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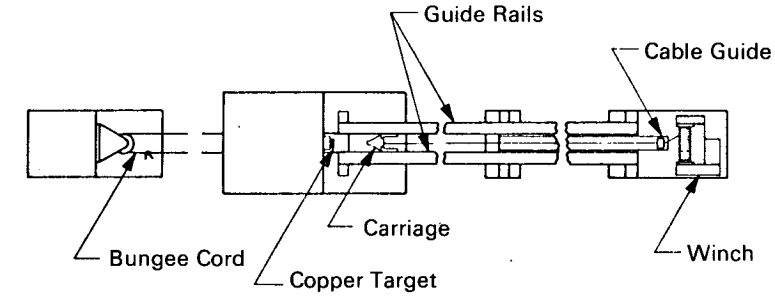
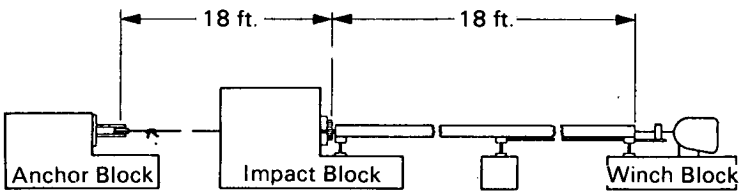
NASA TECH BRIEF

Analysis of Problems Related to Slingshot Shock Machine High-Velocity Shock Testing





General configuration of shock machine

A recent technical report on this subject is available. It includes an abstract, introduction, shape and other limitations of the shock pulse, impact velocity, control instrumentation, recommendations, and figures.

The slingshot device described for production of high-velocity shocks is capable of imparting a square-pulse acceleration greater than 20,000 g with a pulse duration of up to 1.5 milliseconds. General configuration of this shock machine is shown in the drawing.

A light tensile load is initially applied to the bungee cord, and the sled is drawn back to the desired length between two rails. It is released from a distance which will give it a desired velocity at impact. The impact tool on the front of the sled impacts into the copper target block to create the desired pulse. In actual operation several problems exist:

1. The bungee cord is not consistent. Since its spring rate changes with each shot, this makes it difficult to predict impact velocity accurately.

2. The cord during the sled travel is excited in such a manner that it causes, in some cases, second or third shocks to occur. This also fatigues the cord and adds to the first problem. The' phenomenon contributes to the failure of instrumentation cabling.

(continued overleaf)

3. Agreement between the various methods of determining the acceleration is not good.

4. There are limitations on the pulse shape which are not clearly defined.

Engineering analysis of these problems resulted in recommendations that improvement in operation of the slingshot machine should be made. Use of a more sophisticated pretensioning device, such as a screw mechanism in which the bungee cord is terminated into an adjustable shock absorber and no knots are used in the active portion of the cord, could avoid a number of difficulties with the bungee cord. Motion of the sled after impact could be reduced by mounting a transverse wave suppressor on the rear of the target support. More work should be done on the agreement of the force link and accelerometer readings.

Notes:

1. This information will be of interest to organizations concerned with material qualification testing techniques and to manufacturers of the test equipment used.
2. Documentation is available from:
   Clearinghouse for Federal Scientific and Technical Information
   Springfield, Virginia 22151
   Price $3.00
   Reference: TSP69-10506

Patent status:

No patent action is contemplated by NASA.

Source: J. W. Shipley of
Caltech/JPL
under contract to
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