EXPLODING FOIL INITIATOR (EFI), TECHNICAL DISCUSSION

The exploding foil initiator or slapper concept, developed by the Lawrence Livermore Laboratory (Ref. 2) has several advantages over the EBW detonator. The primary advantages include: (1) the metal bridge is completely separated from the explosive by an insulating film and an air gap, (2) the explosive can be packed to a high (near crystal) density, and (3) the least sensitive explosives such as HNS can be detonated, which is extremely difficult with the EBW concept.

Figure 8 depicts the basic detonator component parts of this system. They consist first of the output explosive pressed to a high density for a maximum strength (plastic bonded materials can also be used). Next to the explosive pellet is an insulation disk with a hole in the center. This disk is set against the explosive pellet. Then an insulating flyer material such as mylar with a metal foil etched to one side is placed against the disk. The necked section of the etched foil acts as the bridgewire. Function of the initiator occurs by applying electrical energy to the etched foil on the insulated flyer (see Figure 9).

Figure 8
EFI DETONATOR COMPONENTS

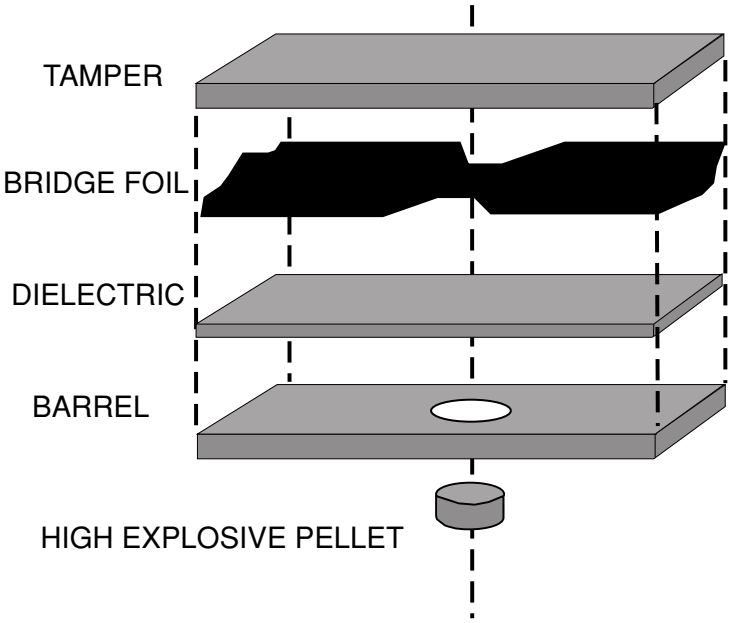
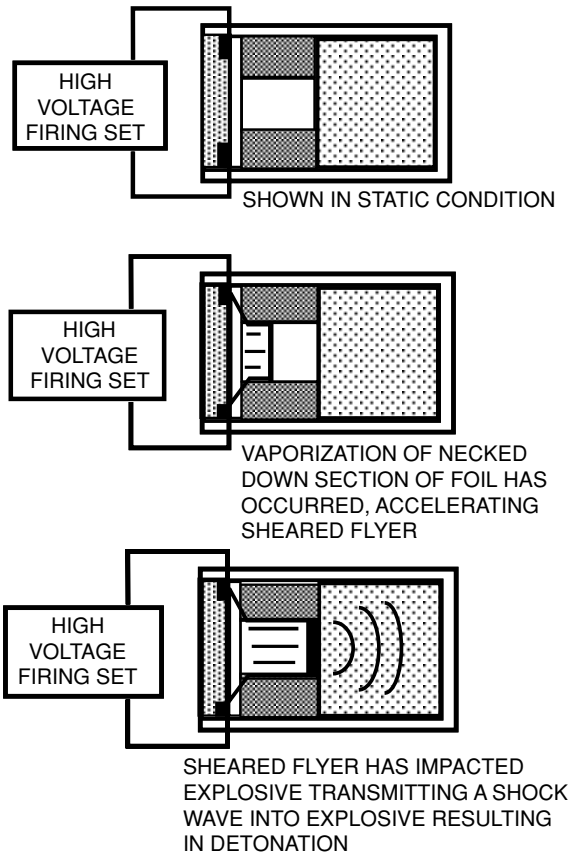


Figure 9
EFI FUNCTIONING CONCEPT



The high current firing pulse causes vaporization of the necked down section of the foil. This then shears the insulated flyer which accelerates down the barrel and impacts the explosive pellet. This impact energy transmits a shock wave into the explosive causing it to detonate.

There has been a great deal of theoretical analysis and test data generated on the shock initiation sensitivity of secondary explosives (see Ref. 3). This initiation concept directly applies and can be evaluated as a function of energy per unit area.

The amount of energy applied to the flyer is dependent upon the etched foil physical parameters and how the energy is applied to the foil. This relationship is discussed in Reference 4.

From an applications standpoint it is important to note that the amount of energy applied to the foil which results in acceleration of the flyer is functionally dependent upon not only the quantity of energy but also the rate at which it is applied. This means that considering this initiation concept, the entire system, including the firing set, connecting cable and the initiator, must be evaluated and controlled. This also means added safety because more than just energy is required.