Making Small Change... Quarter Shrinking

The Quarter Shrinker uses a process called High-Velocity Metal Forming to create pulsed, extremely powerful magnetic fields. We use these fields to squeeze a coin inward, forcing it to rapidly shrink in diameter. There is no direct contact with the coin – all of the reshaping is done by invisible, but incredibly strong, magnetic fields! During operation, the Quarter Shrinker forces a huge current pulse (up to 100,000 amperes!) into a 10-turn work coil made from insulated copper wire. A coin is previously centered within the work coil. Through transformer action, a current of up to ***one million*** amperes is induced within the coin. The instantaneous power applied to the coil is comparable to the total electrical power consumed by a medium-sized city. Another phenomenon, called "skin effect", forces this immense current to flow within a circular ring that's only 1/20" thick along the edge of the coin. The immense circulating current within the coin creates another powerful magnetic field.

The magnetic field from the work coil and field created in the coin oppose each other - an effect called "Lenz's Law"- creating tremendous magnetic repulsion forces between the coil and coin. Compressive forces squeeze the coin inward, reducing its diameter and simultaneously making it thicker. The entire process is over in less than the blink of an eye (~25 millionths of a second!). The coin becomes extremely hot from the combination of rapid mechanical deformation and resistive heating. Although the shrunken diameter of a quarter is slightly less than a dime, the coin retains all of its surface features, and is still easily recognized as being a small quarter! However, there's no, "Honey, I shrunk the kids" magic involved. As the coin shrinks in diameter, it becomes thicker. A shrunken coin still has the same mass, volume, and density as the original coin. The amount of "shrinkage" depends on the energy applied to the coil – a higher energy pulse results in a smaller diameter coin.

There is an equal and opposite action on the coil as intense "magnetic pressure" pushes the inside of the work coil outward, causing it to rapidly expand, and then explode in a shower of potentially deadly copper fragments. As the work coil expands, the wire stretches to less than half its original diameter. The wire's insulation can't stretch to the same degree, and it gets blown off, leaving fragments of bare wire. The coil then explodes violently, ejecting small fragments outward with the force of a small bomb. Smaller fragments can reach speeds of over 5,000 feet/second! To protect nearby objects (and people), coin shrinking must be done inside a bulletproof shield. When the coil disintegrates, residual electrical energy is transformed into a bright ball of blue-white plasma, accompanied by a very loud BANG. We can only shrink one coin at a time. ***And, each coin requires its own carefully hand-crafted work coil, which is explosively destroyed during the shrinking process.***

The Quarter Shrinker works quite well on most circulating US coins and also many foreign coins and tokens. It is particularly effective on US "clad" coins, since these are constructed with a highly conductive pure copper core sandwiched between thin outer layers of a nickel-copper alloy that has a higher melting temperature. Golden Sacagawea or other small Presidential Dollars also shrink well, since these also use a pure copper core sandwiched between layers of a manganese/brass alloy. Bronze pennies made before 1982 also shrink well. However, newer pennies are made using a thin layer of copper plated over a zinc core. If we try to shrink one of these, the copper layer vaporizes, and the zinc core explodes in a shower of molten zinc droplets. US nickels and other nickel-copper alloy coins tend not to shrink as much since this alloy is significantly harder and it also is a poorer electrical conductor. Pure nickel coins (such as older Canadian nickels and quarters) shrink quite nicely, as do most gold bullion coins and larger silver coins such as silver half-dollars and dollars. Unfortunately, silver dimes and quarters tend to melt and fragment, and the rapid heating causes the metal to change to an ugly greenish-brass color.

Bimetal coins (i.e., coins with outer rings and circular centers made from different metal alloys) often show different degrees of shrinkage based upon the electrical conductivity and hardness of the individual alloys. In many coins, the center shrinks more than the outer ring, causing the coin to separate into two pieces. Shrinking coins or tokens that have a hole in the center often causes the hole to shrink or even close up entirely. More information, references, plenty of images, and links to other "interesting" stuff, such as "Captured Lightning" sculptures, can be found on our web site at *http://www.capturedlightning.com*

Physics is fun!

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