NASA TECH BRIEF

Marshall Space Flight Center

Motion Compensator for Holographic Motion Picture Camera

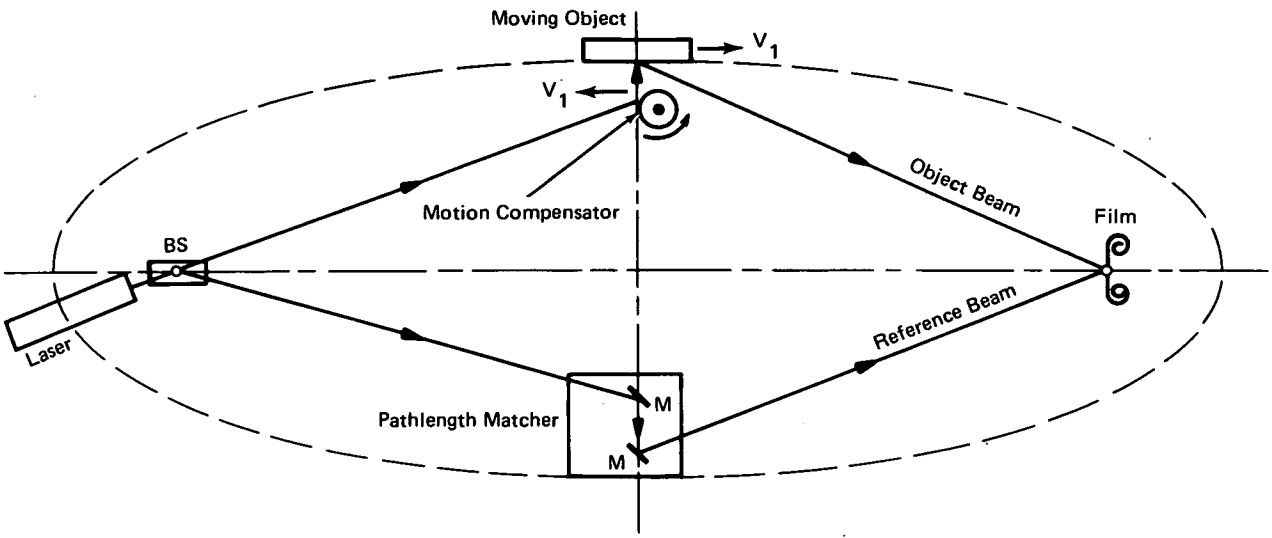

Figure 1. Elliptical Holograph with Rotating Cylinder Motion Compensator

The problem:

Conventional holographic cameras cannot record a true three-dimensional image of a moving object in real time. A hologram requires two beams, an object beam and a reference beam, which must be in phase with each other. Since the phase of the beam is equal to a constant times the path length, any motion of the object will alter the path length and put the beam out of phase. In addition, the frequency of the reflected beam is altered by the Doppler effect. Furthermore, the phase relationship is destroyed when the object velocity is high.

The solution:

Some motion compensation is provided by an elliptical holographic arrangement (described in NASA Tech Brief B73-10421) which takes advantage of the constancy properties of an ellipse. The magnitude of velocity allowable can be extended by the use of a motion compensator, two of which are described here.

How it's done:

An elliptical holography arrangement incorporating a motion compensator is shown in Figure 1. Without the motion compensator, this is the system described in more detail in B73-10421. When the reference beam strikes the target it undergoes a Doppler shift dependent upon the target velocity. To compensate for this, the object beam is first reflected from a rotating cylinder that revolves in a direction opposite to the target but at the same speed. Thus, when the beam strikes the target it is returned to the original frequency and is in phase with the reference beam. Alternatively this motion compensator may act on the reference beam. In this case the object beam frequency is allowed to change, and the reference beam frequency is shifted to match.

(continued overleaf)

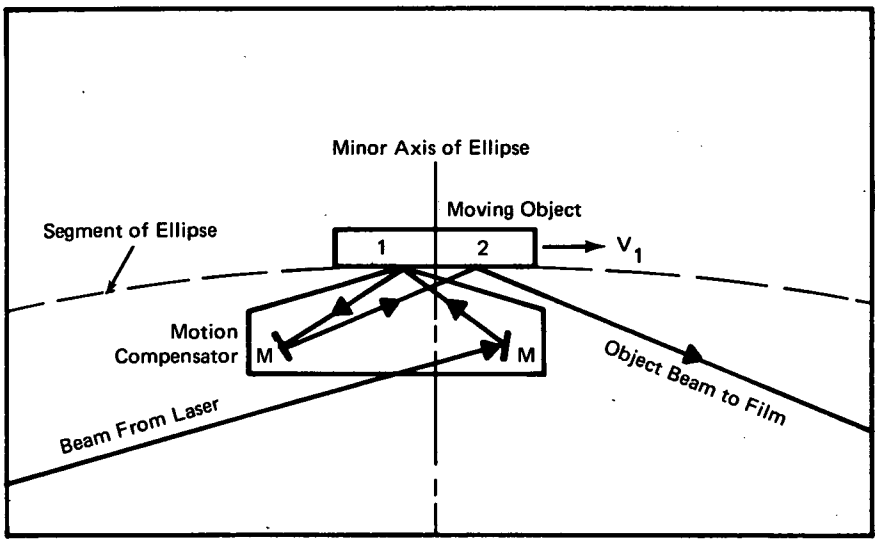

Figure 2. Double Reflection Motion Compensator

An alternate system is shown in Figure 2 (only the object beam in the vicinity of the target is shown). In this system, the beam strikes the target twice, each time from a different direction. The frequency is first shifted up from f to f'. It is reflected and returned to the object from the opposite direction causing the frequency to be shifted down from f' to f. When the object and reference beams recombine at the film, they have no relative phase shift.

Notes:

1. Information on similar and associated devices may be found in NASA Tech Briefs B73-10421 and B73-10435.
2. Requests for further information may be directed to:
   Technology Utilization Officer
   Marshall Space Flight Center
   Code A&PS-TU
   Marshall Space Flight Center, Alabama 35812
   Reference: B73-10434

Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

Patent Counsel
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