PAR 202-A

BRIEFING PRINT ENLARGER

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SUBJECT: Briefing Print Enlarger

TASK/PROBLEM

1. To design and fabricate a prototype enlarger for exposing high-quality briefing prints in format sizes up to and including 20" x 24". Magnification to be in the 10 to 60 diameter range. The enlarger is to have the capability of producing both black-and-white and color prints. Change from one capability to the other should be made with a minimum amount of effort.

PROPOSAL

2. It is proposed that approval be granted to conduct design studies through use of breadboard test equipments and then design and fabrication of one (1) prototype briefing print enlarger. Design studies will explore problems associated with the critical parts or assemblies of the end item as follows:

a. Objective Lens and Condenser Lens Design:

(1) Lens design studies will be conducted to provide two families (black-and-white and color) of objective lenses and their mating condenser systems. Each family of objective lenses will provide for the desired print size and the full magnification range. Each lens in the family group will cover only a limited portion of the whole magnification range (10 - 60X) consistent with good image quality, i.e., one lens may cover 10 to 20X and the next 15 to 25X, etc.

(2) One family of lenses will be corrected for a narrow range in the blue-green region of the spectrum for maximum image quality on non-color-sensitized print materials (Kodabromide or Resisto Rapid types). The second family of lenses will be corrected for the full visible spectrum for use in exposing color print materials or variable contrast papers. Field flattener elements will be employed in the design in both the lenses for black and white and the lenses for color.

b. Enlarger Arrangement: To cover the 20" x 24" format at all magnifications within the field angle-limitation of high-quality objective lenses, considerable optical path length (up to about 7 feet) will be required. Because of this, the operator can only have convenient access to both the negative and print stock through a folded or horizontal optical path. It now appears that the horizontal arrangement may lend itself to better optical quality and simpler mechanisms. However, a variety of folded arrangements will be considered before final commitment to a specific arrangement is made.

c. Lens Focus Control: For the proposed high-quality variable magnification enlarger, a system for precise resetting of the precalibrated focus for each magnification value must be provided. Present opinion is that the "tensioned thread" lens focus mechanism, as used in the 10 - 20 - 40X precision enlarger, combined with a lead screw drive for the print easel should be considered. Servo systems vs manual control of the settings from a tabulation of magnification, easel position, and lens position will also be reviewed with the most suitable solution employed.

d. Illumination System: The design of the condenser lens and/or lenses will be considered with each objective lens design to determine that the proposed field size and desireable lens aperture sizes are compatible with available light sources. It is proposed to use projection-type tungsten lamps as the source(s). Color filtering and heat filtration will be provided in the illumination system design. The lamphouse assembly will be removable to permit gate cleaning and easy replacement for color printing. A mechanism for clamping the negative against the registration glass and releasing the negative for transport or removal will be incorporated in the film gate design.

e. Print Stock Easel Design: The print stock holder will provide for a 20 x 24" exposure format area. Provisions will be made for protection of the print stock from exposure while measuring exposure level. Protection will be such that the raw stock is also protected under subdued white light conditions for loading and removal of negative rolls, minor adjustments, etc.

f. Exposure Monitoring and Control: A system to accomplish exposure control and monitoring must:

(1) Measure the required print exposure (a commercial photoelectric easel photometer [redacted] EP-1000) will be employed).

(2) Control the exposure by adjustment of the lamp voltage and/or exposure time.

(3) Start and end the exposure by turning on and off the printing lamp.

g. Vibration Control: Through previous experience, good freedom from vibration effects has been achieved by building the optical unit as a single rigid system which in turn is isolated from the remainder of the machine and the building by very soft vibration isolation mounts. The design study will investigate rigidity and the mounting of the critical assemblies to the main structure in a manner to insure vibration-free photography.

3. Special consideration will be given to:

a. High-image quality.

b. Reliability.

c. Maintainability.

4. The following items will be investigated to determine degree of effect, if any, on the items listed in par 3 above:

a. Roll paper supply of 250 feet length vs 100 feet length.

b. Rotation of the easel to orient print image.

c. Daylight loading magazines compatible with processors, etc.

5. Design objectives for the enlarger are:

a. Magnification range: Magnification range will be 10 - 60X with the ability to obtain desired magnification within the range through lens selection and pre-set focus.

b. Print size: To be 20 x 24" on roll paper.

c. Negative handling: Provide for roll film, 70mm to 9½" wide and lengths up to 500 feet on MIL Standard spools.

d. Printing capability: The primary optical system to be designed for maximum image quality on color-blind print stock. The second optical system (interchangeable with the primary one) will permit exposure of color materials or variable contrast black-and-white print stock.

e. Film Gate: A fluid injection negative gate with air stream fluid removal will be employed. In addition a means will be provided to quickly present to the printing gate from frame and X-Y coordinate identification the negative area to be printed. It will be possible to place any point within the negative area at the optical axis of the lens.

f. Provide an exposure monitoring photometer.

g. Exterior design: To be smooth to facilitate cleaning as required for proper housekeeping in film handling areas.

h. Insure high efficiency, simple construction and low maintenance requirements.

PROGRAM OBJECTIVE

6. To design, fabricate, test and deliver one each high-quality briefing print enlarger. Effort to be scheduled in two phases:

a. Phase I - Provide preliminary design, final specification and optical designs. To reach these goals will require construction of breadboards and/or models for testing of certain subassembly designs, ie.,

(1) Objective lenses and condenser systems for both narrow spectral band black-and-white prints and full visible spectrum for color reproduction.

(2) Print stock holder.

(3) Vertical fluid injection negative gate.

(4) Negative transport system with X-Y coordinate measuring and frame counting. Test and evaluation of items (3) and (4) of Par 6a. above will be accomplished jointly with the similar effort of PAR 224, 3 - 15X Fluid Gate Enlarger.

b. Phase II - Complete the design, fabricate and accomplish in-house testing of the prototype enlarger.

7. Upon completion of Phase II, the enlarger will be crated and made ready for shipment pending special instructions from the customer.