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IN THIS ISSUE

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M-1 Helmet Lot Numbers

Marc W. Giles

In recent years there has been a growing segment within the M-1 helmet collecting community spending a large amount of time, discussion, and money on the helmet's visor stamp referred to by M-1 helmet collectors as a "heat stamp" or a "lot number."[1] To older M-1 helmet collectors these numbers are relatively meaningless, while to the younger Google-search generation they are often used as attempts to validate claims of authenticity for a specific helmet. Used as a tool of observation, this stamp identified which fabricator pressed a helmet or could help determine if a current hinged chinstrap loop helmet did, in fact, start out with a fixed chinstrap loop. Beyond this, the stamp had little meaning to collectors or any effect on perceived value until the fall of 2007.

The tipping of the scale, from mundane to becoming a major consideration in determining the value of a given M-1 helmet, coincides with the publication of a "lot number chart" claiming to pinpoint the pressing of a McCord helmet body to within the specific month of the year it was fabricated.[2] Although the chart, in its description of use, claims only to approximate a date, and the book in which it was published provides no bibliographical support or explanation for how the author arrived at the charted timelines, a large section of the collecting community has adopted its findings as gospel.

Historians have always put forth hypotheses regarding the specifics of history, however doing so without providing the source for ones published conclusions creates conjecture and misunderstanding. Was this chart constructed upon substantive data or were helmet stamps simply listed in sequential order based on dates derived from the sum of the characteristics of the helmets' component parts (e.g. fixed or hinged chin strap loops, front or rear seam rim, stainless steel or manganese rim, olive drab shade No. 3 straps or olive drab shade No. 7 straps)? If the chart was developed using observation alone, how large was the sampling? Did the sampling allow for refitted helmets? Were all the helmets observed from original manufacturers' applied paint or did some have post-factory-applied paint (and then potentially other post-factory alterations)? The real problem is that without a basis for understanding how the chart was constructed, the results can hardly be seen as reliable.

Fervor over helmet stamping is obvious in on-line debates between M-1 helmet collectors arguing for or against a helmet's date of manufacture. Some sellers have resorted to taking sandpaper to original-finish helmets to better discern a number and argue that value is based on the perceived manufacture date. This debate has even seized the reenacting community as evidenced by requests for specific number ranges prior to purchase or dissatisfaction upon receipt of a helmet without a proper "heat number" for their chosen time period.[3]

FIG 1. Typical example of the of damage done to a M-1 helmet as a result of exposing the lot number in an attempt to maximize profit through perceived manufacture date.

FIG 2. McCord M-1 helmet body after initial 7- inch draw prior to the trimming operation. Note Visor stamp 726C (Credit: Author's Collection)

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So, what exactly is this number stamped on the inside of the M-1 helmet visor and does it correlate to the date of manufacture? It was officially known as a "lot and lift number" used for traceability by the pressing concern in their quality assurance program. To best understand its function and how it relates to the modern day M-1 helmet collector, it is necessary to examine the actual process that existed between the steel supplier and the helmet fabricator during the time that the M-1 helmet first went into production.[4]

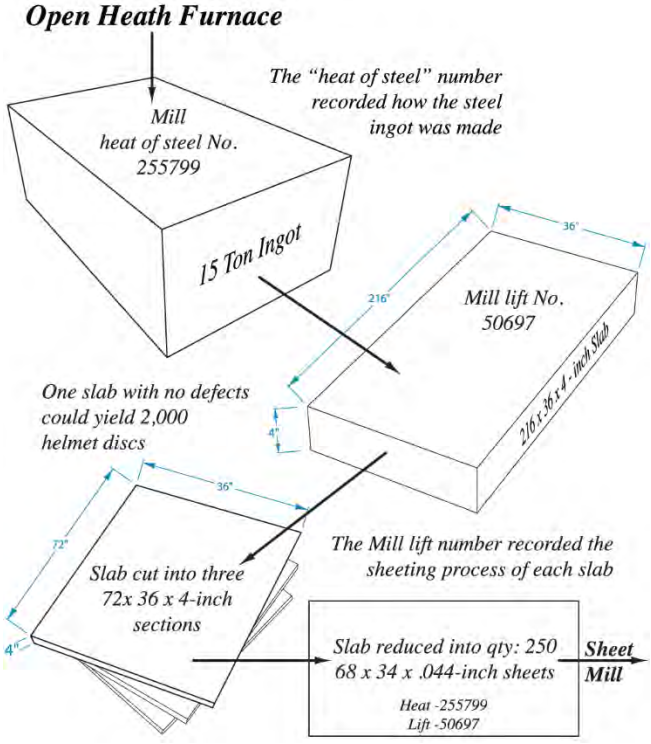
FIG 3. Carnegie-Illinois Steel Corporation - Giant ladle pours molten steel into an open-hearth furnace.
(Credit: ACME-14 June, 1940 - Author's Collection)

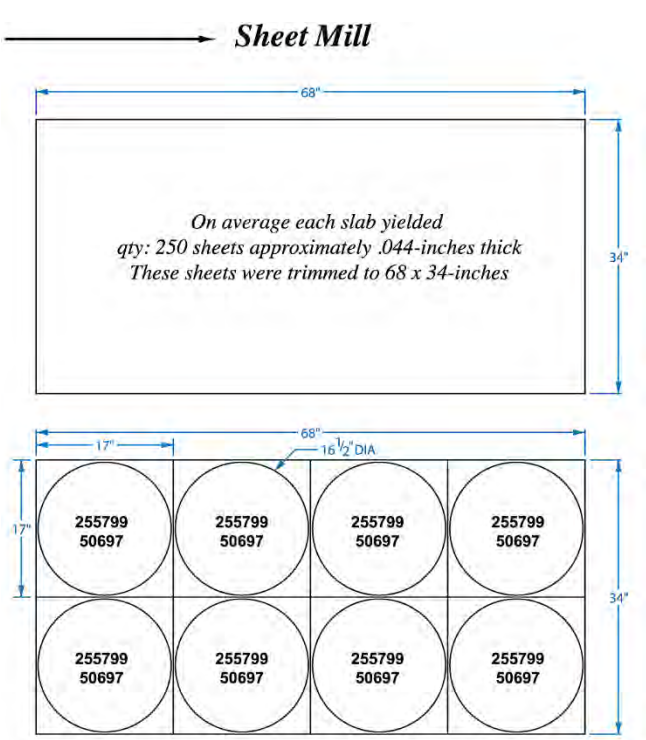
Like its predecessors, the M-1917 and M-1917A1, the steel of choice for the M-1 helmet was Hadfield's manganese. The steel used in the manufacture of the WWII M-1 helmet was produced by two steel concerns: the Carnegie-Illinois and Sharon Steel Corporations.[5] Although the two concerns processed steel differently, the problems associated with the manganese helmet steel produced was basically the same from both facilities. For the purpose of this analysis, only the relationship between Carnegie and McCord will be reviewed.

The manufacture of Hadfield Manganese Helmet Steel at the Carnegie-Illinois Steel Corporation began at their South Works plant where steel was melted in an open-hearth furnace at 2800 degrees Fahrenheit and poured into fifteen-ton ingots. These ingots, referenced by the mill as a "batch of steel" or a "heat," were much too large to be accurately tracked and shipped as a unit. Carnegie chose to reduce each of their heats by sub-dividing them first into billets[6] and then rolling them into 216 x 36 x 4-inch slabs. Each slab was cut into three 36 x 72 x 4-inch sections and sent to the Gary Sheet Mill where they underwent several processes to include shearing, rolling, pickling, and austenitizing.[7] Processing concluded with each slab having been reduced into a quantity of two hundred and fifty 68 x 34-inch sheets averaging 0.044 inches in thickness. Each slab, if free of defects, could yield about 2,000 helmet discs and was referred to by the Mill as a "lift."[8]

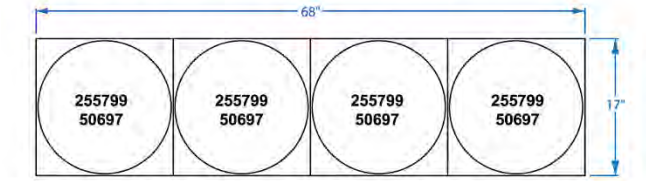
In order to retain traceability between a "heat" and each of its sub-divisions or "lifts," Carnegie first assigned a six-digit number to each heat, referred to by the mill as a "heat of steel" number. This number was used to reference records in the steel-making process. Secondly, each slab was assigned a five-digit "lift" number documenting the sheeting process and identifying each lift as belonging to a specific heat from which it was sub-divided.[9]

Each lift of austenitic sheets was marked off with a grid-work of eight 17 x 17-inch squares, each containing a circle drawn at 16 ½-inch diameter. Each of the eight sections was ink stamped inside the circle with both the five-digit lift number and corresponding six-digit heat of steel number from which they were sheeted. Marked and stamped sheets were then cut lengthwise into two 17 x 68-inch strips and trim cut into 17 x 17-inch squares before arriving at a circling shear to be further trim cut into a helmet disc. Each resulting 16 ½-inch diameter disc that passed quality inspection was coated with oil and banded into bundles of 400 for crating and delivery by freight car to McCord for pressing and fabricating.[10]





Each sheet was marked off into a grid of eight 17 x 17-inch squares. Within each square a 16 ½" circle was drawn and within each circle were two ink stamped numbers. The first stamp indicated the Mill's 6-digit heat of steel number and the second the Mill's 5-digit lift number.



The marked and stamped 68 x 34-inch sheets were cut lengthwise into 17 x 68-inch strips then trim cut into 17 x 17-inch sheets and delivered to a trim cutter for circling into 16 ½" discs.

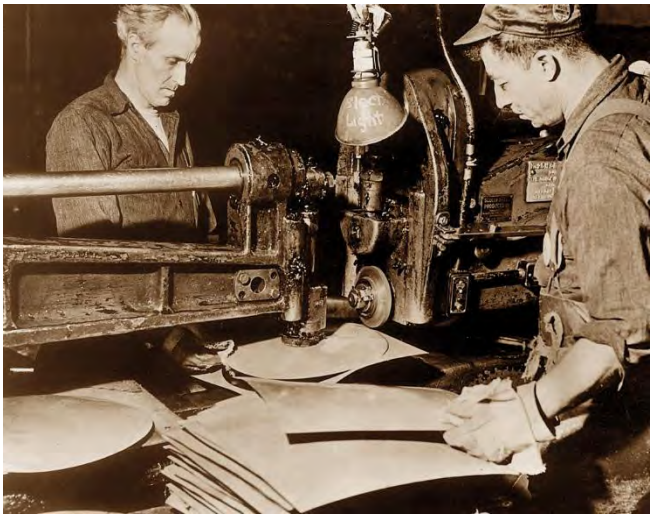


FIG 4. Carnegie-Illinois Steel Corporation - Employees at the Gary Sheet & Tin Mill cut sheets of Hadfield's manganese steel into 16 ½" discs for helmets. (Credit: U.S. Steel Corporation Ref. Dept. - Author's Collection)

FIG 5. Carnegie-Illinois Steel Corporation - During a plant tour, a finished M1 helmet is shown in comparison to the helmet discs from which it was fabricated. (Credit: ACME -20 March, 1943- Author's Collection)

FIG 6. McCord Radiator & Manufacturing Company, Detroit Michigan circa 1935 (Credit: Author's Collection)

Upon arrival at McCord, crates of helmet discs were assigned lot and lift numbers as they were received. This number was intended to travel with the helmet as a permanent record of the steel used in its manufacture. In its most basic form, the numbering system was created for the purpose of traceability between helmets, at any point of manufacture, to that of the steel sheets provided by the steel mill. In essence, the lot and lift number was for quality control and used to identify all helmets within a particular lot and lift to that of the steel mill's records on the lift and the heat from which they originated. Should any helmets from a given lot and lift present with defects or fail the prescribed bend, magnetic, microscopic, or ballistics test, all helmets manufactured from that lot

and lift -- as well as all helmets from the same heat – could be identified and inspected for disposition.[11]

At the time this numbering system was developed, Carnegie-Illinois Steel Corporation was the only steel provider and McCord Radiator and Manufacturing Company was the only fabricator. McCord originally developed this alphanumeric numbering system to document traceability between batches of helmet steel provided by Carnegie and that of the M-1917A1 helmets they were fabricating at the time (1940). McCord continued to use this numbering system when fabrication transitioned to the M-1 helmet in September of 1941.[12]

This alphanumeric numbering system was expressed as a series of numbers followed by a capital letter and accurately expressed as a "lot and lift" number. In correspondence of the time, however, the number is generically referred to as a "lot" number. The numbers were issued, in sequential order, to each individual heat of steel number received from a steel mill. The letter was issued in sequential order at the time each individual lift of a given heat was received for processing.[13]

For example, when the first crated discs from Carnegie's heat of steel number 255799 arrived at McCord, they were assigned the next available McCord lot number of 596. As each sub-division or "lift" of the heat was unloaded from freight cars, they were received under the assigned lot number of 596 followed by a letter, beginning with the letter "A." In this case, Carnegie's lift number 50697 was the third lift received from this heat and therefore assigned the letter "C," resulting in Carnegie's heat number 255799 and lift number 50697 equating to McCord's lot and lift number 596C. Carnegie's lift number 50695 of the same heat was the fifth lift received and therefore assigned the letter "E", resulting in Carnegie's heat number 255799 and lift number 50695 equating to McCord's lot and lift number 596E. Simply put, the Carnegie heat of steel number correlates with McCord's lot number and the Carnegie lift number was represented by the letter assigned to the lift in the order it was received at McCord, *(FIG 7).*

It is important to understand that lot and lift numbers were assigned to crates of helmet discs upon receipt at the fabricator and not in reference to the day that sheets were pressed into helmets. Multiple "lifts" were received at McCord on a daily basis for conversion into helmets and although great care was taken to keep all the lifts of a given heat together during the manufacturing process, apparently little thought was given to the order in which any given lift was staged for production. Arsenal documentation indicates that the sheets of each individual lift were not loaded, shipped, received, or pressed into helmets based on the sequential order of their mill-assigned lift number or by the order that the fabricator received the lifts.[14]

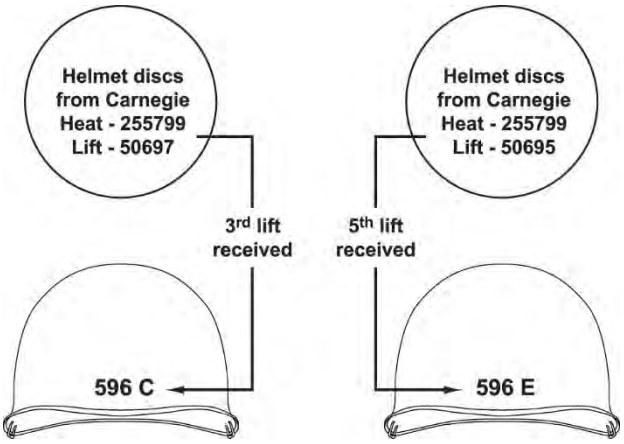


FIG 7. Helmet discs arrive at McCord bundled 400 per unit labeled with both the Carnegie heat of steel No. 255799 and a corresponding Carnegie lift number. Each lift comprises about five units totaling approximately 2,000 helmet discs. McCord receives Carnegie's heat of steel No. 255799 under the next available McCord lot number (596). As receiving progresses, units of discs of each Carnegie lift for heat 255799 are unloaded, in no particular order, and received under a letter of the alphabet. As it turns out, Carnegie lift-50697 was the third lift unloaded and was therefore assigned the letter "C" (596C) whereas Carnegie lift-50695 was unloaded fifth and was assigned the letter "E" (596E).

FIG 8. Carnegie-heat of steel No. 160158 received at McCord under lot No. 843. Carnegie-lift No. 70121 was assigned the letter "D" by McCord indicating it was the 4th lift of heat 160158 received. (Credit: Author's Collection)

FIG 9. McCord Radiator & Manufacturing Co. - Manganese steel discs from Carnegie heat of steel No. 155643 are formed into a helmet in a single operation at one of many drawing presses. (Credit: Library of Congress-April, 1942)

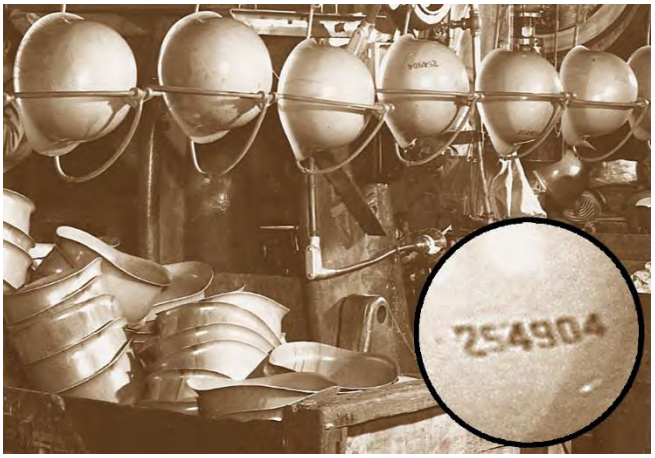


FIG 10. McCord Radiator & Manufacturing Co. - Stamped and trimmed helmets made from Carnegie heat of steel No. 254904 travel in a continuous chain conveyor on their way to receive a rim. (Credit: Library of Congress-April, 1942)

FIG 11. McCord Radiator & Manufacturing Co. - A helmet visor from Carnegie heat of steel No. 245912 is "cold-worked" in a "spanking" operation, which bends the visor down a small degree. (Credit: Library of Congress-April, 1942)

Prior to staging helmet steel to the production floor, a quality inspection was performed on sheets to verify their ability to accept the necessary deep draw without breakage. The helmet discs of each lift were required to meet the prescribed bend, magnetic, microscopic, and ballistics test specifications as first outlined in spec AXS-645 and later in spec AXS-1170.[15] Sheets that passed inspection were delivered to a small punch press where each was embossed with a fine-line stamp of their assigned lot and lift number.[16]

After receiving a lot and lift number stamp, sheets were delivered to large presses that pressed them into a 7-inch deep pot. From this point in the fabrication process until the helmet body received paint, each helmet body visibly had both the Carnegie heat of steel and lift number stamping as well as the McCord lot and lift number stamp.[15]

Schlueter Manufacturing Company of St. Louis, Missouri, June-1942 to August-1945[17] altered the McCord lot-numbering system with the addition of a capital "S" to differentiate helmets of their manufacture from those produced by McCord[18] (e.g. S-199A). Parish Pressed Steel Company of Reading, Pennsylvania, March-1945 to August-1945 differentiated their helmets by stamping a capital "P" in front of the lot number (e.g. P-2D).[19]

Another modification to early lot and lift numbers arose from experiments performed to resolve issues like "age cracking." Age cracks were fractures in the helmet body that occurred over time after a helmet had been manufactured. They were due to residual stress left in the steel from being "cold worked"[20] into its pot shape and were caused by both the quality of helmet steel and the cold working necessary to shape the helmet and achieve its required ballistic strength. Records from Watertown Arsenal indicate that tests were conducted on steel of varying formulas at McCord,[21] and on an edge-annealing process at Schlueter, in an effort to stop the formation of cracks.[22] When tests were authorized, the pressing concern would receive the sheets from the mill assigning the heat a standard lot and lift designation with the addition of a number after the alpha suffix to segregate the lot from the control. An example of this was a test performed to determine the effect of edge-annealing on age cracking in the helmet visor. Discs from Sharon Steel Co. heat No.73191 and Schlueter lot and lift number 213B-S were pulled and separated

into two test groups - 213B2-S and 213B3-S. 213B2-S was the control and was manufactured under current standards while group 213B3-S had the brim annealed in a seam welder.[23]

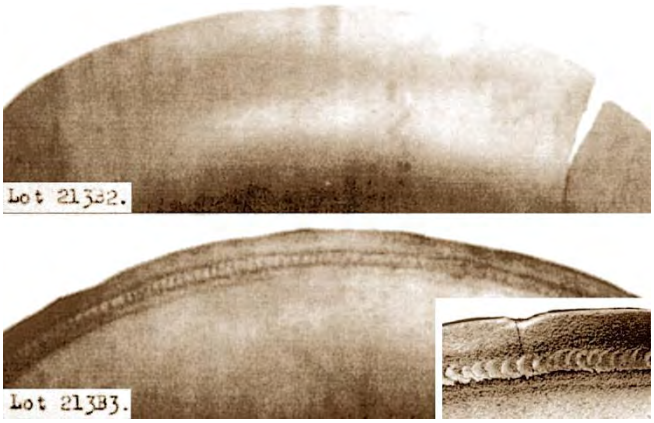
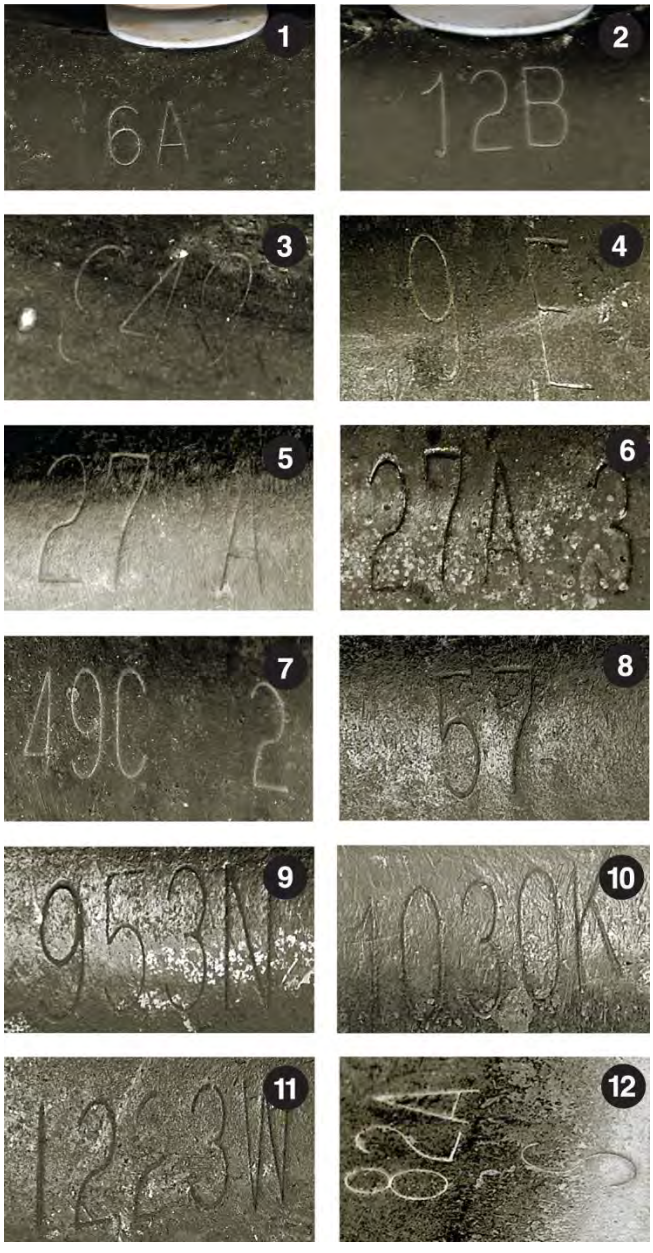


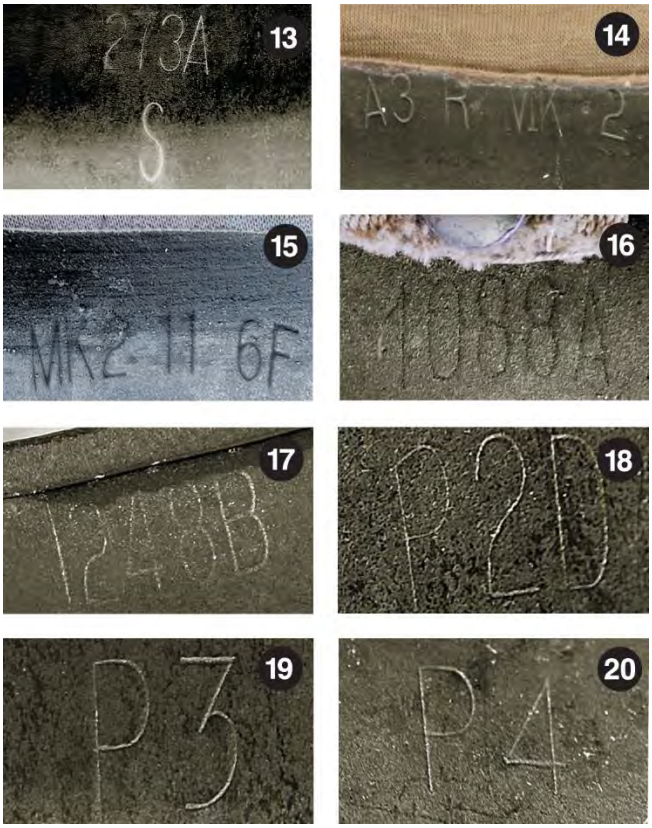
FIG 12. (WAL) Seam welding applied to the visor of the M1 helmet during experiments attempting to prevent age cracking. (Credit: Watertown Arsenal Laboratory Report WAL 710/612 -April, 1944)

Arsenal records provide little insight to specific pressing dates. They relate that all McCord lots of 55A or below were manufactured prior to January 24, 1942. McCord lot 88 was pressed on April 8, 1942; lot 148 on July 24, 1942; and lots 863 and 865 were pressed on August 19, 1944. (When the dates of known examples, like those above, are compared to the date they should plot on the aforementioned chart combined with the fact that lot and lift numbers were assigned to helmet discs upon receipt at a pressing concern -- not when they were fabricated). And with the knowledge that lot and lift numbers were quality control tools used to connect helmets to the records of the steel manufacturing process (which would have been considered irrelevant in a production environment unless the steel presented with a defect), the deficiencies of this or any chart attempting to divine the date of a specific helmet's production becomes evident.

In fact, even with answers to questions on the rate of production as compared to the rate of receipt, knowing if discs were staged direct from receiving into production or if they were warehoused (and, if so, how they were stored)[24] would only serve to further convolute dating helmet production by lot and lift number. Lot and lift numbers are a valuable tool when used within the confines of what is known about them however, precluding actual production records from pressing concerns, all lot and lift numbers can contribute to the date of pressing is a ballpark guess dividing helmets into early, mid, or late-war categories. Perhaps one day actual pressing records will surface, but until such time each M-1 helmet collector/historian must answer for himself how to handle lot and lift numbers – as a divining rod or as a tool.

FIG 13. Typical thin line stamped lot and lift numbers found in helmets of WWII manufacture. Note the lack of an alpha lift suffix in several examples. The reason for the lack of a lift letter may be as simple as the quantity of helmet discs provided for the pressing was a small enough subdivision of the heat from which they came and was therefore unnecessary. This was certainly the case regarding the experimental TS-3 helmet, which was a contract for a quantity of 200 complete helmets. Further research may one day definitively answer this question. (Credit: Author's Collection)





McCord Radiator & Manufacturing Company M1917A-1 helmets (1, 2) - McCord TS-3 helmet (3) - McCord early wartime manufacture M-1 helmets (4, 5, 6, 7, 8) - McCord late war time manufacture M-1 helmets (9, 10, 11) - Schlueter Manufacturing Company M-1 helmets (12, 13) - McCord early manufacture Navy MK II helmet (14) - McCord late manufacture Navy MK II helmet (15) - McCord M-3 flak helmet (16) - McCord M-5 flak helmet (17) - Parish Pressed Steel Company M-1 helmet (18, 19, 20). (Credit: Author's Collection)

Notes:

1. *Heat stamps and lot numbers are M-1 helmet collector slang terms used generically in reference to a thin line stamp of numbers and letters pressed into the inside visor of a M-1 helmet. (Parish Pressed Steel placed their stamp to the right inside body near the chinstrap loop)*
2. *Regis Giard and Frederic Blais, Helmets of the ETO: a historical guide, (Histoire & Collections Paris 2007), 27.*
3. *Conversation with Joshua Murray, Owner of J. Murray Inc. 1944, http://www.jmurrayinc1944.com/*
4. *Watertown Arsenal Laboratory - Experimental Report No. WAL 710/700, Investigation of Fractures Responsible for Service Cracking of M1 Helmets, A. Hurlich, September 18, 1944*
5. *Ibid., 3.*
6. *Billets are semi-finished solid metal forms.*
7. *Austenitizing is part of the heat treatment processes of steel. Heating helmet steel to 1800˚F creates changes in the crystal structure allowing the steel to absorb carbon in order to provide strength and resistance to the steel. Undissolved carbides due to improper heat treatment at the steel mill were a major factor in production breakage and age cracking of the M-1 helmet.*
8. *Report WAL 710/700, Appendix F., 2.*
9. *Ibid., 7.*
10. *Steel, Volume III, "New Combat Helmets", (Cleveland, Ohio, October 5, 1942)., 123.*
11. *Report WAL 710/700., 7.*
12. *Ibid., Appendix A., 2.*
13. *Ibid., Appendix A., 13-15.*
14. *Ibid., 7.*
15. *Originally, AXS-645 "Helmet, Steel, M1" covered the purchase of steel and fabrication of helmets however; it was limited in scope and not rigidly followed by all parties involved. It underwent revisions as knowledge of the necessity of both steel quality and manufacturing practices was gained. In March 1944, it was replaced by AXS-1170 "Steel Nonmagnetic, Sheet and Strip (for Body Armor and Helmets)"*
16. *Steel, Volume III., 123.*
17. *Mark A. Reynosa, The M-1 Helmet: A History of the U.S. M-1 Helmet In World War II, (Schiffer Publishing Ltd.; Atglen, PA 1996)., 23.*
18. *Floyd C. Shoemaker, Steel Bonnets For The Yanks, (Missouri Historical Review; Volume 39, No. 4, July 1945)., 497*
19. *Watertown Arsenal Laboratory - Memorandum Report No. WAL 710/794, Investigation of Helmets Conducted at Watertown Arsenal 1940 – 1945, A. Hurlich, March 15, 1946., 11*
20. *"Cold Working"- Manganese steel becomes harder and stronger when worked "cold" or without using heat. The entire M1 fabrication process was performed cold. When the steel was not completely austenitic it was too brittle for the initial draw or would "age crack" on the visor where a spanking process had cold worked the metal in the opposite direction of the draw.*
21. *Report WAL 710/794., 13.*
22. *WAL 710/612, A Study of the Seam Welding Process Applied to Prevent Stress Cracking of the Visor of the M1 Helmet, A. Hurlich, April 13, 1944*
23. *Ibid., 3.*
24. *In manufacturing, "ideal value stream" defines as raw materials receipt moving directly to production then to shipping. In reality receipt is often greater than production and warehousing raw materials becomes necessary. In this scenario (FIFO), first in first out, becomes ideal as the first received would be produced first, minimizing risk of damage to raw materials. However, storage environments rarely allow for FIFO. Materials are stacked against walls creating FISH, first in still here, meaning units received later are converted first while the first units received remain in the warehouse until the final days of the production run. – (Principles of Lean Manufacturing).*