

Press Guarding for Shattered Die Fragments

There is very little consideration given to safeguarding presses to contain shattered die fragments within the die space. There are a few exceptions including some hydroforming work where the danger is obvious and closed die cold forging in large mechanical presses where a double hit may cause the die shrink rings to explode into shrapnel. The writer is aware of several cases where shattered die parts have proven fatal to operators and observers. For some unknown reason our plant cultures result in an injured person being pronounced lucky—it could have been worse. This concept is illustrated in Figure 1.



Figure 1

Medical radiology departments are acutely aware of the problem. When X-Rays are made, it is common to see metal fragments in the arms and upper body including the head of power press operators and those diemakers who dry out dies. A normal question before a magnetic resonance imaging (MRI) test is done is if you have worked in a machine shop, pressroom or other occupation that could have caused metal fragments to become embedded in your body because you may have sharp fragments that need removed before an MRI test and not even be aware of being hit.

Small high speed metal fragments are often a result of a drill shattering, an end mill breaking, and a misfeed in a die. Figure 2 illustrates how a misfeed in a punching operation can cause a punch to shatter sending fragments at high velocity.

The science of terminal ballistics of firearms can give an investigator a good estimate of how fast a die part was traveling when it hit a human. This can be estimated by the weight of the fragment and the damage done to flesh and bone—especially the depth of penetration.

Terminal ballistics may seem to be a grim science but is necessary to choose the type of firearms used by our military, police forces, and persons needing a firearm for protection.

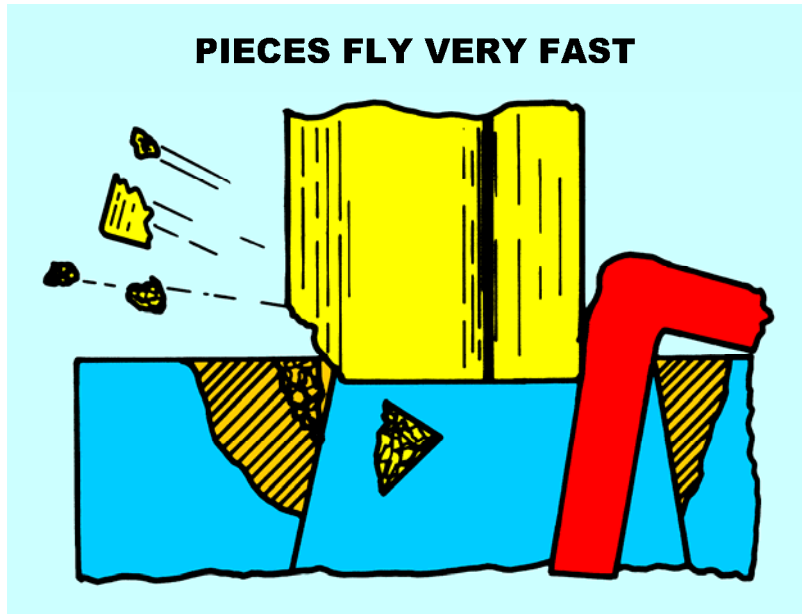


Figure 2

Humor is helpful when conducting training even though we are dealing with a serious risk factor. The concept of comparing a piece of die shrapnel to a bullet helps people to realize the danger of bad hits and dies that do not have a means to retain parts such as cam return springs in the event of detachment. Injuries to the head can result in the loss of vision, serious closed head injuries, and the loss of teeth and facial disfigurement. The cartoons have shown in figures three and four helps to discuss the energy of shrapnel.



Figure 3

An example of a press accident occurred when cold forging automotive piston wrist pins using a 1,700 ton mechanical crankshaft type. The operator had removed a solid steel barrier guard to see why the machine quit cycling. The operator failed to notice that the last formed pin had not ejected from the die. This was a nearly fatal error because the operator inserted another blank pin and cycled the press without the barrier guard in place.

This type of die cavity is held in compression with several shrink rings and is very robust construction. When the press cycled the die exploded sending pieces of shrink rings and the die cavity flying in all directions. The accident victim was pronounced lucky in a discussion with the plant tooling and safety engineer. A piece of shrink ring tore away a portion of his lower jaw but missed his eyes and brain. Other fragments entered his chest and lodged in his lungs missing his heart.

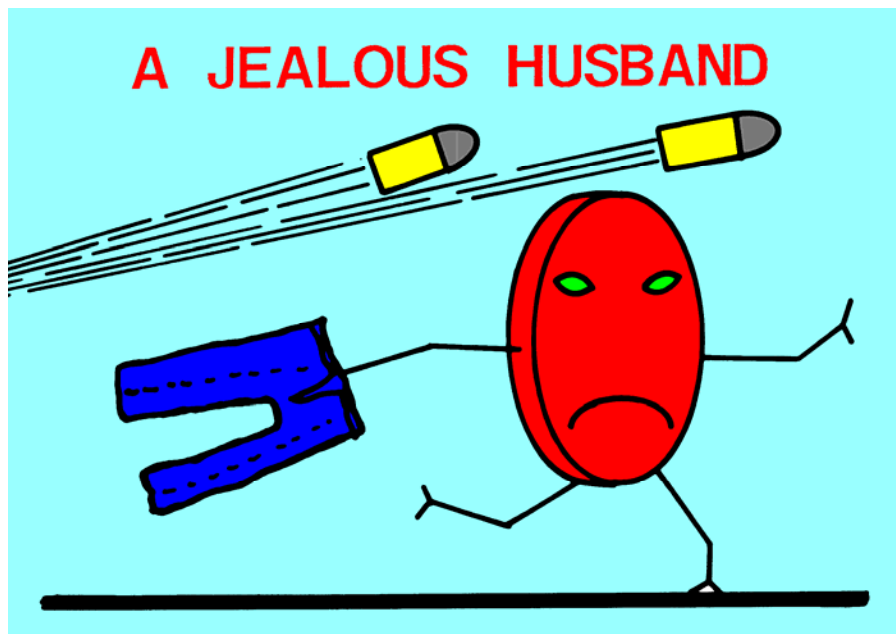


Figure 4

The point here is that many jobs cannot protect the operator just by wearing approved safety glasses. There are jobs where engineering judgment should indicate the need for a sturdy solid steel shield or a clear plastic shield when vision of the process is required.

Bullet Proof Glass?

Bullet proof glass may be a listing in commercial supply source catalogs but in reality should be thought of as bullet resistant. Figure 5 illustrates a 1.625 thick of layered GE Lexgard™ plastic that has successfully stopped a 357 caliber jacketed hollowpoint +p bullet fired at close range. This round has approximately 500 foot pounds of energy at close range. The Site: www.closefocusresearch.com is a good source of information on test results of various ballistic threats and the thickness of bullet resistant armor and glazing required to defeat the threat.



Figure 5

Figure 6 illustrates the back side of the test sample which shows a pronounced bulge. Because the product is layered, each layer can stretch assisting in absorbing the energy of the impact. This is seen in the test samples supplied by a Mechanical Engineer who has many years experience in developing weapons systems.

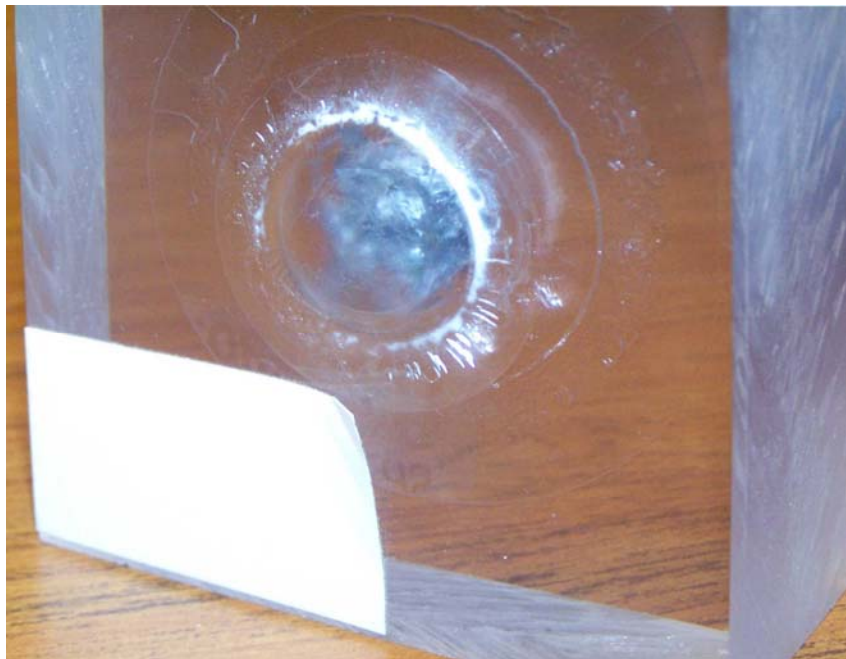


Figure 6

