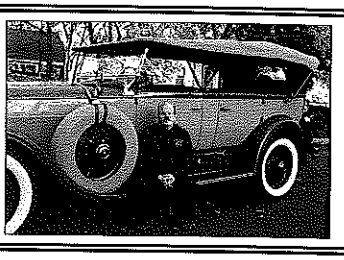
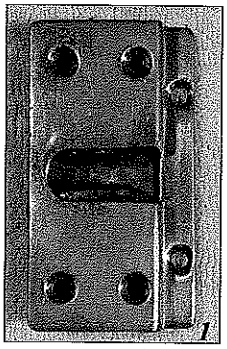
Rebuilding a Door Bumper

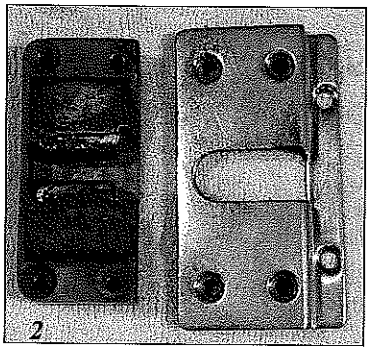
An Example in Machining Basics and Simple Casting

By Chris Wantuck



There are many projects during an auto's restoration where several processes must come together to achieve the final desired results. Rebuilding this sedan's Door Bumper assembly is a good example. This Door Bumper is used in the door jamb area to provide a degree of tension to keep the door from rattling against the body's jamb and sill plate. It has essentially two parts, the wedge side mounted in the door and the receiver side that mounts in the door jamb (Photo 1). Under the decorative cover of the receiver part is an enclosure that holds two rubber friction blocks with rectangular metal cups (Photo 2). This door bumper receiver has two things going against it: old brittle pot metal and old hardened rubber. It's not certain how it happened, but the speculation is that the rubber blocks hardened over time and repeated door closing caused the hardened rubber to push against the pot metal housing and fracture the thin wall facing the wedge (Photo 3). This article covers the methods used to replace both the housing and the rubber block assemblies.





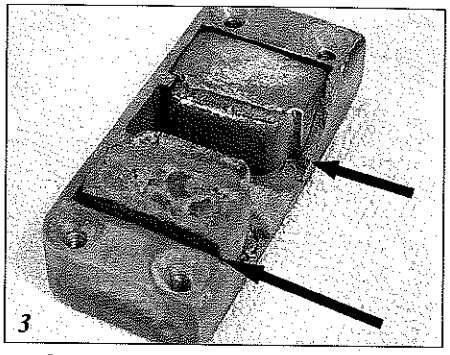
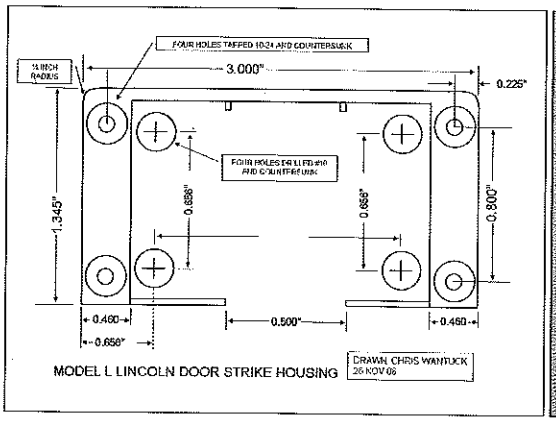
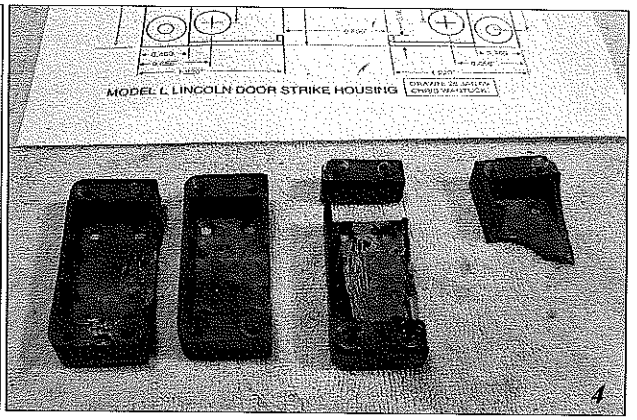


Photo 1: *The door bumper receiver with the decorative shroud covering the pot metal housing.* ***Photo 2:*** *The same door bumper with the decorative shroud removed to show the rubber blocks and metal cups.* ***Photo 3:*** *Clos up view of the pot metal housing showing the damaged edge on the right. Also note the gap between the lower rubber block and the bottom of the housing.*

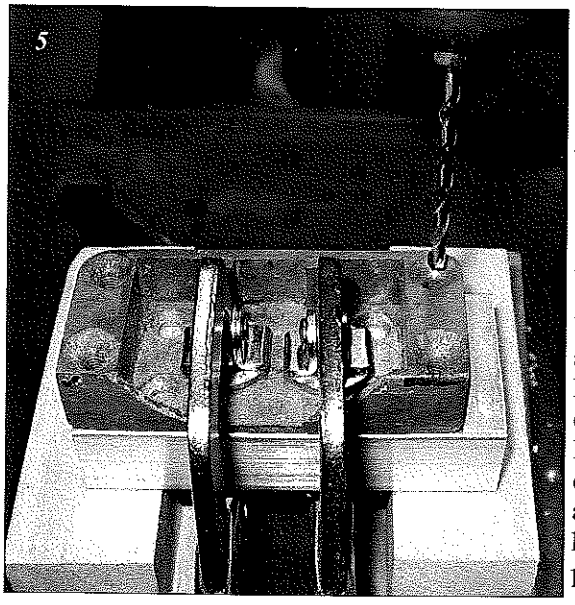




Above: *The drawing to document the dimensions needed to recreate the part.* ***Photo 4:*** *The remains of the door bumper housing originally cast in pot metal. Some of the pieces are intact enough to extract useful dimensions, otherwise this housing has deteriorated too much to be repaired. The referenced drawing that will be used is in the background.*

Beginning with the enclosure part, a drawing was needed to document the dimensions needed to recreate the part. Between the various broken pot metal pieces and making one assumption that the upper and lower halves are symmetrical, the drawing shows dimensions referenced from two sides (Photo 4). Fortunately one of the enclosures had enough of the material together to permit it for use as a drilling pattern. Eight holes total are required, four inside countersunk holes that are located under the rubber blocks and four outside holes retain the decorative shroud. The four outside holes are drilled slightly smaller knowing they will be tapped for a #8 screw (Photo 5).

Photo 5: *The original housing is used as a guide for drilling the eight holes into the solid aluminum block. Using a drill press ensures their perfect alignment.*



Simple machining at least in the context of this article is a systematic removal of material to create the desired shape and dimensions from a solid piece or block of material. Industry professionals refer to this as *Hogging Out*. In this milling operation, the cutter is fixed and spinning at high speed and the work piece is slowly moved back and forth. We say *systematic* because the steps taken and their order have a significant bearing on the outcome. In this case as in most, planning is everything. Drilling, cutting, cutting depth, clamping or holding, tool bed backlash, tool cutting speed, and cutting direction are just some of the terms and operations that are performed here. A closer look at the broken pieces and the drawing reveal an im-

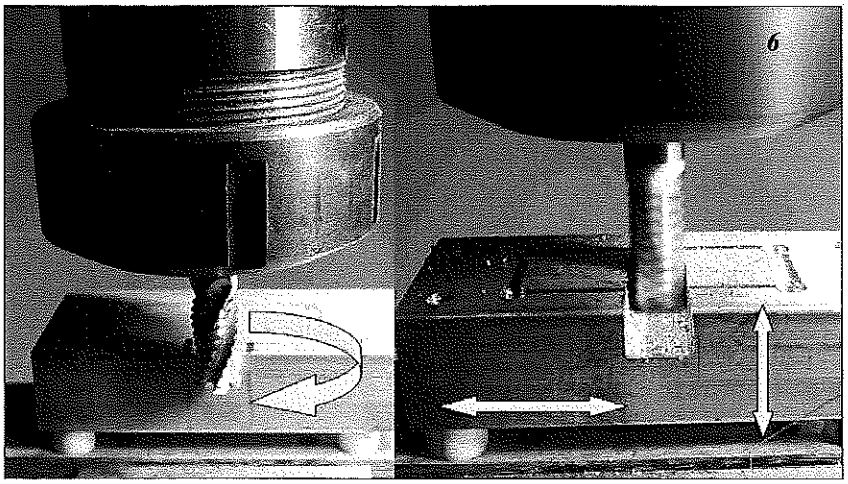


Photo 6: *The four outer holes are tapped size 8-32 using a hand tapper to ensure straight alignment and used to hold the aluminum workpiece onto a hardwood block. Small 1/4 inch nylon spacers elevate the block so the milling machine cutter will machine the entire outside edges. Shown here is a roughing bit that is designed to aggressively remove a lot of material before and during the milling operation.* ***Photo 7:*** *Sheet plastic is cut into strips and segments used to assemble the eight molds for the rubber blocks using Cyanoacrylate adhesive (super glue). Note the flat segment under each side that holds the metal cup and serves to suspend the mold.*

portant clue: the four outside holes that are tapped with an 8-32 thread. These threaded holes are intended to hold the decorative cover over the front but can also be used to hold the block of material from the underside on a scrap piece of material in the vise while performing all the cutting operations from the top (Photo 6).

The machining process is performed in two stages, a roughing part and a finishing part. The roughing part uses a cutting bit spinning at high speed that is slightly tapered and has edges (called flutes) that facilitate the removal of the metal cuttings. The roughing process is not intended to make the cuts in the material look pretty or be close to the end tolerances, but rather aggressively remove as much material as possible (Photo 6). In contrast, the finishing stage uses a variety of thinner cutting bits to precisely cut the material to the exact dimensions. Finish machining is applied to both the outside and inside edges. While cutting inside edges, the thinner the cutting bit the more accurate the cuts and the tighter the corners will become.

Refurbishment of the rubber blocks begins with separating the metal cups from the old hardened rubber. Once separated, the years and layers of paint overspray are easily removed. The metal rectangular cups could be sent to a plater, but only the edge is visible through the metal shroud (Photo 1). The decision was made to powder coat these metal cups in silver and it seemed adequate enough. The casting of the rubber blocks became quite simple with a visit to the local hobby store. Sheet plastic that is 0.060 inches thick is cut into strips and then segments and carefully glued together using Cyanoacrylate adhesive (ZAP-A-GAP super glue). The length and width dimensions are that of the metal blocks. Note the design includes a flat segment under each side that serves two purposes: it holds the metal cup inside the mold and permits the mold to be suspended while curing (Photo 7).

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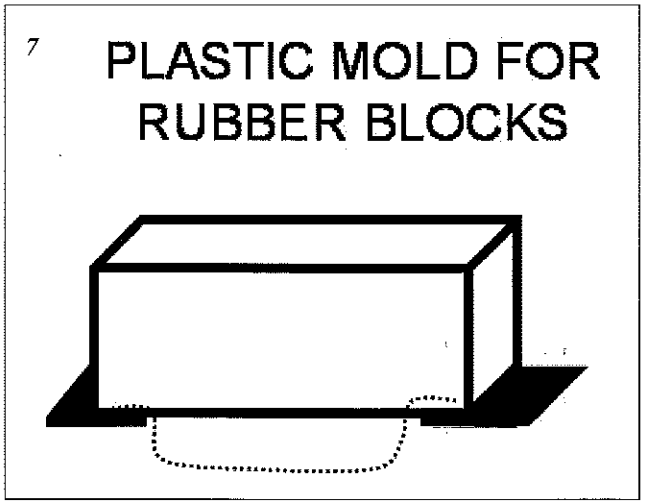

The liquid rubber used for this project is Devcon 80, a Urethane based flexible compound that has a Shore A hardness rating of 80. The Shore A scale ranges from 20 which could be a soft foam rubber or a rubber band to 100 which is a very hard rating, close to the rating of the wheel on a shopping cart (Photo 8). Based on the scale provided by Devcon, a Shore A hardness of 80 (heel of a shoe) seemed too hard for this application. Some sample mixing confirmed that a Shore A rating of 50 would be more appropriate for this project. The Devcon Flexane compound is mixed with its hardner at a ratio of 77:23 which is by weight, but the Flexane Flex-add is mixed soley by volume (in ounces). The Flex-add additive softens the Devcon Flexane mixture, the more you add, the softer the cured compound, but it also increases the curing time. A digital postal scale set to the grams scale makes quick and accurate mixing of the basic Flexane compound (Photo 9) with four ounces of Flex-add and then poured into the waiting molds (Photo 10).

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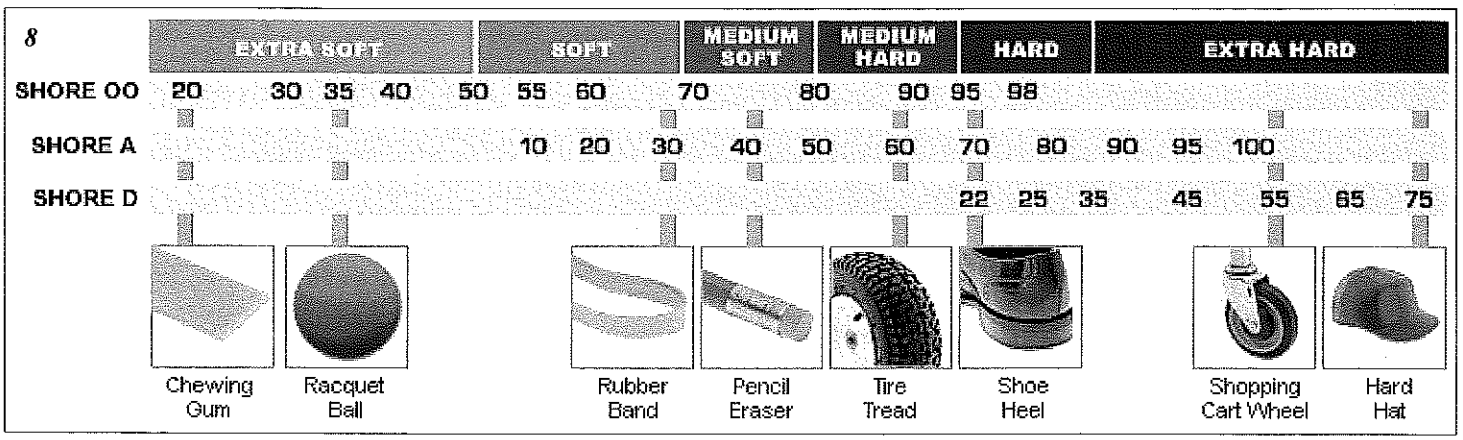

Photo 8: *Shore Hardness Guide.*

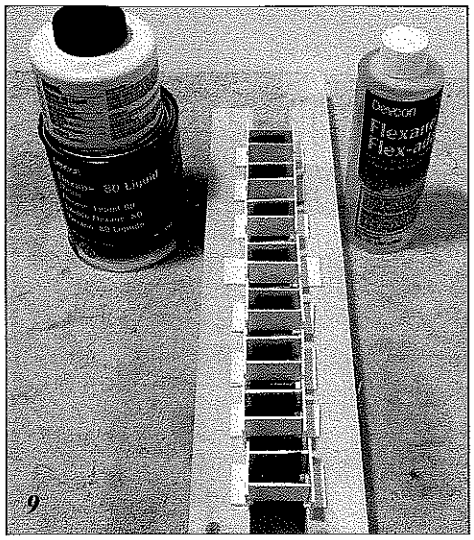

Photo 9: *The eight plastic molds are waiting for the Devcon 80 liquid rubber. The plastic molds are held together using Cyanoacrylate adhesive (super glue). The metal rectangular cups have already been powder coated and are placed in the bottom of the molds.* ***Photo 10:*** *The Devcon 80 liquid rubber (urethane) requires careful mixing. The basic material is mixed according to weight and the softening agent is mixed according to volume. This postal scale set to grams and zeroed to account for the weight of the cup makes quick work when mixing the 77:23 ration for a total of 100 grams. Approximately 4 ounces of softening agent changed the mix from a shore hardness rating from 80 to 50.*

Once the rubber blocks have cured and removed from their molds, any residual rubber that weeped onto the metal cup is easily cleaned off. The blocks are trimmed with a sharp hobby knife and in some cases can even be trimmed and shaped using a belt sander. The blocks should fit snuggly into the machined housing (Photo 11).

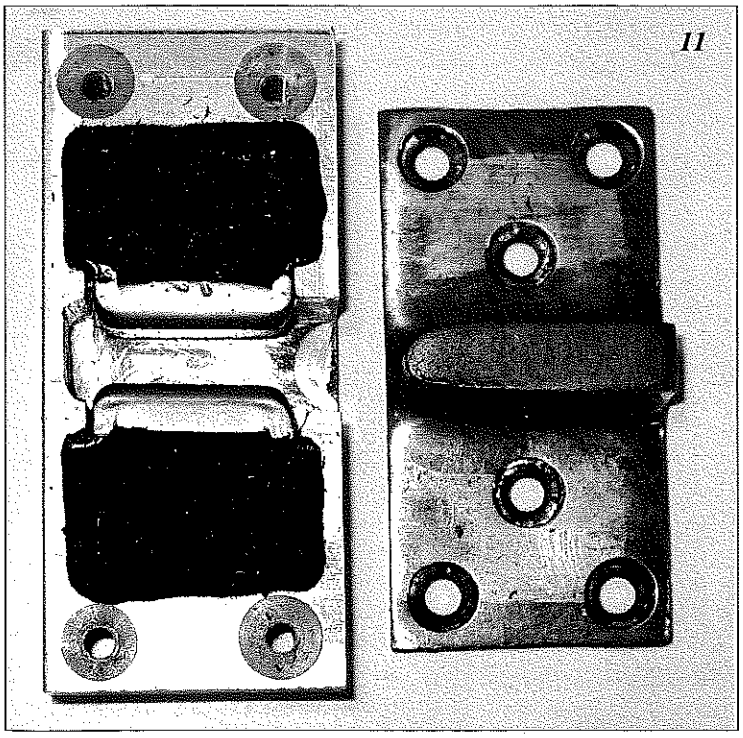

Photo 11: *The completed housing with the rubber blocks installed. Pictured is the receiver housing with its companion wedge to show the relative size.*

Conclusions:

Creating the drawing based on the broken pot metal parts aided greatly in finalizing the design of the replacement housing. When machining, referencing the dimensions from two sides helps when performing the finishing milling stage. The Devcon Flexane may weep out of the molds a little, so be ready to add additional compound to the mold to top it off as the Flexane begins to cure. Any residual Flexane is easily removed when cured and removed from the mold. This article is not intended to teach the art of machining but rather make the reader appreciate the steps involved in the making the individual housing. A total of 32 hours was spent making these replacement door bumper assemblies:

Resources:

Devcon Flexane 80 part number 15800 and Flex-add part number 15940, available from Grainger, Website: www.grainger.com Phone: 1-800-323-0620 to find the closest branch.

Aluminum Metal Stock, Alro Metals Plus/ASAP Division, 2466 South Industrial, Ann Arbor, MI 48104, Website: www.asapsource.com Phone: 1-877-668-0676.

Pot Metal: A slang term that refers to alloys that consist of inexpensive, low-melting point metals used to make fast, inexpensive castings. There is no scientific metallurgical standard for pot metal; common metals in pot metal include zinc, lead, copper, tin, magnesium, aluminum, iron and cadmium. The primary advantage of pot metal is that it is quick and easy to cast. Due to its low melting temperature no sophisticated foundry equipment is needed and specialized molds aren't necessary either. It is sometimes used to experiment with molds and ideas before using metals of higher quality. It is sometimes referred to as white metal, die cast zinc or monkey metal. Examples of items created from pot metal include toys, furniture fittings, tool parts, electronics components and automotive parts.

The definition goes on to say:
Pot metal can be prone to instability over time, as it has a tendency to bend, distort, crack, shatter and pit with age. The low boiling point of zinc and the fast cooling of the newly-cast part often allow air bubbles to remain within the cast part, weakening the metal. Many of the components of pot metal are susceptible to corrosion from airborne acids and other contaminants, and the internal corrosion of the metal often causes the decorative plating to flake off. Pot metal is not easily glued, soldered or welded.

The phrase *tendency to bend, distort, crack, shatter and pit with age* is an understatement! Pot metal is the only material that can probably crumble just by looking at it. *-CW*