

Need a hydraulic press, but own only mechanical presses?



Make Mechanical Presses Adjustable with Hydraulic Cushions

The automotive industry is currently designing its product using exotic metals and combinations of metals to produce body parts from Class A tooling. Tool designers today have a much larger responsibility in reducing costs and increasing production efficiencies.

The current scenario is for a large tooling design house to develop tools and produce an acceptable part, which is then transferred to its customer's production division where hard tooling is necessary.

Production people have discovered that by using a full hydraulic press they can produce a quality part with less tonnage. Infinitely adjustable controls provide a consistent end product. Because new hydraulic presses are expensive, engineering has been given the responsibility of duplicating the production scenario using existing mechanical presses for new die trials.

Our engineering concept was a system that incorporates a hydraulic cushion system with infinitely adjustable controls installed in an existing mechanical press.

The following criteria had to be met:

1. Flexibility to address new product design changes.
2. Comply with automotive design engineers requests for multiple-gage welded steel that gave the end product high integrity and reduced costs.

3. Ability to use materials from aluminum to composites because automotive body parts are fabricated from a variety of materials.

4. Die design with off-center or side-loading restraints to avoid orange peel or fracturing.

5. Produce a green die in design that makes consistent quality parts using the same parameters as in the customer's hydraulic production press.

The problem is how do we make a mechanical press respond like a production hydraulic press? If we engineer a solution, we know considerable time and cost can be saved in reworking the green dies to accommodate the production press at the customer's factory. We also know that if we take this time, it gives the design tooling company much more efficiency, which yields more capacity.

The following is an actual engineered system that has been in operation since mid-1997. It is a solution that met the aforementioned criteria. Although there are hydraulic-, pneumatic-, and nitrogen-activated cushions, we concentrated on hydraulic cushions with infinitely adjustable controls.

PAUL PFUNDNER

Chief Executive Officer
Red Stag Automation Inc.
Crivitz, WI

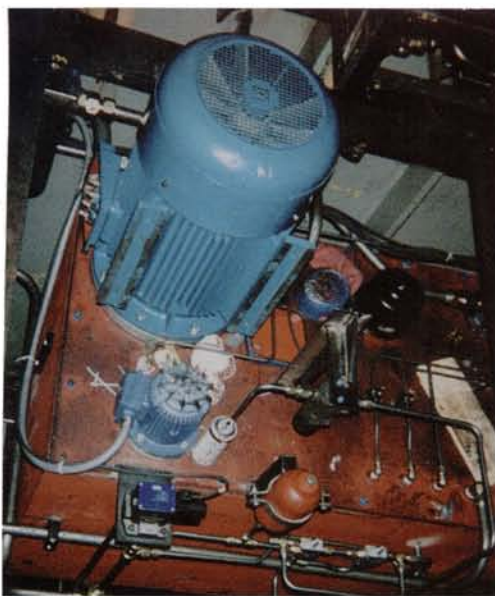
When forming automotive body parts, the cushion's primary objective is to set the bead. After that is done, being able to control the cushion can have real advantages in eliminating problems with orange peel and fracturing.

Let's say you have a 1200-ton (10.7 MN) press with a 400-ton (3.6 MN) cushion. The die requires 375 tons of force (3.3 MN) to set the bead, followed by 6" (152 mm) of forming or drawing.

With a pneumatic or nitrogen cushion, you only have 825 tons (7.3 MN) of down-acting pressure available from the moment the bead is set until the press has formed the part when reaching the stroke's bottom.

With a hydraulic cushion, you can set it to provide 375 tons (3.3 MN) for the first inch (25 mm), then reduce cushion tonnage to 150 tons (1.3 MN) while still holding the bead 360°. This gives the press 825 tons (7.3 MN) of down-acting pressure when setting the bead. It then increases available tonnage when the cushion tonnage is reduced. Now you find that you would like a little material slippage between 1 and 3.5" (25 and 89 mm), and to hold the bead firm after that. You could set the cushion tonnage to 275 tons (2.4 MN) for zero to 1" (25 mm); then 34 tons (0.3 MN) from one to 3.5", (25 and 89 mm) followed by 150 tons (1.3 MN) from 3.5 to 6" (89-152 mm).

The most critical engineering factor



This top view of the oil reservoir shows pump motors and piping layout.

is dealing with ram speed. A mechanical press' ram is like a freight train when it contacts the cushion. Hydraulic engineers affectionately call the moment of impact the "Big Bang". If the big bang is not correctly dealt

with through sophisticated hydraulic engineering, quality parts can not be produced and the cushion will be seriously damaged.

By engineering the complete system with the controls, valves, and information feedback devices currently available, we have an incredible amount of control at our fingertips. Tonnage has infinite control at any level between zero and full tonnage, plus infinite stroke control from zero to 24" (610 mm) (for 24"-stroke cushion design). Steps can be programmed so you can have a number of different pressures at different heights while going through the cushion's stroke. This engineering gives the tool designer flexibility to

help reduce production costs.

Now let's carry this one step further. Say you are trying to form a part, but it is fracturing in one corner. If cushion pressure is reduced on the whole cushion, the bead does not hold and you

get a bad part. In this event, you would typically have to rework the die to make it work. With a six-cylinder hydraulic cushion design, we can control each corner independently. This way, pressure on the bead is reduced during the time you want some material slippage, thus making good parts. If this is a required feature, it must be designed into the cushion from the beginning because it radically changes the cushion's design.

Another area in which this feature is valuable is forming parts made of different steel thicknesses—tailor-welded blanks. We have seen more and more parts being formed from blanks made up of several different material gages welded together. Common sense tells you that each gage requires different cushion responses. By designing each corner of the cushion to have its pressure controlled independently, it will be much easier to make and operate a die that produces high-quality parts every stroke. Once you have all of the steps programmed into the cushion PC, the cushion will give you excellent repeatability.

The foregoing solution developed the following engineering ideas that also worked into a total solution:

1. Due to the long hydraulic stroke's infinite control, we can use standard-length cushion pins, thus eliminating multiple lengths, and reducing die change over time.

2. Standard-length cushion pins were even more efficient if used in combination with a moving bolster. The moving bolster also reduced die change over time and was far safer when handling heavy automotive dies.

3. With the moving bolster, we were able to engineer a more rigid press bed, thus controlling deflection and parallelism more accurately.

Software is now available so a program can be developed at the design level that can be used directly in a production environment.

To eliminate considerable expense and time in the development of green dies and transition to production dies, it is valuable to have a trial press that operates similar to your customer's hydraulic production press.

For more information about hydraulic cushions, Circle 361 on the reader service card.

Scotchman®

HYDRAULIC IRON WORKERS

Five built in work stations

- ① 85 ton punch capacity 1 1/8 in 1"
- ② Flat bar shear capable of shearing 1" x 12" base plate
- ③ Angle shear 6" x 6" x 1/2" without loss of material
- ④ Rod shear 1 1/2" round, 1 1/2" sq.
- ⑤ Rectangular notcher 3" x 5" x 1/2"

Other Models from 40 to 120 ton capacity

Optional tooling: Brakes, Channel Shear, Pipe Notcher, Picker Tool and more.

Free Catalog

Ask about a demo at your site
Lease / Purchase - reasonable terms
We have a representative near you

Scotchman Industries, Inc.

P.O. Box 850, Philip, South Dakota 57567-0850

www.scotchman.com



Made in U.S.A.

Circle 65

1-800-843-8844

Fax 1-800-843-5545