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NASA TECH BRIEF

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Optical-Noise Supression Unit: A Concept

The problem:

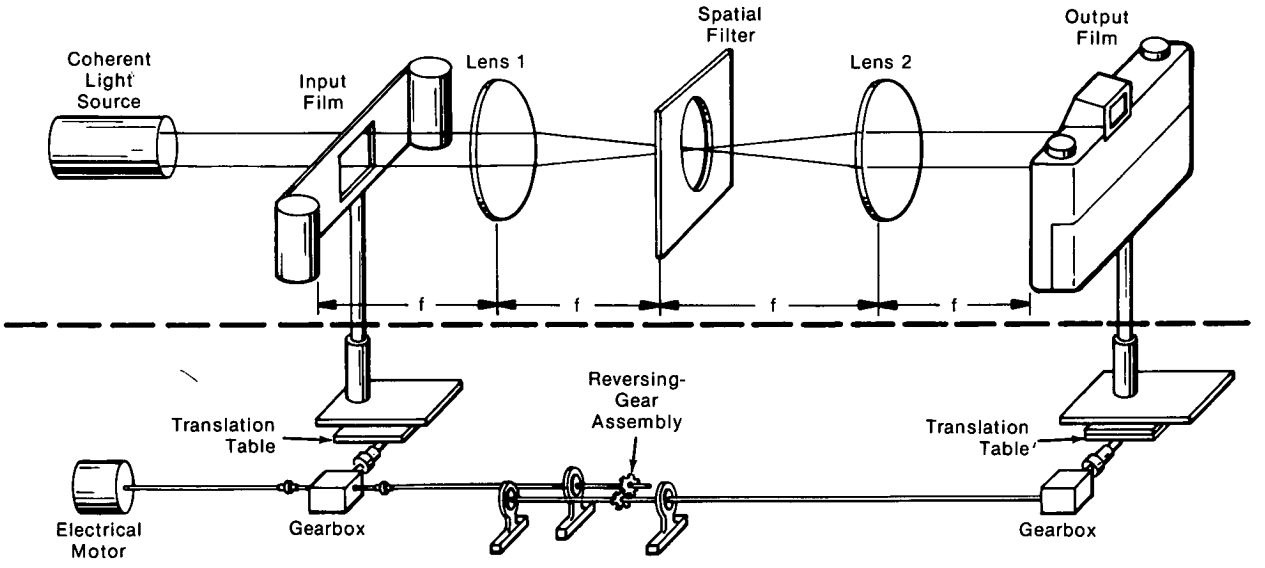
In optical data processing, optical signals are generated by highly coherent light sources (e.g., lasers). The signals are subject to optical noise introduced by the lenses in the system. The optical noise results from the diffraction of light by lens imperfections — tiny air bubbles, dust, included foreign particles, and microfissures produced in the lens surface during grinding and polishing. Since perfect lenses are not achievable using current technology, other methods are used to eliminate the optical noise. For example, mechanical lens rotation and multiple light sources have been applied. Unfortunately, they are difficult to implement in multiple lens systems because of high cost, difficulty in alinement, and problems in fabrication.

The solution:

A new optical-noise suppression unit is proposed which is inexpensive to manufacture. The unit is made from readily-available standard components, and its alinement is not critical.

How it's done:

The noise suppression unit is shown in the illustration (below the dashed line) as it is used with a coherent optical-processing, spatial-filtering computer (shown above the dashed line). Briefly, the computer includes a laser or a blackbody source illuminating the input film. The image on the input film undergoes a two-dimensional Fourier transform as it passes through lens 1. Lens 2 inverse transforms the spatially filtered signal and focuses the filtered image onto the unexposed photographic output film.



f = Focal Length

Optical-Noise Suppression Unit in Use With Optical-Processing Computer

(continued overleaf)

The image is exposed through a shutter mechanism included in the camera body output film holder.

Optical noise is suppressed during the exposure while the two films move in synchronism in opposite directions perpendicular to the optic axis of the system. Since the noise pattern produced by the lenses is stationary, this motion averages out the noise, effectively suppressing it while the image moves through. Any desired degree of noise suppression can be obtained by adjusting the exposure time of the output film and the distance that the film moves during the exposure.

The noise suppression unit, driven by an electrical motor in synchronism with the shutter, includes two identical gearboxes, each linked to a translation table. One translation table supports the input-film holder, while the other supports the holder of the output film. The gearboxes are linked through a reversing-gear assembly with a given gear ratio. This gear ratio must be equal to the inverse of the system magnification to maintain high resolution of the noise suppression system. For the same reason, care is taken to prevent any backlash, slippage, or imperfections in the gears.

Note:

Requests for further information may be directed to:

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Reference: TSP75-10315

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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Categories: 03 (Physical Sciences)
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