

CQMD HISTORICAL STUDIES: Report No. 5

THE HISTORY OF THE HELMET LINER

By

Merion Massen

Historical Branch, Technical Information Division
Chicago Quartermaster Depot, ASF
Brig. Gen. J. E. Barzynski, Commanding

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FOREWORD

This monograph on the history of the helmet liner has a double purpose: to give the main historical facts of the development of one of the unusual items designed for World War II from the first conception to fast-rolling production; and at the same time to give a somewhat detailed account of the procurement of the liner as it has been carried on by the Chicago Quartermaster Depot, the sole procurement agency for the item.

In the series of studies prepared on the special activities of the Chicago Quartermaster Depot, this monograph is No. 5, and the first to deal with a Clothing & Equipage item. The bulk of the Chicago Quartermaster Depot historical studies deals with subsistence, since procurement and development of subsistence items are outstanding activities of the Depot and the Quartermaster Subsistence Research & Development Laboratory located at the installation.

Although the helmet liner is by no means the only C & E item developed especially for this war by the Quartermaster Corps, it is considered one of the main contributions to a soldier's comfort and safety, and because of the Chicago Depot's important role in turning it out for troops, its story was chosen for writing as one of the outstanding facets of the Depot history in World War II.

The function of the Chicago Depot in the procurement mission was more or less paternalistic in helping the new industry; and the many problems peculiar to this function are described in the monograph as they arose and were solved.

J. E. BARZYNSKI,
Brigadier General, Q.M.C.
Commanding.

PREFACE

The history of the helmet liner as set forth in this monograph treats only of the origin, development and procurement of this piece of equipage which first came into use with World War II. Detailed information as to the success of the liner in the field is lacking, for reports on the helmet liner in action are thus far very limited at both the writer's station and in the Office of The Quartermaster General.

Facts for this report were gathered from a variety of sources. Correspondence files of the Helmet Liner Section, Miscellaneous Supply Branch, Procurement Division, at the Chicago Quartermaster Depot, supplied the largest proportion of the information used as basis for writing. Much supplementary information was obtained, however, through interviews with Maj. M. C. Pratt, officer in charge of the Miscellaneous Supply Branch, Capt. C. R. Raattama, of the same Branch, since assigned to the Inspection Branch, and Richard C. Linn, principal inspector on helmet liners, who were helpful also in clarifying puzzling statements and situations described in documents examined. Mrs. Mary Schwartz, clerk in charge of the Contract Section, brought together statistical information on contracts and costs which proved most valuable in writing certain sections. Background material of value also resulted from visits to the Scholl Manufacturing Company and the Seaman Paper Company, the latter the one Chicago firm engaged in the manufacture of the helmet liner. Some note material was forwarded, in answer to specific requests, by the Historical Section, Office of The Quartermaster General.

To the above individuals and others in the Procurement Division who assisted the writer in assembling the facts for this monograph an expression of thanks is made. As in the case of other historical accounts of this type written at the Chicago Quartermaster Depot, the raw research material of correspondence stands out as the main source of information; consolidated reports and diaries or daybooks which would be useful in filling out the story rarely exist. Substantiating knowledge frequently is needed to confirm into fact information gleaned from correspondence, and such knowledge is most swiftly, and, it is hoped, most accurately secured from persons who have had a close association with the subject under study. In fact, it is quite correct to say that without the aid of these persons in the Procurement Division, it would have been almost impossible to produce the history of the helmet liner.

Chicago, Illinois
April 30, 1944.

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INTRODUCTION

When the Chicago Quartermaster Depot was charged with the procurement of Liner, Helmet, Steel, M-1, in early 1942, it faced one of the most unusual procurement assignments, among equipage items, of World War II.

An auxiliary to the newly redesigned steel helmet, without which the latter in fact could not be worn, Liner, Helmet, Steel, M-1, in itself was a completely new item. The concept of using a hat-shaped lining for a helmet had never before been considered in the long history of warfare; and while the idea had already been adopted by the War Department when the Chicago Quartermaster Depot was assigned its procurement, the design for the liner still was in the formative stage. Though the new type steel helmet which it was to carry was already in work, first production of the liner, as a fiber "hat," was barely contracted for, and there were no guidelines on such factors as production rate and cost price. The fact that the liner design as finally conceived in the Military Planning Division of the Office of The Quartermaster General involved the use of plastics, introduced yet another element of uncertainty. With plastics still in the experimental realm, there were many chances for miscalculation in the production process, and little in the way of experience to make possible the laying down of rules. Thus the Chicago Depot was confronted with several out-of-the-ordinary problems in fulfilling this procurement mission.

Approximately 15,000,000 plastic helmet liners were put into production from February 1942, to July 1943, the first year and a half of

procurement, and the period during which many of the difficulties that beset the item at the start of manufacture were overcome. During this period, industry and the Quartermaster Corps worked together closely to bring about the solution of these difficulties, with the Chicago Quartermaster Depot assuming appreciable responsibility, handling matters that ranged from technical troubles to materials supply. In describing and analyzing the part played by the Chicago Depot as sole procurement office for the helmet liner, this monograph in effect becomes a history of the development of the liner because of the Depot's association with the item from its earliest production stage.

CHAPTER I. FORBEARS OF THE PLASTIC HELMET LINER

The Liner, Helmet, Steel, M-1, is a totally new development of World War II. It has utilized a new material for soldier headgear---plastics---and performed a function entirely different from the helmet in previous warfare, acting both as a hat and as additional helmet protection. The helmet and liner combination in a way reverses the idea of one General Adrian, French Army Officer in colonial service before World War I, who upon seeing one of his men wearing a metal mess-bowl inside his hat introduced the metal cap under the kepi as equipment of every French soldier on active duty.¹ The steel helmet and its liner are a radical departure from the "tin hat" worn by the American doughboy in the first World War, which was neither comfortable nor an adequate protection from shrapnel flung upward from the ground. "M-1917", as the World War I helmet was called, was so heavy that it gave the wearers stiff necks when they used it as a rain hat back of the fighting front; the head harness which carried the helmet was attached to it with large rivets which frequently were driven into the skull with a direct hit from bullet or shrapnel.

The helmet of World War II is comprised of an outer steel body which is pot-shaped, and a snugly inserted plastic shell which contains a suspension, or hammock, to fit the whole assembly comfortably to the wearer's head.² Except in the tropic theaters of war, the steel

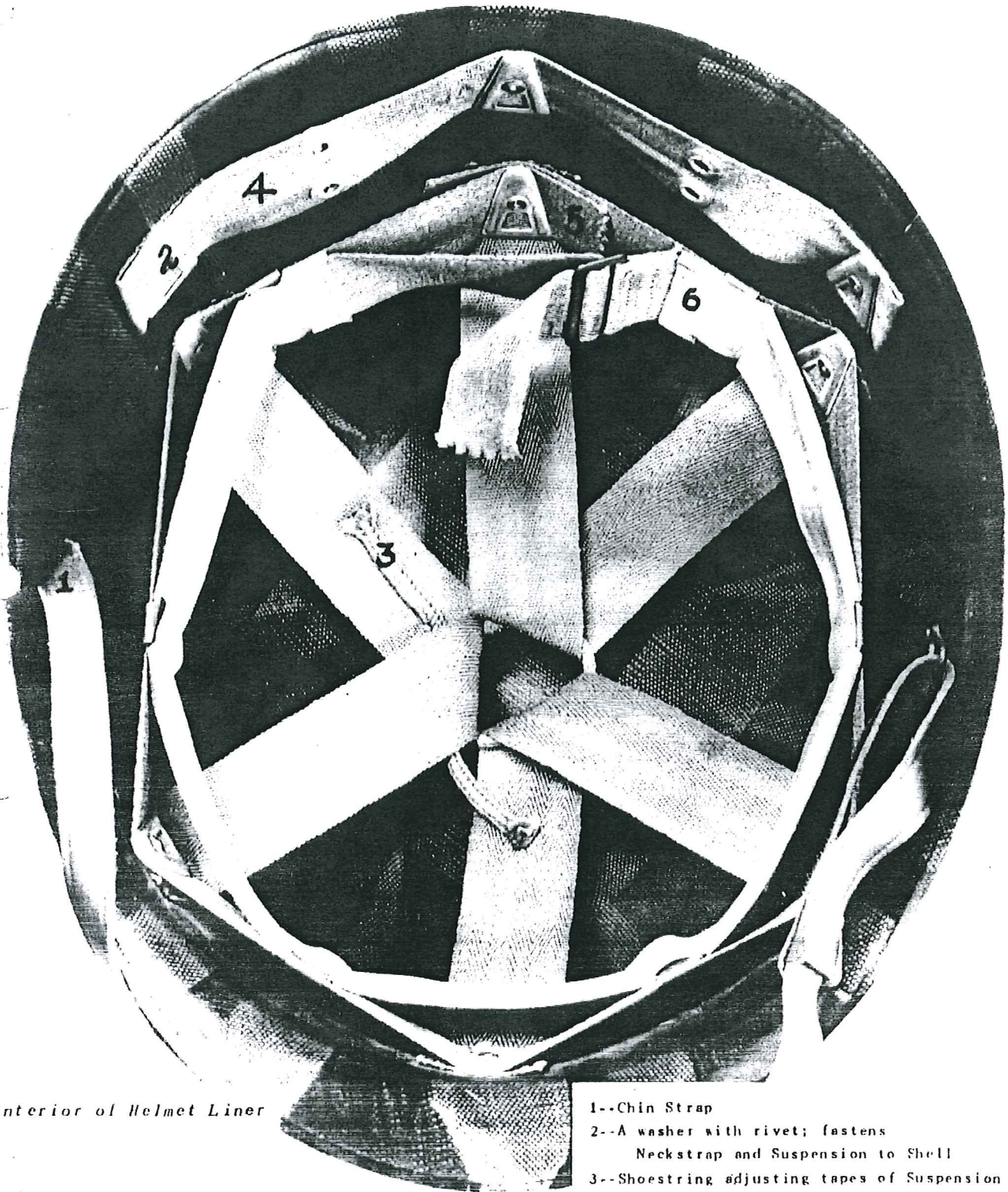
¹Bashford Dean, Helmets and Body Armor in Modern Warfare (New Haven: Yale University Press, 1920), pp. 55-56.

²See illustrations.



Liner, Helmet, M-1 on head of soldier is about to have "snapped" over it the steel helmet.





Interior of Helmet Liner

- 1--Chin Strap
- 2--A washer with rivet; fastens Neckstrap and Suspension to Shell
- 3--Shoestring adjusting tapes of Suspension
- 4--Neckstrap, to which Neckband (not shown) is snapped
- 5--Suspension
- 6--Adjustable Headband

helmet and the liner are always worn in combat. In jungle warfare, where stealthy movement is very important, the steel hat has been found to cause noise when branches brush against it, and the helmet liner sometimes is used alone for combat fighting.³ Behind the lines, in all theaters, the liner becomes a safety helmet, in use as a garrison cap, and is suitable both for tropic and, with addition of a specially designed knit cap, for Arctic wear. The steel helmet in this situation being without head harness, can be used as a wash basin, water bucket or in dozens of other ways. Together, helmet and liner weigh approximately 3 pounds; the liner by itself about 10 ounces. The helmet with the liner will withstand penetration of a .45 calibre bullet at a 5-foot range, and the liner alone will take a direct hit without splintering. Made in one size, to fit the conformity of the steel helmet, the liner carries an adjustable headband inside the suspension which, with a neckband in three sizes, makes possible a close fit to every head. The outer surface of the helmet, which is finished in olive drab or camouflage, reflects no light, being treated with a dull-finish, textured paint.

Since January 1, 1943, every new soldier in the Army Ground Forces has been issued a helmet liner, which he becomes used to long before he dons the steel cap for combat; and the liners have become more or less familiar sights in this country, being worn in troop travel to avoid packing them.⁴ Parachutists in the airborne troops of

³ Interview with Maj. M. C. Pratt, officer in charge, Miscellaneous Supply Branch, Procurement Division.

⁴ In January 1944, the helmet liner was made an article of the uniform, which meant that any non-soldier wearing one could be held by Military Police and the person who supplied it to him charged with the violation. Section 125, The National Defense Act.

the ground forces, and the ground crew members of the Army Air Forces likewise wear the helmet liner, and the U. S. Navy and Marines procure it for combat use. A total of nearly 30,000,000⁵ of the liners have been contracted for since February 1942, when they went into first production.

Helmet Liner Developed as a Joint Product--The liner for the combat helmets of World War II armed forces developed as a joint product of the Army Ordnance Department, the Quartermaster Corps, private invention and private industry. The Quartermaster Corps, which was responsible for much of the research on the liner before its design finally was perfected, and which made entire procurement from the start, was concerned most closely with it.

The helmet liner may be said to have derived from a plastic football helmet and suspension invented and patented by John T. Riddell, a Chicago manufacturer of football supplies.⁶ This helmet, in limited production about a year before the emergency was declared, consisted of two thermoplastic halves fastened together, under which was a paper pulp helmet similar to that used in tropical helmets. It was first brought to the attention of the military in early 1941 through

⁵Procurements through the year 1944 included in this figure.

⁶The use of a fiber "sandhog's" helmet as all-purpose Army headgear was suggested by a Quartermaster officer as early as 1932, at a time when a study was under way looking toward a replacement for the service hat. The idea of supplementing it with a steel cap for combat use was also brought forward at that time. The Office of The Quartermaster General, however, did not take up the project and it has not been possible to trace a line of development from this suggestion to the present helmet liner. Apparently the Infantry Board took up the helmet liner project several years later from an entirely different point. Comment of Dr. Thomas M. Pitkin, Historical Section, OQMG, and copy of letter in OQMG Procurement Planning File (400.12): Substitute for Service Hat, May 16, 1932, in communication from Capt. A. K. Thornton, Officer in Charge, Historical Section, OQMG, to Capt. Joseph H. Burkhart, Historical Officer, CQMD, SPQGH 421.2 Chicago, 1st Ind., May 20, 1944.

Col. H. G. Sydenham, member of the Infantry Board stationed at Fort Benning, Georgia. Colonel Sydenham had been approached by John T. Riddell, Jr., at Fort Benning, who suggested the football helmet as part of the equipment of parachute troops training there. At the same time Colonel Sydenham and others were attempting to work out designs for a steel helmet shell of more adequate protection to replace the M-1917 of World War I. The result of the meeting between the colonel and Mr. Riddell was the fabrication of a model for a helmet assembly---shell and liner.⁷ After certain field tests at Fort Benning, this experimental helmet assembly was given tentative approval by the War Department, and the Ordnance Department instructed to follow through with further experimentation. The Riddell company was turned to, and sample helmet liners made up by injection molding⁸ with tenite the plastic. The liner made by this method was much heavier than the War Department cared to have, however, and steps were taken toward a substitute for plastics, though the suspension was definitely accepted⁹ and Ordnance designers were at work on such details as headbands and chinstraps.

⁷ The original version of M-1, of vinylite, a plastic which could be molded in hot water, was made in Colonel Sydenham's kitchen by young Riddell to fit a new-type pot-shaped steel helmet beaten out by the local blacksmith. Interview with John T. Riddell, Sr., Chicago, Jan. 28, 1944.

⁸ Injection molding is accomplished by a kind of "squirt gun" operated by hydraulic pressure in contrast to compression molding done by weight pressure, which came to be the preferred method on helmet liner manufacture.

⁹ The War Department secured permission to utilize the plastic helmet and suspension on a license basis, paying John T. Riddell a percentage on the first 2,000,000 helmet liners manufactured on his patents No. 1886551 and 2250275. The Riddell Company at this writing still makes a few football helmet-type "crash hats" for the parachute troop trainees. Interview with Mr. Riddell, Jan. 28, 1944.

There was great necessity for speed in securing some kind of satisfactory liner, for since February 1941, dies had been under construction at the McCord Radiator and Manufacturing Company to produce the new steel helmet, which could be worn only with a liner, and instructions had been given to discontinue production of the M-1917 model about May 1, 1941.¹⁰ Given some assurance that they would receive orders for both helmet and liner, although procurement for them actually was not cleared through the War Department until May 16,¹¹ the McCord company relinquished the injection molding idea and proceeded to get in touch with the Hawley Products Company at St. Charles, Illinois, which already was producing tropical helmets for the Army. Without specifications, invitations for bid or other official description of the still rather nebulous liner, the Hawley firm was asked to accept the assignment of making samples and dies, on the chance it might later receive a sub-contract from the McCord company. Attacking the problem at once, the Hawley engineers, in collaboration with research personnel of the McCord company and

¹⁰The McCord Radiator and Manufacturing Company, Detroit, Mich., was the sole manufacturer of the M-1917 helmet for the new Army of 1940-41, and continued as sole contractor for the M-1 model replacing it until late 1942, when oth other company was given contracts. See Appendix VI.

¹¹On this date, the Standards Division of the Office of the Under Secretary of War charged the Ordnance Department with the purchase of 962,000 helmets of the new M-1 type, complete with liners, headbands and neckbands, and instructed that after this first lot had been contracted for, Ordnance was to continue buying the steel helmet bodies but the Quartermaster Corps was to have charge of procuring liners and straps. The ultimate transfer of procurement of the liner from Ordnance to Quartermaster thus was provided for in the original instrument authorizing purchase of the item. 1st Ind., War Dept., Office of the Under Secretary of War, Washington, D. C., May 16, 1941, to the Adjutant General, Washington, D.C.

others,¹² within a short time produced samples which to them seemed to approach closely what the Army wanted. Between April 3 and 11, 1941, the first complete liners came off the assembly line and 100 of them were shipped for trial use. On April 28, the Office of The Quartermaster General telephoned the Hawley Company its approval of the samples, and asked that preparations be made for large-scale production.

The first helmet liner looked very much like a tropical helmet.¹³ According to the specifications, which were written several months after the first samples were accepted and bought by the Army, the fiber body was to be made of

two shells, each a one-piece rigid fiber form, impregnated with varnish or other water insoluble and water repellent materials, securely cemented together with a suitable thermoplastic or thermosetting material which shall be insoluble in water.¹⁴

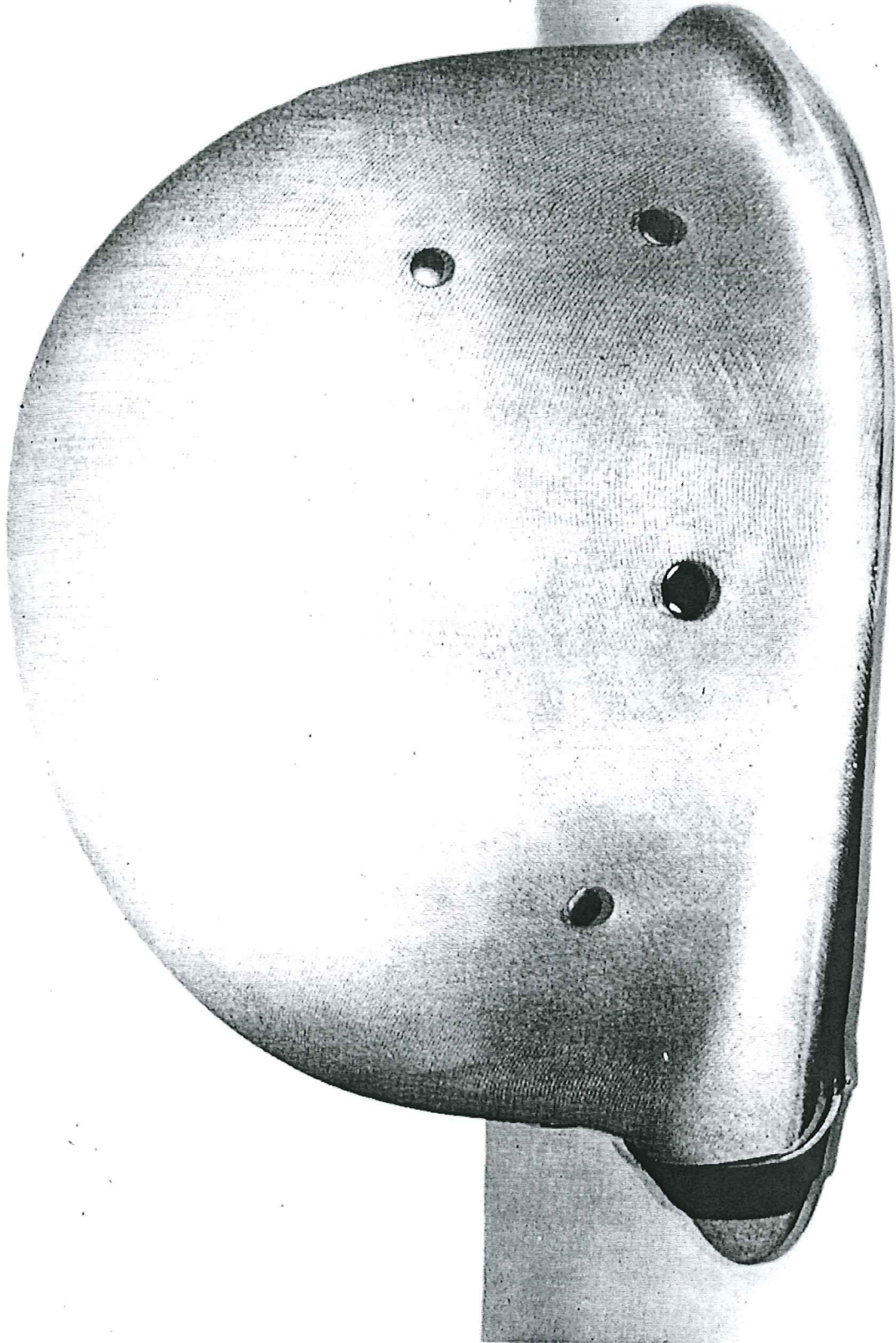
Over this body was cemented smoothly a piece of olive drab gabardine or twill; the shape and size of the "lining," as it was called, was to be such that it would slip-fit into the M-1 steel helmet. A suspension, neckstrap at back of neck, and adjustable chinstrap were considered part of the fittings, the headband and neckband inserts, of varying sizes to fit individual soldiers, being supplied when the liners were issued the soldiers. The strength test of the liner proper was that it support, when dry, "a load on top of the crown of 100 pounds without failure at rim or sides of the crown."¹⁵ Under a temperature variation

¹²The Lilley Company, a Detroit company working with the George R. Carter Company, a firm also in the Detroit area, was asked to make up a webbing suspension according to the Riddell pattern. The rayon webbing which the company supplied was accepted for only a brief period, however, because it failed to meet strength tests. Interview with Garnett C. Skinner, Scholl Mfg. Co., Dec. 16, 1942.

¹³See illustration.

¹⁴Ordnance Department Tentative Specification, AXS-644, dated Oct. 30, 1941.

¹⁵Ibid.



Side view of the Hawley fiber liner.

from -50° F. to -170° F. there could be no substantial change in the physical characteristics of the helmet. A tear test of the leather in component parts, a try for fit in the steel helmet, and a webbing tear test comprised the other tests specified.

Owing to the volume of liners required, the Hawley Products Company had to construct a new building and secure a quantity of new equipment including stage ovens, hydraulic drawing presses, trimming presses, a conveyor oven and toggle presses. These acquisitions were made at company expense, and the production line for the helmet liners was set up within a period of approximately five months. About three percent of the total number of liners were sub-contracted to the General Fiber Company in St. Louis, with the Hawley company installing equipment and supervising employees in the liner production. Approximately 3,900,000 fiber liners were made by the Hawley company for the Army from late 1941 to mid-November 1942, when production of this type of liner was discontinued. Nearly 375 employees, 40 percent of whom were women, worked on the helmet liners at the Hawley plant at the peak of production.¹⁶

Though procurement continued for a year, the fiber helmet liner was considered unsatisfactory almost from the first. It had extremely high moisture absorption, poor dimensional stability, low strength, and poor durability. The cloth outer layer was easily frayed, quickly worn through and soon soiled.¹⁷ For its probable length of

¹⁶Information in entire paragraph taken from letter of Col. C. N. Elliott, Director of Procurement, OQMD, to War Production Board, relative to "E" Award to Hawley Products Co., Jan. 29, 1943.

¹⁷Memorandum of Lt. Col. L. O. Grice, Chief, Standardization Branch, OQMG, to Chief, Clothing and Equipage Branch, OQMG: Helmet Liners for Helmet, Steel, M-1, Nov. 8, 1941.

service, it also was considered to be comparatively expensive, unit prices for the liner, with suspension and chinstrap installed, ranging from \$1.4878 to \$1.54.¹⁸

The Beginnings of the Plastic Liner---The July 9, 1941, purchase order to the Hawley Products Company for the first 950,000 fiber liners had scarcely been signed, when experimentation on liners using various plastics began in earnest in the Standardization Branch of the Office of The Quartermaster General. Contacts were established with industrial firms which seemed likely potential producers, and they were asked to make up sample plastic liners for further work-over and test by the Standardization Branch or in the laboratory of the United States Bureau of Standards. Hats for miners and firemen, and industrial helmets of various sorts were brought in for examination. The Hawley company, suspecting that its molded fiber liner would not stand up well, proposed a "plastic combat helmet liner" of "high impact plastics."¹⁹ The Inland Manufacturing Division of General Motors Corporation, Dayton, Ohio, made up sample liners of high-impact thermoplastic resins, macerated canvas molding compositions, impregnated crepe paper and fabric, impregnated paper pulp, rubber, sisal and redwood bark.²⁰ Mine Safety Appliances Company, Pittsburgh, submitted liners with a canvas base

¹⁸Some "seconds" also were bought, at prices ranging from \$1.155 to \$1.30 per helmet. Fifty-two thousand of them, at the \$1.30 price, were supplied the Chinese Army through Lend-Lease.

¹⁹Letter from S. H. Young, Hawley Products Company, to Mr. Tupper (sic), Standardization Branch, OQMG, Aug. 2, 1941. Copy in Historical Section Files, OQMG. The Hawley company was evidently anxious, before completing the Ordnance contract, to switch to plastics production which Mr. Young said could be accomplished in 24 hours, utilizing the same equipment. No contract for plastic liners was ever given this company, however.

²⁰Publicity article released by Inland Aug. 7, 1942.

treated with phenol formaldehyde resin. Other firms making up samples included the Gemloid Corporation, Elmhurst, L.I., New York, which proposed a linen acetate combination; Standard Products Company, Detroit, a thermosetting resin with impregnated felt; and Woodall Industries, Inc., Detroit, a molded sisal fiber.²¹

Meantime, the Standardization Branch, Office of The Quartermaster General, worked out with the Bureau of Standards feasible ways of testing the durability of the liner samples, and by early November 1941, the conclusion was reached in the laboratory that the best plastic helmet liner for military purposes was one made of phenol formaldehyde-impregnated cloth laminated by high pressure. Maximum toughness seemed obtainable with use of the smallest amount of resin which would give necessary waterproofness and dimensional stability to the reinforcing material. Because of the light weight desired---not more than 7 3/4 ounces including outside coating, or 11 1/4 ounces complete with suspension tapes, rivets, chinstrap, headband and neckband---the lightest reinforcement medium for the resin, such as a light-weight duckcloth, seemed necessary.²² The laminated phenolic resin-impregnated fabric, which could be impregnated up to 46 percent without resulting in a heavy hat, therefore was decided upon for production, although sample liners of cyclocized composition rubber and resin-impregnated felt also showed promise in the laboratory tests.²³

²¹Lt. Col. L. O. Grice, Chief, Standardization Branch, OQMG, to Bureau of Standards, Aug. 14, 1941.

²²"The Army Helmet Liner," Modern Plastics, XVIII, (May 1942) 35 ff.

²³Memorandum from Brig. Gen. C. L. Corbin, OQMG, to The Assistant Chief of Staff, G-4, Dec. 20, 1941: Helmet Liner, M-1.

Upon request of the Office of The Quartermaster General, approximately 600 plastic liners utilizing phenol-aldehyde-impregnated cloth were manufactured on a sample mold constructed by the Inland Manufacturing Division of General Motors, and, in competition with the Hawley fiber hat, were tested by various Service Boards, including Infantry, Cavalry, Medical, Signal, Air Corps and Anti-Tank. One-third of the sample liners were produced according to a formula submitted by the Inland company, one-third on the proposal of Mine Safety Appliances, and one-third according to the formula of the Westinghouse Electric Company, Trafford, Pennsylvania, which had lately submitted trial models. During this period of experimentation, also, the LeGrand Daly Company, synthetic rubber and plastics engineers working in conjunction with the St. Clair Rubber Company, in Marysville, Michigan, proposed a low-pressure method of molding a plastic helmet liner.²⁴

Results of the Service Board tests and further laboratory examination were reported toward the end of January 1942, at a meeting of the Quartermaster Corps Technical sub-committee in charge of helmet liner research. Although one or more members of the committee indicated reluctance to adopt a substitute for the Hawley fiber liner, the consensus was that a ballistics test at extreme ranges of temperature should prove the comparative merit of the fiber liner with the plastic type.²⁵ Accordingly, arrangements were made through the Ordnance

²⁴ Descriptions of both high-pressure and low-pressure methods of molding may be found in Chapter III of this monograph.

²⁵ Lt. Colonel Grice to General Littlejohn, Chief, Clothing & Equipage Branch, OQMG, Jan. 28, 1942: Helmet Liners. The ballistics test determined whether or not a liner would fragment in such a way that particles of liner material might be imbedded in the wearer's skull.

Department for ballistics tests at the Aberdeen Proving Ground, Aberdeen, Maryland, on February 2, 1942. Hawley, St. Clair, Westinghouse and Inland liners were tested at temperatures ranging from 20° to 30° below zero to 180° to 200° F. The Westinghouse liner performed best, followed by Inland and St. Clair, while the Hawley liners were found to have the least suitable characteristics.²⁶

Action now was rapid. The next day the sub-committee of the Quartermaster Corps Technical Committee adopted as standard a cloth impregnated helmet-liner body "similar and having the properties of" the Westinghouse liner tested at the Aberdeen Proving Ground, and recommended that other types not be bought except to meet requirements of troops until the newly adopted type was available.²⁷ The importance of the ballistics performance of the liners, as shown in the comparative tests, had been so impressive, also, that the Standardization Branch recommended that a provision regarding ballistics standards be included henceforth in procurement directives, invitations for bids, and contracts.²⁸

The Inland Manufacturing Division of General Motors received confirmation of an award for 1,000,000 of the new M-1 helmet liners on February 11, 1942, by which date Tentative Specification OQMG No. 42 had been written and amended to include the ballistics test clause. The net unit price the Government was prepared to pay was \$1.89, including the suspension, front eyelet and chinstrap.²⁹ A unit price of

²⁶Ibid.

²⁷Grice to Littlejohn, Feb. 3, 1942; Helmet Liners.

²⁸Ibid.

²⁹As in the contracts with McCord Radiator and in all other contracts to follow, headbands and neckbands were purchased separately by the Quartermaster Corps.

\$2.194 was to be paid on the first 480,000 liners of the lot, however, to help carry the amortization cost of the 73 molds required by the company.³⁰ Delivery of the entire million liners was to be completed by November 1942. Contracts for a second million liners at unit prices of \$1.833 and \$1.62 were made in February with the Westinghouse Electric Company, and Mine Safety Appliances in the same month agreed to manufacture 384,000 liners at unit prices of \$2.35 and \$2.00.³¹ The St. Clair Rubber Company, whose low-pressure hat had not stood up nearly so well in the Aberdeen tests because it tended to fragment dangerously, nevertheless was given a contract for 450,000 liners, also in February, to supplement production until manufacturing equipment for the high-pressure molding could be secured.

At the same Quartermaster sub-committee meeting marking the decision to adopt the plastic liner, it was decided to recommend procurement and test of several types of adjustable headbands, and of new-style neckbands and chinstraps which had been produced experimentally at various manufacturing plants in the search for improvements on these components.³² Thus it came about that before the first fiber liners were actually in production,³³ approval for new ways of fabricating the shell

³⁰Col. W. R. Buckley, OQMG, to Inland Mfg. Div., Gen. Motors Corp., Feb. 11, 1942.

³¹The higher unit price in both cases was allowed to help amortize the cost of tooling up and getting into initial production. See p. 32.

³²Memorandum of Colonel Grice to General Littlejohn, Feb. 4, 1942: Helmet Liners. The decision which eventually reduced the number of sizes of headbands from 13 to 1 (adjustable) involved several months of testing before acceptable products were hit upon. An account of the changes and of other alterations of design in the helmet liner components may be found in Chapter V.

³³First production date from the Hawley Products Company was in April 1942.

had been given, and before the latter methods could be placed in production, changes again were contemplated relative to the important function of fastening them on the wearers' heads. Because it was so necessary to produce the liners for the steel helmets seriously needed for combat as actual warfare got under way, however, the best possible liner available at the moment had to be ordered into production, with experimentation for improvement going forward at the same time.