



2007 IMDA Annual Convention



Belvac Production Machinery

Roger A. Baker P.E.

THE BELVAC “BOTTLE CAN MANUFACTURING SYSTEM” (BCMS)

Belvac Production Machinery has partnered with Rexam BCNA to design and build the first continuous motion, 600 cpm **Bottle Can Manufacturing System** for use with D&I Aluminum cans. The BCMS is configured to produce a 14 oz – (211) diameter X 38mm or 28 mm threaded closure aluminum bottle from a 16 oz “D & I” aluminum can pre-form. This same machine is also capable of producing a 10 oz - 204 diameter X 28 mm threaded closure aluminum bottle from a 12 oz “D&I” aluminum can pre-form.

Process development is underway at a satellite Belvac facility in Lynchburg, Virginia. The presentation will describe the features of the BCMS and will include a short video of the machine in operation at the Belvac facility

THE CANMAKER

THE CANMAKER





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**Belvac Production
Machinery**

Roger A. Baker P.E.

Roger has a BS in Mechanical Engineering from General Motors Institute of Flint, Michigan, a Master of Science in Engineering Management from the University of Missouri, Rolla, Missouri, and is a Registered Professional Engineer (P.E.) in the State of Missouri.

Roger was the Director of Technology for Roeslein and Associates for 10 years, and held various positions in Engineering and Operations at Metal Container Corporation for 13 years.

Roger lives in Crystal City, Missouri with his wife, Cindy and has two grown children, Jonathan and Wendy.

THE CANMAKER

THE CANMAKER



IMDA CONVENTION

May 25, 2007

**MANUFACTURING SYSTEMS
FOR ALUMINUM BOTTLES**

ROGER A BAKER, P.E.

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PRODUCTION MACHINERY**



MANUFACTURING SYSTEMS FOR ALUMINUM BOTTLES

- **THERE ARE TWO SYSTEMS COMMONLY USED TO PRODUCE ALUMINUM BEVERAGE BOTTLES:**
 - **IMPACT EXTRUSION (I.E)**
 - **DRAW WALL-IRON (DWI)**



MANUFACTURING SYSTEMS FOR ALUMINUM BOTTLES

- THE IMPACT EXTRUSION (I.E.) PROCESS HAS BEEN AROUND SINCE THE 1930'S PRODUCING COLLASIBLE ALUMINUM TUBES, AEROSOL CANS, MARKING PENS, AND RESEALABLE ALUMINUM BOTTLES
- THE ALUMINUM BOTTLE SEGMENT OF THE 3.0 BILLION CONTAINERS PER YEAR IMPACT EXTRUDED BUSINESS HAS GROWN TO AROUND **180 MILLION CONTAINERS** PER YEAR IN THE USA



MANUFACTURING SYSTEMS FOR ALUMINUM BOTTLES

- **THE DRAW WALL-IRON PROCESS (DWI) WAS DEVELOPED BY THE ALUMINUM COMPANIES IN THE 1960'S AS A NEW USE FOR ALUMINUM**
- **THE DWI 2-PC ALUMINUM BEVERAGE CAN DEMAND HAS GROWN TO ABOUT 250 BILLION CONTAINERS PER YEAR WORLDWIDE AT THE END OF 2006**
- **THE NORTH AMERICAN MARKET CONSUMES ABOUT 114 BILLION OF THE 250 BILLION BEVERAGE CANS PRODUCED WORLDWIDE**



IMPACT EXTRUSION PROCESS FOR ALUMINUM BOTTLES

- IMPACT EXTRUSION IS A **SERIAL PROCESS**:
- EACH MACHINE IN THE PROCESS IS LINKED TO THE NEXT WITH A PIN CHAIN OR A PAN CONVEYOR THAT CARRIES THE CONTAINER THRU THE PROCESS SINGLE FILE



IMPACT EXTRUSION PROCESS FOR ALUMINUM BOTTLES

- THE SERIAL OR SINGLE FILE NATURE OF THE I.E. PROCESS IS VERY FLEXIBLE
- HEIGHT AND DIAMETER CHANGES ARE FAST AND EFFICIENT
- THE I.E. PROCESS IS WELL SUITED FOR TALL, SLIM CONTAINERS



IMPACT EXTRUSION PROCESS FOR ALUMINUM BOTTLES

- **THE I.E. BODYMAKER CONVERTS AN ALUMINUM DISK (APPROXIMATELY 2.5' x 0.250 THICK) INTO AN EXTRUDED 211 x 804 TALL CONTAINER**



IMPACT EXTRUSION PROCESS FOR ALUMINUM BOTTLES

- THE I.E. CONTAINER IS TRIMMED TO LENGTH IN A MACHINE VERY SIMILAR TO THE DWI PROCESS
- THE TRIMMED CONTAINER IS PLACED ON THE HORIZONTAL CONVEYOR AND TAKEN TO THE NEXT OPERATION



IMPACT EXTRUSION PROCESS FOR ALUMINUM BOTTLES

- WASHING, COATING, AND DECORATING IS SIMILAR TO THE DWI PROCESS, EXCEPT THE PROCESS IS SINGLE FILE, OR SERIAL, RATHER THAN IN MASS



IMPACT EXTRUSION PROCESS FOR ALUMINUM BOTTLES

- NECKING AND FINISHING OF THE ALUMINUM BOTTLE IN THE I.E. PROCESS IS USUALLY DONE ON A ROTARY-INDEXING MACHINE



HINTERKOPF NECKER



IMPACT EXTRUSION PROCESS FOR ALUMINUM BOTTLES

- **ROTARY-INDEXING NECKERS ARE VERY FLEXIBLE**
- **THE HEIGHT CHANGE IS VERY FAST AND EFFICIENT**
- **THESE NECKERS ARE WELL SUITED FOR SHORT PRODUCTION RUNS**



FRATTINI NECKER



IMPACT EXTRUSION PROCESS FOR ALUMINUM BOTTLES

- THE I.E. PROCESS IS ALSO CAPABLE OF BODY SHAPING IN A SEPARATE MACHINE



FRATTINI SHAPER



IMPACT EXTRUSION PROCESS FOR ALUMINUM BOTTLES

- THE IMPACT EXTRUDED BOTTLE CAN PROCESS IS TOTALLY INTEGRATED AND WILL PRODUCE ALUMINUM BOTTLES AT **150 TO 200 CONTAINERS/MIN**
- AN IMPACT EXTRUDED LINE COULD PRODUCE ABOUT **75 MILLION ALUMINUM BOTTLES PER YEAR**, OPERATING **24/7**



MALL + HERLAN SYSTEM



DRAW WALL - IRON (DWI) PROCESS FOR ALUMINUM BOTTLES

- THE DWI PROCESS IS USED TO MAKE THE FAMILIAR ALUMINUM BEVERAGE CAN
- THE DWI PROCESS IS ALSO CAPABLE OF PRODUCING “PRE-FORMS” FOR THE NEW DWI-BASED ALUMINUM BOTTLE



DRAW WALL - IRON (DWI) PROCESS FOR ALUMINUM BOTTLES

- THE DWI PROCESS HAS MANY SIMILARITIES TO THE IMPACT EXTRUSION PROCESS, BUT DIFFERS IN SEVERAL IMPORTANT WAYS....
- THE ALUMINUM STOCK COMES FROM A LARGE COIL RATHER THAN A DISK



DRAW WALL - IRON (DWI) PROCESS FOR ALUMINUM BOTTLES

- THE DWI PROCESS USES A VERTICAL PRESS, OR “CUPPER” TO **DRAW** A SHALLOW 3 1/2” CUP FROM APPROXIMATELY 0.011” THICK ALUMINUM SHEET, PRODUCING 14 CUPS ON EACH STROKE



DRAW WALL - IRON (DWI) PROCESS FOR ALUMINUM BOTTLES

- THE CUP IS THEN **RE-DRAWN** FROM THE 3 1/2" DIAMETER CUP TO THE FINAL CAN DIAMETER, AND THE SIDE WALL OF THE CAN IS **IRONED** TO ABOUT 30% OF ITS ORIGINAL SHEET THICKNESS IN THE **DWI PRESS** OR "BODYMAKER"
- A DWI PLANT HAS AS MANY BODYMAKERS AS NEEDED TO SUPPORT THE DESIGN LINE SPEED AND PRODUCTION REQUIREMENTS



DRAW WALL - IRON (DWI) PROCESS FOR ALUMINUM BOTTLES

- THE DWI CAN IS TRIMMED TO LENGTH, THEN CLEANED IN A WIDE MASS WASHER



DRAW WALL - IRON (DWI) PROCESS FOR ALUMINUM BOTTLES

- THE DWI CAN IS NEXT DECORATED ON THE OUTSIDE, THEN SPRAYED ON THE INSIDE.....
- THE PROCESS IS MUCH THE SAME AS THE IMPACT EXTRUDED CONTAINER, BUT AT MUCH HIGHER SPEEDS



DRAW WALL - IRON (DWI) PROCESS FOR ALUMINUM BOTTLES

- THE DWI CAN IS FINALLY CONVERTED INTO A METAL BOTTLE IN THE NECKING PROCESS....



DRAW WALL - IRON (DWI) PROCESS FOR ALUMINUM BOTTLES

- THE NECKING PROCESS FOR DWI COULD USE THE SAME ROTARY-INDEXING MACHINE AS THE IMPACT EXTRUSION PROCESS....
- OR IT COULD USE THE BELVAC BOTTLE CAN MANUFACTURING SYSTEM (BCMS).....



HINTERKOPF NECKER



FRATTINI NECKER



DRAW WALL - IRON (DWI) PROCESS FOR ALUMINUM BOTTLES

- THE BELVAC BCMS IS BASED ON THE TRADITIONAL BELVAC NECKING TECHNOLOGY AND PROVIDES FOR A CONTINUOUS MOTION, RECIRCULATING SYSTEM TO PRODUCE METAL BOTTLES AT 600 CPM

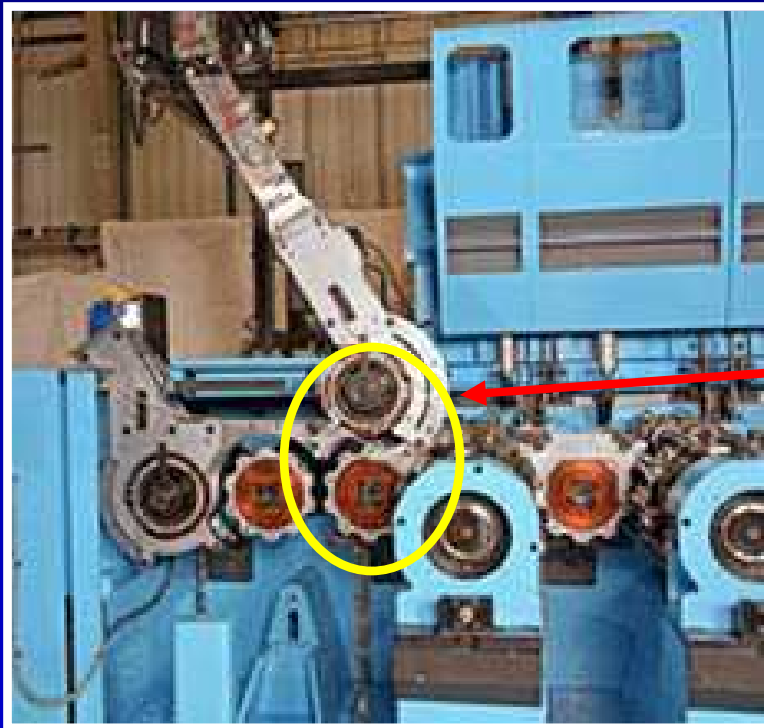


DRAW WALL - IRON (DWI) PROCESS FOR ALUMINUM BOTTLES

- **BASED ON THE 10-POCKET BELVAC 810-K NECKER**
- **202 TO 307 DIAMETER**
- **307 TO 804 HEIGHT**
- **2.75" DEEP NECK CAPACITY**

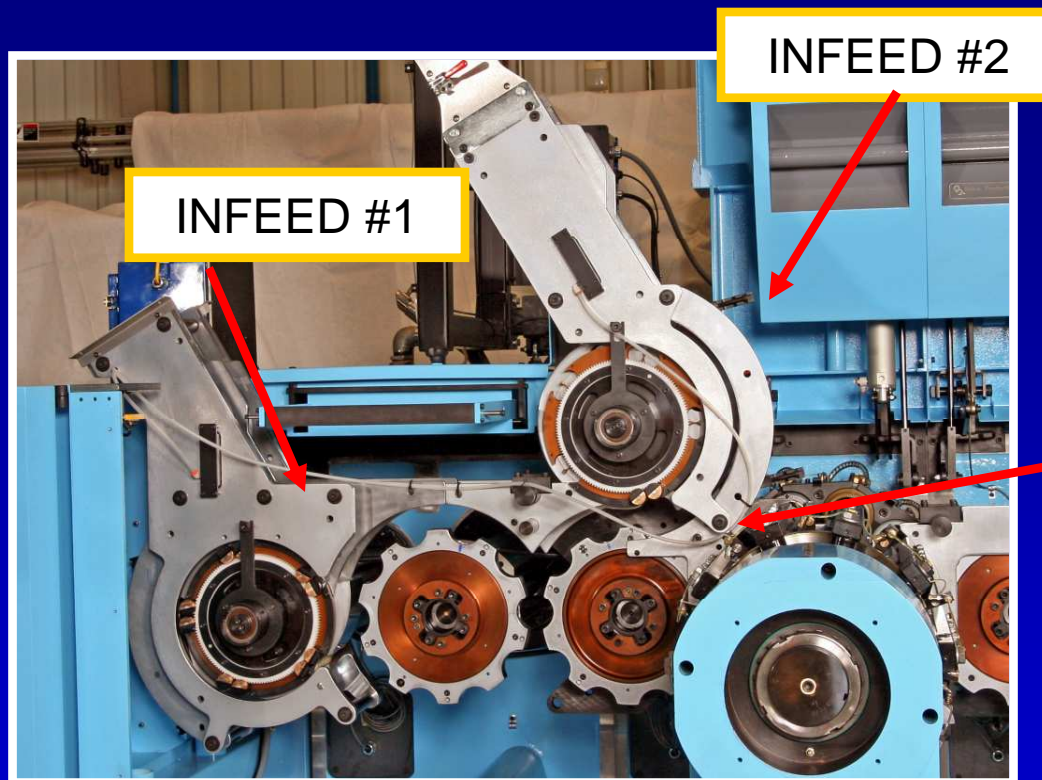


BCMS 810 DUAL INFEED MODULE



- THE BCMS USES A DUAL INFEED, RECIRCULATING PROCESS TO ACHIEVE THE REQUIRED NECK REDUCTIONS, UP TO 34 STEPS
- BOTH INFEEDS PLACE CANS ONTO A COMMON STARWHEEL ON “EVEN / ODD” ALTERNATE POCKETS.

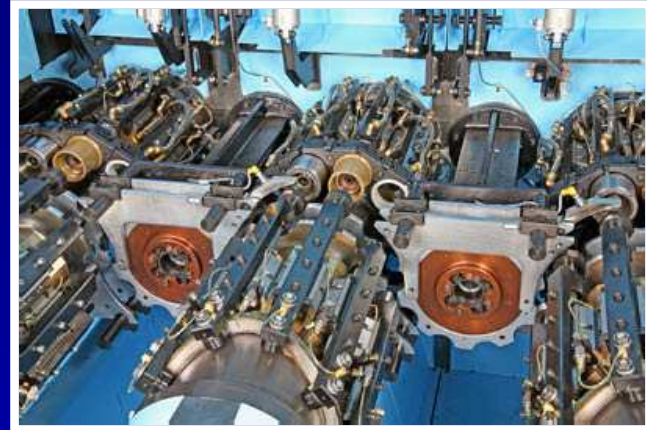
BCMS 810 DUAL INFEED MODULE



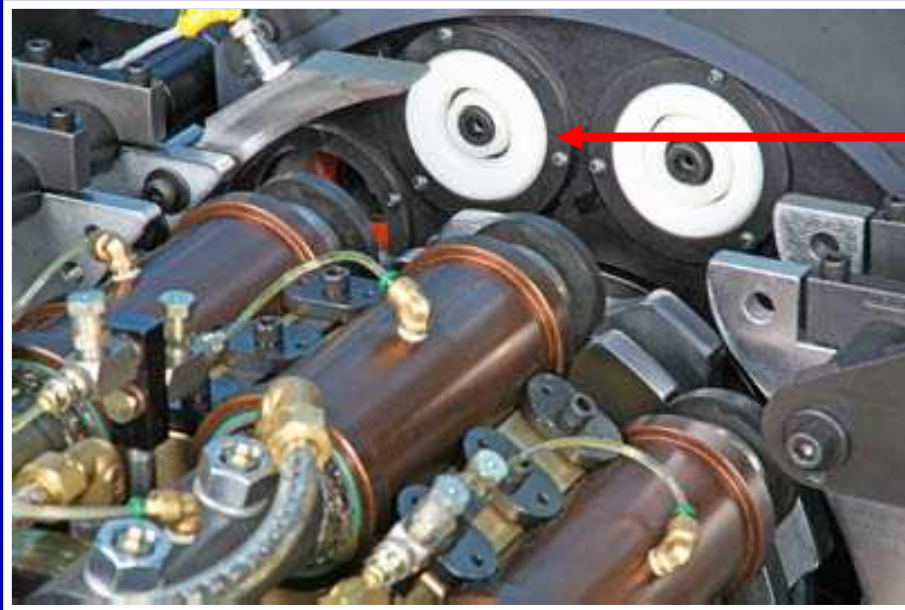
- CANS ENTER THE BCMS THROUGH THE INFEED #1, ARE WAXED...
- AND FED INTO ODD NUMBERED POCKETS OF THE FIRST TRANSFER / NECKING TURRET.....

BCMS NECKING MODULE

- THE CANS THEN PASS THROUGH (17) STAGES OF NECKING.....



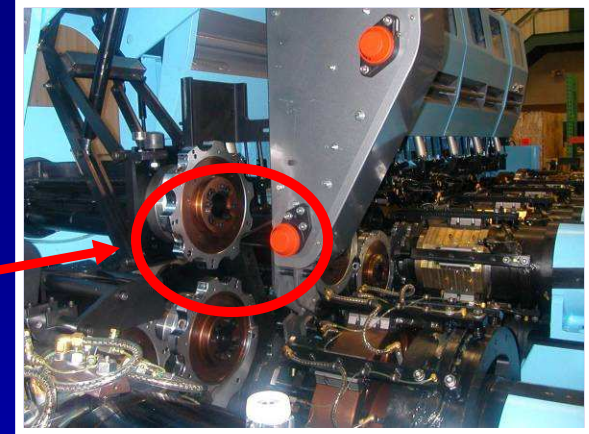
BCMS TRIMMER MODULE – FIRST PASS



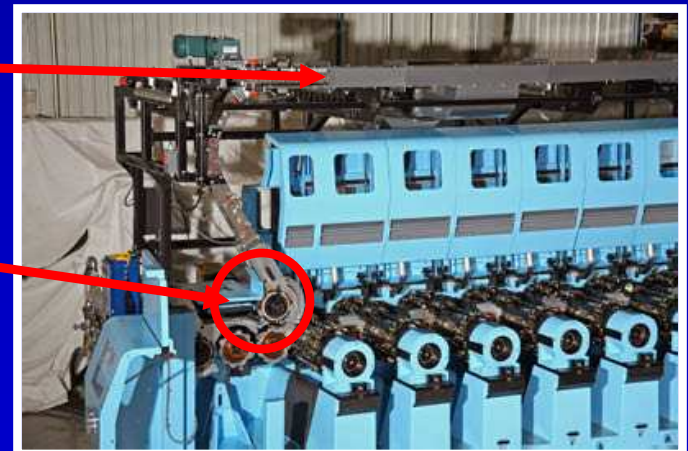
- **THE CANS ARE THEN TRIMMED TO REMOVE “EARING” FROM THE FIRST PASS NECKING PROCESS.....**

BCMS RE-CIRCULATING MODULE

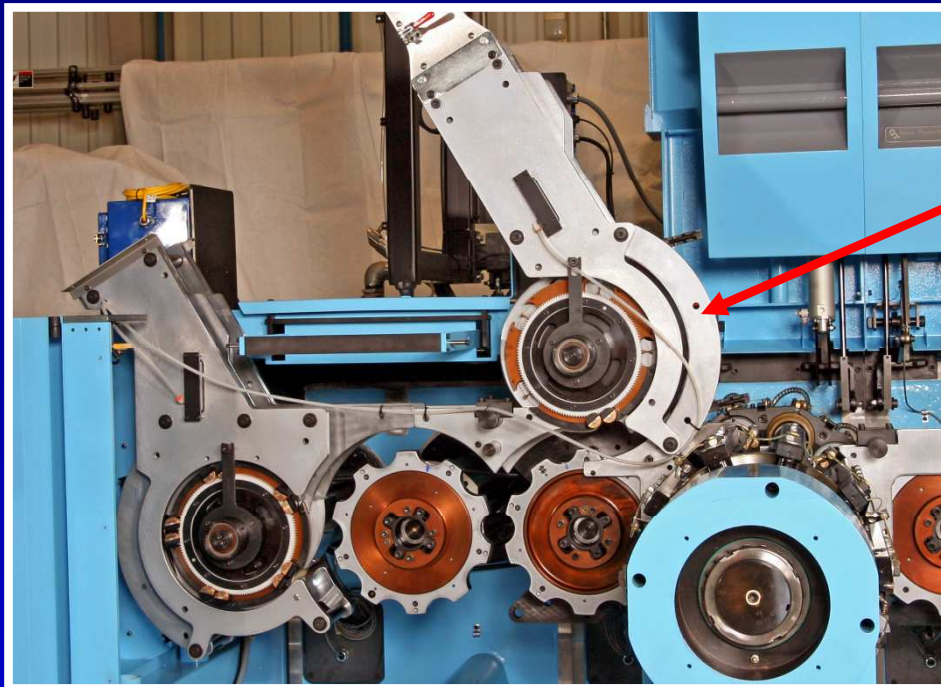
- THE CANS ENTER A DUAL DISCHARGE WHERE THE ODD POCKET CANS ARE REMOVED



- THEN SENT ON A VACUUM CONVEYOR BACK TO INFEED TURRET #2



BCMS 810 DUAL INFEED MODULE



- THE CANS ARE THEN WAXED AGAIN ON THE INFEED TURRET #2
- ...THEN ENTER THE EVEN NUMBERED POCKETS OF THE FIRST TRANSFER/FIRST NECKING STAGE...
- FOR A SECOND TRIP THROUGH THE 17 NECKING TURRETS AND AN EXPANDER TURRET.....

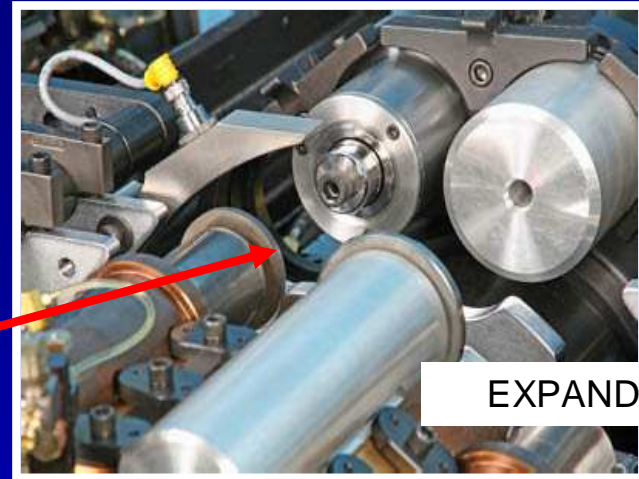
BCMS TRIMMER MODULE - SECOND PASS



- WHEN THE CANS COMPLETE THE SECOND PASS, THEY ARE TRIMMED A SECOND TIME.....
- THE CANS NOW GO ON TO THE “FINISHING SECTION” OF THE BCMS.....

BCMS EXPANSION MODULE

- **THE CAN NECK IS EXPANDED FOR THE “R.O.P.P.” BAND**

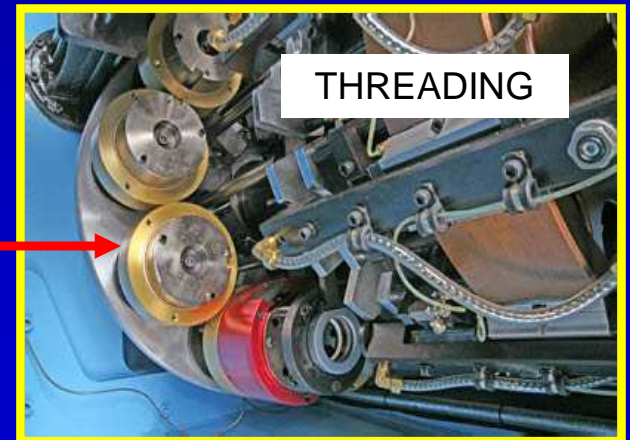
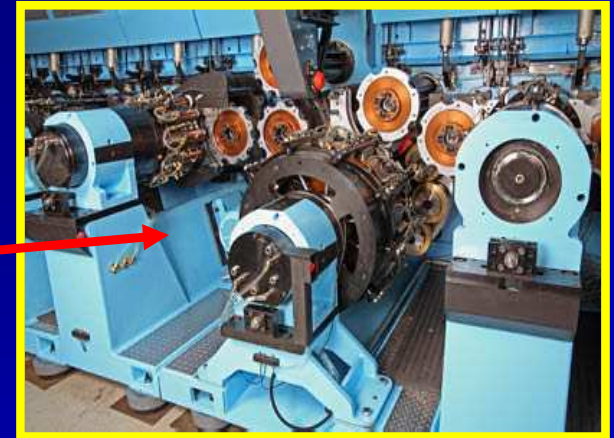


EXPANDING



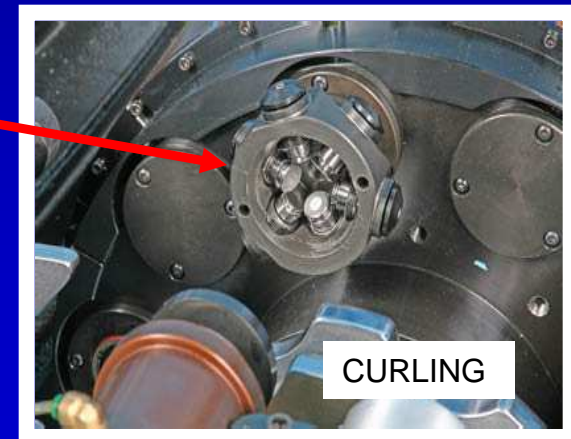
BCMS THREADER MODULE

- THE THREADER MODULE HAS (5) STATIONS
- THE THREADING MODULE ROLLS THE 38MM OR 28 MM THREAD ONTO THE BOTTLE CAN NECK



BCMS FINISHING MODULES

- SEVERAL MORE NECKING OPERATIONS REDUCE THE DIAMETER ABOVE THE THREAD.....
- THEN CURLING COMPLETES THE FINISHING OPERATIONS



MANUFACTURING SYSTEMS FOR ALUMINUM BOTTLES - SUMMARY

- **THE IMPACT EXTRUDED AND THE DWI SYSTEMS EACH HAVE THEIR OWN ADVANTAGES AND DISADVANTAGES.....**
- **THE “BEST SYSTEM” IS DEPENDANT ON THE BEST COMBINATION OF THE FOLLOWING FACTORS:**
 - **CONTAINER COST**
 - **CONTAINER SIZE**
 - **STRAIGHT WALL OR SHAPED**
 - **CHANGE OVER TIME**
 - **PRODUCTION LOT SIZE**
 - **TOTAL PRODUCTION VOLUME REQUIRED**



MANUFACTURING SYSTEMS FOR ALUMINUM BOTTLES - SUMMARY

- **THE IMPACT EXTRUDED SYSTEM WILL HAVE THE FASTEST CHANGE-OVER TIME**
- **THE IMPACT EXTRUDED SYSTEM WILL HAVE THE MOST FLEXIBILITY FOR CONTAINER LENGTH, NECK DEPTH, AND SHAPING**



MANUFACTURING SYSTEMS FOR ALUMINUM BOTTLES - SUMMARY

- THE IMPACT EXTRUDED CONTAINER WILL HAVE ABOUT TWICE THE METAL CONTENT AS A DWI CAN OF THE SAME VOLUME, SO IT WILL COST MORE TO PRODUCE....METAL IS ABOUT 70% OF THE COST OF THE ALUMINUM BOTTLE CAN

- THE IMPACT EXTRUDED LINE IS A SERIAL OR SINGLE FILE CONFIGURATION AND HAS AN OPERATING SPEED OF 150 TO 200 CONTAINERS PER MINUTE, OR ABOUT 75 MILLION CONTAINERS/YEAR....IT IS NOT EASILY EXPANDED



MANUFACTURING SYSTEMS FOR ALUMINUM BOTTLES - SUMMARY

- **THE DWI SYSTEM WITH A BELVAC BCMS WILL HAVE LONGER CHANGE-OVER TIME, SO IT BETTER SUITED FOR LONGER PRODUCTION RUNS**
- **THE DWI/BCMS WILL HAVE THE GOOD FLEXIBILITY FOR CONTAINER LENGTH, NECK DEPTH, BUT DOES NOT OFFER SHAPING YET**



MANUFACTURING SYSTEMS FOR ALUMINUM BOTTLES - SUMMARY

- THE DWI CONTAINER WILL HAVE ABOUT **HALF THE METAL CONTENT** AS AN IMPACT EXTRUDED CONTAINER OF THE SAME VOLUME, SO IT WILL COST MUCH LESS TO PRODUCE
- THE DWI/BCMS CONTAINER LINE COULD BE ADAPTED FROM EXISTING DWI LINES WITH THE ADDITION OF A BELVAC BCMS MACHINE
- A DWI/BELVAC BCMS LINE CONFIGURATION HAS AN OPERATING SPEED OF 600 CONTAINERS PER MINUTE, OR ABOUT **225 MILLION CONTAINERS/YEAR**



MANUFACTURING SYSTEMS FOR ALUMINUM BOTTLES - CONCLUSIONS

- **THE IMPACT EXTRUDED PROCESS IS THE BETTER SYSTEM FOR ANNUAL VOLUME REQUIREMENTS OF LESS THAN 75 MILLION CONTAINERS**
- **THE IMPACT EXTRUDED PROCESS IS THE BETTER SYSTEM WHEN MULTIPLE CONTAINER SIZES ARE REQUIRED IN SMALL BATCHES OF LESS THAN 50,000 CONTAINERS**



MANUFACTURING SYSTEMS FOR ALUMINUM BOTTLES - CONCLUSIONS

- **THE DWI PROCESS IS THE BETTER SYSTEM FOR ANNUAL VOLUMES OF MORE THAN 75 MILLION CONTAINERS**
- **THE DWI PROCESS IS THE BETTER SYSTEM IF DWI CAPACITY FROM AN EXISTING FACILITY IS AVAILABLE**
- **THE SAVINGS FROM LARGER ANNUAL VOLUMES WILL BE SIGNIFICANT WITH THE DWI PROCESS OVER THE IMPACT EXTRUSION PROCESS**





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