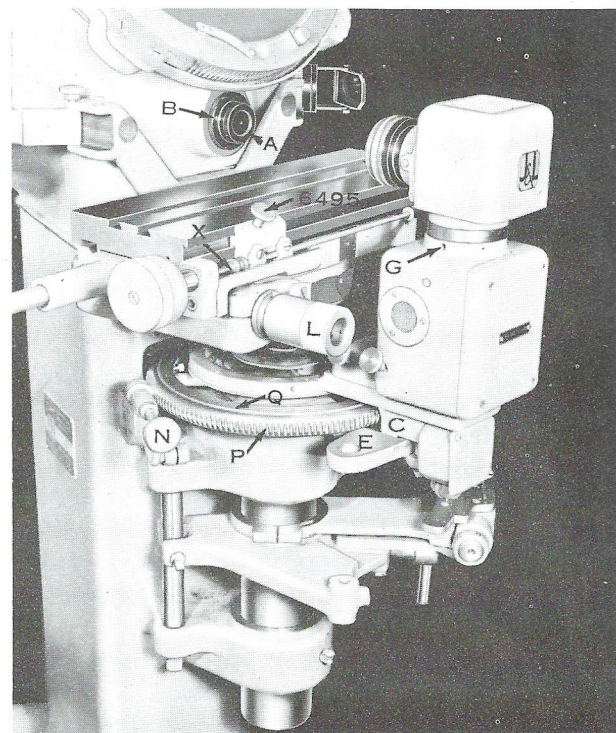


Fig. 5

Move the condensing lens until a clearly defined image of the lamp filament appears on the screen. Centralize for final adjustments to the vertical centerline, by readjusting screws (G).

To test the light beam for parallelism completely open the iris diaphragm and place a white card directly in front of the condensing lens. Measure the diameter of the lighted area on the card. Move the card close to the light aligning diaphragm and again measure the diameter of the lighted area. Move the condensing lens until the lighted area in both cases is approximately equal.

TO ADJUST SCREEN

Remove light aligning diaphragm and mount the desired lens system in position, making sure that the lenses are firm in their cells and that the cells are securely in place.

TO OBTAIN PROPER MAGNIFICATIONS

The comparator is equipped with mirror magnification stops located in a spool 30049 (Fig. 1 & 3) at the rear of the hood. Each lens system supplied with the comparator has its corresponding stop set at the factory. The only adjustment required, therefore, is to locate the mirror assembly AC-2366 (Fig. 1) in proper relationship to the magnification stop pin 30064. The magnification of each lens system is stamped on the stop pin spool next to the corresponding stop pin.

Rotate the stop pin spool (30049) to bring the proper stop pin in line with the stop block 30048. Slide the mirror assembly to bring the stop pin in firm contact with the stop block, and tighten the mirror binding screw 6650.

The alignment of the right angle lines on the screen with the top of the table is accomplished by means of the aligning fixture (pin block) supplied with the machine. The aligning fixture is placed on the table top with its tongue in the slot of the table. Move the table vertically until the image formed by the top of the vertical pin of the aligning fixture is approximately on the horizontal center line of the chart. Move the table in or out by means of the focusing knob (L) (Fig. 5) until the image becomes sharply defined.

Set the graduated chart ring for a zero reading on the vernier. Rotate the glass screen in the chart ring until the horizontal line remains in constant contact with the shadow of the top of the pin as the aligning fixture is moved back and forth before the projection lens. The lines on the chart are now in proper relation to the table top. Lock chart in position with the three clamps provided.

It is desirable to use only the lenses supplied with the machine. However, lenses can be interchanged provided the magnification is carefully checked and magnification stop pins readjusted.

Magnification stop pin settings for any lens system may be checked by measuring the screen image of a recommended size test pin (Fig. 7) FOR EXAMPLE: If the machine is equipped to give 62-1/2 magnifications, the width of the shadow of the test pin on the screen must be 62-1/2 times the actual diameter of the test pin used. Measurement of the width of the image on the screen will prove the proper setting for the desired magnification. (See recommended test pin sizes.)

TEST PIN SIZES FOR 14" SCREEN

LENS POWER	125	100X	62.5X	50X	31.25X	20X	10X
PIN SIZE	.080	.100	.160	.200	.320	.5000	1.000
IMAGE SIZE	10.000	10.000	10.000	10.000	10.000	10.000	10.000

If the correct magnification cannot be obtained by following the above procedure, it will be necessary to adjust the setting of the magnification stop pin. To increase magnification, unscrew stop pin. To decrease magnification, screw stop pin into spool until exact magnification has been obtained. CAUTION: Before any adjustments are made, a thorough check of the lens system should be

made to see that it is in its proper position. Particular care should also be taken to check all measurements of the test pin and the image received on the screen. In the event that an inaccurate reading has been taken the consequent readjustment would result in inaccurate settings.

Test pins and glass scales may be obtained from J & L to check accuracy of machine.

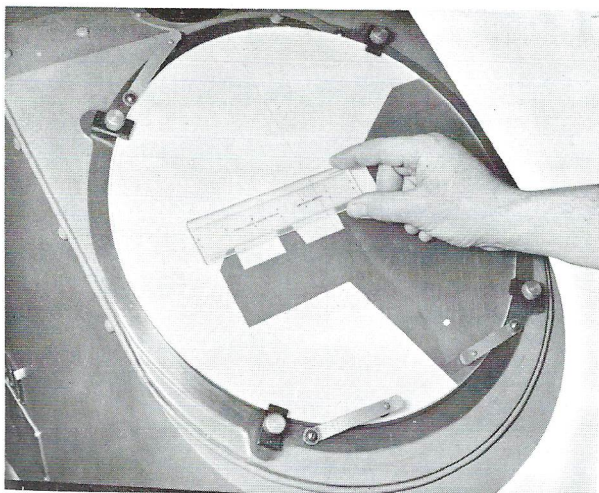


Fig. 6

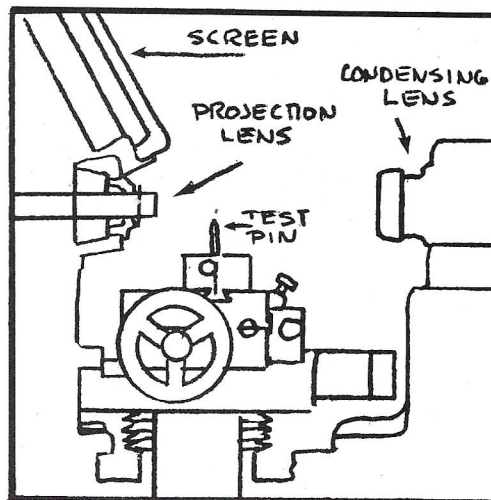


Fig. 7

OPERATING INSTRUCTIONS

PROJECTING PROFILES NORMAL TO THE HELIX

The table on any Pedestal Type Comparator can be swivelled so that the helix on such parts as screws, worms, hobs, etc. is parallel to the beam of light.

If the machine is equipped with the Table Angle Attachment AC-2025, (M in Fig. 4) set the table at the proper angle using the vernier attachment.

To adjust the helix parallel to the axis of the projection lens, on a machine that is not equipped with the Table Angle Attachment, loosen the 30604, (Fig. 2) binder screw and swivel the table slowly until the shadow of both flanks is sharply defined. Then tighten screw 30604.

The table may be reset at right angles to the optical system by match-

ing the line on the front of the spindle to the line on the top surface of the spindle clamp, or by matching the zero lines on the vernier of the Table Angle Attachment.

To check the squareness of the table with the optical system, an indicator and surface gage may be used. Remove the lens system, place the surface gage on the table and indicate from one side of the lens mount to the other by moving the table from side to side. If the machine has no Table Angle Attachment, loosen the spindle clamp and swivel the table until the indicator reads zero when moved across the lens mount. If the machine has a Table Angle Attachment, loosen the spindle clamp and turn table angle adjusting worm (front cover) swiveling the table until the indicator reads zero when moved across the lens mount. Tighten spindle clamp. If the vernier does not read zero, loosen vernier segment attached to the spindle and adjust until it reads zero.

HORIZONTAL OR LATERAL MEASUREMENTS

The table having 4" of travel is mounted on balls. The base supporting the table is provided with a 1" micrometer graduated in either .0005" or .0001" (metric micrometer graduated in either .01 m/m or .005 m/m). Along the front of the table bed and in line with the micrometer is a V trough for supporting end measuring bars (X in Fig. 5). On the front of the table is an adjustable anvil in axial alignment with the micrometer anvil. A counterweight pulls the table with constant pressure in the direction of the micrometer. The micrometer is used when decimal measurements up to an inch are to be measured. Standard end measuring bars, or blocks permit more rapid measurement of definite increments.

In making lateral measurements, the micrometer is set at even graduation, a standard end measuring bar or size block nearest in size to the space to be measured is inserted between the anvils. With screw 6897 (Fig. 4) adjust the shadow laterally to match the chart centerline. Remove the end measuring bar and with the micrometer adjust the shadow of the second position to coincide with the chart centerline. The exact measurement may then be read on the micrometer.

The table can be locked to prevent lateral movement by tightening the knurled nut 30041 (Fig. 5) on the guide which encases the body of the lateral adjusting screw.

VERTICAL MEASUREMENTS

The Pedestal Comparator will measure 4" vertically with the graduated handwheel P (Fig. 4 and cover). The handwheel with which the table is adjusted vertically is provided with a slip ring graduated in .0001" or .005 m/m divisions. The hub of handwheel P (Fig. 4) is supported on ball bearings and acts as a nut on the accurately ground table spindle.

The graduated ring Q is held in the handwheel by a screw and pin in a dovetail groove, and is used for locking the ring to the wheel in any required position.

When assembling the centers and center blocks, the rack adjusted center should be on the end of the table opposite the micrometer.

On a machine equipped with 8" table travel, a trough is provided to support an end measuring micrometer and end measuring bars or blocks. It is also provided with a dial indicator.

To make lateral measurements, the shadow of the object to be checked is properly aligned with the centerline on the chart or screen. The necessary measuring bars, or blocks, and end measuring micrometer are placed in the trough. Loosen the screw 6495 (Fig. 5) and slide the anvil stop U-150 toward the indicator pushing the measuring bars before it, until contact is made with the indicator spindle. Lock in this position with the clamping screw. Set the indicator at zero. Then, either the end measuring micrometer is closed the desired amount, or an end measuring bar, equivalent in length to the distance over which it is desired to measure, is removed from the trough and the table is moved until the shadow of the part is again in proper position on the chart. At this point the indicator reading should again be zero if the dimension being measured is correct. If the shadow of the new tooth (or new portion of the object), which is brought before the lens is to the right or left of the centerline on the chart, it indicates error. The amount of error can be measured with the end measuring micrometer or the indicator by moving the table until the shadow coincides with the centerline.

To make vertical measurements, loosen screw in graduated ring (Q). Disengage worm N, (Fig. 5 and front cover) and use the handwheel to bring the object shadow approximately to the horizontal center line on the screen. Worm (N) is then engaged with the handwheel for accurately matching the shadow to the line.

With graduated ring Q free to rotate in the handwheel, the zero line on the ring is set to match the line on pointer (O) (Fig. 4) and locked in this position. Disengage worm (N). Raise or lower the table until the

shadow of the second position of the object is approximately aligned with the horizontal center line on the screen. Engage worm (N) (Fig. 5) for final adjustment. The amount of vertical displacement may be read directly on the graduated handwheel ring.

With an 8-pitch thread on the spindle, each complete revolution of the handwheel represents .125" vertical movement when the machine is arranged for English measurements and 3 m/m when arranged for metric measurements. The English ring is graduated to read .0001" and the metric ring is graduated to read .005 m/m. The same procedure may be used with the power elevating attachment.

ANGLE MEASURING ATTACHMENT (Refer to Front Cover)

To position the graduated chart ring and chart line to correspond with the angle of any image on the screen, disengage the angle adjusting worm and rotate the graduated chart ring to the approximate location required to match the chart center line with the image shadow. Engage the worm with the graduated chart ring and bring the chart center line into exact coincidence with the image received on the screen. The corresponding angle of rotation may be read directly on the graduated ring and interpreted to the nearest minute of arc by use of the one minute vernier.

CARE OF MIRROR

We recommend the use of a solution called Mir-O-Len for removing any marks or grease deposits which may collect on the mirror. This solution should be used according to instructions printed on the bottle.

For cleaning the glass receiving screen, use soap and water.

To clean the projection or condensing lenses use clean soft cloth or absorbent cotton to avoid scratches. If, for any reason, the lens components are removed from their assembly, extreme care should be exercised to reassemble the parts in their exact original arrangement.

REFLECTION ATTACHMENT

Attach the assembled Reflection Attachment, Fig. 8 to the machined surface of the hood below the projection lens with the screw 8828, and the split washer 30198.

Insert the lamp cord plugs in the sockets on the sides of the machine. Adjust the illuminating units with screw 256 to bring the center line of the lamphouses at right angles to the axis of the projection lens. Remove the diaphragm from the projection lens system. This diaphragm is located inside the tube of compound lens systems and attached to the end of simple lens systems.

Loosen the screw 6338 of one unit and move the mirror 30200 toward the projection lens to a minimum clearance between the lens and the mirror, by moving the tube 30199.

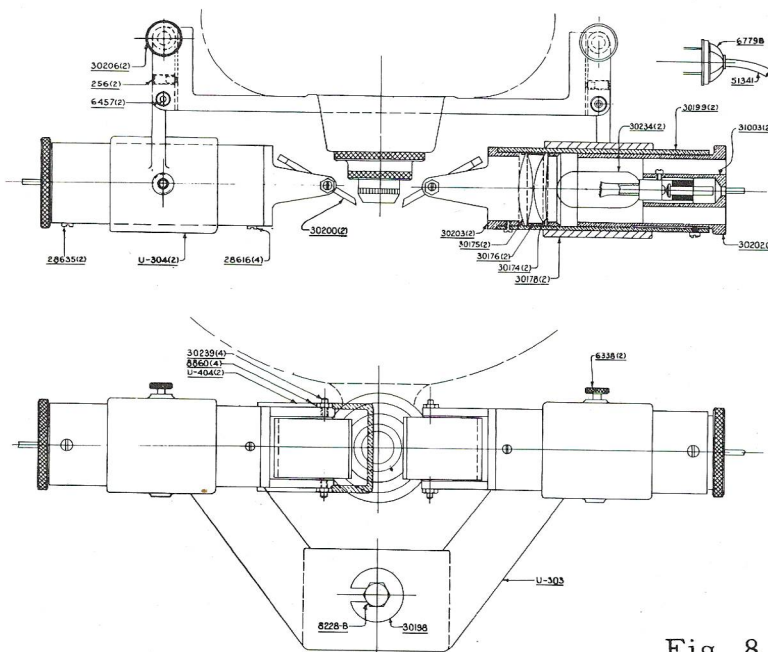


Fig. 8

With the projection light turned on, place a plain white card in the focal plane of the projection lens by focusing on the edge of the card. Then move the card in front of the lens. Close the iris diaphragm on the projection lamphouse. A spot of light will be observed on the card. Concentrate the light from each unit of the reflection attachment on that spot. Concentrate the light of one unit by adjusting the lamphouse tube 30202 away from the mirror 30200. At the same time, direct the concentrated light at the spot on the card by swivelling the mirror for lateral position. Revolve the mirror and lenses by turning the tube for vertical position. Lock the assembly in this position with screw 6338. This same procedure should be followed to adjust the second unit.

Place a polished specimen before the projection lens with the polished surface in the focal plane of the lens system. The face of the object to be reflected should be parallel to the table slots and the polish on grinding marks should be perpendicular to the table top.

Now adjust the lamphouse tubes 30202 toward the mirror 30200 until the reflected image of the object on the screen appears with maximum clear illumination.

In some cases, it is advantageous to swivel the mirror 30200 slightly to obtain the best illumination.

When not in use, the Reflection Attachment units may be swivelled about the pivot screw 30206 to position them by the side of the hood and away from the table.

PHOTOGRAPHS

To take photographs remove the chart ring and replace it with the adapter for mounting the 8x10" chart holder and photo-plate holder. Lock it in position using locking clamp 6764, (Fig. 10). This adapter locates the plate or chart in the same position as the ground glass screen that has been removed and does not change the magnification.

Place the 8" x 10" ground glass screen or blank chart in the chart holder. Move the shadow of the object to the center of the screen and bring the shadow into sharp focus.

DOUBLE PLATE HOLDER

Load the plate holder with plate, sensitized paper or film in a dark room and locate it in the adapter in place of the chart holder. Place a card over the projection lens and turn off the light to prevent any light from contacting the plate. Remove the slide from the plate holder and the card from the projection lens and turn on the light for the proper length of exposure. After the desired exposure is obtained, again place the card before the projection lens and replace the slide. Remove the plate holder from the machine and develop the paper or plate in a dark room.

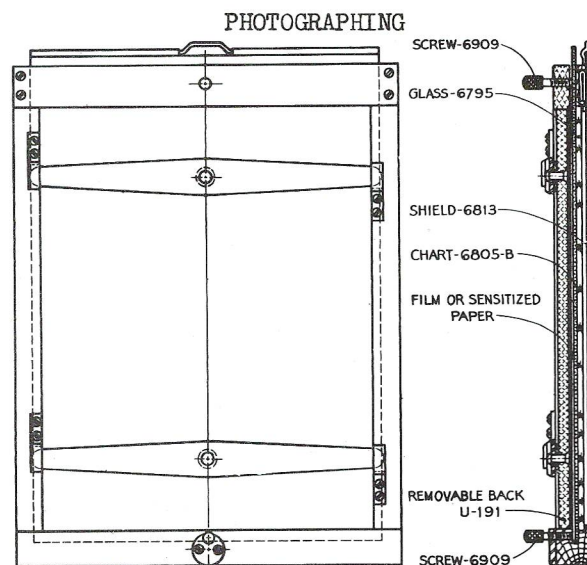


Fig. 9

COMBINATION CHART AND PLATE HOLDER

If the combination chart and plate holders are to be used, insert the combination holder, (Fig. 9) in the adapter. Remove the shield and back U-191. Insert the chart on which there is a magnified outline of the object. Adjust the shadow of the object to match the outline and clamp the chart in position with the screw 6909. Make certain that the combination holder contacts the three locating pins in the adapter to insure duplicating the position of the holder when the picture is taken.

Remove the combination holder from the adapter, and, in a dark room, insert the shield and load with sensitized paper, film or plate. The sensitized side should be toward the chart. Assemble the removable back U-191. Return the holder to the machine, making certain that it contacts the three locating pins. Place a card before the projection lens and turn off the light to prevent any light contacting the plate. Remove the

shield from the plate holder and the card from the projection lens. Turn on the light for the proper length of exposure. Replace the shield and return the holder to the dark room for developing the picture.

For negative photographs use Agfa Ansco Brovira Hard. For direct positive photographs use Eastman Kodak Direct Positive Paper. The instructions for developing are supplied with each package of paper.

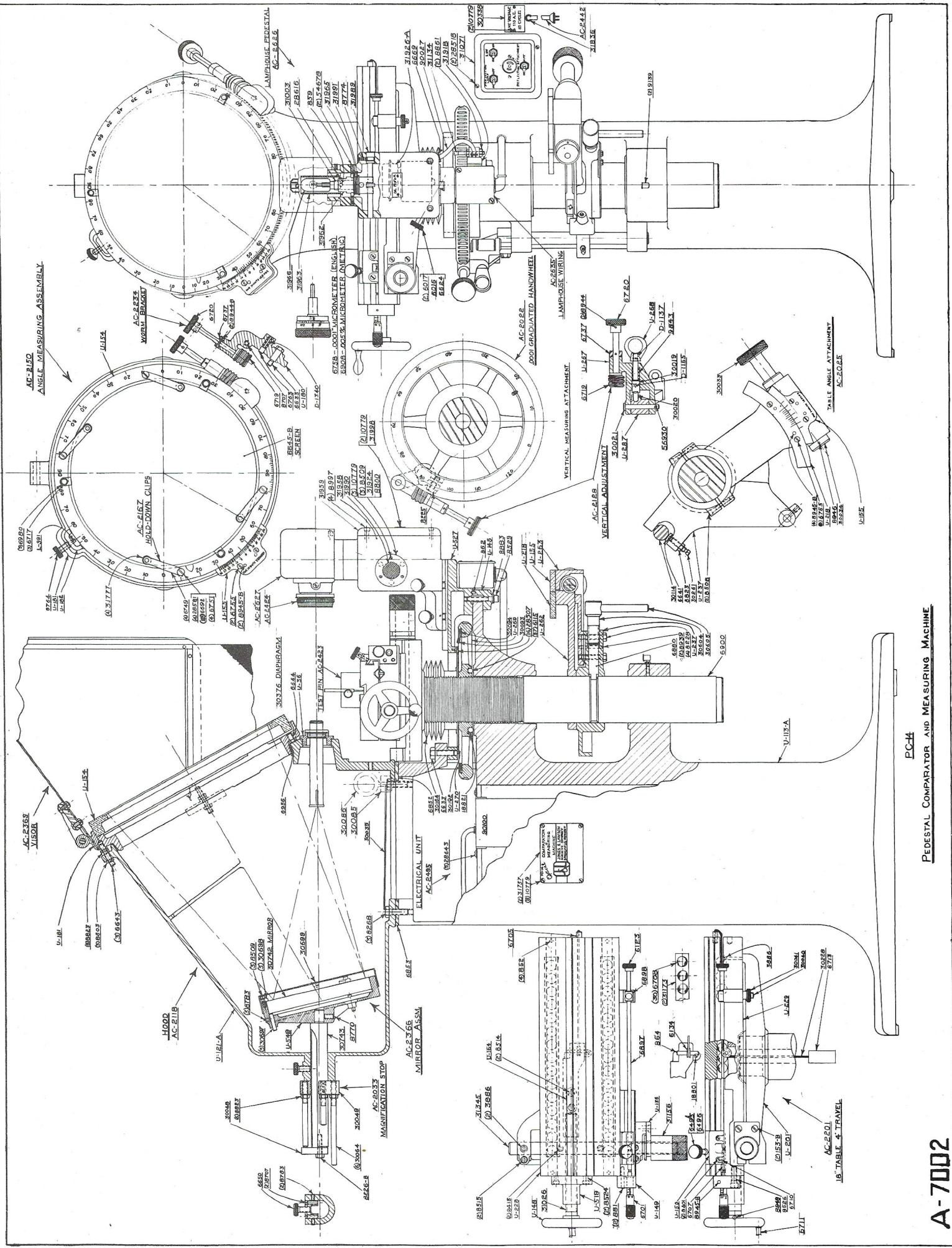
STAGING FIXTURES

When designing fixtures for staging parts on the Comparator it is important to bear in mind that different lens systems are required for projecting various size objects. These lens systems have different focal lengths; that is, the distance from the face of the lens to its focal plane varies. These distances may be found in the General Comparator Catalog under lens data.

All fixtures should be so constructed that the face of flat objects, or the axis of cylindrical objects to be projected, will come over the center of the tongue on the fixture base, and within the vertical range of the table.

Switch the light off when the Comparator is not in use.

When replacing the light bulb, adjust the alignment as previously outlined.



PEDESTAL COMPARATOR AND MEASURING MACHINE

Fig. 10

A-7002



M A C H I N E T O O L C R A F T S M E N S I N C E 1 8 3 5

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