

CONTROL IN EVERY MODEL. THIS ACCURACY REFERS TO MAXIMUM ERROR OF CONTOURS AND SHOULD BE CAREFULLY DIFFERENTIATED FROM CONSISTENCY OF SETTING ON A GIVEN POINT WHICH MAY RUN AS HIGH AS  $\frac{1}{12000}$  FOR A GOOD OPERATOR.

WITH SINGLE LENS CAMERAS NOW AVAILABLE WITH PRACTICALLY THE SAME ANGULAR COVERAGE AS THE FOUR COUPLE CAMERAS, THE EFFECTIVENESS OF THE STEREOPLANIGRAPH SHOULD BE IMPROVED AS THERE IS AN UNDENIABLE LOSS OF ACCURACY DUE TO THE SMALL RESIDUAL ERRORS OF A FOUR LENS SET UP.

#### VERTICAL SUMMARY

<u>MAIN RESERVOIR AREA</u>	<u>No. of FIXED Elevs.</u>	<u>LOOP CONDI- TIONS</u>	<u>DIFFs. OF ELEV.</u>	<u>No. OF POINTS</u>	<u>Max. CORRECT (CM)</u>	<u>PROB. ERROR (CM)</u>
BOULDER DAM TO BOULDER CANYON	2	8	39	33	22	$\pm 1.23$
BOULDER CANYON TO HUALPAI WASH						
BLOCK 1	3	10	36	29	27	$\pm 1.07$
BLOCK 2	2	4	12	10	17	$\pm 9.2$
BLOCK 3	4	25	43	22	47	$\pm 17.4$
HUALPAI WASH TO PIERCE'S FERRY	6	30	45	21	58	$\pm 13.9$
VIRGIN RIVER						
BLOCK 1	4	24	37	17	23	$\pm 9.6$
BLOCK 2	5	22	37	20	28	$\pm 9.3$
BLOCK 3	9	24	42	27	19	$\pm 7.3$
BLOCK 4	6	31	50	24	30	$\pm 8.2$
BLOCK 5	4	24	41	21	38	$\pm 13.8$
BLOCK 6	3	19	34	18	17	$\pm 8.5$
BLOCK 7	2	17	27	12	18	$\pm 7.2$
BLOCK 8	2	24	40	17	30	$\pm 9.3$
<u>RIVER GORGE</u>						
DIAMOND CREEK TO NEW WATER CANYON	3	FAILURE = 84 CM THROUGH 53 LINES = 1.6 CM PER LINE.				
NEW WATER CANYON TO PIERCE'S FERRY	2	FAILURE = 17 CM THROUGH 33 LINES = 0.5 CM PER LINE.				

#### OVERHEAD VERTICAL REFLECTING PROJECTOR

BY

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(PAPER PRESENTED AT THE ANNUAL MEETING OF THE AMERICAN SOCIETY OF PHOTOGRAMMETRY  
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DURING THE PROCESS OF CONSTRUCTING A PLANIMETRIC MAP FROM AERIAL PHOTOGRAPHS THE CONTACT PRINT IS THE BASIS OF A SYSTEM OF COMPILATION. THEREFORE, IT WAS MOST IMPORTANT TO DESIGN A PROJECTOR, SIMPLE OF OPERATION, BUT ONE THAT WOULD ACCURATELY PROJECT THE AERIAL PHOTOGRAPH AT VARIOUS PRECISE SCALES DIRECTLY TO THE FINAL OR BASIC MAP; ALSO TO BE ABLE TO CHANGE THE SIZE OF THE PROJECTED IMAGE TO FIT PREDETERMINED RADIAL CONTROL POSITIONS.

THE VERTICAL REFLECTING PROJECTOR IS DESIGNED AND CONSTRUCTED TO ACCURATELY PROJECT TEN INCH BY TEN INCH (10" x 10") AERIAL PHOTOGRAPHS, NINE INCH BY NINE INCH (9" x 9"), SEVEN AND ONE-EIGHTH BY NINE AND ONE-EIGHTH INCH (7-1/8" x 9-1/8") AERIAL CONTACT PHOTOGRAPHS ON TO A DRAWING BOARD. IT WAS ALSO ARRANGED THAT THIS

INSTRUMENT HAVE THE POSSIBILITY OF HANDLING ANY PORTION UP TO TEN INCH BY TEN INCH (10" x 10") OF LARGE SCALE ENLARGEMENTS OR PORTIONS OF LARGE MAPS THAT MAY BE FOLDED OR ROLLED. THIS WAS ACCOMPLISHED BY ATTACHING A MAP ADAPTOR TO THE PRESSURE PLATE. (SEE ILLUSTRATION #2). THEREFORE, IT IS POSSIBLE TO USE THE SAME INSTRUMENT FOR GENERAL DRAFTING OF ANY KIND OF A MAP, I.E., COPYING DATA TO AND FROM MAPS AT VARIOUS SCALES.

THERE IS SUFFICIENT CLEARANCE SO THAT THE OPERATOR OR DRAFTSMAN SITTING AT A TABLE APPROXIMATELY THIRTY INCHES HIGH HAS PLENTY OF HEAD ROOM AND ARM MOTION. THE THREE ADJUSTMENTS OF THE INSTRUMENT, VIZ., FOR FOCUS, MAGNIFICATION AND THE HORIZONTAL MOVEMENT, ARE ACCESSIBLE FROM THE SITTING POSITION OF THE OPERATOR AND THESE ADJUSTMENT CONTROLS ARE OPERATED WITH THE LEFT HAND, LEAVING THE RIGHT HAND OR BOTH FREE FOR DRAFTING.

THE CONCENTRATION OF REFLECTED LIGHT ON THE OBJECT IN THE PLATE HOLDER IS SUFFICIENTLY STRONG IN ITS PROJECTION TO OPERATE THE INSTRUMENT IN A PARTIALLY ILLUMINATED ROOM. THIS IS QUITE AN ADVANTAGE AS IT IS NOT NECESSARY FOR THE OPERATOR TO BE CONFINED TO A COMPLETELY DARKENED ROOM.

#### GENERAL PERFORMANCE

1. THE PRESSURE PLATE FOR HOLDING VARIOUS SIZES OF AERIAL CONTACT PHOTOGRAPHS CONSISTS OF A DOOR WITHIN A DOOR, EACH HAVING ITS INDIVIDUAL LOCKING DEVICE WITH HEAT-PROOF KNOBS AND HINGES. THE DOORS ARE LINED WITH DEAD BLACK FELT TO REDUCE REFLECTIONS WHEN PICTURES ARE SMALLER THAN 10" x 10" AND ALSO ACTS AS MATTE TO PRESS PHOTOGRAPHS FLAT AGAINST A GLASS PRESSURE PLATE. ON REMOVAL OF THIS AERIAL PHOTO HOLDER A LARGE MAP ADAPTOR IS FURNISHED. THIS ATTACHMENT IS SUFFICIENTLY RIGID AND OF PLANE SURFACE TO HOLD ANY 10" x 10" SECTION OF A ROLLED MAP FLAT AGAINST THE GLASS PRESSURE PLATE; THIS IS ACCOMPLISHED BY SPRING TENSION AND TRAVELS WITH THE LAMPHOUSE ALONG THE HORIZONTAL WAYS. A FLAT, FIXED PRESSURE PLATE IS MADE OF CLEAR, COLORLESS GLASS WITHOUT FLAWS OR DEFECTS. THIS IS USED TO KEEP FLAT THE SURFACE OF THE MATERIALS TO BE TRACED, AND PERPENDICULAR TO THE OPTICAL AXIS OF THE LENS WHICH SHALL INTERSECT THE PHOTOGRAPHIC AERIAL PRINT AT ITS GEOMETRICAL CENTER. THIS AERIAL PHOTO HOLDER IS ROTATABLE THROUGH NINETY DEGREES (90°) ABOUT THE CENTER OF THE PHOTOGRAPH; THIS ADJUSTMENT IS VERY CONVENIENT FOR ORIENTING THE PHOTOGRAPH IN AZIMUTH IN CASE THERE HAS BEEN CRAB IN THE PHOTO DURING FLIGHT. THIS ROTATION IS ACCOMPLISHED BY MEANS OF AN EXTENDED HANDLE WHICH IS ATTACHED TO RACK AND PINION MOTION. IT IS POSSIBLE TO INTERCHANGE THE AERIAL PHOTOGRAPHS DURING THE OPERATION OF THE MACHINE THROUGH THE REAR OF THE HOLDER WHICH IS WITHIN CONVENIENT REACH.

2. THE ILLUMINATING UNIT SYSTEM FURNISHES AT LEAST 3.3 FOOT CANDLES AT THE PROJECTED IMAGE ON A SHEET OF WHITE BOND PAPER AT A FULL APERTURE OF 4.5 AND AT A MAGNIFICATION OF 2.5 TIMES. TWO PREFOCUS BASE PROJECTION TYPE LAMPS OF 500 WATT WERE USED. REFLECTORS OF GLASS AND MIRROR ARE PLACED IN FULL ADJUSTABLE BRACKETS TO OBTAIN BEST FOCUS OF LIGHT DISTRIBUTION. THESE REFLECTORS ARE EASILY REMOVED FOR CLEANING PURPOSES.

3. VENTILATION. THE VENTILATION IS BY FORCED MEANS OF A FAN AND MOTOR AND IS SUFFICIENT TO KEEP THE AERIAL PHOTOGRAPH OR MAP, AND ALL INTERIOR PARTS OF THE UNIT, AT A TEMPERATURE BELOW THE DAMAGING POINT DURING CONTINUOUS PROJECTION. THE MOTOR IS OF UNIVERSAL TYPE OPERATED AT 115 VOLTS; THIS AND THE FAN ARE MOUNTED FREE FROM ANY VIBRATION WHICH WILL INTERFERE WITH THE PERFORMANCE OF THE INSTRUMENT. A COMMON SWITCH MAKES IT IMPOSSIBLE FOR THE LAMPS TO BURN UNLESS THE BLOWER CIRCUIT IS CLOSED.

4. DIAGONAL MIRROR FOR ERECTING IMAGE. THE MIRROR IS A FIRST SURFACE MIRROR. THIS MIRROR IS COATED WITH CHROMIUM FILM FACED WITH A DEPOSIT OF ALUMINUM KNOWN AS A "CHROLUMINUM" FILM. THE MIRROR HAS SUFFICIENTLY GOOD OPTICAL SURFACE TO PRODUCE NO VISIBLE DISTORTION OF THE IMAGE FORMED BY THE PROJECTION LENS. THIS MIRROR IS MOUNTED IN A RIGID HOLDER TO MAINTAIN THE OPTICAL AXIS OF THE LENS PERPENDICULAR TO THE PHOTOGRAPHIC PRINT, BUT CAN BE EASILY REMOVED FOR CLEANING PURPOSES.

5. PROJECTION LENS. THE LENS IS SET IN AN INTERCHANGEABLE BASIS WHICH PERMITS THE USE OF LENSES WITH VARIED FOCAL LENGTH. MAINLY THE INSTRUMENT IS DESIGNED FOR A LENS OF 12" FOCAL LENGTH, WITH AN IRIS DIAPHRAGM GIVING VARIED F VALUES. THE LENS IS MOUNTED SO THAT ITS OPTICAL AXIS IS PERPENDICULAR TO THE AERIAL PHOTOGRAPHIC PRINT, AND INTERSECTS THE LATTER AT ITS GEOMETRICAL CENTER. THE OPTICAL AXIS, FURTHERMORE, IS PERPENDICULAR TO THE BASE OF THE INSTRUMENT.

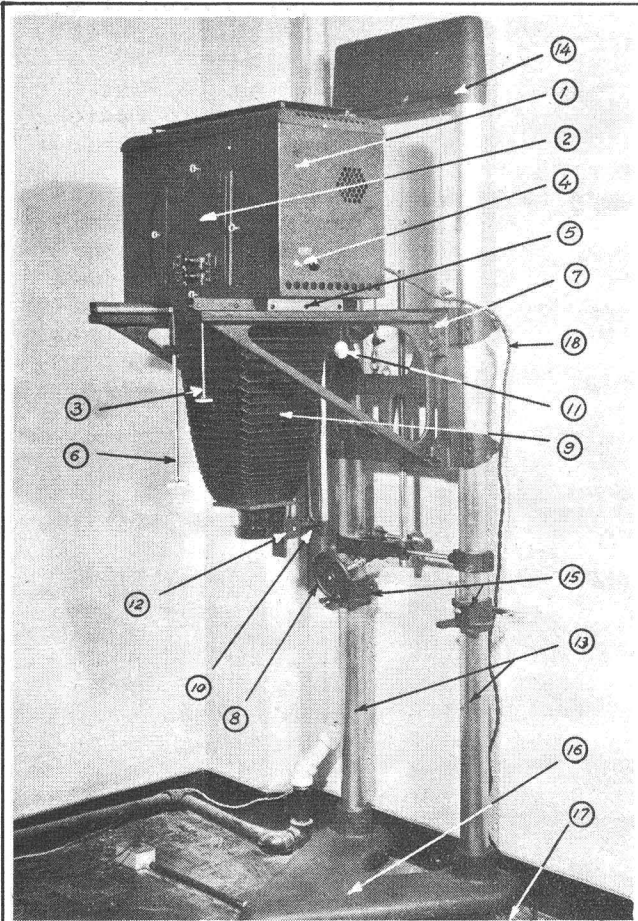


ILLUSTRATION No. 1

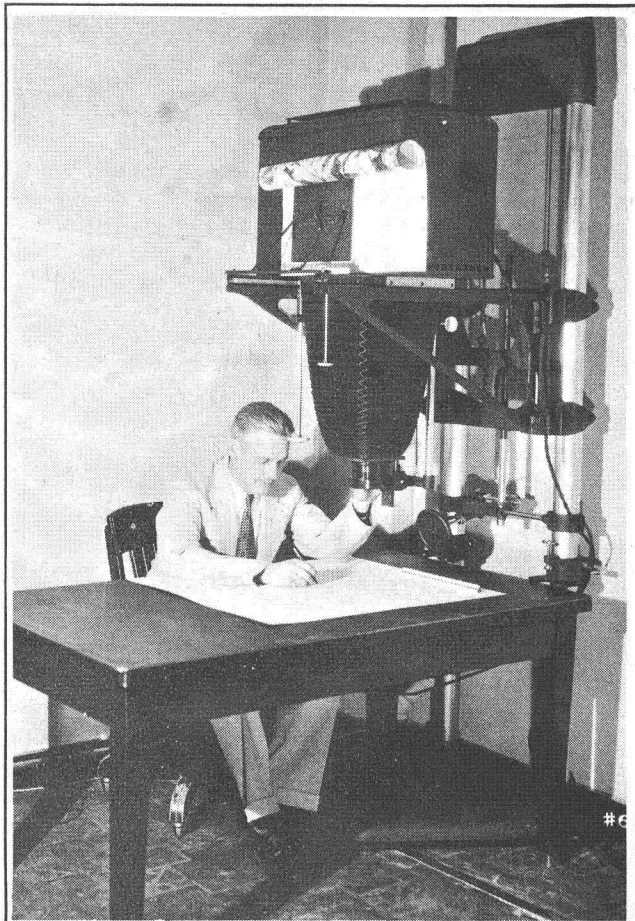


ILLUSTRATION No. 2

1. DIAGONAL FIRST SURFACE MIRROR AND REFLECTOR UNIT.
2. AERIAL PHOTO HOLDER, INTERCHANGEABLE FOR ROLL MAP ADAPTOR.
3. SLOW MOTION ADJUSTMENT HANDLE FOR ROTATION ABOUT OPTICAL AXIS.
4. VENTILATING MOTOR, REOSTAT CONTROL AND MAIN SWITCH.
5. ROLLERS FOR HORIZONTAL TRAVEL OF REFLECTOR UNIT.
6. ADJUSTMENT HANDLE FOR HORIZONTAL TRAVEL.
7. VERTICAL CARRIAGE UNIT.
8. ADJUSTMENT WHEEL FOR RAISING AND LOWERING CARRIAGE UNIT.
9. BELLOWS
10. BELLOWS SUPPORT AND COUNTER-BALANCED SPRING.
11. LOCK FOR BELLOWS SUPPORT.
12. ADJUSTMENT FOR SLOW MOTION FOCUS OF LENS.
13. MAIN SUPPORT (2 COLUMNS).
14. REFLECTOR UNIT, COUNTER-BALANCED WITHIN COLUMNS.
15. TWO TABLE CLAMPS.
16. BASE CASTING.
17. THREE POINT LEVELING JACKS.
18. ELECTRIC CORD CONNECTION.

USING THE TWELVE INCH (12") FOCAL LENGTH LENS, A RANGE OF MAGNIFICATION OF TWO POINT FIVE (2.5) DIAMETER TO A POINT FOUR (.4) DIAMETER IS POSSIBLE. THE INSTRUMENT CAN BE FURNISHED WITH A REDUCTION ADAPTOR, FOR EXAMPLE, AN EIGHT INCH (8") LENS AND A MAGNIFICATION AS LOW AS POINT ONE SEVEN (.17) CAN BE HAD.

6. ADVANTAGES OF PROJECTOR AND SAVING. WITH THIS APPARATUS IT IS POSSIBLE TO PROJECT THE AERIAL PHOTO DIRECT TO A RADIAL PLOTTED BASE SHEET AND TO CONTROL THE VARIOUS CHANGES IN SCALE. THIS BASE SHEET IS METAL-MOUNTED AND AFTER ALL OF THE DELINEATION HAS BEEN TRACED ONTO THIS SHEET BY THE PROJECTION METHOD, IT IS INKED IN AND FINALLY PHOTOGRAPHED FOR FINAL PUBLICATION.

THE OLDER METHOD CALLED FOR A TRANSPOSITION TO A VELLUM SHEET. THIS SHEET BECAUSE OF IRREGULAR EXPANSION HAD TO BE ADJUSTED TO THE GRIDS PLOTTED ON CELLULOSE ACETATE. THIS SHEET HAD THEN TO BE INKED IN AND THEN TRANSPOSED PHOTOGRAPHICALLY ONTO OUR PRESENT METAL MOUNTED SHEET.

THESE STEPS, WHICH WERE COSTLY, ALSO LEFT TOO MUCH CHANCE FOR ACCUMULATIVE ERRORS; THEREFORE, WITH THE USE OF THIS TYPE OF OVERHEAD OPAQUE PROJECTOR, WE CAN REPORT THE FOLLOWING SAVING IN DELINEATION AND DRAFTING, ALSO RETAIN MORE ACCURACY IN MAP COMPILATION:

COSTS SAVED BY USE OF VERTICAL PROJECTION

TRANSFER TO VELLUM.....	\$1.00	PER SQUARE MILE
DRAFTING ON CELLULOSE ACETATE.....	1.30	" " "
TOTAL SAVING.....	\$2.30	PER SQUARE MILE

PHOTOGRAMMETRIC PROGRESS IN THE HYDROGRAPHIC OFFICE DURING 1936

BY

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AERIAL PHOTOGRAPHIC DATA COVERING ALL COASTAL DEVELOPMENT OF THE NAVAL SURVEYS CONDUCTED BY THE HYDROGRAPHIC OFFICE DURING THE 1936 FIELD SEASON WERE OBTAINED IN PRECEDING YEARS BY THE NAVAL AIR SERVICE, ON THE EAST COASTS OF PANAMA AND COSTA RICA, AND BY THE COLOMBIAN AIR SERVICE IN COLLABORATION WITH THE NAVAL SURVEYS OF THE NORTH COAST OF COLOMBIA. IT IS PROPOSED TO FLY ABOUT 600 LINEAR MILES OF 5-LENS PHOTOGRAPHS ON THE EAST COAST OF CENTRAL AMERICA DURING 1937. IN GENERAL, SINGLE FLIGHT LINES WILL BE FLOWN TO COVER THE SHORE LINE; BUT IN CERTAIN LOCALITIES PARALLEL FLIGHT LINES WILL BE SPECIFIED TO INCLUDE DESIRABLE FEATURES FARTHER INLAND. THESE PHOTOGRAPHS WILL BE TO A 1:20,000 SCALE.

THIS OFFICE IS USING THE STEREOMETER AND PRISMATIC STEREOSCOPE IN THE ANALYSIS OF AND PLOTTING FROM AERIAL PHOTOGRAPHS. THE PURCHASE OF FURTHER SCIENTIFIC INSTRUMENTS FOR THIS PURPOSE HAS BEEN DEFERRED IN VIEW OF THE RAPID DEVELOPMENT IN SUCH INSTRUMENTS AND IN TYPES OF AERIAL PHOTOGRAPHIC CAMERAS. EXCELLENT RESULTS, FOR NAVIGATIONAL PURPOSES, HAVE BEEN OBTAINED WITH THE STEREOMETER AND PRISMATIC STEREOSCOPE IN THE DELINEATION OF SHORE LINE AND FORM LINES AND IN THE DETERMINATION OF ELEVATIONS WHERE OCCASIONAL CHECK ELEVATIONS WERE AVAILABLE.

THE PRESENT USE OF AERIAL PHOTOGRAPHY, IN CONJUNCTION WITH HYDROGRAPHIC SURVEYS, BRINGS INTO SHARP CONTRAST THE CRUDE EFFORTS OF THE PIONEERING DAYS OF 1923 WHEN THE HYDROGRAPHIC OFFICE FIRST EXPERIMENTED WITH AERIAL PHOTOGRAPHS AS A MEANS OF DEVELOPING LOW SWAMPY SHORE LINES IN THE TROPICS. TWO YEARS LATER, SYSTEMATIC FLIGHTS WERE MADE BUT THE ANALYSIS OF THE PHOTOGRAPHS HAS PROVED TO BE A GRADUAL EVOLUTION, REACHING A RELATIVELY HIGH STATE OF ACCURACY AT THE PRESENT TIME.

THE DEVELOPMENT OF THE WIDE ANGLE, SINGLE LENS CAMERA WILL BE OBSERVED WITH INTEREST AS IT IS BELIEVED IT MAY BE PARTICULARLY SUITABLE FOR HYDROGRAPHIC WORK.