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TO: W. H. COLEMAN II

FROM: J. R. BALIO J R Balio

MAY 22, 1989

PROCESS ENGINEERING

DEPARTMENT 9281

ENGINEERING PROGRESS REPORT

APRIL 1989

CONFIDENTIAL

TECHNICAL SUPPORT TO OPERATIONS

- ROLLS FOR CADILLAC ROLLING MACHINE - (R. L. HATFIELD)
  Roger investigated a breakage problem on the rolls used to mark 1187 receivers. The receivers are rolled on the Cadillac rolling machine. Three broken rolls were metallurgical examined, microstructure, composition and hardness were all in specification. Further investigation revealed that the machine was rolling at to high of pressure causing an unnecessary stress being placed on the outer edge of the roller.

- DESIGN REVIEW OF NSARR: (P. JOHNSON / R. POLLEY / R. HATFIELD)
  Phil, Ron and Roger evaluated the suggested materials for the new auto-loading 22 caliber rifle. Several recommendations were made to the design review team. The recommendations took several things into consideration such as, availability, process feasibility, machinability, performance, alternate materials and cost.

- DRILLING PROBLEMS WITH HAMMER STEEL: (R. L. HATFIELD)
  Roger investigated a problem involving the drilling of hammer steel. The microstructure of several hammers were checked, nothing unusual was noted, the structure was predominately pearlitic as expected. Gary Barnes investigated the drilling operation and discovered that the wrong coolant was being used.

- MODEL 700 BOLT HANDLES: (R. L. HATFIELD)
  Cracked model 700 bolt handles were investigated by Roger. The cracking was found at the brazing operation by the operator. The cracks were located at the neck just below the ball of the handle. All handles are statistically tested at 500 pounds to determine if the ball will fail prior to the 300 pound test after the brazing operation. The later test is used to evaluate the braze joint. The cracking was due to porosity in the neck of the handle combined with the 500 pound static test. The cracking causes no unsafe condition but is a cosmetic defect. All handles are currently being visually inspected under a 10X lense after the 500 pound static test, if the crack is visible the handle is being rejected. A program is being implemented to inspect the handles before being accepted by purchase parts. Also, the possibility of decreasing the 500 pound static load is being explored since the only purpose of this test is to determine if the ball will break during the 300 pound static test of the braze joint.

TECHNICAL SUPPORT TO OPERATIONS
(continued)

- MODEL 700 RECEIVER STEEL: (R. L. HATFIELD G. CIOCH / J. SMITH)
  In March Roger reported on 24 tons of receiver steel from LTV which came in under the target hardness of 170 Brinell. The problem associated with "soft" steel is machining problem at the screw machine and at the broaches. A production lot of the softest material was released and followed through the screw machines by Gary Cioch and through the broach operations by Jim Smith. No problems were encountered at either operation. The steel will be accepted.

- CORROSION 89 CONFERENCE: (R. L. HATFIELD)
  The week of 4/17/89 Roger attended "Corrosion 89" which was sponsored by National Association of Corrosion Engineers in New Orleans Louisiana. Roger attended 27 presentations ranging from microbiological induced corrosion to high temperature corrosion resistant alloys as well as a special presentation on cold fusion. Roger also attended the corrosion show where several hundred suppliers demonstrated their products. Roger made contact with many vendors who may have something to offer Remington Arms Co. such as high temperature alloys which could be used to fabricate heat treat equipment where high temperature corrosion resistance is needed, also, a new type surface polish cleaner was discovered, the possibilities of this product are being explored with Joe Mead and Tim McCormack.

- TOOL CHATTER PROBLEM ON VENT RIB: (R. L. HATFIELD / L. CASALE)
  Lisa Casale and Roger investigated a tool chatter problem on vent ribs. A visual inspection and micrograph was made to determine the direction of the chatter. The micrograph revealed tool chatter up and down as well as side to side. This information was important in designing a fixturing tool.

- 1140 MODIFIED 552 AND 581S RIMFIRE BARRELS: (R. L. HATFIELD)
  Roger performed a magnetic particle inspection on several 552 and 581S rimfire barrels made from 1140 modified steel instead of the current 1212 steel. The 1140 modified steel is being investigated as an alternative to 1212 because it is harder and as easily machined. All barrels passed the inspection.

- DISTORTION IN FIRING PINS: (R. L. HATFIELD)
  A distortion problem was encountered in heat treating firing pins. The firing pins are heat treated in the fluidized bed furnace. Roger's investigation revealed that the polymer quenchant was below the recommended concentration and the fluid action of the furnace with the current rack configuration is causing the distortion. The following corrective action has been taken: the polymer quenchant has been brought back to its recommended concentration, a work order to modify one rack has been submitted and a Tool Design Request has been submitted to design heat treat racks to be used in the Microcarb furnace which will be used as an alternate heat treat procedure.

TECHNICAL SUPPORT TO OPERATIONS
(continued)

- BROACHING PROBLEM WITH HAMMERS: (R. L. HATFIELD)
  Roger metallurgically examined hammer steel in which a broaching problem was encountered. The hammer is fabricated from AISI type 8640 steel. The hammers inspected had the correct microstructure, hardness and composition. A different heat treat procedure is being explored.

- SP-10 MAG: (DICK STAFFORD)
  - GFM Barrel 30" - Found Bore Gage B-47833 was not designed correctly. Altered Gage and Machine Study was completed 2/13/89. Broke two Mandrels on Set Up which left us with two Mandrels to make run. Additional Mandrels were put on order 2/9/89 with a delivery date of 4/5/89. The Mandrels were ready for Production on 4/21/89.

  -GFM Template - Found that the original Template had to be shimmed to produce the proper size and that it is soft. On 3/10/89 a new Template D-48286 was designed and Work Order issued to the Tool Room with a requested completion date of 4/1/89. The Template was completed 4/27/89.

- AJAX INDUCTION HEATER: (DICK STAFFORD)
  A pre A-5 Inspection with the Safety Office was done resulting in a number of changes to be made. On 2/15/89 a letter was issued for changes and assigned responsibility. The majority of the changes have been completed.

  On 2/15/89 the factory man burned out the Ircon Optical Pyrometer. The Heater can be still run on time without the Pyrometer. The Factory Man returned on 4/11/89 and installed the Ircon Unit which is working the way it was intended.

  The Trial and Pilot Run of four Magnum Calibers was started on 4/20/89 with 129 Blanks being Upset.

- M/552/572 BOLT DCR: (DICK STAFFORD)
  The Model drawing change to reduce the body diameter, has been transmitted 2/29/89 for the DCR that Dick had issued to R&D on 1/24/89. The Model Drawing change has been given to the Vendor through Purchasing. The Operation 4T will stay in effect until all of the old parts have been issued.

- 552-572 FRONT SIGHT: (DICK STAFFORD)
  On 3/15/89 Dick made out a DCR to R&D requesting that the N/66 Front Sight be used on the M/552 and M/572. This would eliminate the Projection Welding of a Bead on the current 552 and 572 Front Sight.

  On 3/23/89 the Process Records and Structure changes were issued to add the N/66 Front Sight to the M/552 & M/572 BDL.

TECHNICAL SUPPORT TO OPERATIONS
(continued)

- AUTO DRILL FOR SHOTGUN BLANKS: (DICK STAFFORD)
  The 12 Ga. Drills C-44345-A used on the Auto Drill Line were a one tome usage and then throw away. Dick has been working with a Vendor who can Re-tip the Used Drill Heads up to three times at approximately 60% of the original cost.

  On 4/19/89 Dick wrote up the Cost Savings which amounted to $10,590 per year.

- CENTERFIRE BARREL BLANK: (DICK STAFFORD)
  The punch on the Robot Upsetter for Centerfire Barrel Blanks cracks after approximately 1000 parts. After consulting with P. Johnson it was decided that try a different material.

  On 3/27/89 Dick made a Drawing A-TS-7531 and gave it to Purchasing with a request for a quotation. On 4/19/89 a Purchase Requisition was issued for three Punches.

- 552 TEST GUNS IN R&D: (DICK STAFFORD)
  R&D complained that after 8,000 Rounds that they started Blowing Cases. Three Guns were taken from the Test and each one shot 100 Rounds in the Gallery. There was one malfunction which was EDS, (Extractor Drops Shell). The three Barrels were to gauge. The three Guns were returned to R&D on 4/20/89. The conclusion was that it was either the lot of Ammo being used or the method that was being used to fire the Guns.

- PROCESS RECORD CHANGES: (DICK STAFFORD)
  Dick completed Process Record changes:

  - 4/6/89 - M/870 Barrel Assembly - add two Part Numbers to process for Parkerized Barrels.

  - 4/10/89 - M/870-1100 28&410 Ga. and 870 20 Ga. L.W. Barrel Assembly for removing the Levels.

  - 4/11/89 - M/870 28-410 & 20 Ga. L.W. Barrel Assembly Complete.

  - 4/19/89 - M/870 12 Ga. Barrel Assembly for removing the Levels. This included 17 pages of Structure changes.

  - 4/19/89 - M/870 12 Ga. Barrel Assembly Complete - Removing 16 Part Numbers that were taken out of Barrel Assembly Process.

  - 4/18/89 - XP-100 Barrel by adding Operation #49 for Turn Before GFM for the Barrel to be Turned as an 18 1/2" M/700 NFT.

- ESTIMATES: (DICK STAFFORD)
  Dick completed Process Engineering Estimates for the following:

  - 4/21/89 Adding the 6MM REM and the 257 ROBERTS to the M/700 Mountain Rifle

  - 4/14/89 - For the 300 Savage in a M/700 Classic.

TECHNICAL SUPPORT TO OPERATIONS
(continued)

- NEW PRODUCT ESTIMATES: (G. BARNES/E. FORD/J. MEAD/R. STAFFORD)
  Class "C" estimates for the New Semi-Automatic Rimfire Rifle (NSARR), the New Bolt Action Rifle (NBAR) and the New Centerfire Auto-loading Rifle (NCAR) were developed and submitted in April.

- M/700 HARD 'OFF' SAFE: (G. BARNES / M. PAESTELLA)
  Investigation revealed that all components were dimensionally correct. The detent ball hole in the safety arm contained excessive die break leaving nearly half of the material thickness with a very rough surface. The application of a lubricant would allow a marginal hard safe to work freely, but through use would require additional operating force. The level of die break is uncontrollable. The vendor has submitted a quote for $.05 per piece and a $950 tooling charge to ream the hole.

- XP-100 HARD 'ON' SAFE: (G. BARNES / M. PAESTELLA)
  With the occurrence of the final inspector performing the final inspection operation, rejects due to hard safe's have increased. The M/D component tolerance stack up prevents a smooth 'on' safe action when the sear lift exceeds .013". After working with J. Hutton and T. Plunkett, a solution was obtained. A DCR was submitted to increase the cams nose radius from .025" to .035". This change does not effect sear lift but does enhance the safeties smoothness. The transmittal was received and forwarded to the vendor. Square Stamping has submitted a quote of $2100 and a 8 week delivery. The P.O. has been forwarded for the rework.

- M/11-87 HAMMERS BINDING: (G. BARNES / M. PAESTELLA)
  The hammers were binding on the carrier latch plunger. The plunger hole position was found not at the 20 degree angle causing the hammer to rub when cocking. The head was realigned to correct the situation.

- M/7400 FOLLOW DOWN: (G. BARNES / M. PAESTELLA)
  Several guns were found in the gallery that would follow down. Investigation showed the connector left and the disconnector to be reversed. The safety concerns were express to the area supervision at the final assembly and trigger plate assembly areas. There is a need for an inspector to monitor the work coming from that area and review the problems with the concerned employee's.

- M/11-87 CRACKS IN THE BOWS: (G. BARNES)
  The trigger plate assemblers found small fractures in the bow area. This crack was not visible until the high gloss finish was applied. The line was screened finding 200 of 1800 castings being bad. The #7 cavity made up the majority of the bad castings. The cracks were caused by the shaving die at the vendor.

BARBER - PRESALE R 0117796

TECHNICAL SUPPORT TO OPERATIONS
(continued)

- M/870 SEARS FAIL TO RETRACT: (BARNES / M. PAESTELLA)
  The 870 trigger plate assemblers discovered that the sears would not fully retract into the hammer notch. The hammers were found to contain a small step at the bottom of the notch. The broach insert was found to have been badly worn causing a built up edge to create the step. This was not visible with the illuminated 4X glass and barely visible with the 10X magnifier. The lot 14,000 hammers were screened with about 75% being rejected. In the past the operation was set up and run to what ever the order called for, in this case 14,000. Gary has written a procedure and a flow chart to inspect the hammers at the broach operation. In addition to the procedure a maximum limit of 5,000 pieces are to be run on a broach insert before it is re-ground. A log is being kept to closely monitor the pieces.

  Gary attended an SME seminar on broaching in Detroit the week of 5/1. He is also arranging on site broach training.

- SP-10 MAG T&P: (J.MEAD)
  Trial and Pilot operations were supported for the Barrel and Receiver Sub-Assembly on the Goff shotblast operations. All parts were processed on time and minor fixture alterations were completed. Time was spent with miscellaneous finishes on various small parts. As well as shot peen variations for the link. Quite a lot of time was spent modifying and setting up the Empire shotblaster in building 50-3.

- WORK ON MATTE POWDER MODULE START-UP: (J. MEAD)
  A total of three attempts were necessary in the production setting in order to get our matte module to work correctly. It was necessary to modify the height of the pickup tubes, and the air velocity through the booth. In addition we had to add an Aluminum Oxide charging particle to the powder to get it to accept and hold an electrostatic charge. We ran the module for three production days with no charging problems. The problem now, is in keeping the powder out of the holes due to excessive charge.

- PROBLEMS WITH 150 GRIT SETUP WHEELS: (J. MEAD)
  A great deal of time was spent during the month evaluating problems with the setup wheels that are used throughout the plant to polish various parts. All aspects of the procedure, as well as all the the variations on materials were evaluated prior to resolving the problems.

- M/552-572 RECEIVER CASTING DRAWINGS: (J. MEAD)
  One of our vendors, who is attempting to build a replacement die to cast our Aluminum Receivers, is having difficulties due to the lack of dimensions on the drawings. A great deal of time was spent working with the vendor, and R&D in an attempt to resolve the problems. The part is currently being modeled on the CV in an attempt to obtain the dimensions needed.

TECHNICAL SUPPORT TO OPERATIONS
(continued)

- M/870 SP MAGAZINE TUBES: (ED FORD)
  Ed wrote a program for the Miyano lathes to repair 300 magazine tubes for the M/870 Special LW-20 which were approximately 1.75" too long. Ed trained an operator on how to operate the program and the tubes were repaired enabling production to meet March's schedule.

- M/700 ARYLON STOCKS: (ED FORD)
  Purchased parts inspection rejected a shipment of 600 Arylon stocks for cosmetic defects. These defects included:
  - step in the tang cut
  - sharp point on the bolt slot
  - poor glue joint between the butt pad and the butt of the stock

  Skip Smith contacted the vendor and made arrangements for the vendor to come on-site to repair the stocks. After the first day of their visit, Lee Six and Tony Culpepper decided that it would be more efficient to repair the stocks at the plant in Arkansas. The stocks were packaged and returned for repair. A visual sample was marked and returned with the shipment.

- M/700 BOLT HEAD: (ED FORD, JIM SMITH)
  Bolt head #1 was producing up to 40% scrap due to poor concentricity of the firing pin hole. Jim adjusted the saw cutter used to machine the black oxide salts bleed out slot so it would not intersect the firing pin hole. This adjustment prevented the drill from wandering and good parts were produced.

- M/700 BOLT POLISH: (ED FORD, JIM SMITH)
  Jim set up the bolt polish machine to operate with a new abrasive paper from 3M. This paper is of micron grade with a film backing and can be used in synthetic coolant thereby eliminating the use of Freon as a de-greaser. The results obtained are excellent. The borders on the bolts are sharp and the finish is much better.

- M/700 RECEIVER: (ED FORD, JIM SMITH)
  The operator of the 3-pass broach tap operation asked for new wrenches to replace his badly worn wrenches. Jim made sketches of the wrenches and submitted them to tool room. The wrenches were built and placed on the job during the week beginning 4/17/89. The wrenches have been used successfully ever since.

NON-TECHNICAL SUPPORT TO OPERATIONS

- M/7400 FRONT SIGHT RAMPS CHIPPING: (G. BARNES)
  The front sight ramps were chipping as the front sight was being assembled. The front sights were found to have raised material on both sides of the 60 degree dovetail. Powder metal was contacted to correct the situation. A TDR has been issued to design an assembly fixture to eliminate the chip out.

- INCOMING INSPECTION MISC. CASTINGS: (J. MEAD)
  An abnormal amount of time was spent this last month on the inspection and acceptance of common Trigger Plate castings. The vendors are all running tests through the line, and one vendor is having difficulty with porosity.

- ON-THE-JOB SAFETY COMMITTEE: (ED FORD)
  Ed attended two meetings during the month to organize the committee into two-person teams. Each team was then assigned to investigate one safety concern that was mentioned at the 1988 Safety Conference.

- M/700 FIRING PIN: (ED FORD, DICK FRAPPIER)
  Three firing pins came apart at final assembly. Dick found that the firing pins were assembled without the pin that holds the assembly together. All firing pins were sent back to be 100% screened. The area proprietor was notified that this job is not to be used as a "fill in" operation.

- M/700 7X57: (ED FORD, JIM SMITH)
  The M/700 7X57 caliber was failing the function test in the gallery with the "rings on shoulder" malfunction. Ed and Jim found that the reamers used at the heading operation were bad. The reamers were re-ground at cutter grind and returned to the heading job. The rings were eliminated. A burnishing operation was used to remove the rings from the shoulder of those guns already in the line.

- M/700 STOCKS: (ED FORD, DICK FRAPPIER)
  Ten stocks were found to be cracked at both the gallery and final inspection. All ten guns were assembled by the same assembler. Dick found that the sear pin which holds the fire control in place was sticking out about .125" and staked. This additional pressure on the stock caused it to crack.

- M/XP-100 RECEIVER: (ED FORD, JIM SMITH)
  The operator of a Delta drill press was breaking the buttmills used to drill the bolt stop spring recess hole. After aligning the buttmill with the bushing, Jim found that the buttmill was hitting the bolt stop slot cut. The slot cut was checked and found to be .006 out of gage. This misalignment was shearing the flutes off the buttmill causing it to break. The parts were screened and 400+ were found to be out of gage. Five receivers were assembled and checked at assembly by Fred Martin. Fred determined that the receivers were usable. The locator for the bushing will be moved .009 so the parts can be run without breaking the buttmills.