War Production at Armstrong Cork Company 1940-1945

By Samuel E. Dyke

Introductory Notes By the Author

Forty years have passed since these related facts were happening, and almost half of the people involved in creating these facts have gone to their final reward.

The writer has felt for years that a written story of their achievements in Armstrong war production should become a matter of record. During the war period, production records and locations were restricted.

Few persons remain that had this *total* experience as did the author. Few records were retained by the company, and most of those used herein were retained by the writer.

This story is an attempt to record the marvelous cooperation and results achieved by these employees under the guidance of a well-instituted corporate management.

The writer cannot name individually all the persons, now living or dead, who were responsible for carrying out these achievements. They left their mark in the final tally of what was accomplished by Armstrong during World War II.

All of the records kept by the author and the late Mr. James Grove are being turned over to the custody of the Lancaster County Historical Society.

My personal thanks to George Blaisdell, J. W. Grove, Victor Despard, Ted Weeks, "Ding" Young, Dan Rhoads, and all Armstrong people who assisted in compiling this story.

Samuel E. Dyke
March, 1981

War Activities

Late in December of 1940, President Roosevelt first challenged the United States to become the "Arsenal of Democracy." It was obvious to the government and to industry that this war was to be a war of production and that the country that could produce the best aircraft, tanks, ships and guns in the shortest time and greatest numbers would, with requisite manpower and economic resources, win the war.

There were at this time, few major manufacturers of basic war materials in the United States. The potential for such production would be in the automobile and infant aircraft industry.

Where could America start this vast mobilization of the industrial might to meet the needs of the nation at war?

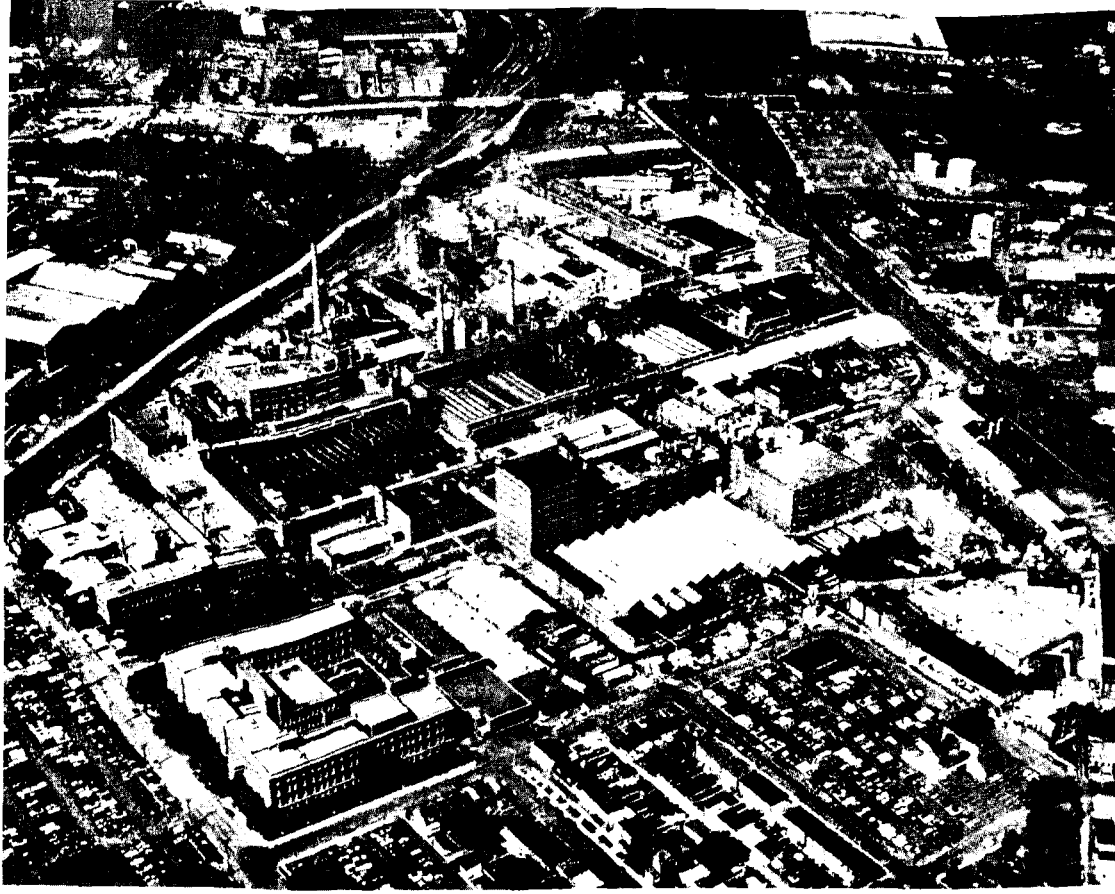
As a start, President Roosevelt, early in 1942, created the comprehensive War Production Board. This action authorized the direction and control of the industrial might of America.

Armstrong Cork Company at this time was identified in industry as a non-metal manufacturer. Its main products were all types of floor coverings, felt and insulation materials, glass bottles, metal and bakelite closures, and a full line of cork gaskets, pipe coverings, etc. Little of the major equipment used to manufacture these items was suitable for war production materials.

Early in 1939, viewing the pending European war encroachment to additional areas, Armstrong created a War Activities Committee. This committee was charged to evaluate the possibilities of producing needed war materials in any existing facilities or to suggest the creating of such necessary facility.

The chairman of this committee was Alfred Jones, who had been instrumental in making Armstrong an important manufacturer of floor coverings of all types. Also, he had created an experimental run of 4.7 mm. artillery shells in the machine shops in Lancaster during World War I.

In due course of time, this War Activities Committee reported that with our proven ability to make shells in 1918, there was no reason why we should not tool up and make shells again. Also, this committee, in visiting aircraft man-



Lancaster Plant – Floor Division.

ufacturing companies, found that hydraulic presses similar to those operating on linoleum could be easily adapted to the manufacture of aircraft parts.

At this time, the company was also beginning to feel the effects of the curtailment of shipments of materials needed in its peacetime production.

The Board of Directors decided to try to secure a contract for shells and any other product to help in the war effort and as a substitute for its loss of volume in its regular products. To accomplish this end, it created in April, 1941, a new corporate division called the Munitions Division.

This new division was headed by a former vice president and general manager of the company's foreign subsidiary, The Manufacturos de Corcho, under the direction of John J. Fitzpatrick.

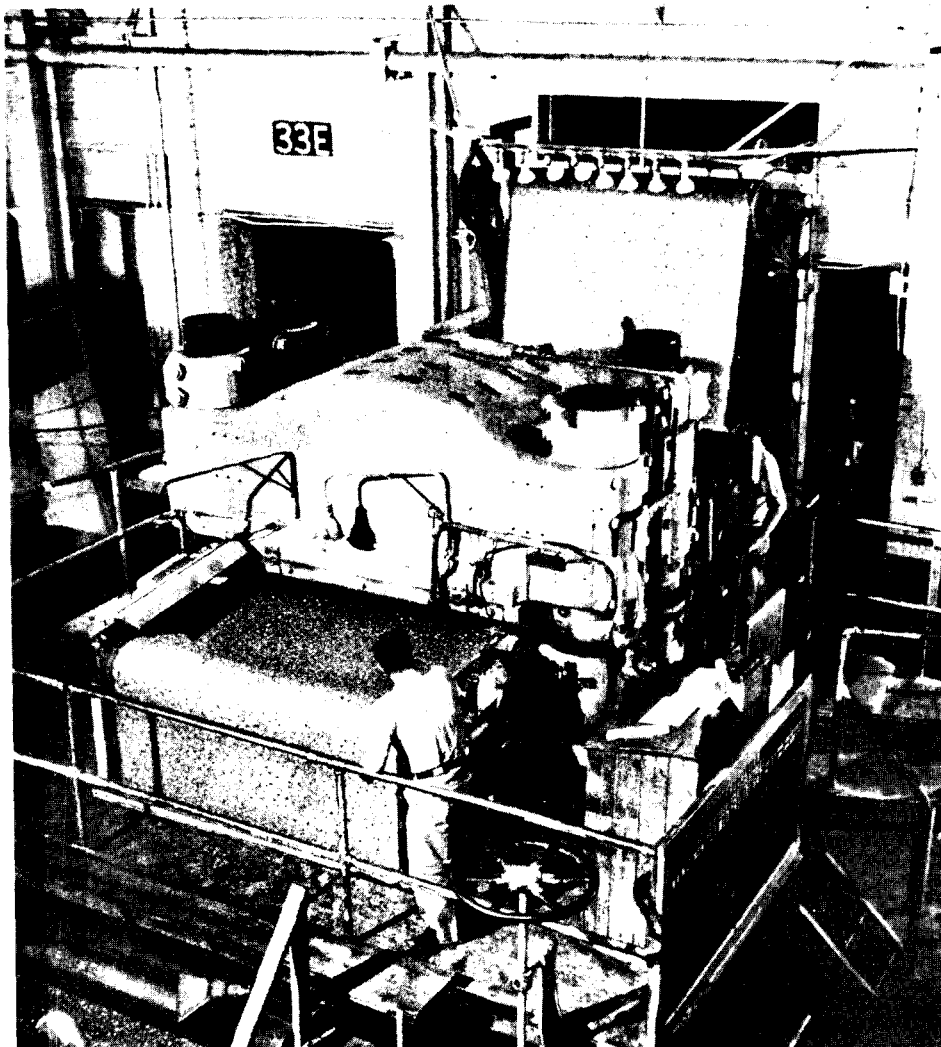
Associated for consultation with, but not responsible to Mr. Fitzpatrick, were the following heads of:

Engineering	C. F. Hawker
Manufacturing	S. E. Dyke
Research and Development	E. T. Claxton

Mr. Fitzpatrick's line responsibility personnel were:

Fred Ritts, Assistant General Manager
James H. Binns, Assistant General Manager
Alfred Jones, Consultant
Ralph Clark, Engineering Chief
Dr. E. J. Pieper, Research

Hydraulic press for making linoleum converted to make aircraft parts.



Major S. Detweiler, Washington Representative
C. B. Grove, Commodity Manager
W. L. Clausen, Industrial Engineer
L. H. Lockwood, Engineering Projects
Victor Despard, Commodity Manager
Fred Daum, Office Records
H. D. Stehman, Cost Accounting

Under this initial organization, Armstrong's munitions volume expanded from $1,000,000 per year in 1941 to $40,000,000 per year in 1945. This achievement was not easy, as was often the opinion of the uninformed. Contrary to popular opinion, contracts for munitions were not laid in the "commodious corporate lap," so to speak. Securing contracts was accomplished by perseverance, courage, sound "back-up organization" and a lot of hard work by everyone concerned. The rapid growth of munitions contracts came through persistent solicitation, with a corporation willing to take capital risks and provide sound engineering.

The Munitions Division's organization and line of authority and responsibility impressed the various military Ordnance Divisions visiting the company, and, our performance on the first shell contract awarded in January of 1941 additionally impressed them.

Each munitions contract received was analyzed and assigned to a commodity manager for its execution. These commodity managers were responsible for every phase of the contract's execution and worked very closely with corporate heads of engineering, production and research.

After a munitions item had been investigated, cost assembled and quoted to Ordnance, nothing further except follow-ups could be accomplished. When we received the order from Ordnance, the following steps were taken.

1. All drawings, specifications and details, along with the original estimate of cost, went to the munitions commodity manager responsible for it.

2. All necessary tooling, gauges, equipment needed were checked, made and placed in the Production Planning Department by the Engineering Department.

3. Sub-orders from Production Planning to Purchasing to Manufacturing. Inspection started the order in the plant to which it was assigned.

As previously pointed out, Armstrong had very little metal-working equipment. Many of the prime contracts secured, some 70%, had to be subcontracted locally. In order to handle this volume, a Subcontract Department was established. This department was really an extension of the corporate Purchasing Department. During the war period, a total of 5,300 subcontracts was made to local companies which generally had less than a total of 100 employees. The dollar volume of these subcontracts was over $15,000,000 during the war period.

From the foregoing descriptions of the steps necessary to get a munitions contract "in the works," one can begin to wonder about the manpower necessary to execute some 400 prime and 5,300 subcontracts in eight of the company's plants.

The recruiting of the required manpower for the increasing volumes of orders during these war years was a truly fantastic achievement by the Personnel Departments of each plant.

Our manpower needs were as follows:

1940 – 9,607	1942 – 14,292	1944 – 17,258
1941 – 11,367	1943 – 17,239	

In order to meet these manpower needs, the company established a program called Manpower Recruiting and Control Program. It was tried and approved for all Armstrong plants, and then copyrighted and widely used through the War Manpower Commission in other plants.

Equally important to the procuring of necessary manpower was the adequate training of these employees for the work assigned to them. This training was done by Armstrong training personnel, sometimes done in special schools, and sometimes by an operator on the job. Each department had one or more job trainers assigned to that department.

Many of our Armstrong trained personnel were sent to other plants doing similar work or trainers were brought in to do the job. To maintain a work force of 16,000 employees, we usually had approximately 2,000 people in training at any one period at all eight plants.

Our constant turnover, because of draft requirements and sickness required these persons in training. (Armstrong had in the military services at its peak some 4,458 former employees).

Obviously, our main recruitment was women. Every news media available to us was used to obtain people. We had to compete with some 80 plants in our area for employees. We were successful in hiring employees from the anthracite coal regions in northeastern Pennsylvania. To insure that this group stayed on the job five days per week, we bussed some 140 women, who were taken home on Friday night and brought back to Lancaster on Sunday night. They stayed in dormitories at Millersville State College and dined in the company cafeteria.

The local Draft Boards followed War Manpower Commission's orders and took very few of our key personnel. The company asked for no exemptions from the Draft Boards.*

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*Looking back on this crucial manpower situation in World War II and trying to visualize where we would get manpower in another war if the government would draft women in the armed services, God help America on the production front. (author's comment)

Up to this point we have reported the formation of the Munitions Division, how it worked and what had to be done to convert a non-military supplier to one which, when established, created a very credible war record in producing the following items.

Shells

Shell production was the first item to be contracted for by the Ordnance Division. In December, 1939, Armstrong bid for 5,000 75 mm. high explosive shells. The order was given to Armstrong in March of 1940. This order required the acquisition and installing of all the necessary machine tools, gauges, and steel forgings. This first order took almost one year to complete or until January, 1941.

The completion of this first contract satisfied the Philadelphia Ordnance Division and was the genesis of the establishment of the shell lines in Pittsburgh, Beaver Falls, and the two Lancaster plants.

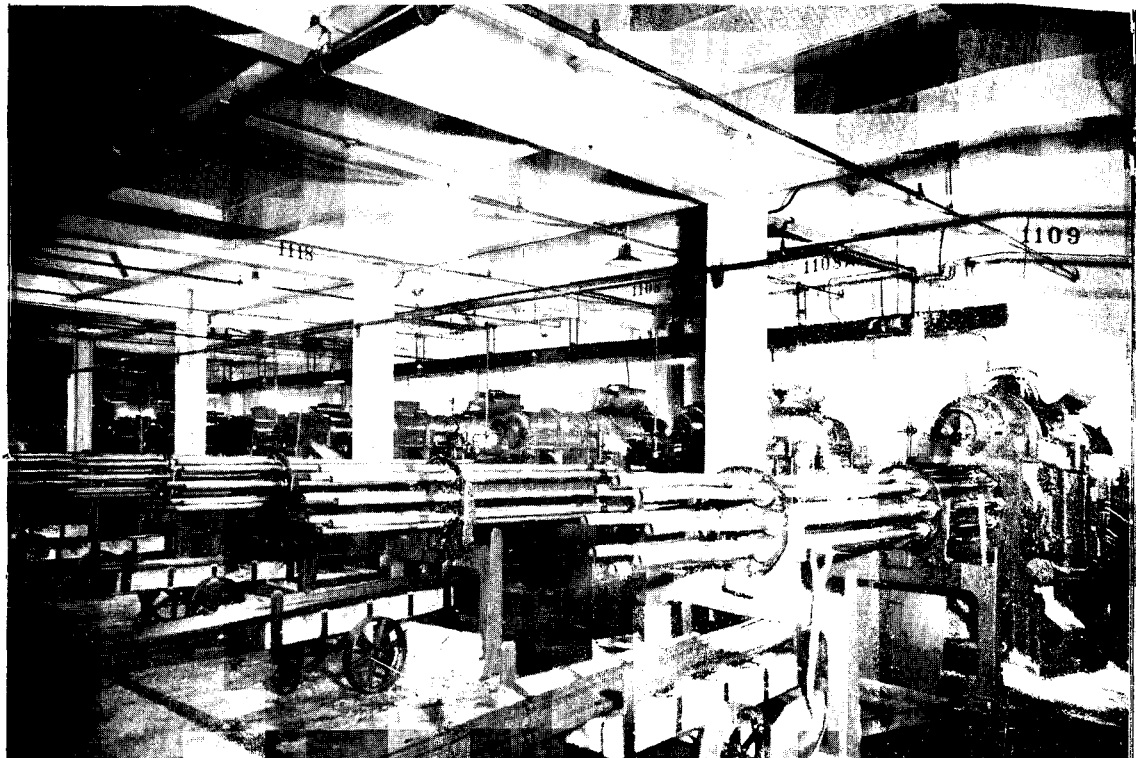
The sizes and types of shells made by Armstrong during 1940-45 is quite comprehensive. They were as follows:

Display board showing all types of 20mm shells made at Armstrong, 1940-1945.

Size	Type	Co. Plants Made This Type
20 mm.	Armour piercing, high explosive	Lancaster Floor
40 mm.	High explosive	Lancaster Floor
3 in.	High explosive	Lancaster and Pittsburgh
75 mm.	High explosive and chemical	Pittsburgh and Beaver Falls
81 mm.	Mortar shell	Pittsburgh
105 mm.	Chemical	Pittsburgh

Before the V. J. Day, Armstrong was accredited by the Pittsburgh and Philadelphia Ordnance Offices as being the second largest shell producer in their areas. The reason: Armstrong shipped 81,938,000 shells during 1941-45. To make this record possible over $4,000,000 was required for machinery and plant equipment. Armstrong made over 1,000,000 20 mm. shells per day, seven days per week for months.

Automatic turrett lathes for 20 mm shells.



75 mm shell line in Pittsburgh, Beaver Falls and Lancaster.

Miscellaneous Acessories

As an adjunct to shell manufacture, brass cartridge cases and adapters were produced in large quantities. The cartridge cases required very large presses capable of forming a brass shell from a solid slug of brass by extrusion through steel dies. We made these in 40 mm. and 75 mm. sizes. At the closure plant al-

was a steel sleeve like a tube, threaded at one end. This sleeve was ultimately fixed to the shell. Its purpose was to serve as a cavitiy holding the chemical, between the projectile and the detonating cap. The largest size made was for the 105 mm. shell. A total of 17,126,670 adapters were produced in Lancaster plants.

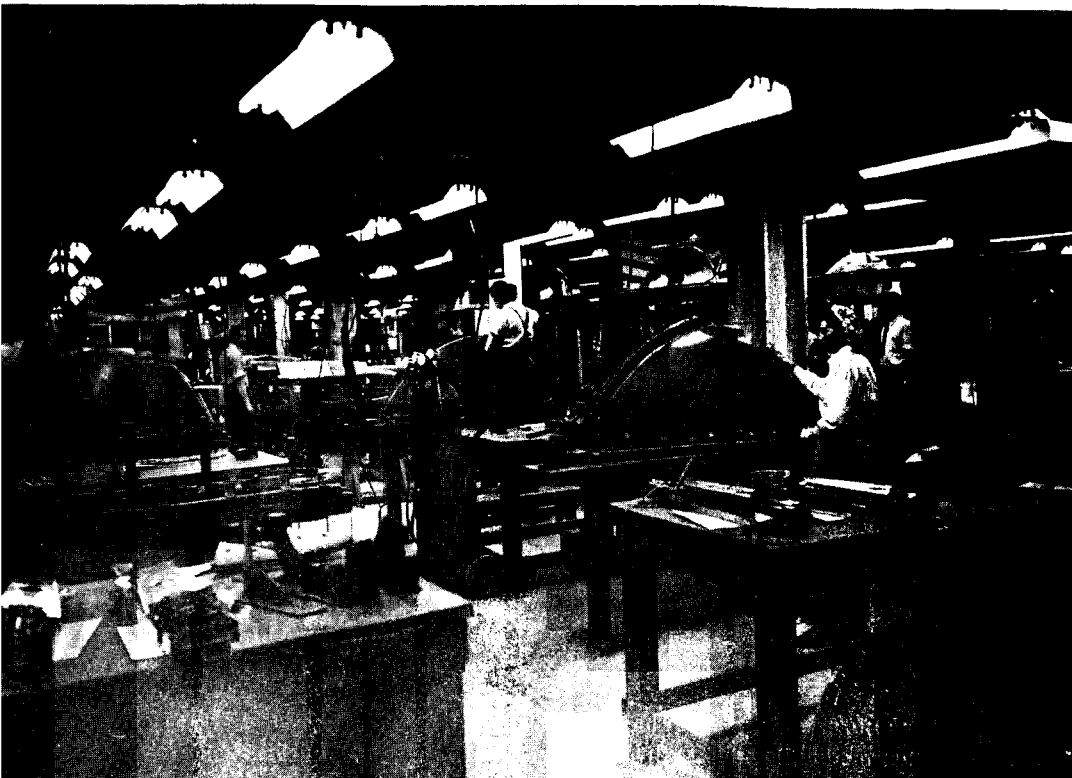
Aircraft

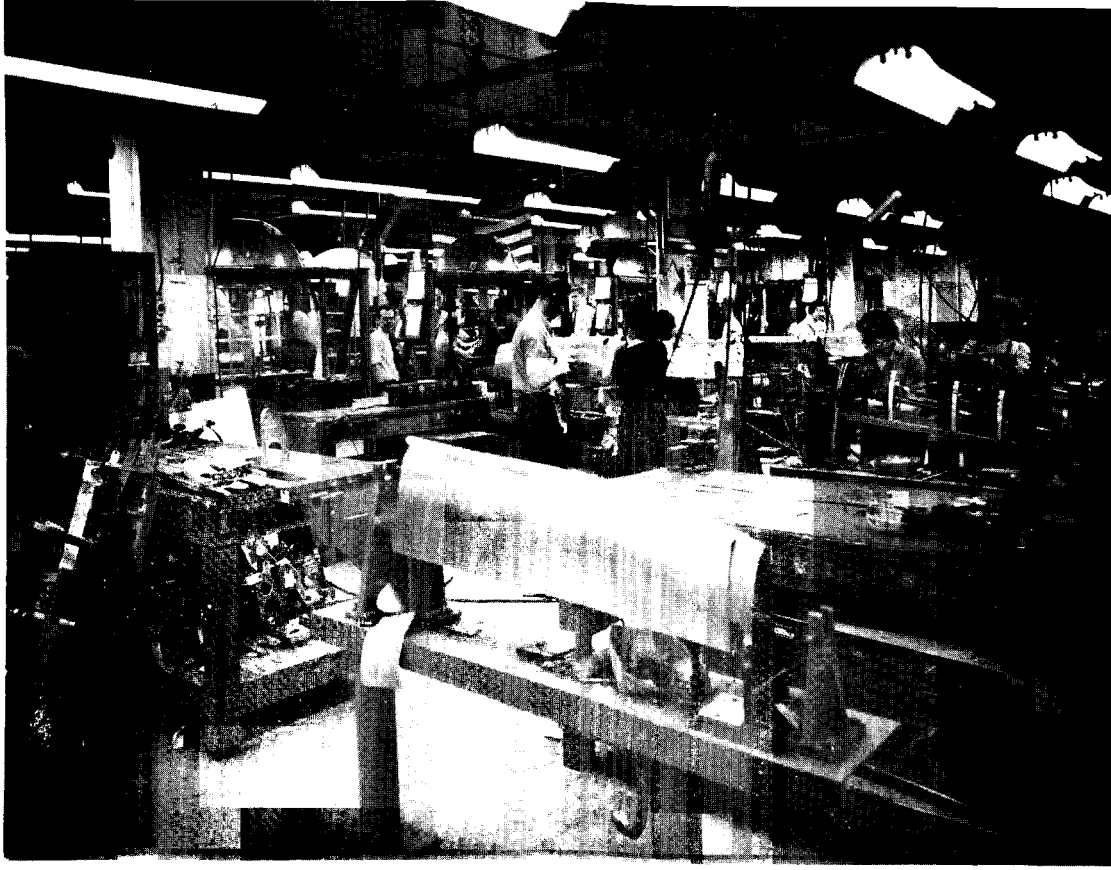
The most publicized and exotic product made by Armstrong were the aircraft sections for the Famous Corsair Navy fighter planes.

As previously mentioned, the fact that Armstrong owned and had in operation the huge Birdsboro presses for linoleum production made the company a possible subcontractor of aircraft parts because several major aircraft industries were using these same type of presses.

Munitions commodity managers contacted some of the major aircraft builders such as Martin-Marietta Corp., Goodyear Rubber and Chance Voight.

Front section "Corsair" fighter plane.





Wing tip assembly room.

Through successful bidding and inspection of our facilities, Martin gave us a contract to make the wing tips for the famous Martin B-26 bombers. Also, Chance Voight Corp. gave us trial orders for parts and sub-assemblies on the Navy Corsair fighter plane.

Armstrong's performance and quality led into vast orders for aircraft formed and welded assemblies. Our order resume indicated for the war period that Armstrong produced aircraft parts and sub-assemblies amounting to 40,000 pieces per day to a maximum of 1,000,000 parts per week.

The rapid expansion of aircraft orders necessitated the construction of a new building called the "500 Building," along the Dillerville Road between the main line and Columbia Branch Railroad tracks. At this time, over 300,000 square feet of floor space was used in aircraft manufacture. Also, there were 287 salaried supervisors and approximately 2,500 people employed in aircraft on a three-shift basis.

The expanded aircraft industry had some problems in making satisfactory spot welds of aluminum. Armstrong inherited these problems with the orders for assemblies. The problem was that aluminum sheets as received were not chemi-

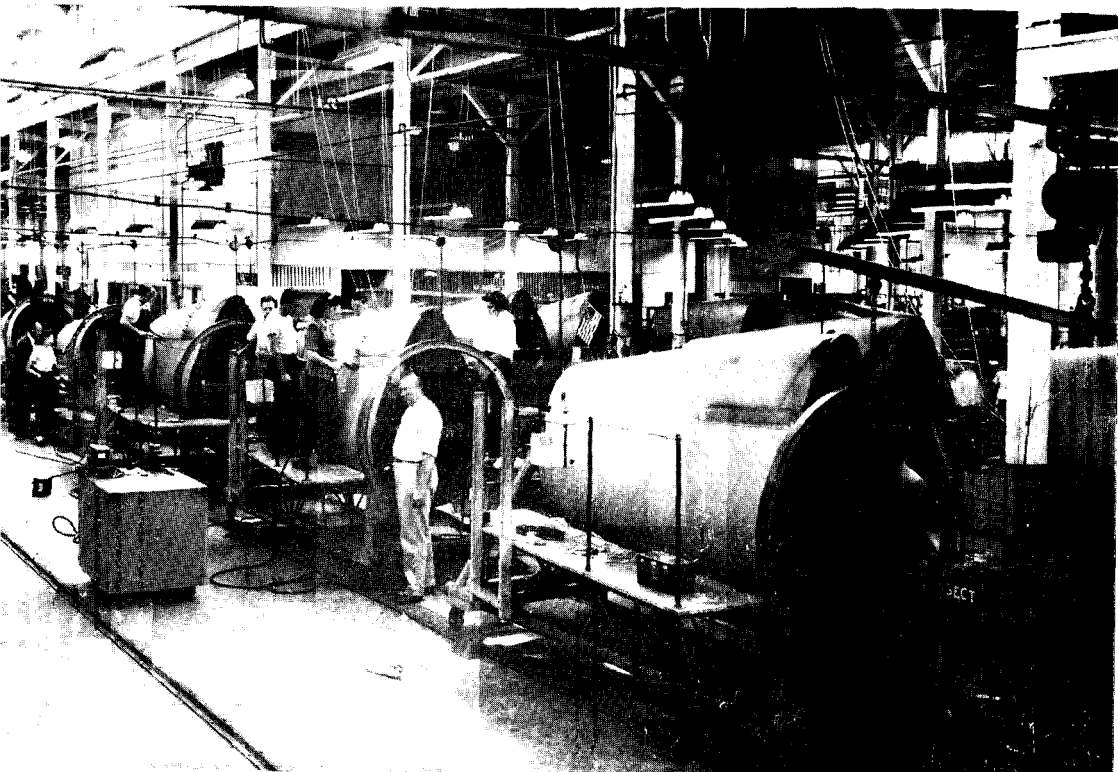
cally or mechanically clean. Thus, when these surfaces were subjected to spot welding, an inferior weld resulted.

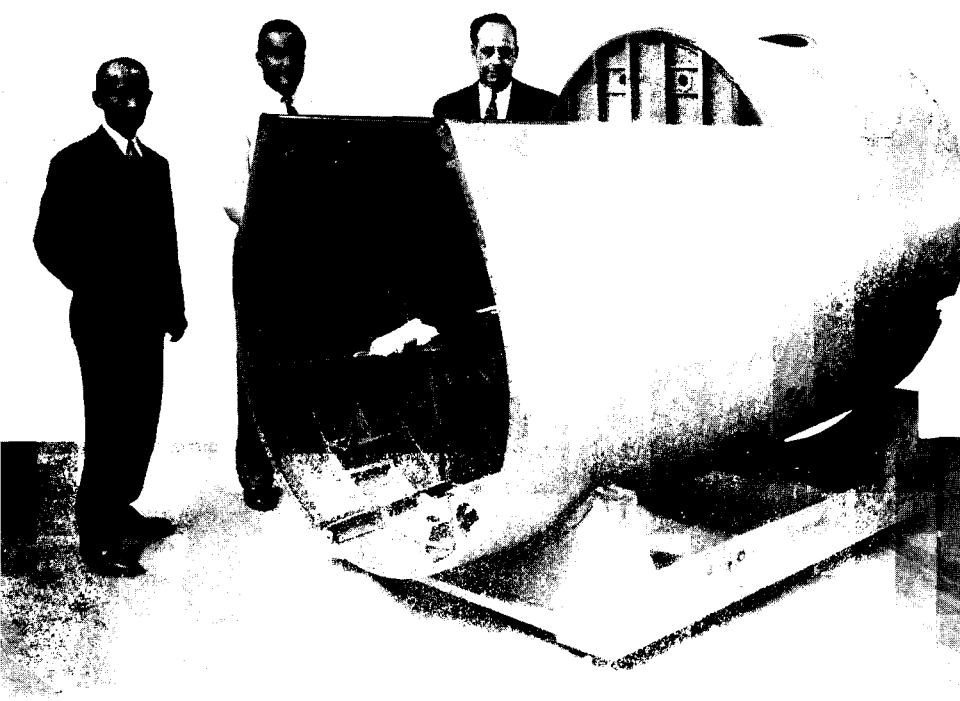
The Armstrong Research and Development Center, then called the Technical Center, was given the problem for solution. In due time it evolved a new economical method, to clean sheets. Also, researchers developed a method of determining the degree of cleanliness of surfaces by measuring the electrical resistance variables in welding. Finally, the researchers found a method of X-raying the welded sections and established a standard of strength acceptable to the structural engineers of the Navy.

The Navy recognized the new Armstrong developments and adopted them as standard techniques for industry. To acquaint the industry, a conference of members of the American Welding Society and American Institute of Electrical Engineers was held at Armstrong on May 4 and 5, 1944. Representatives of 38 aircraft and other metal fabricators attended the seminar.

The progress made in production and research by Armstrong prompted the Navy to expand their use of Armstrong facilities. A Navy Corsair fighter plane

Midsection assembly for "Corsair" fighter plane.





was brought to Armstrong in Lancaster.* First, the tail surfaces, the fin, rudders, ailerons and tail assembly; then the middle section and finally the front section were put into production. The nose or front section was made by Chance Voight in Connecticut. Armstrong assemblies were shipped by special truck (at night time) to Connecticut.

Plexiglass Canopies

Early in 1940, Armstrong bid for the production of plexiglass turrets. The early success in forming these turrets deluged Armstrong with orders. In time, turrets were produced in four different areas, Lancaster, Philadelphia, Camden and Pittsburgh. The raw plexiglass sheets came from Rohm & Haas Chemical Co. in Philadelphia, generally by truck.

The design of the finished product was translated from the flat sheet by means of stretching the material over wooden or metal molds. The tooling or molds were made by Armstrong. They were covered with a felt so as not to scratch the sheet as it was forced over the mold.

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*The performance by Navy pilots and the stability of these Corsair fighter planes was recognized worldwide.

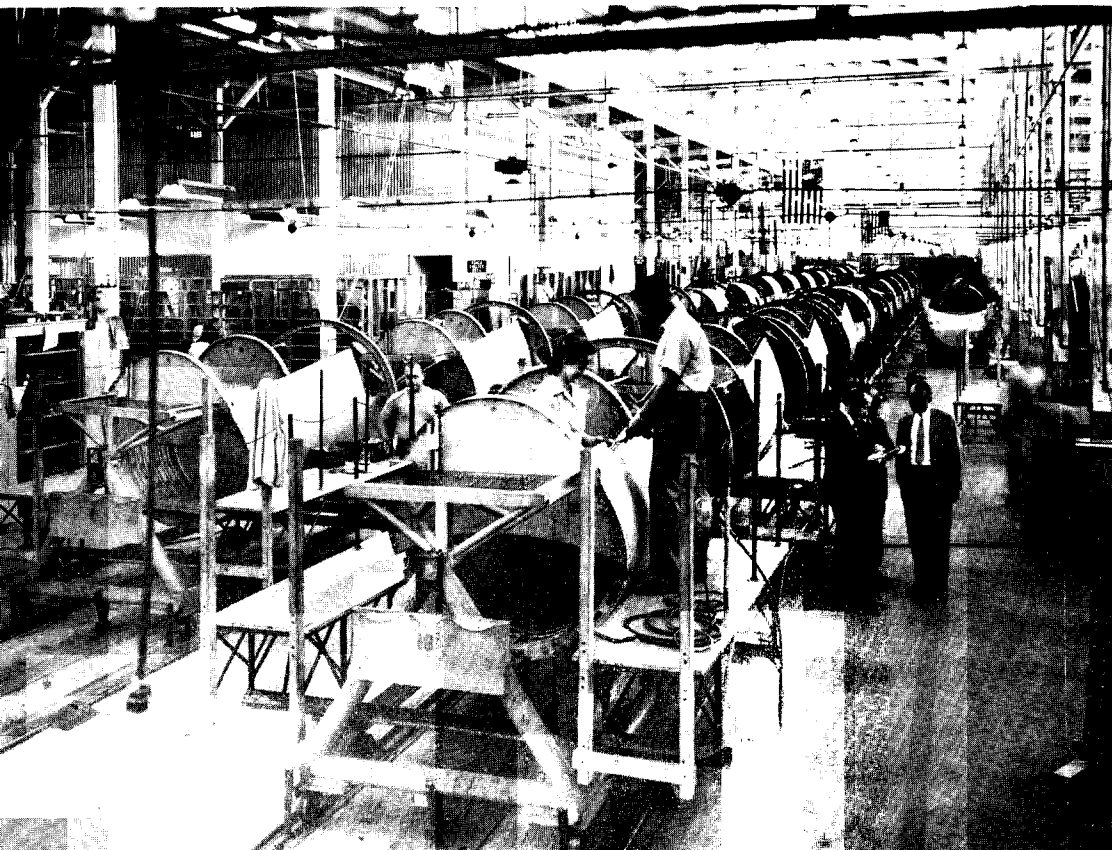
Again, Armstrong made another noteworthy contribution to the manufacture of these turrets.

Scratching during the forming operation was the major cause of rejects. Research developed a lubricant to be spread over the mold, thus eliminating this defect. Secondly, research developed a glue or adhesive to fasten sub-assemblies that was of superior strength. Armstrong produced over 91,000 turrets and sub-assemblies for most of the major aircraft manufacturers.

Camouflage

As early as 1935, Armstrong had inquiries regarding the manufacture of camouflage materials. On December 15, 1941, the government procurement agencies sought Armstrong as a major supplier. On January 5, 1942, we received our first order of 50,000 yards from the Navy. (Armstrong made several different types such as feathers, steel wool, dyed canvas or cloth, all of which were

Front section assembly for "Corsair."

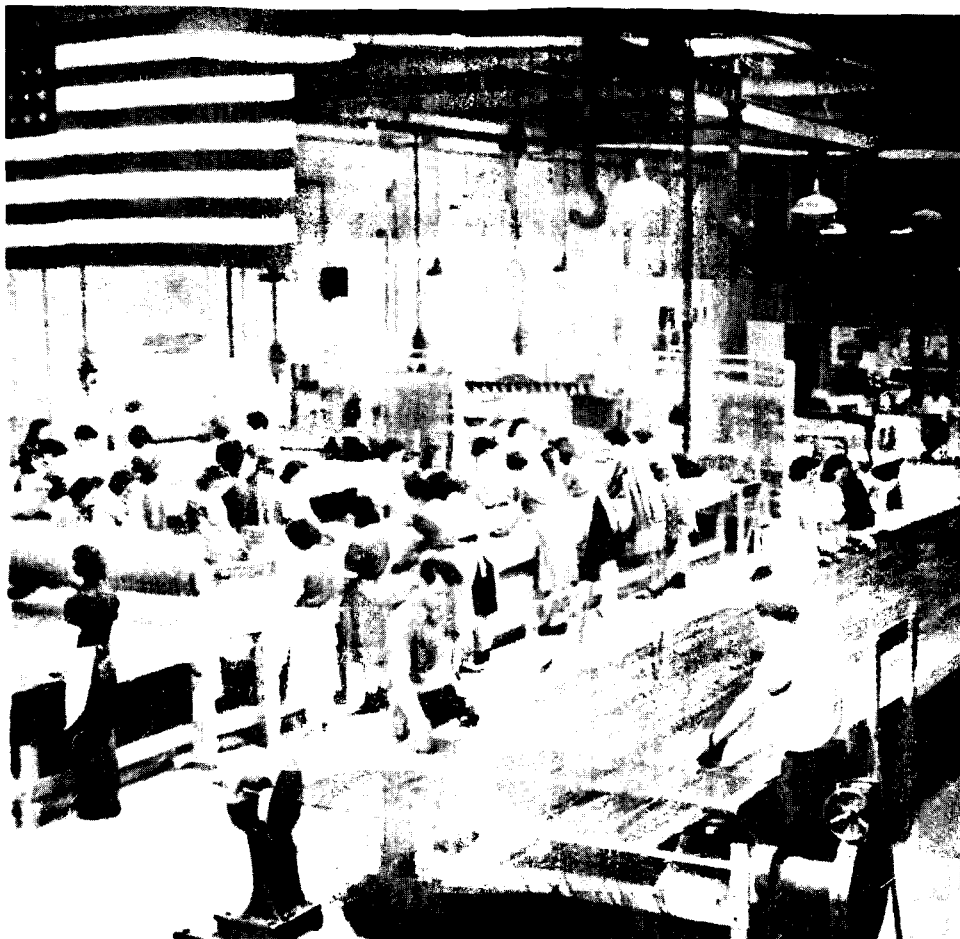


stapled to a wire mesh carrier). In fact, Armstrong issued a sales bulletin to its own customers indicating the types of camouflage available as a regular product.

Also, Armstrong had printing and coating presses, plus drying ovens which made it a prime source for coated and printed duck or canvas materials. Shrimp nets were also coated or dyed.

Both the Pittsburgh, closure and floor division plants were involved in its manufacture. In all, Armstrong produced 66,000,000 yards of camouflage material.

Camouflage netting being made by Armstrong workers.



When the conflict in the Pacific was reaching a peak, the military developed a magnesium fire bomb. Magnesium as a metal, once ignited, cannot be extinguished by ordinary means. The bombs were purely incendiary, and consisted of a hexagonal-shaped body with a cast iron weight integrally cast in one end. The other end contained a detonating device and fins for aerial guidance of the bomb when released.

Armstrong sent engineers to determine how and what equipment was needed to manufacture the bombs. Furnaces and casting molds and equipment were purchased and set up in a special building away from all main buildings. Crews were trained and production started about May 5, 1942.

These bombs were made in two and four-pound sizes and Armstrong made over 10,000,000 bombs at Lancaster.

At the same time as the magnesium bomb was being engineered, a suitable bomb rack or carrier was being made and engineered by Armstrong. This rack was to carry multiples of five bombs, such as 15-20-25 in a cluster, and would control the discharge by the bomber pilot. The Aircraft Navy Control Board adopted Armstrong design. A total of 3,000,000 bomb racks were produced by the company.

Many miscellaneous items such as fuse heads, adaptors, detonators, were also made. In addition, parachute hardware and chutes were made at the old Folmer-Clogg Umbrella Plant at West King and South Mulberry streets.

After one year of munitions manufacture by Armstrong, the high command of the Army and Navy were entirely satisfied with the results. On November 30, 1942, the first Army-Navy "E" Award was given to the company. The second award came with its star on June 26, 1943. On January 15, 1944, the third award was made and finally, on July 7, 1944, the final award was given.

It would be in order at this time to give a summary of the war production efforts and results by Armstrong which earned these prestigious awards of Army-Navy "E".

A. Shells

20 mm. armour piercing and high explosive	49,188,206
40 mm. high explosive	24,747,413
3 inch high explosive	3,149,138
75 mm. chemical high explosive	2,632,501
81 mm. mortar shell	617,404
105 mm. chemical and high explosive	1,604,296
Total Shells	81,938,958

B. Miscellaneous Items

37 mm. cartridge cases (experimental)	77,000
40 mm. cartridge cases	3,760,206
fuseheads and adapters	17,126,670
detonators, metal	87,612,488
detonators, plastic	5,617,087
flare bases (parachute)	850,905
magnesium bombs	10,890,404
bomb racks	2,824,013
Total Miscellaneous Items	128,758,773

C. Camouflage

glass and steel wool on wire	10,928,922 yds.
shrimp net type coated	38,000,000 yds.
Army duck printed, coated	17,535,769 yds.
Total Camouflage	66,464,691 yds.

D. Aircraft Major Assemblies

Corsair front section	1,926 units
Corsair mid section	3,565 units
Corsair wing section	11,412 units
Corsair fins-rudder	13,875 units
Martin B-26 wingtips	7,027 units
Total Major Assemblies	37,805 units

E. Plexiglass Canopies

turrets, domes, blisters	31,840 units
miscellaneous sub-assemblies	58,579 units
Total Plexiglass	90,419 units

With the ending of the hostilities, we all knew that production would phase out as fast as people could be reassigned and peacetime production would start.

Armstrong in anticipation of the ultimate moves, studied the best ways to handle and marshal the untold millions of individual facts into indisputable statements of policy. The policies and procedures were assembled in a treatise called *War Contract Pre-determination Planning.* The manual (largely the work of Jim Binns) was copyrighted and by request of the Ordnance Officers, distributed to other manufacturers.

Armstrong, using the manual as a guide, with its well-trained organization,

completed negotiation of all its war contracts, including disposition of materials and equipment in seven and one-half months after V. E. Day.

Thus ends the story of the great part a non-military manufacturing corporation played in World War II in helping to win the war. □

Notes from the President

By John W. W. Loose

To open the 1981-1982 season your Society dedicated a plaque erected in recognition of Louise Arnold Tanger and the arboretum that honors her and bears her name. At 7:30 P.M., 13 October 1981, members of the Society gathered at the side entrance to pay tribute to the long-time member of the historical society Board.

Dr. George L. Heiges, president of the Society during Mrs. Tanger's service on the Board, delivered a speech in which he reviewed her life and many interests. Mrs. Tanger was born in 1889, the daughter of Ira W. Arnold and Netta Forney Arnold. She was a graduate of Miss Stahr's School (later to become the Shippen School, and eventually, when combined with Franklin and Marshall Academy, the Lancaster Country Day School), and the Baldwin School at Bryn Mawr. She was a botanist, a founder of the Muhlenberg Botanical Society, and did notable field work in locating rare plants, one of which – a form of Trillium – is named for her. Her extensive herbarium is located in the North Museum of Natural History, Franklin and Marshall College.

Not content with botany, Mrs. Tanger also was an avid ornithologist. She