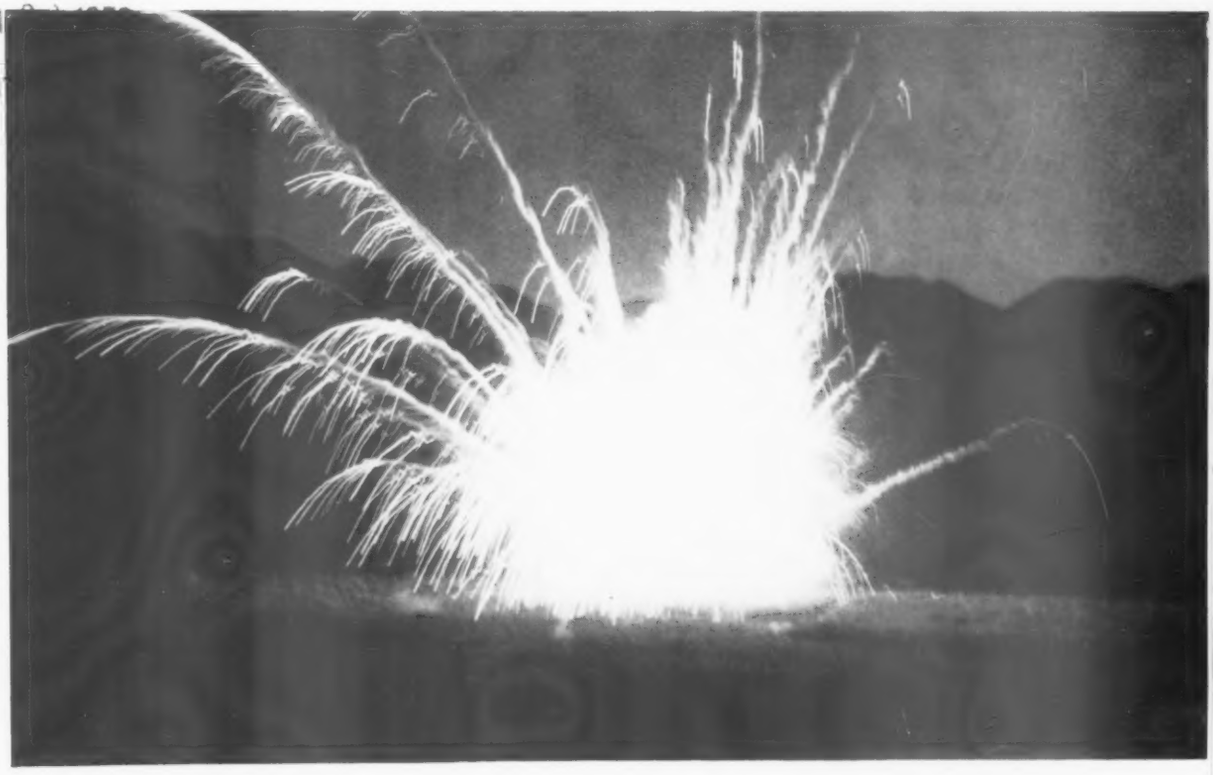
ARMED FORCES CHEMICAL JOURNAL



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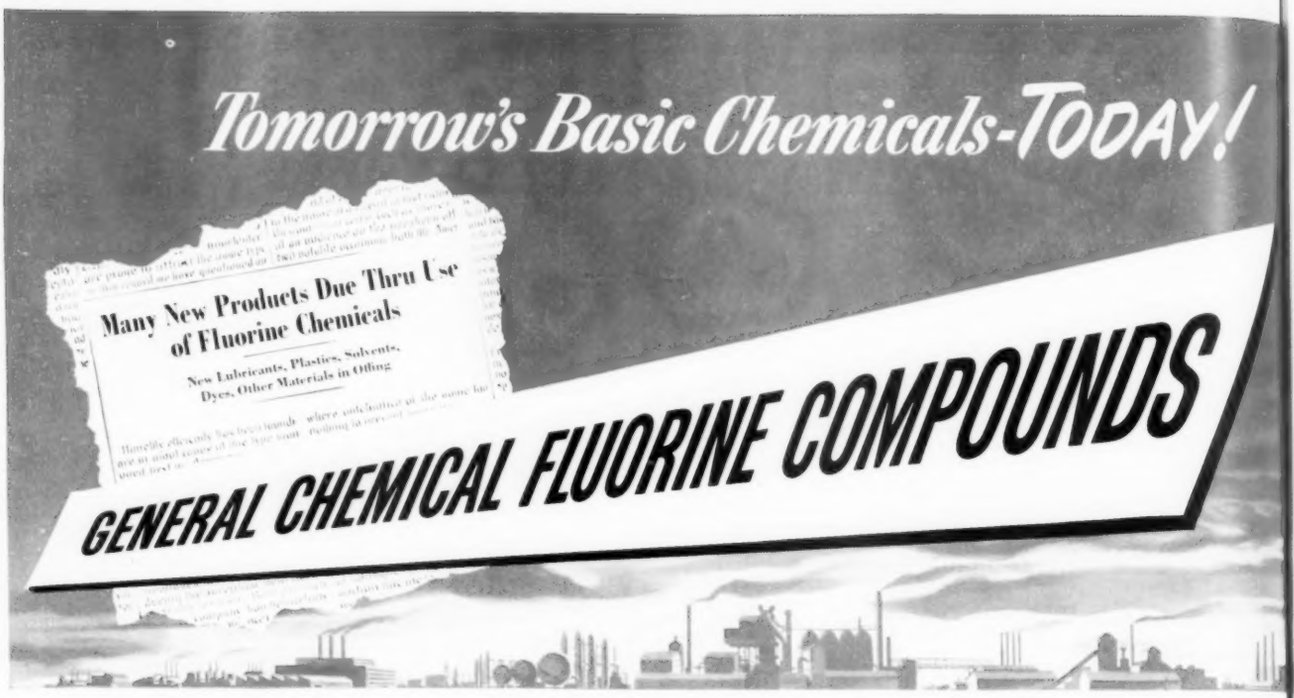

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COVER PHOTO

A white phosphorous bomb is exploded by TNT blocks in the face of a Chinese Communist attack in Korea.
—U. S. Army Photo

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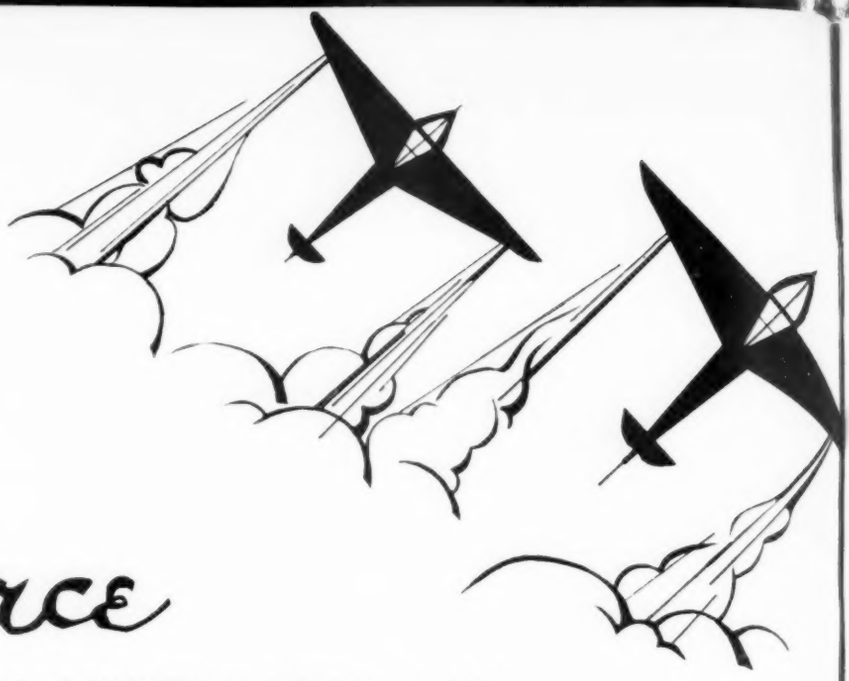
CHEMICAL WARFARE IN THE *Air Force*



By Colonel AUGUSTIN M. PRENTISS, JR., USAF

When the National Defense Act of 1947 created the Air Force as a separate Department in our national defense structure, a number of officers of the Chemical Corps transferred to this new Service. Most of these had been on duty with the Army Air Forces during World War II, either as members of chemical organizations serving AAF units or as chemical staff officers.

AUGUSTIN MITCHELL PRENTISS, JR.
Colonel, USAF

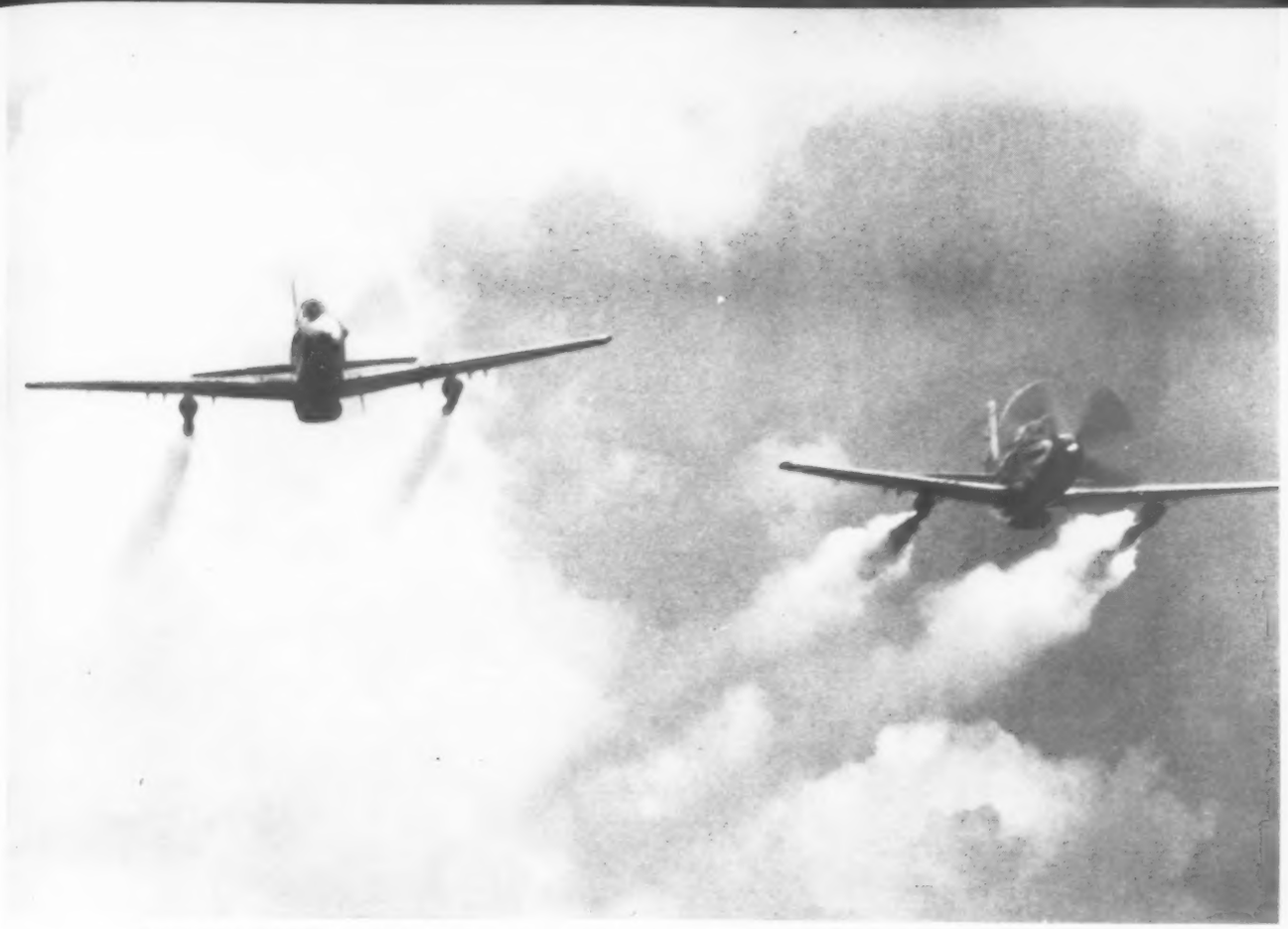
Upon transferring to the new Service, these officers took off their "crossed retorts" and lost that ready identity with their specialty which this distinctive insignia bestows upon its wearer. It has been a matter of some speculation, therefore, among those interested in chemical warfare, as to how and by whom this subject is handled in the Air Force.

Before going into the present chemical warfare set-up in the Air Force it might be well to trace a bit of history. The idea of employing toxic agents as air weapons is anything but new. Shortly after the Chemical Warfare Service was set up as a separate branch of the Army in 1920, a small Air Corps detachment was assigned to Edgewood Arsenal to provide the means of testing and developing air chemical munitions. Here, during the twenties and thirties, small scale but persistent efforts were made to develop chemical bombs and spray tanks. In those days of small budgets to the military, it is a tribute to this handfull of pioneers in the air chemical field that they made as much progress as they did.

By the beginning of World War II, the CWS had standardized several chemical bombs and two types of spray tank ready for Air Corps use. At about the same time, the Air Force Combat Command was organized to mobilize the offensive power of the Air Corps. This Command had a chemical section as a part of its headquarters, headed up, in 1941, by Colonel William N. Porter who left the job that same year to become wartime chief of the Chemical Warfare Service.

Early in 1942 the Army Air Force was organized and the Air Force Combat Command passed out of existence. The Chemical Section of the old command, now headed by Colonel Thomas A. Doxey, moved across the river from Bolling Field to Gravelly Point and became the nucleus of the Air Chemical Office, Headquarters, Army Air Force.

Late in 1942 Colonel (later Brigadier General) E. Montgomery was assigned as Air Chemical Officer. Under his able leadership great strides were made during World War



ELGIN FIELD, FLORIDA. Two North American P-51s start smoke screen run for tactical demonstration at Orlando Army Air Base.

II to turn the potential capability of the AAF to employ chemical weapons into a reality. Chemical Air Operations Companies and Air Depot Companies were trained and deployed to all theatres; chemical staff sections were placed in virtually all echelons of command. Large quantities of toxic munitions were stockpiled in the various overseas theatres and considerable training was given in their employment.

All during World War II, when the Air Force was under Army jurisdiction, Chemical Warfare functions were divided between the personnel of the Air Corps and the Chemical Warfare Service. Procurement, supply, storage and issue of chemical bombs, bulk chemical agents and incendiaries was carried out by the CWS itself or by CWS officers and units detailed to duty with the Air Corps. Squadron level installation of bombs and spray tanks was usually accomplished jointly by CWS and Air Corps armament personnel.

This system was the natural outgrowth of the phenomenal expansion of the Air Force during World War II. Created from a pre-war Air Corps which depended almost completely upon the other branches of the Army for its supporting services, the AAF was forced to draw more and more upon those branches for its specialized officer personnel. In the case of its chemical warfare functions, this was particularly true. While most of the Air Corps officers had some idea of squadron supply, and the handling of guns and high explosive bombs, very few had any knowledge of the new and to a large extent untried toxic munitions.

As the war progressed and the threat of enemy employment of toxic weapons decreased, the CWS officers detailed to the AAF found themselves, for the most part, in the position of the fireman when there is no fire. While the large scale use of incendiaries and the somewhat less widespread use of smoke kept the Air Operations Companies and combat unit chemical officers fairly well occupied, many a Service Group or Depot Group Chemical Officer found himself running the motor pool or the officers' mess "in addition to his other duties." This unfortunate condition, so symbolic of general apathy toward chemical warfare, became even more pronounced after the war ended. While no blame can be attached to harried air base commanders trying to get maximum utilization out of their personnel in a rapidly demobilizing Air Force, the existence of this widespread indifference drives home the fundamental truism that *overall interest in chemical warfare always varies directly as the probability of its use against us.*

When the United States Air Force was created in 1947 there was much debate as to how the various specialized services—Quartermaster, Signal, Engineer and Ordnance as well as Chemical Warfare—were to be integrated into the new organization. After much careful consideration, it was decided that only doctors, lawyers, and chaplains would have separate branches and promotion lists within the US AF structure and that all other specialties would be shown by MOS (military occupation specialty) numbers. It was felt by those charged with molding and shaping the new Air Force that compartmentalizing highly specialized functions into a "corps within a corps" type of organization was not suited to the needs of the USAF.

In 1947 the Air Force adopted for its field installations a "wing base" type of organization. Briefly this was a func-

tionally organized base at which one operational group, together with its supporting maintenance and supply group, and airdrome group, are all under one wing headquarters. A "chemical and radiological officer" was included in the wing staff organization combining the functions of the old wing and base chemical officers and adding responsibility for radiological defense.

As this action set up a fairly substantial requirement for base level chemical officers, an Air Chemical School was established at Keesler Air Force Base, Biloxi, Mississippi. The establishment of this school marked the first attempt by the USAF to train its own chemical officers. Under the dynamic leadership of Colonel James E. Reilly, an ex-CWS officer, this school achieved a notable success in accomplishing this mission.

In the summer of 1948 it was decided by the Air Staff to place all air armament matters, including the air chemical weapons, into an integrated program in order to insure that armament developments kept pace with the rapidly improving aircraft performance. Accordingly the Air Chemical and Air Ordnance Offices of Headquarters, USAF were abolished and replaced by a Directorate of Armament. Following this action at Headquarters, USAF, ex-Ordnance and ex-Chemical officers became "air armament" officers and a new MOS-4590 was created to cover this combined career field. Chemical, ordnance, and armament functions were generally integrated on the staffs and bases of the various Air Force Commands.

The base level officer training problem posed by this amalgamation of ordnance and chemical functions was solved by the creation in 1949 of the Air Armament Officers School at Lowery Air Force Base, Denver, Colorado. The Air Chemical School at Keesler Air Force Base was moved to Lowery and became a part of the new Armament School which assumed the twofold mission of cross-training ex-chemical and ex-ordnance officers and training new Air Force armament officers.

At the present time there are no purely chemical warfare organizations in the Air Force. Offensive chemical training is completely integrated into the armament career field; enlisted specialties are shown by appropriate SSN's (specialist serial numbers). Defensive training is given to all individual airmen. Decontamination of aircraft and other base chemical defense functions are usually carried out by personnel of the Maintenance and Supply Group and the Airdrome Group under supervision of the Wing Chemical and Radiological Officer.

Chemical Supply has likewise been integrated into the overall Air Force supply system. Munitions are handled by armament personnel, other items of supply by the usual supply procedures. Procurement of chemical equipment and research and development in this field is handled by the Army Chemical Corps.

In 1950 the Directorate of Armament was phased out of the Headquarters USAF picture, and armament matters, including chemical warfare, were spread "across the board" of the Air Staff. This was in line with the basic philosophy of the Air Staff organization—that all matters be handled under one of the five Deputy Chiefs of Staff with a minimum of "specialist" offices. Under this arrangement, chemical-trained officers were placed in the offices of the Deputy Chiefs of Staff for Operations, Materiel, and Research and Development to handle the various aspects of chemical warfare and associated problems.

With the heightening of international tension following the outbreak of the Korean War, interest in Chemical Warfare as in all other potentially powerful weapons greatly increased in the USAF. A need became apparent for an overall monitoring agency to provide technical advice and assistance to the various operating agencies of the Air Staff on chemical warfare matters. Accordingly, in 1951 a new division was included within the office of the Deputy Chief of Staff for Operations to carry out these functions.

No discussion of chemical warfare activity in the USAF would be complete without a few words as to the overall Air Force attitude on this important subject. The Air Force is a relatively new organization, in many respects still feeling its growing pains. In contrast to the Army Chemical Corps it is primarily a "consumer" service rather than a "producer" service. The Air Force is deeply and genuinely interested in obtaining as rapidly as possible the maximum capability to effectively exploit the great potentialties of chemical weapons. Its officers have been and are now working in close harmony with the Chemical Corps to achieve this end. In the true spirit of unification the Air Force stands ready to play its part in giving this nation the most powerful air chemical weapon in the world.

North American P-51 "Mustangs" lay smoke screens during "Operation Combine" at Lawson Air Force Base, Fort Benning, Georgia.

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ERGS, IONS AND SALT WATER

By NATHANIEL S. PRIME, Rear Admiral, USN, Ret.
Vice President, Armed Forces Chemical Association

FOREWORD

The following Article has been rigged in story form as a conceit of the author and in the hope that the reader, who is surely plagued beyond tolerance by fusty and dusty relations of fact and circumstance, may relax and enjoy that which might otherwise be a painful penetration of education regarding the U. S. Naval Officer's concern with Chemical Warfare.

APPRECIATION

"COMMENCE FI———!", The rest of the ultimate word of command was lost in the noise of action;—soft and deep the chug-chug of the powder hoist; muted the clang of steel as the twin breech-blocks levered open and swung to meet their stops; sharp and brutal the slam of 105 lb. projectiles as they hit the loading trays; hoarse the gasps of rammermen as the projectiles were shoved home to grunt capably as they seated in the bores. The ready-light on,—frantic churning of the pointer's hand-wheels as he elevated at speed—then,—"MATCH!", from the pointer and instantaneously a paralyzing shock, an earthquake of vibration followed by an enormous slapping shudder of sound as the guns fired. Recoil—counter-recoil, and before the guns were in battery the pointer had depressed the gun muzzles, breech-blocks were unlocked and swinging; air hissed—volumes of high-pressure air to clear the bores of gases, flames and burning grains of unconsumed powder. "BORE CLEAR", from both rammermen, and then the slamming of the trays, projectiles, powder-bags; and breeches were locked, guns up, and again the millionth of a second of suspense before the twin-mount shook and heaved and rocked to the guns firing.

The Turret-Officer, Jimmie Lee, Ensign, U. S. Navy, his bottom perched perilously on a narrow tool-box, observed his stop-watch. Five and a half seconds per load. The crew were on edge for this one, all right! The time was perfect. Long Range Battle Practise on a 7500 Ton six-inch Cruiser in Panama Bay. A "First" on this run might and probably would mean the Battle-Efficiency Pennant, the old "Meat-Ball" for his ship.

What a surprising lot went through the mind in an instant of time, Lee thought. He watched the violent, furious, magnificiently controlled energy output of the men. Movements timed by days and days without end of drill, drill, drill. Muscles bulged and flattened, nerves strained and relaxed, color mounted and receded as action was followed by pause. Lee thought about the chemical machine which is the human body. His moving eyes focussed upon Kirchoff, rammerman, left gun. A farm boy, Kirchoff, eighteen, lean, red hair, freckle-faced, less than a year in service. He might weigh one-fifty, soaking wet. And here he was laying a rammer on the base of a 105 lb. projectile every five and a half seconds, accelerating it on the tray, into the breech and up the long powder chamber of the gun, up the slope of the chase, and finally slamming it home at full ram length, the abrupt deceleration jarring his upper body, then withdrawing the rammer in one long, fluid reversal of motion.

Lee thought about the chemistry of powder, propellant and primer too. His mind attempted to conceive the incredible speed of flame propagation through the charge, the fantastic build-up of pressure as solids turned to gases and heat pervaded the expulsive mass of gas. He knew, a little uncertainly, that the concept had eluded him. He lacked facts as well as experience, He lacked knowledge. He was briefly ashamed.

"FOUL BORE!" The cry was clear—not frantic, but with a note of fear. Lee was not shocked from reverie. His mind was alert to this despite his recent mental exercise. His separation from his seat was not the slightest fraction of a second delayed. Yet, quick as he was, the flame was quicker. The right gun was poised, breech open, tray flat and its toe in the breech. The bore-clearing air had failed to trip. A gray-black ball of smoke rolled with a genie's speed down the bore towards the breech. It reached the breech and became a cloud, a blanket, a fog. Through it came flame, red, vicious flame,—a tongue that licked and spat at all around it.

With speed equal to that of flame the turret-captain, Crawford, flashed in motion. With one convulsive effort he catapulated himself six feet to the left-gun tray, plucked the 29-lb. powder-bag from its groove and tossed it over his shoulder in a perfect backward pass—into the gun tub. In that instant Lee expelled his word, "SILENCE." People froze!

Tableau! It was a picture framed in an aura of fear. Lee looked, hesitated a second in sheer fascination with this intimate kiss of the Devil,—then, "RIGHT GUN CEASE FIRING, LEFT GUN RESUME FIRING," he ordered. His eye had seen the two powder bags in the train of men at the right gun. The spell broke! The left gun crew found another powder-bag and continued the fire.

"CEASE FIRING!" The left gun was silent. The right gun had failed on the eighth salvo. They had missed the ninth and tenth in the paralysis caused by the flare-back. Left gun had tuned in from eleven through sixteen with the other guns of the ship. Lee reported, had the mount trained in and ordered the crew to return the extra powder and projectiles to the magazines. Soon came the order to secure and lay forward to report.

Ensign Lee walked forward on the fantail, mounted the ladder to the after gun-castle, passed between Nos. 11 and 12 six-inch guns, descended to the main deck, and moved briskly up the port side. At the quarterdeck he paused, hearing his name called from aft.

"Mr. Lee," it was Kirchoff. "Sir———." The boy demonstrated mournful, embarrassed confusion.

"Yes," offered the officer.

"Mr. Lee,——you gotta report to the Gunnery Officer, to Commander Miller, don't you, sir?"

"Yes."

"Sir,——sir," The boy stopped. Lee waited, turning his eye seaward. It came, in a rush of words.

"Sir, I—I know I looked a fool,—I *was* scared, Sir, but,—you don't mean to report me, do you, sir?"

In his mind Lee saw a picture that had flashed, when it happened, across his mental memory-film. He saw Kirchoff at the moment flame had issued from the right gun. The boy had turned so white the freckles had stood out like scars. His hair had literally stood on end. He had dropped his rammer, turned and made for the exit door at the rear of the mount. The door had been locked open, a bar across the passage. The rear of the mount had been out to starboard, fifteen feet clear of the vessel's side, and directly below had been the forward screw. At twenty-five knots the swirl of spray and wake had been tremendous. Kirchoff had gotten one leg over the bar and had been prepared to jump, unthinking, overside. At that instant Lee had roared out that "SILENCE." Drill and training had fashioned automatic reaction. Stopped cold at the instant of execution, Kirchoff had stood there, half-in, half-out, as though hung up on a picket fence. He had then spun, picked up his rammer, and followed procedure.

Lee turned and looked at Kirchoff. He laid a hand on the boy's arm and smiled. "I don't know what you're talking about, Kirchoff. I'm sure of one thing only—nobody was more frightened than I was." He turned again and went forward.

Lee mounted the ladders to the bridge. He saw the Gunnery Officer in conference with the Captain. Discreet, he stayed on the wing and waited. He looked to port, There, far away on the horizon, was the target.

"Come here, Lee—" he started, to see the Gunnery Officer near him, on the bridge-way. Miller led the way to a more secluded spot near the flag-bag. He turned and faced the Ensign. "All right, son, now tell me what in hell happened down there."

"Flare-back, sir," Lee said, and saw the Gunnery Officer stiffen. "Right gun, sir. Air failed. Just like the reports on the 'Mississippi'." He went on and described the action, what had happened,—what steps he had taken. "The observer will verify my report, sir," he ended.

The gunnery officer digested what he had heard,—then, "Very well, Mr. Lee, Carry on. I'll talk with the others and then call you again. In the meantime, write it down, official report of casualty, you know."

"Aye aye, sir," said Lee, and saluted. As he turned away the gunnery officer stopped him. "—er—Lee, well done, my boy. You probably saved the ship, you know."

"Oh, no, sir," responded Lee quickly. "It was Crawford and—and the rest of the crew, too, sir. They acted magnificiently, sir."

Lee went below. As he sat at the wardroom table composing his report, he remembered the curious moment of thought he had had just before the flare-back. Chemistry—and *there* was something. "I wish I knew more about it," he mused, speaking, in his concentration, aloud. "I've got some studying to do."

That night and the next day the Division stayed at sea, other vessels firing. And just as they were all fed-up with dragging along having nothing to do, the signal went up on the flagship, "Course 015. Return to port." They anchored at dusk, the softness and hush of the southern seas enveloping them. Lee secured to find himself with the duty. Changing quickly, he reported to the Officer-of-the-Deck and relieved the Watch. Routine went normally. Inspection of liberty party, calling away the boats, calling the eight o'clock reports.

Noise drifted away, and the decks became quiet. The crew lay aft to the movies. The moon rose. There was no wind. The lights of Panama City were three miles away, soft and gleaming across the water. Lee watched a dim figure in whites approach down the deck. He recognized the gunnery officer.

"Lee?" It was questioning.

"Here, sir," with a salute.

"Carry on. I want to talk to you a bit." The Officer of the Deck relaxed.

"What do you know about Chemical Warfare?"

The coincidence shocked Lee like a physical blow. It took him a moment to recover. Then he replied, firmly enough, "Not a thing, sir."

"Ever think about it?"

"Yes, sir, quite a bit. It's quite a coincidence that you should ask that question, sir. Just the last few days I've been thinking a lot about it."

"So. That's interesting. Look over there towards shore. Here is a fleet, over two hundred vessels. All at anchor. Imagine for a moment a breeze blowing at maybe five to ten knots from that point of land. Conditions are heavy lapse, right now, perfect. A good cloud could be set up from a dozen or so cylinders on that point. Can you think of what might happen on board these ships?"

Visions, confused and vague, filtered through Lee's mind. "No, sir, I don't think I can. I don't know enough about it."

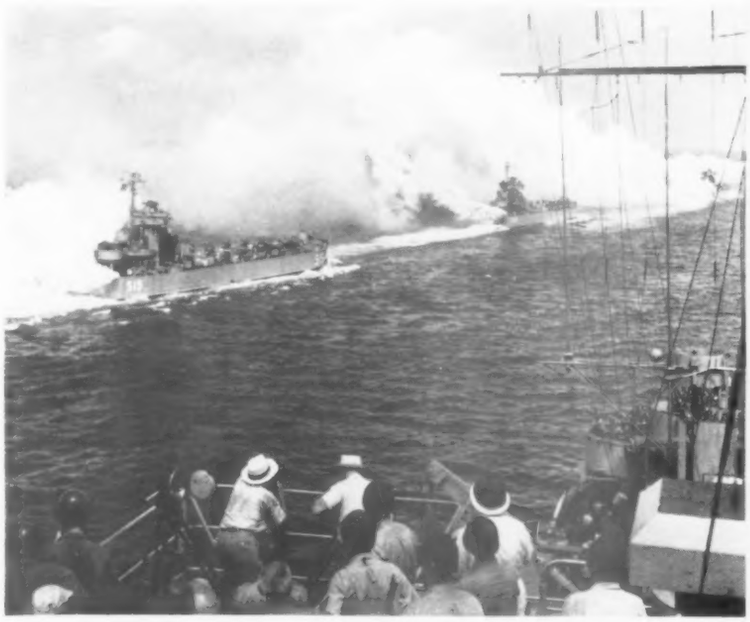
The gunnery officer faced him squarely. "Lee, on my desk is a general ALNAV requesting nominations of ensigns to Chemical Warfare School in Edgewood, Md. I'm thinking of sending in your name. Would you be satisfied to go if chosen?"

The ensign considered. It was time out of the Navy. It was Sea-Duty time gone forever. It might lead to many complications. But the prospect attracted him. He might,—he would find the answers to many of the questions that plagued him. He lifted his head, "Commander, I'll put it this way. I've no objection to your nominating me, if you think I am eligible. I'll not seek it, but I'll not turn it down."

Miller looked at the youngster. "Thank you, Lee. I'll do as I think best." He turned and left the quarterdeck. The moon shone brilliantly as it emerged from behind a thin cloud. The ensign looked at it and, suddenly, he began shaking. He was excited.

EDUCATION

Ensign James Lee, USN, stopped his car at the Main Gate of Edgewood Arsenal on the morning of May 4, 1928. Six weeks later, on June 13 he left on leave, having graduated from the Chemical Warfare School. Many things happened to Lee in those few days. He did not become a chemist; he did not become an expert in Chemical Warfare. His mother died during those days, and with her died



the sweeter, more boyish part of the man who was Ensign James Lee. Another part of him, a shining Godlet of brass that had been deliberately built up in him for four long years in Annapolis, became slightly, just slightly, tarnished. He began, in a groping sort of way, to realize that there were other men in other suits than blue who also served; that, oh, of course, the Navy was the best, no doubt of that, but after all, these guys in khaki *did* have some brains,—weren't quite the slugs he had believed.

The first impressions were bad. The rather barren flatness of the land; the decrepit buildings, wartime temporaries; the lack of greenness. He compared it to Annapolis, and in the comparison Edgewood suffered. There was nothing here that matched the exquisite beauty of the Severn in spring; no majesty such as the facade of Bancroft Hall; no spick-and-span-ness such as that which was so all-pervading at the Naval Academy. It was not noticed except when one compared with it some lesser installation. The khaki was a jarring note, too. He was rather suspicious of these "foreigners." He had a strong tendency to stick to the other men in blue. There were fourteen Navy in all. They were a club, a clique, a group alien to these surroundings, and therefore kept together as a group.

The first crack in his unconsciously assumed armor came in the first class. It was a mixed group, somewhat more Army than Navy,—the teacher a man in khaki. As Lee looked and listened he began to shake. This was unexpected, different, not what he had been told. This man KNEW. The man himself was tall and solid, a perfect figure of a first-class soldier. He was competent. Lee knew as he watched that this was a man. His rank was Captain, Chemical Corps, USA.

It was noon-time and two classes later that Lee snapped out of his shock. His mind began, then, to function. He knew that this was it. He knew he would have to work like blazes, and that even then he would not get much out of it. He wasn't ready, prepared. He was out of his league.

By dinner-time he had it worked out. This was going to be tough, very tough, but he would slog it through and work his hardest and his best and try to get the most possible out of it. After dinner he got the books laid out and went to work.

The work paid off, although Lee didn't know it. It seemed to him that every struggling effort merely left him deeper and deeper in the morass of a highly selective type of information which he never, never, never could assimilate. There was Organic Chemistry. But Organic Chemistry, he came to see, was a study of things which had been learned solely as the results of experimentation. It was like a series of rather unrelated ladders of varying lengths, the bottoms of which rested on foundations which sometimes resembled one another, but more often did not, and which stretched away into a sort of never-never land which, he was assured, was always colored with the same roseate hues of Hope and Promise, but which rarely took on the solid quality which makes it certain that you have reached the end of the road. Of course, he was not prepared for Organic, that exquisitely beautiful Pathway to Paradise for the investigative researcher which is founded in the strength of men's hearts and which stretches along its Alabaster Arch supported on the columns of Pure Reason. Even his Inorganic was three young-man's years behind him,—almost forgotten.

The material was well-presented. The lightest emphasis was placed upon the least important phases, the chemical names of the gases, for instance. It was hard to form a mental picture of "CHLORPICRIN." It became easier when you thought of "Lung Irritant." He found that he did not have to remember the chemical formula for "Mustard." By means of colored slides projected on screen during a lecture he found that he had engraved for all time upon his memory a picture of burn-wounds and men in agony that screamed the word "MUSTARD" at him till his ears rang.

Handling a Stokes Mortar with White Phosphorus shell made Lee aware of smoke as a shroud for activity. From then on throughout his life he never heard the word "screen" used in any sense without the automatic visual image of a "White Phos" burst. He also learned the fearful and deadly character of the burns caused by skin contact with that chemical. The lesson was learned all over again, that rarely on this earth does benefice appear without its compensating opposite, disaster. This new field of land warfare, terrain, lugging weights, supply problems, dirt, became an absorbing interest, a thing to be mastered, and, in the end, became fun.

The days flew by at the school. Classroom work was over, it seemed, almost before it had gotten well under way. The teaching was done in the field, and it was hot for May. First there was a tour of the chlorine plant. A collection of buildings that were falling down years before. Broken lines, gaping wooden tanks, missing valves. A horror of a plant, yet they managed to make chlorine. The method was clear, and the instructors were production men. Lee learned about chlorine. Next were masks. The class was not alone taught how to use it, but also how it was made. Lee learned that face-pieces have varying porosities, that they had peculiar differences in their resistance to aging under the influence of oxidation, that material must compromise between being sufficiently rugged and being sufficiently flexible. Lee learned about masks.

Later there were field exposures. These were first conducted in a shed, an exposure chamber. There a tear-gas was used to demonstrate the fact that the gas was effective without a mask or when the mask was ineffective, and also that the mask was effective when it fitted, was applied properly, and was in ready condition. Each man was caused to suffer a mild Mustard burn. Then, in the field, toxic smokes were set off so that a cloud was generated. The class then walked through the cloud with masks on. Where

masks leaked men were sick. No one of the group, seeing those men, ever forgot how sick they were.

Last of all, possibly for emphasis on its importance, came decontamination. Lee was taught the mechanical end, the labor end, of chemical neutralization. He slogged and slaved under a broiling sun scrubbing lime into a steel plate that had been treated with mustard, very lightly treated. After hours and days of hard work in which he felt sure that he had worn the plate clean through, the indicators still picked up traces of the liquid gas. And during that week on "decon" he learned the odors of the many chemical warfare agents. However, he learned them chiefly from "paper," and he did not feel that he knew them very well, or that he would retain the knowledge. It was too bad, he thought, that on board ship there are so many different odors, strong and mild, that it might be very possible that the odor of a poisonous or toxic agent might be masked, for too long a time for masks themselves to be of any use. In the fire-rooms and engine-rooms, for instance. He was troubled.

So arrived graduation. Lee went to the ceremony in the main lecture hall that morning with mixed feelings. He was glad with a warm gladness that he was going back to the Navy. Yet he felt a wrench at leaving Edgewood. He had learned here, and he had been treated well. The past six weeks had been definitely in the "gain" column. He couldn't afford many of these "vacations from the fleet," but this one, he was sure, had been well worth-while. He was alert when he entered the hall, and he sat with his ears open and his mind on what he heard. The speaker was the Commanding Officer.

"You gentlemen," the boss-man said, "leave this installation and return to your own branches of the service as officers not deeply changed from those who came here six weeks ago. You who were not chemists have not become chemists; you who were naval officers are still naval officers. You have been exposed, here, to Chemical Warfare as we understand it today. You have breathed its 'perfume.' You know what it is, what it could be, and you have, I think, an idea of why we continue to work on it. This above and beyond all you must have learned, for it is the basic and underlying reason for being of all Chemical Warfare; that if War means Death to men then the cheapest way to kill is with gas, and if War means Wounds to men, then the least painful, the least horrible, and the most surely cured wounds are those caused by gas. Chemical Warfare is the smallest and the 'coolest' Hell of all the Hells that War can be. Whether or not it is a practicable means of waging war upon armies and navies as well as upon civilian enemies is a question we must leave to the consideration of greater and wiser soldiers than are we. Time alone will reveal the answer."

ACTION I

"Right, Standard Rudder,—Steady on ONE EIGHT TWO." The Senior Watch Officer and present Officer of the Deck of the USS Cadillac, DD 1707, Lieutenant James Lee, USN, took a check look to starboard and then turned to face the Captain. "Swinging right to new base course, Sir. Six and one half minutes until we reach firing bearing." The Captain grunted an acknowledgment and reached to flip the switch on the teletalk. "Guns!"

"Director, Aye, Aye," came instant reply.

"Approaching base course. Six minutes," said the Captain clearly.

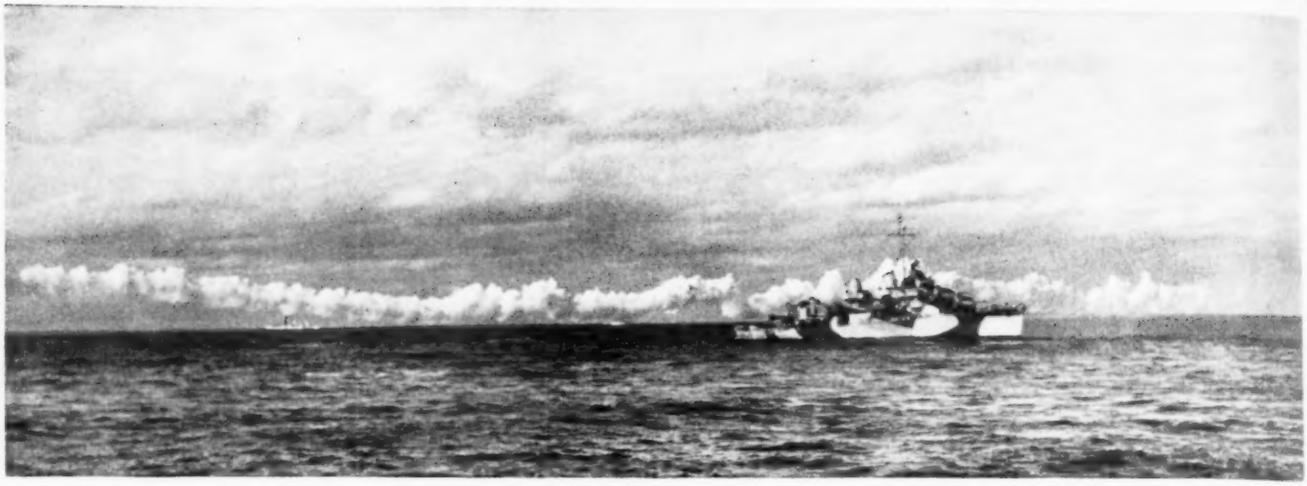
"Six minutes, Aye, Aye. Battery is ready, Sir."

The ship steadied. As Lee looked ahead he observed two ships close together and slightly on his port bow. They were on a crossing course, heading towards the target. "Screen, Captain," he reported, and immediately that part of his mind not required for the routine operation of the ship became absorbed in the pattern of training action which began to develop as he watched.

An old picture of the Chemical Corps School. When this picture was taken, the building on the right was used as the school, the building on the left housed the reproduction plant, with quarters on the second floor for student officers

Unless a great many ships are present all modern tactical ship against ship actions are simple in plan. Even high-speed destroyers take a long time to move from here to there, and once the commanders have accepted action and selected their attack-plans maneuvers are the simplest and most direct possible in view of the mission, which is almost always to attack and destroy the enemy. In this exercise the Destroyer was simulating a Destroyer Division and was to attack an enemy of the same type, simulated by a single high-speed sled target. Attack was from an unfavorable position, on the enemy port quarter on almost parallel courses, converging only enough to permit the entire battery to bear. The enemy was two ships stronger and was presumed to be without Radar. Wind was from ahead and light. The Screen was two Destroyers whose job it was to make a high-speed countercourse attack with torpedoes, laying smoke in the process.

"Screen Smoking,—Screen attacking with torpedoes,—Screen approaching bearing." The reports came in tumbling one upon the other's heels. "Captain to Torpedo Officer,—Train all tubes abeam to port. Set angles forty-five degrees right. Two-degree spread. Report when ready." Fifteen seconds later came the report, "Torpedo Battery ready to port, Sir." The Captain carefully gauged the course of the onrushing Screen. From their sterns came huge billows of dense white smoke. From their stacks boiled up and away equally huge clouds of black boiler-smoke. The relative speed of the two units was nearly sixty knots. As Lee watched the developing situation, trying his best to read the Captain's intentions, he saw the Screen come into line of bearing with the "enemy." "Torpedo Battery Stand By," the Captain said. "On bearing," sang out the Gunnery Officer. "Gun Battery Commence Firing," said the Captain carefully. He noted his watch and kept looking at it. As the twentieth second passed, "Right full rudder," he commanded. "All ahead two-thirds." Then, "Steady on 219." And a few seconds later, as the ship steadied up, "Steady on Course," from the helmsman, and "Fire Torpedoes," from the Captain. Only the forward pair of Five-Inch were firing now, trained nearly dead ahead. The bearing drew left slowly. A few moments and the report came, "All Torpedoes Fired, Sir," and at that instant the ship nosed into the smoke screen. The Captain had eyes for the Radar only. He watched, sweating it out, and then slowly let his breath go, relaxing. He flipped the teletalk, "Cease Firing, Guns," he said. "We got 'em." Lee gazed at the Radar screen as the Captain stepped back. He noted the range and bear-



ing of the target. In a moment he saw what had happened. A few seconds after they had fired torpedoes the enemy had turned towards the smoke. It was just what one would expect an enemy in superior force and not equipped with Radar, with its inferior target obscured by smoke, to do. He had walked right into the torpedo spread. He could not possibly have escaped severe losses. By waiting the twenty seconds before turning the Captain had avoided the probable position of enemy torpedoes if fired at the screen. It had been thoroughly well done.

After the torpedoes had been recovered and all boats were secured for sea the Captain directed Lee to close the target. They loafed over at twenty knots. It was apparent at a distance, through the glass, that direct hits had been scored. As the ship came close aboard the target it was seen that more than half the sled target screen had been shot away. The ship slid on until the towing vessel was closed. The Captain hailed, "Hi, Joe, how went the fish?" "You lucky b——d," came the reply, "Every damned one was within the target limits. One right under us. Glad your depth settings were O.K." A wave and a chuckle, and the Captain went to the Public Address. "Attention, All Hands," he said easily, "This is the Captain. The entire ship's company has contributed to a most successful practice. I congratulate you. Well Done. We are returning to port."

Lee conned the ship into her proper position in the formation and took up prescribed course and zig-zag. He felt a strong, warm swell of pride in his heart. The Skipper was a sharpie. This was a lucky ship. If he had to go to war at least he was in the best possible ship in the fleet. A fleeting thought crossd his mind; he hoped that his ship would never be in the screen in an action like that! As he brought the ship to anchor and reported, "Chain Secured," to the Captain he received the next order, "All officers to the Wardroom, Mr. Lee, please." He passed the word and followed the Captain below.

"Gentlemen, today we have concluded training. We proceed at dawn to the yard. We will remain there seven days. We will then proceed to an Action Theatre. I am not permitted to inform you of our destinations. I advise you to put your heavy gear ashore and stock up on gray uniforms. That is all." They needed no further word. In 1943 that meant the Pacific.

ACTION II

The Force was in trouble. Five destroyers, one an old four-piper with no Anti-Aircraft except a short-barreled 3-inch and a few fifty calibers. The five were steaming a circular screen on a tow. And what a tow that was! A heavy cruiser with fantail almost awash, two torpedoes in her engine-room together with thirty dead men, on the end of a towing cable dragged at three knots by a seagoing tug.

South of Guadalcanal, mid-afternoon, and with an overcast twelve hundred feet up; sea easy; wind soft; enemy in command of the air. The seven ships were horribly lonely. There was a carrier, fortunately, only about fifty miles away, and her AirCap was up and watching. But her primary mission was the protection of a second Force, and if the little group around the tow was to get support it would have to result from the failure of the enemy to launch simultaneous attacks on the two groups.

James Lee, Lieutenant, USN, had the watch. A modified General Quarters was in force, with guns manned by skeleton crews and a junior officer in Gun Control. He listened as the Captain spoke to the Division Commander, "Sir, I suggest that we might request a couple of TBF's or SBD's with smoke apparatus. If they come in it will be bombers or torpedo planes. We cannot hope to get them all if an attack is pressed home. But, if we could get an air-laid smoke screen we might save the cruiser." The Commodore thought it over. "Skipper, at least it is a better idea than any I have been able to come up with. We can try. Will you please have a message prepared."

So, half an hour later, they had a pair of SBD's flying over and around the formation. They might do some good, and at least all that could be done to prepare to defend had been done. The tight circular screen continued.

It was about sixteen hundred that the first warning came. "Bogies—Many Bogies, bearing three four seven, range sixty-five miles." It came from the outer vessel in the screen. All ships went to General Quarters immediately, and the Commodore sent a message to the SBD's. "Take position five miles upwind from this formation. Attack will probably come from starboard. Interpose heavy screen as practicable." Then came the waiting. As they waited the bearing changed constantly to the south. It looked as though the enemy was after the other group. Intercepted radio signals indicated that they were preparing a hot reception for him. The command relaxed slightly.

Quite suddenly and frighteningly the radar stopped training. The bearing became constant. The Division Commander took one long look and jumped for the T.B.S. transmitter. "All ships and planes under my command," was the message, "Stand by to repel air attack from One Nine Zero True. Planes make smoke."

Looking toward the cruiser Lee noticed that all the men on deck, (and the whole crew were on deck) wore lifejackets. Of course, there was no power on the ship. The only defence possible was with ready ammunition and machine guns. A quick anticipatory grief struck him as he realized that the chances of survival of that ship were poor indeed. Even as he swung his head around to look

south he heard a shout, "There they are, Starboard quarter, altitude five hundred." He saw them coming in, bunched together. He counted ten bombers, and then, as he looked, a blanket obscured the enemy. The two SBD's powering their way across the path of the enemy advance and flying just under the overcast, were really putting out smoke. They had only one chance, and they sure were making the most of it. Thick, parallel vertical blankets of FM were shooting downwards behind them. The timing was perfect. The outer plane was laying its screen a thousand yards from the cruiser, and the other was just two hundred yards short. Obscurity was complete.

Two of the enemy tried hard. They dove to get beneath the screen before it touched the water so they could maintain their firing course. But the maneuver was rushed and instinctive. Both crashed and burned. The others carried on, using instruments. As they passed the destroyers between the two smoke blankets every gun on every ship fired. They were riddled, and two more were blazing as they passed through the second screen. As they emerged on the far side of the second screen they were over the ship before they could really see it. All torpedoes dropped, but all were over-shot. And then, going away, they failed to alter course. With minimum rate of change of bearing they were sitting ducks for the destroyers' five-inch. Shot after shot found the targets and one by one they exploded and disintegrated. None got away.

Lee gazed over at the cruiser as they re-formed the screen. He saw men on deck praying in thankfulness at their deliverance. He joined in, silently, and briefly. He looked about. The smoke was still hanging in approximate position; thinning now, but still fairly effective. He stuck his head in the pilot-house door to give an instruction to the helm, gave it, and saw the Commodore shaking hands with the Skipper and smiling. He heard, "Thanks, old man. Your idea saved the day, and probably my two-stars are safe, now, when I come up for selection. I hope I may do the same for you, one day, and you may be sure that you will get full credit in my report."

The Captain smiled and said, evenly, "Thank you, Sir. And now, if you don't mind, I'd best get after the writing of my report." "Mr. Lee, I will be in the Sea-Cabin."

ACTION III

The brazen clang of the general alarm—CLANG—CLANG — CLANG — CLANG! Lieutenant Commander James Lee, USN, Gunnery Officer, hit the deck with the first CLANG. In the dim, blue light of the battle lantern he swiftly dressed, slung his binocular strap around his neck, and charged out into the corridor. By the time he reached his station in the forward gun-director he was winded for fair. There were nine separate ladders between his state room and the director, and he had taken them all in the dark in seventy seconds from the time the alarm was pulled. He sat at his periscope seat, carefully regaining even breathing while the reports came in. At last all was ready. He called the bridge. "Bridge! Guns! Ship's Batteries manned and ready, Sir." In a few minutes the Captain called, "Guns! We are steaming north, speed two five. Broad on the port bow is an unidentified pip. Present range about forty thousand. It is too far away to be a small ship. We suspect an enemy force with cruisers or battleships. Task Force Commander has ordered battle disposition. We will start to close the enemy shortly. Our station is third ship, leading cruiser division. You may secure small-arms and machine-guns and send their crews to augment eight-inch supply train. There will be coffee and sandwiches for all hands in five minutes. Have gun crews mess on station. Report when fully ready."

With a quick, "Aye, Aye," Lee turned to his job. He relayed the news on food to all stations, then ordered all ready racks opened, checked, and filled; all magazines at ready; fresh primers served to bag-gun captains. He checked the wind, sea, and moon, ordered radars to check on other ships of own force, then took a quick director check. He directed Combat Information Center to set up for Surface Action, checked all range-keepers, all telephone and auxiliary circuits, and then cut out his own director train and swung the director slowly around the compass, checking the positions of all ships in the force. The force had achieved battle disposition by now, and he noted the destroyers in the van racing to gain distance; those in the rear steaming towards the rear to open out on the center. The carrier and her guards were at high speed to starboard. He could just see the blue flames of exhausts as the planes were warmed up on deck. There were no battleships in the force. The two divisions of heavy cruisers were in column of open-order columns, his division in the lead, with two ships ahead and one astern of his own. Then he turned to port. The radar showed clearly, now, though without differentiating single ships, three large pips. The one in the center was the larger, and those at either end of the line were smaller. A force about the same size, he figured. Range was still thirty-five thousand yards. The bearing was almost steady, slightly drawing aft. Probably they had not been discovered.

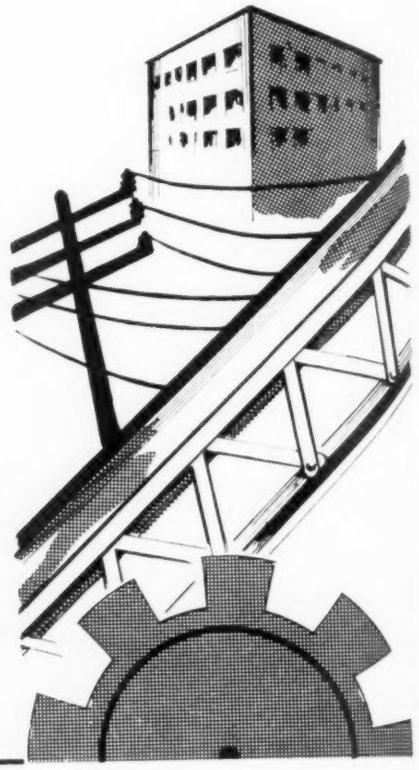
The wind was from a bearing well to the left of the enemy. It looked all right at the moment. Then came the general order, "All ships change course to the left simultaneously by ten degrees." They swung to port, bringing the enemy sharply on the bow. For an hour they steamed so, reducing the range to the center to twenty-two thousand yards. Then came the order, "Leading Cruiser take Force Guide. Destroyers in the Van execute torpedo attack on the enemy rear. After firing torpedoes continue to engage the enemy with guns, executing harassing attacks on the rear. Detail one ship to attack with guns rear ship of enemy main body. Use smoke freely." The radar revealed the action. As the Van destroyers fired torpedoes a new order came. "Change base course to the left by ninety degrees by units in succession from the Van." As the signal was executed the leading cruiser turned sharp left. In her wake went the second, and then Lee felt his own ship heel to starboard as she took the rudder. As she came around to port he heard a new order, "Divisions upon reaching new base course will form open-order column." As the fourth ship of the division straightened up on the new course he felt his own ship swing right as the Captain adjusted to open-order. The new position was four degrees on the starboard quarter of the guide.

The enemy was now to starboard. Lee looked through the periscope and saw gun flashes, smoke and flame as the Van destroyers engaged with guns. One ship was aflame. He looked at the radar. As he watched he saw the enemy formation change. By all the gods! The Tactical Commander had won his gamble! The enemy had been persuaded to reverse course and bring the main body down to help his rear ships. He was trapped. In five minutes the two cruiser divisions would be smack across the line of bearing of the enemy. The "T" would be crossed. He heard the Task Force Commander, "Van destroyers, disengage the enemy and retire to the east under cover of smoke. Aircraft attack the enemy main body from westward. Main Body prepare to open fire on enemy main body." At that moment he coughed, then coughed again. He gazed around him. Nothing could be seen except the instruments, of course, but even those seemed blurred and indistinct. Then his brain worked. On this course and in this position from the guide they were directly down wind. The stack-gases from the ship ahead were blanketing right down on them. And they would commence action in a moment! He told the talker, between gasps, "Tell all stations troubled by stack-gases to assume gas

(Continued on page 54)

PERRY T. FORD—Civil Defense

By PERRY T. FORD, Director
Engineering Services,
Federal Civil Defense Administration



Purposes and Aims of Engineering Services of Federal Civil Defense Administration

The stressed and strained condition of world affairs may bring a catastrophe any day or week that may test, to the limit, the capacity of our people to survive in a free world. By reason of the elements of uncertainty now prevalent throughout the world we are forced in common with all free peoples everywhere, to gird ourselves in defense of our way of life.

To do this successfully, it is necessary that all our resources in manpower and equipment be inventoried and co-ordinated for the purpose of meeting any eventuality.

Our awareness of the dangers that threaten should convince us that a lethargic attitude toward Civil Defense may lose for us our cherished freedoms.

There are many avenues of activity in this country, each the product of private enterprise, the sum total of which constitutes our American way of doing things.

The inter-relationship that exists between, and the interdependence of each to the other, has been accepted in a matter-of-fact way without pausing, "in our hurried rush of life," to contemplate the vast resources of our people.

Before entering into any discussion with regard to Civil Defense, I would invite attention to three phases in our approach to the subject in hand, in order that we may be properly conditioned to attain to some firm and helpful conclusions.

First: We must make up our minds as to whether we are really confronted with an emergency.

I doubt if there is anyone in the entire country who is so naive or uninformed as to believe that we, along with the rest of the free nations of the world, are not threatened by a ruthless power bent on the destruction of the so-called Capitalistic System.

It would be disastrous to assume that we alone possess the instruments of destruction, the means of delivering them, or a perfect defense against them. And our potential enemy is threatening both from without and from within. All of the things we hear about Russia having also developed atomic weapons, maintaining subversive agents and spies the world over, and promoting hostilities among nations, are not unfounded rumors and are too obvious to be denied.

We should not and cannot ignore the fact that AN EMERGENCY DOES EXIST!

Second: Having then made up our minds that we are faced with a threat to our very

existence by the designs of an unfriendly power, let us next explore our vulnerability to attack by atomic, bacteriological, chemical, and other destructive agents.

We are fortunate in that this country has never been invaded and exposed to the destruction that rained down upon our allies and enemies during World Wars I and II. Consequently we must rely on whatever we can learn from others in our endeavor to assess a potential enemy's weapons and his ability to use them against us. It was a need for self protection and self preservation that prompted our forefathers to go about carrying a pistol or rifle. Self protection has been unnecessary for so long a time that it is now difficult to comprehend that today we live under a constant threat. What we have learned is that WE ARE VULNERABLE.

We are vulnerable to attack both extensively and intensively. By "extensively" is meant that there is no area in this country from the Gulf of Mexico to Canada and from the Atlantic to the Pacific that is out of range of bombers. And by "intensively" we mean that the attacker is capable of delivering bombs, and using against us bacteria or gases in sufficient quantity to destroy our industrial potential along with our manpower, if we have no protection. Our enemy will seek to destroy our will to fight by directing his attack against our homes and families. And he is going to make every effort count by directing it at those strategic points, the points we know to be "target areas."

And we may as well admit our vulnerability since it is impossible to set up an absolute and total military defense.

Third: Admitting then that we are faced by an emergency and that we are vulnerable to attack, let us now consider what we are to do about this situation.

First of all it should be realized that there is no spot in this vast land of ours which is immune to attack. We do not live in a vacuum; our cities, be they large or small, are important. It is important not alone to you, it is important if even in small measure, to our entire economy. As such, we must regard an attack on any city as an attack upon our own. We are all in this struggle together and therefore must realize that together we will either survive or lose the freedom which constitutes the basic concept of our way of living.

A correct perspective of dangers confronting us is necessary properly to condition the minds of our people to wage a defensive war for the survival of our ideals. Even the very existence of our lives could be the stake at issue.

The arts of war have undergone many changes in the last half century. War is now waged over unlimited areas with types of weapons that strike at noncombatants and combatants alike. Our homes, our stores, our factories are and will be the "battle-line." Mass destruction of people and property is the forecast for the plan of conflict.

A realization of this situation has made necessary the formation of the Federal Civil Defense Administration, created to promote the organization of our civilian population, our noncombatants, so that they, along with our armed forces, will be able to meet an enemy attack in whatever form it may come. Even as our soldiers, sailors, air force and marines are prepared to meet an enemy, so must we civilians be prepared to meet an enemy attack. And this we propose to do by marshalling our civilian resources in self-defense. The armed forces make up the cutting edge of the wedge, our industrial army with its technical know-how make up the body of the tool. All of these together give us our power or total ability to wage war.

Public Law 920, under which this administration was established, in its declaration of policy states that the Federal Government shall provide necessary coordination and guidance in addition to providing material assistance within the limitations of the Act. In its simplest terms, our job is to provide *coordination* and *guidance* in organizing, training, and equipping a civil defense force to minimize the effects of an enemy attack.

One of the areas in which the Federal Government undertakes to provide coordination and guidance is that which embraces the Technical Services Office. The administration has assigned to this Office *seven services*, each of which has definite, well defined duties and responsibilities which it is called upon to exercise, *not* as separate undertakings, but in the sense of cooperating elements in the Civil Defense program.

We shall here limit our discussion to but one of these Services since it is the one in which the Chemical Industry are most interested, namely the *ENGINEERING SERVICE* which is generally regarded as the most technical of the Technical Services.

A brief summary of the "Administrator's Order" establishing this Service might be in order.

The duties of Engineering Services are many and varied and include services in an advisory capacity to all levels of FCDA, more specifically the Engineering Service:

Develops plans and methods for organizing similar services on State and local level.

Initiates engineering plans and methods for emergency restoration of all facilities common to a community.

Conducts research studies, projects and tests to develop adequate methods and equipment. This includes study and development of techniques for assisting rescue and fire fighting workers in the clearance of debris and demolition of structures and buildings.

Initiates the need for complete inventories of equipment, materials, and manpower that a community may determine its capacity for self defense and rehabilitation.

Assists in developing methods to aid communities in determining an adequate support area and to correlate local and State plans for mutual aid.

Establishes requirements for stockpiling of critical items where found to be deficient.

It is the concern of this Service to restore to a minimum operational condition the various community services; such as water supply, sewage and waste disposal, power transmission lines; to make emergency repairs to damaged hospitals, community facilities, and dwellings; to shore up or demolish structures that are a hazard to the safety of Civil Defense personnel or that stand in the way of the fire fighting or rescue workers. It is this Service which will remove rubble, clear roads, aid transportation facilities (air, rail and water) to get back into operation; conduct surveys to locate possible shelter areas in existing structures, and advise with regard to building alterations to effect structural changes which will reduce the hazards and damage incident to any possible enemy attack.

It must be realized, of course, that to carry on these many and varied activities, properly will demand the services of a great many skilled and experienced individuals along with their tools, machines, and supplies. This being so, the Engineering Services is enlisting and receiving the help and cooperation of existing organizations concerned with the various activities for which it is held responsible.

Everyone knows that if there is trouble with the water supply it is but a simple matter to telephone to the Department of Water Supply and the difficulty will be promptly remedied. The same thing applies to gas, telephone, or electric systems. Every public and private utility does have emergency repair crews who are fully equipped to go into action immediately and repair or restore their service.

In addition to these *public* services, we have been assured the active support of many *private* groups, such as,

the building contractors, associations of plumbers, electricians, road builders, and others. They have not only the personnel, but also the equipment necessary for their own type of operation.

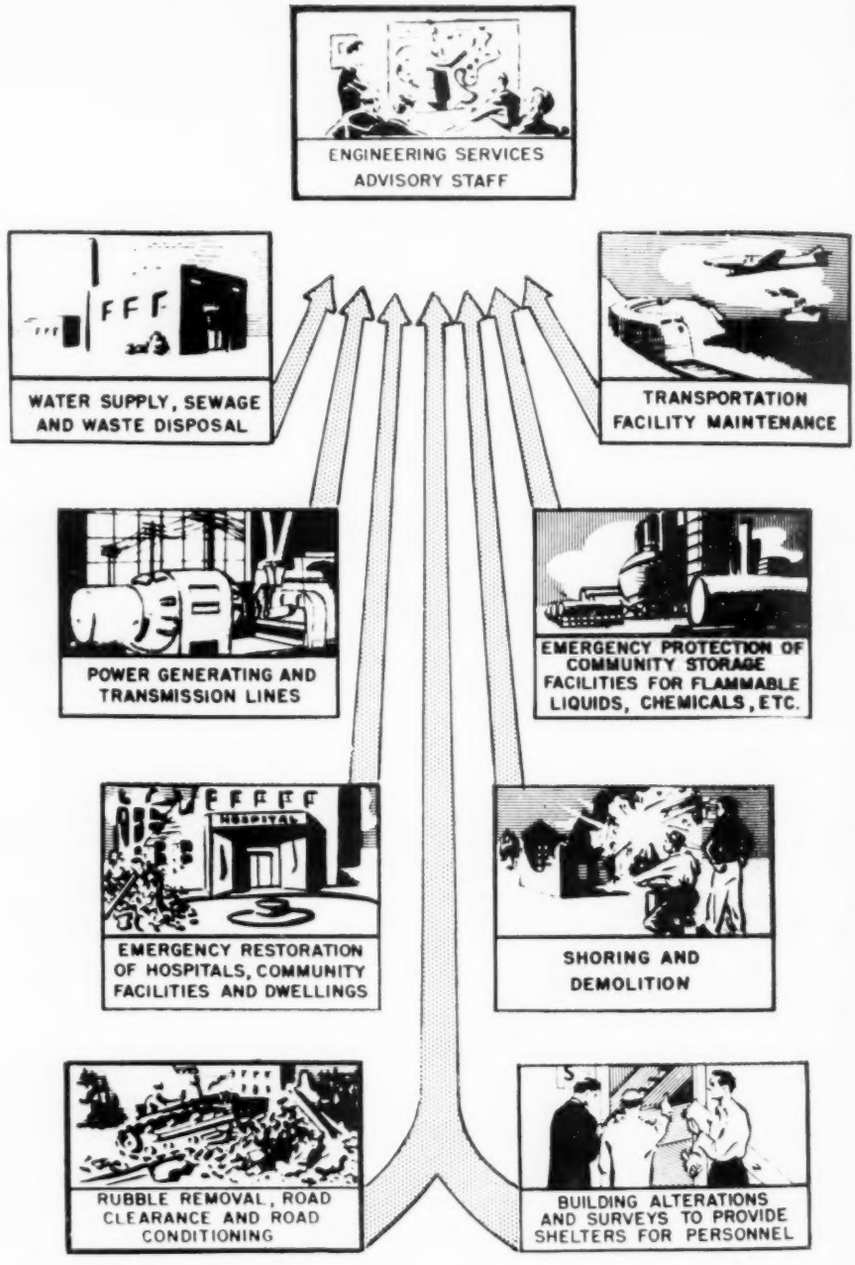
These *public service* and *private* groups we designate as the operational elements of our Engineering Services. But equally important is the assistance and advice which is freely made available to us by chemists, scientists, and groups such as the Armed Force Chemical Association, that is, the learned societies, the associations of professional, scientific, and other qualified personnel. It is to them that we look for guidance and counsel in every phase of our program, the objective of which is to build an organization which will understand our problems, and be informed of the methods and procedures which must be established in order to enable us to promptly and properly resolve them.

Merely to request and receive the very necessary and helpful cooperation of all these groups is not enough; the Engineering Services must organize them and, in time of disaster, augment their operating personnel. Although our existing groups are sufficient to carry on under normal conditions, it will undoubtedly be demanded that we relieve or replace these people should it become necessary to work on a twenty-four hour, round-the-clock schedule.

Let me briefly detail what may be involved in the procedure of just one of these Services in the event of an attack. The reason for selecting this particular service is first, that it has to do with a subject with which we are all acquainted, and second, it lends itself rather well in that it brings up a great many situations which will, in all likelihood, arise in the field and which must be resolved if we are to do our job properly.

Let us consider this matter of water supply. Under normal conditions, the local organization responsible for operating our water supply system is in a position to take care of a leak in a pipe leading from a main to the premises of a user. It is also well equipped to repair or replace a break in the main itself. We would rarely be confronted with difficulties of this sort at more than one or two points, and our supply of pipe for replacement would be adequate, as would the required tools, trucks, and workers.

If an enemy attack were to occur, we would not have one or two leaks or breaks to take care of, but an uncounted number located over an extended area in or near the point of detonation of whatever type of missile were used. Not only would we have burst mains; we might find that our pumping machinery as well as our



water treatment system is knocked out. It may be found that the damage has occurred at the main source of our water supply, or that because of damage to the sewage system the water which does flow is contaminated by seepage.

But *water is essential*, so, in the face of a situation such as is pictured here, the Engineering Services may be called upon to lay hundreds of feet of pipe in order to obtain a supply for use by our fire fighters or by our hospitals. The fire people are not concerned with the purity or potability of whatever water is made available, but our hospitals and our welfare people are. Thus, chlorinators or purifiers will be needed.

Ample supplies of light-weight, portable pipe, portable pumps, chlorinators, and other supplies and equipment are not likely to be available if and when needed, *unless* they have been provided in advance.

In the course of this work of restoring our water supply, we require the use of trench digging machines, cranes and other power machinery.

We are endeavoring to convey by implication some of the many matters with which the Engineering Services must cope if it is to discharge properly its vital functions in our CIVIL DEFENSE.

To merely call attention to some of the situations and problems which will confront the Engineering Services would contribute little that could be considered as either helpful or practical to the fulfillment of its legal re-

(Continued on page 50)

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Biological Warfare

By WILLIAM M. CREASY
Brigadier General, U. S. Army
Commanding General Chemical Corps Research and Development Command

BRIGADIER GENERAL WILLIAM M. CREASY

This address was presented in the Central Auditorium of the University of Maryland at College Park on December 5, 1951, under the auspices of the Division of Physical Sciences of the University. It is the first of a series of three lectures on Science in Future Warfare, given by Chemical Corps specialists in their particular fields. Subjects and tentative dates for the next two lectures are: "Gas, Smoke, and Flame," March 1952; and "Medical Research," April 1952.

Since this is the first of a series of talks on the research, development and engineering work of the Chemical Corps, it may be well to preface my remarks on biological warfare by a brief discussion of the work as a whole.

The Chemical Corps is a branch of the Department of the Army and has certain responsibilities in the field of chemical, biological, and radiological warfare. These responsibilities relate not only to the Department of the Army, but to the entire national military establishment. Your friends and relatives, now fighting in Korea, depend upon the effectiveness of fire bombs, flame throwers and mortars in hurling back the enemy to his present position. You may also have heard of the important, but less spectacular parts played by screening and signal smokes.

The research, development, and engineering activities of the Chemical Corps are directed toward making available to our troops the best modern weapons, protection and countermeasures in the field of chemical, biological and radiological warfare. All these activities are conducted by the Research and Engineering Command of the Chemical Corps. Throughout that organization, we find soldiers and civilians working side by side. Many of the soldiers are trained scientists and engineers, and many of the civilians have had military service.

Chemical, biological and radiological warfare have in common the use of air-borne toxics as weapons and the protection of civilians and soldiers from the action of such toxics by suitable protective devices and decontamination methods. The dissemination of air-borne toxics and smokes of whatever nature, by whatever method, must take into consideration the factors which influence the flow and mixing of currents of air near the ground. All of these air-borne toxics (and this is also true of flame throwers) are especially effective in those places where a soldier has taken cover from projectiles which move in a straight line. All air-borne toxics are of but two kinds: vapors and smokes. Vapors are removed from an air stream by activated charcoal and smokes (and other suspended particles) are all removed by filters especially constructed for the purpose.

Thus, much the same principles govern the development of the weapons and protective devices of chemical, biological and radiological warfare. While special staffs and equipment are necessary to conduct research and various stages of development in these three fields the proving ground function and engineering function are accomplished by a minimum number of installations serving all the other agencies.

Some idea of the magnitude of the work of the Chemical Corps will become apparent to you as I describe the functions of our operating agencies. This work is distributed among several agencies all reporting to the office of the Commanding General, Chemical Corps Research and Engineering Command.

In order to supervise the work of so large an organization, it is necessary to have a staff who are not only trained in many branches of science and engineering but also able to work smoothly with other scientists and administrators. At the present time, furthermore, the Chemical Corps has many outside contracts with various industries and institutions amounting to many millions of dollars. Coordination of this vast program by the Chemical Corps requires the guidance of a vigorous scientific engineering organization, staffed with personnel who command the respect of their fellows in industry and education.

The commanding general and his immediate staff are guided in the conduct of their work by directives from the chief chemical officer based upon guidance received from

the general staff and the research and development board. We work in close cooperation with Dr. W. Albert Noyes, the senior scientific advisor of the chief chemical officer and Dr. H. Fraser Johnstone, the chairman of the Chemical Corps Advisory Committee.

I should like to describe to you each of our operating agencies.

For the development of weapons, smoke generators and protective devices for chemical and radiological warfare, we have in the research and engineering command the Chemical Corps Chemical and Radiological Laboratories located at the Army Chemical Center. This organization handles all research and development in connection with chemical weapons and with protective devices for chemical, biological and radiological warfare. It is housed principally in a large two-story building and over one hundred smaller buildings. It has an excellent technical library of some twenty thousand volumes of scientific and engineering books, hundreds of thousands of technical reports and over one hundred current periodicals. The equipment and laboratories compare favorably with those of any technical organization of equal size in the world.

Research on the efforts of gas, smoke, flame and radiological weapons on the human organism and on methods for the treatment of injuries from such weapons are conducted in the medical laboratories also located at the Army Chemical Center. These laboratories have the most modern scientific equipment and are housed principally in a two-story building nearly as large as the chemical and radiological laboratories. Near this building are found well equipped toxicological laboratories, a large building for the care of laboratory animals and a fair-sized lecture hall. The medical laboratories have a library of their own and is only a short distance from the library of the chemical and radiological laboratories.

Research and development in the field of biological warfare is conducted in the biological laboratories at Camp Detrick near Frederick, Maryland. It has a large and up-to-date scientific library and well-equipped laboratories.

When a weapon or a protective device from one of these agencies has passed through the research stage and been developed to the point where an experimental model is available and has been given preliminary tests, it is referred to the engineering agency at the Army Chemical Center for final production design of chemical corps weapons and equipment. This newly created agency has moved into quarters formerly occupied by the Chemical Corps School. The agency is staffed largely by people with broad experience in the development of military equipment and with a liberal addition of engineers experienced in the best industrial practices.

When a sufficient number of a weapon or protective device has been procured or manufactured under the supervision of the engineering agency, it is then tested either at the Edgewood Proving Ground or the Dugway Proving Ground. The results of those tests and of the experimental production which preceded them may require modification of the item and corresponding revision of the specifications and drawings for its procurement.

The Edgewood Proving Ground is located at the Army Chemical Center and its principal function is to test Chemical corps equipment when these tests can be safely conducted in a limited area and without danger to the nearby population centers.

Dugway Proving Ground is the largest and newest of the research and development installations of the Chemical Corps. It is located seventy-five miles southwest of Salt Lake City, Utah, on the level floor of a prehistoric lake largely surrounded by mountains. Since World War II, it has been used for large-scale field tests of chemical warfare agents and munitions.

The scientists and engineers of the Research and Engineering Command are engaged in a most important work. Preparation for the National Defense in the Field of Chemical, Biological and Radiological Warfare has attracted some of the best scientists in this country. Some are consultants and members of important advisory committees. Others participate directly in our program by means of research contracts. Others are on active duty as reserve officers. Still others are now civilian employees in the Office of the Commanding General and the several operating agencies of the command.

We believe there is a real opportunity in the command for young men of promise. Promotion within the command has been rapid. Sometimes it may seem that such rapid promotions threaten to outstrip the professional development of the individual. But we are constantly reassured by the rapidity with which our younger men grasp the scope of their new responsibilities and by the efficiency and enthusiasm they display in attacking new problems. The young men of the Chemical Corps in World War I are now among the leading scientists and engineers of the country. A large proportion of those engaged in Chemical Corps research, development, engineering and production in World War II now occupy responsible positions in industry and the universities. Some are continuing research in the fields to which they were then introduced. Others are applying knowledge gained to the solution of industrial problems. They have no cause to regret the time spent with us.

With these rather lengthy preliminaries out of the road, I would now like to deal in some greater detail with the capabilities and limitations of biological warfare.

I am delighted to have an opportunity to explain why I feel—quite strongly—that biological warfare is of vital concern to every thinking citizen of the United States. The problem is complicated by the fact that it is somewhat difficult to sell a closed package. It is not possible nor, I believe, even desirable for me to allow you to examine the interior of the biological warfare package. I am sure you will understand why. I do believe, however, that by looking at the form and shape of the package and its wrappings that you can determine whether this is a package whose contents you would wish to safeguard and store in a place where they could grow, or to thrust them back into the closet where they would wither and die; in the latter case, accepting the risk of someone else using his own developments in this field against us at a later date.

I should like to emphasize that nothing I shall say here is not already available to you in the open literature in the form of civil defense manuals, or articles by reliable and informed public health or other authoritative sources. During the past few years, a large number of popular articles on BW have been published. Unfortunately, some of these articles have been inaccurate and misleading, mainly because of their highly sensational nature. In my remarks this evening, I hope to correct some of the false impressions which may have been created and to add what I can to such knowledge of biological warfare as you now have.

We, of the Chemical Corps, have been charged by the Department of Defense, and I quote an extract, "To study and investigate . . . biological warfare . . .; to provide technical supervision of the training of the Army in this field; and to develop, manufacture, procure, and supply material and equipment pertaining to this type of warfare . . ."

In December 1950, the executive office of the President issued a manual entitled, "Health Services and Special Weapons Defense." This manual categorically states that "an enemy . . . could employ . . . biological warfare against us effectively." As the official position of our government, this statement deserves the due respect of every citizen regardless of his previous opinions or preconceived ideas.

You, as citizens, may take any stand on the subject that you wish, but let it be an intelligent one based on facts and not on sensational hearsay or unintentional ignorance.

I believe it is immediately apparent, after even a cursory examination, that if biological warfare should be used clandestinely against us by an enemy it would do us more damage than any advantage we might hope to secure through a similar use against him. Accordingly, we must, as an absolute minimum, have a thorough knowledge of its potentialities when used in this—or in other ways—and examine very critically the biological warfare responsibilities of both our military and civilian organizations. Only then can we determine what action is necessary by this country.

Biological warfare is essentially public health and preventive medicine in reverse. Except for novel methods of achieving deliberate dissemination of pathogenic microorganisms, it is a form of warfare which nature has waged against man for thousands of years, and against which our modern health practices have produced effective defenses.

A more precise definition of biological warfare is "the intentional use of living disease agents, or their toxic products, for the purpose of producing disease or death in man, animals, or crops, and defenses against the use of these materials for these purposes."

BW represents another attempt to examine and control the forces of nature for the benefit of our people—specifically here in connection with their military application. Unlike the atomic bomb or other blast weapons, biological warfare is essentially anti-personnel in nature because it does not destroy buildings and machines but it is directed at man himself or his food supply—that is, his animals and crops.

The concept of biological warfare is not new. Even with no help from man, germs have entered every major military campaign. Plague cut down the Crusaders at the gates of Jerusalem. Typhus riddled the Moors in Spain and dysentery thinned the ranks of Napoleon's Grand Army as it moved on Moscow. During the Boer War, typhoid laid low more men than did bullets. In the early days of World War II, malaria heavily attacked our own forces in the South Pacific.

More than once germs, not generals, have decided the outcome of a conflict. But these have been natural attacks and epidemics, and against these our defenses are good and are getting better.

So far, no one has really used biological warfare, although some small-scale attacks have been tried. Before we got into World War I, secret agents working in the United States infected livestock with a disease called glanders as the animals were being prepared for shipment to the Allied Nations of Europe. Those attacks were very crude. They had no real effect on the outcome of the war, since only a few animals were infected. They relied on natural spread to accomplish large-scale infection. Such attacks hold little danger or promise—depending on the point of view—of really sweeping results.

Now I would like to mention briefly and dispose of two of the more sensational aspects of biological warfare. These are the concepts of super-virulence and epidemicity. Nowhere in biological warfare publications by reputable authorities does one find mention of hypothetical new agents of unknown characteristics or "Super Virulence." It would appear probable then that such a concept lies in the realm of pure speculation. Moreover, most authorities seriously question the concept that a self-propagating epidemic must be anticipated. First, because they doubt that such an epidemic could be started, and secondly because they feel that a strengthened public Health organization could promptly control one if it did occur. Let us consider one example of the workings of our nationwide system to prevent and control disease outbreaks of all kinds. In 1947 a man with an active case of smallpox was discovered in New York. This man had traveled within the city, shopped in its stores and used its buses and subways. He unquestionably came into direct contact with hundreds of New Yorkers during the several days in which he was, in effect, a disseminator of BW. But prompt preventive measures, including vaccination of more than six million people, limited secondary outbreaks of smallpox to only 12 cases. If we accept this efficient operation of our public health authorities as typical—and I believe we can—and if we quite properly ignore such figments as super-virulence, we can them focus our attention on the real and the practical.

The importance of air as a means of spread of *naturally* occurring disease has long been a disputed question. This question has received intensive study in the last 15 years and it still remains to be conclusively proved that the airborne route is an important factor in the spread of *naturally* occurring disease. However, knowledge accumulated during this period has clearly established some of the mechanisms of airborne infection. Airborne spread of disease is a reality in the experimental laboratory and known to be a common cause of many accidental human infections. The fact that the hazard of aerial contamination is widely accepted is indicated by the extreme precautions that are taken not only in studying highly infectious agents but also in dealing with routine hospital problems.

The size of single bacterial cells, fungal spores, rickettsiae and virus elementary bodies is somewhere under 5 microns, which means that such single particles can penetrate to the lungs. However, pathogenic agents rarely exist in nature as single cells; rather, they tend to grow in clumps or chains. Furthermore, they are almost always intimately mixed with moist organic matter and when naturally dispersed into the open, tend rapidly to adhere to dust or lint and become even larger, thereby greatly facilitating their filration. It would seem to be an entirely reasonable conclusion that single pathogenic cells are only rarely dispersed into the air under natural circumstances and that the human species has not been forced to contend with a wide variety of finely dispersed bacterial aerosols and therefore has not faced the biological necessity of developing a natural mechanism to defend against them.

Artificial circumstances present an entirely different picture since many pathogenic agents may be grown in almost limitless quantities and may be dispersed into the air as single cells. Although most of such cells would probably be trapped and rendered ineffective by the body's physical defense mechanisms, enough might reach the lungs to cause infection. The purposeful creation of clouds of such individual cells could then be one of the most important objectives of biological warfare.

Let us now elaborate on how an enemy might use the airborne route of infection in biological warfare against man. The frequency with which certain and even fatal infections occur among laboratory workers demonstrates that a material proportion of the adult population of this country is susceptible under such conditions of exposure. The question, therefore, resolves itself to the simple proposition: can the enemy reproduce at will the conditions known to cause accidental laboratory epidemics?

So far as we know, the aerosol method of spreading pathogenic microorganisms has never been tried in actual warfare. We don't know whether it ever will be tried, but, apparently, it could be used, and so we must make our preparations accordingly.

It would seem that no new principles are involved. If grinding infectious tissue in a laboratory will contaminate the room, or if concentrating a suspension of pathogenic agents in a centrifuge will contaminate a whole building,

(Continued on page 46)

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In Chicago, Ill., Witco's expanded facilities have more than doubled production of Napalm and other vital chemicals.

In Lake Charles, La., Witco-Continental's new plant, capacity 25 million lbs. a year, is in full-scale production of High Abrasion Furnace black.

In Sunray, Texas, Witco-Continental has substantially increased its facilities for production of Semi-Reinforcing Furnace black.

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In Chicago, Witco has added a two-story wing to its research and technical service laboratory. Work will be carried out on a variety of important organic chemicals.

In Amarillo, Texas, Witco has opened a new laboratory devoted to research and technical service on carbon blacks.

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Resinate, Calcium, Type I (USA-50-11-896)
Resinate, Manganese (Navy 52-R-8a)
Resinate, Sodium (MIL-S-6138-Aer.)
Zinc Naphthenate (for use in Army Spec. AXS-1296) (52-D-7 Navy) (AN-TT-D-643)
Wood Preservative, Copper Naphthenate (52 W 5 Type A)
Carbon Black, Dry (for explosives) (JAN-C-306)
Case Liner Adhesive (JAN-P-140, Type II, Grade A)
Paint, Acid Proof, Black (for ammunition) (JAN-P-450)
Composition, Top Coating Material Bituminous (JAN-P-102)
Compound, Chassis Coating (Army AXS-1827)
Compound, Protective Strippable (Army AXS-1756)
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The Seventh Annual Meeting of the Armed Forces Chemical Association will be held in Chicago on May 15th, 16th and 17th. The headquarters for the meeting will be at the Congress Hotel. This meeting is sponsored by the Chicago Chapter of the Association, which has assumed the active management of the affair.

Each of the three days of the Meeting will present interest-packed events for the members attending. Announcement of the details of the program is being withheld until all arrangements have been fully completed and approved. Similarly, announcement of the speakers is withheld until definite acceptances are obtained. Assurance is given by those charged with this part of the program that the speakers will be truly distinguished.

The Chicago Chapter has assumed its role as host with characteristic enthusiasm. It expects that the Association's Seventh Annual Meeting will top all records with the size of its attendance and the quality of its program.

"Chicago is at its best in May," said Mr. James J. Doheny, Secretary-Treasurer of the Chapter, on a recent visit to AFCA headquarters. "The City itself will prove a magnificent attraction, and will not disappoint those who attend the Meeting."

A few of Chicago's attractions are touched upon in the following promotional material forwarded by the Committee for inclusion in this article. This commentary was written by Mr. Dickson Hartwell.

Chicago is sometimes naive, often surprising and always colossal. It grew from a hamlet to the country's second largest city in a sensational sixty years. It has the world's largest hotel, as much railroad track as all of New York State, and it produces nearly half the nation's candy and radar equipment. Its principal amusement park is bigger than Coney Island.

The first skyscraper was built in Chicago. Ten blocks of its 143 block-long State Street comprise the most con-

AFCA 7th ANNUAL MEETING
CHICAGO . . . MAY 15th, 16th and 17th

centrated retail shopping area anywhere, attracting 500,000 customers a day. Its pushcart center on Maxwell Street rivals New York's lower East Side. The day and night displays of its Buckingham Fountain aren't duplicated on the continent.

The city has never received its proper due. Visitors to London, Paris and New York expect, and therefore usually get, a thrill. When people announce, "I'm going to New Orleans," or even "I'm off to San Francisco," they say it with a lilt as an exciting adventure. But "I'm going to Chicago" is a flat statement of fact with no implication of expectancy. Yet there is more to do in Chicago after 4 a.m. than there is in Paris.

The man who made Chicago a gathering place for celebrities was the late Ernest Byfield, who gave the town its famed refreshment stands, the Buttery and the Pump Room, and whose father opened the first night club in America in 1902, the College Inn of the Hotel Sherman.

Byfield's effect on eating in Chicago has survived him. The Pump Room still draws celebrities. The Chicago Inn has become the Porterhouse, where as Byfield planned it, exceptional steaks are served by waiters in cowboy suits in a ranch atmosphere. There are Indians for atmosphere, too.

Aside from Byfield's celebrities, some of whom don't know a truffle from a painful case of smorgasbord, Chicago doesn't attract many gourmets. But some of its beaneries could, with a little publicity, become widely celebrated. No better Italian food can be found anywhere than at El Bianco. The Black Forest has excellent German cooking and Little Bohemia is a haven for those who know native dishes. Nowhere outside of Hawaii is exotic Oriental food better than at Shangri La. Many discriminating diners-out end up in the Union Station, of all places, simply because

the Harvey Boys operate one of the best of the Fred Harvey restaurants there.

An exhibit for which Chicago is famous is in the fabulous Museum of Science and Industry, which resembles an ordinary museum about as much as South Pacific resembles Goldsmith's She Stoops to Conquer.

This exciting institution contains a coal mine where you see real coal being mined by real miners. There is an exact replica of a small town Main Street of 1910, gaslighted and with a nickelodeon where for five cents you may be entertained with the flicker pictures of the period, such as The Great Train Robbery. It is the last five-cent movie house in the country. There is an exhibit of old time

(Continued on page 5.)

Composite view of Operations Area

DESERET C

Just fifty miles southwest of Salt Lake City, in Utah's Rush Valley, lies a sprawling military installation known as Deseret Chemical Depot. The depot's 19,000 acres covers a large portion of the desert valley which many hundreds of years ago was a part of the Great Lake Bonneville, now known as the Great Salt Lake, then covering so much of this now habitable land. Elevation of the entire valley is approximately 5000 feet.

Deseret is unique in many ways because of its natural surroundings, ranches, silver and copper mines, and the fact that it is one of three military installations within a sixty mile radius. The depot is located between the Tooele Ordnance Depot and Dugway Proving Ground, which, prior to the outbreak of hostilities in Korea in June 1950, was combined with Deseret Chemical Warfare Depot as the Western Chemical Center; however, after July 1950 the Defense Department saw fit to establish Dugway as a separate command in order that its mission could be more effectively accomplished. At this time Deseret assumed its present title of Deseret Chemical Depot.

Kenneth A. Cunin, Colonel, Cml C, Commanding Officer, Deseret Chemical Depot, Tooele, Utah

Deseret Chemical Warfare Depot, as it was originally named, was first realized as a Chemical Warfare Service installation in the early months of 1942 when it became increasingly apparent to the Chemical Corps that storage, processing, and shipping of chemical agents necessary in the prosecution of the war effort would be much greater than the facilities then available to the Service could provide.

The present location of Deseret was chosen, after much deliberation, as the most ideal site by virtue of its isolation and the desire not to locate such an installation near a large residential area, such as Salt Lake City. This latter reason was due to the fact that Chemical Materials to include toxics were to be stored, processed, and shipped.

On 11 March 1942, authority to acquire 12,000 acres of land was given the District Engineers, then located at Salt Lake City, and on the same date instructions were issued to begin construction. In this respect, however, many difficulties confronted the Engineers, partly because of the lack of time allowed to thoroughly study the area, and the inability to use gravel deposits located on the depot because of a surface coating of lime, which rendered the pebbles and gravels unfit for use. This resulted in hauling

*Captain Wilmore is on the Headquarters Staff, Deseret Chemical Depot

T CHEMICAL DEPOT

By Captain ALLAN E. WILMORE, CmlC*

thousands of cubic yards of material many miles over poor roads to the post. In addition, priority restrictions on critical supplies presented other problems in spite of the fact that, as early as 8 June 1942, the Army-Navy Munitions Board submitted a request for an A-1 priority rating for certain materials covering, principally, trucks, cranes, locomotives, and other steel products required in the depot's construction. Substitutions of materials had to be made in many cases—thus aggravating the construction program.

An important part of the work was grading and leveling large areas. Clearing of the sagebrush and other desert vegetation produced further hardships on the employees, since the continued strong winds raised huge dust clouds. This condition, along with the isolation and emergency living conditions, contributed appreciably to the tremendous labor turn-over, which reached the almost incredible rate of 400 per cent during the first six months of construction.

Except for a few small farm communities, the only nearby sources of labor supply were Tooele, twenty miles distant, and Salt Lake City, fifty miles distant The already existent Tooele Ordnance Depot, located just outside the city limits of Tooele, had practically drained that source of labor supply while the surrounding Salt Lake City areas had some fifteen large military installations in operation. Not only was the labor supply critical, but the adverse living conditions made it even more difficult to obtain and hold the small amount of labor available.

In the original draft of facilities to be provided, allowances had been made for the construction of dwellings for certain essential civilian laborers. These were limited to four buildings aggregating approximately 3,000 square feet of space. On May 1942, the Chief, Industrial Service, CWS, called to the attention of the Office of the Chief of Engineers the need for living quarters on the post, for civilian as well as military personnel. The initial plan had estimated the number of civilian workers necessary to carry on depot operations at 205. On 22 August 1942, at the direction of the Office of the Chief, CWS, the Depot Commanding Officer submitted a revised program calling for 308 employees. A short time later he estimated that housing facilities should be made available for 300 women and 440 men, with one unit of each type of dormitory to be ready for occupancy by 1 October 1942.

On the basis of information furnished on 5 September 1942, by Deseret Depot Headquarters, to the National Housing Agency (Kansas City Office), in response to that

ALLEN E WILMORE
Captain, MI-(TC)

Top: View of Operations Area. Above: Headquarters Building, Deseret Chemical Depot, Tooele, Utah

agency's questionnaire, the Regional Director of the Federal Public Housing Authority, Region VII, recommended construction of the following units at Deseret Depot: 448 Dormitory Units, 90 Detached Houses, 64 Apartment Units.

Actual construction of the dormitories was begun under the direction of the District Engineer about 1 February 1943, and the first building was available for occupancy in April. Work on the housing units administered by the FPHA commenced in mid-April, and tenants began to move in the latter part of August.

On 31 December 1942, the Area Engineer rendered the following report on the status of work under the original contract:

Administration Building	100.00%	complete
Dispensary, Fire and Guard hqs	95.50%	complete
Cafeteria Building	98.00%	complete
Communications Building	100.00%	complete
Road grading and rock base	98.10%	complete
Road mix laid	41.60%	complete
Fence lighting	96.50%	complete
Water lines	99.50%	complete
Sewer lines	100.00%	complete

Personnel were moved into the Administration Building on 9 January 1943. By the end of that month, work had progressed so far that in his monthly report the Area Engineer could state:

"Under the Architect-Engineer contract, all items are completed with the exception of the railroad, which is expected to be completed on or about 15 February 1943.

"Under the lump-sum contract, all buildings have been turned over to the Post Engineer, and are accepted, subject to minor corrections. It is expected that the light and power distribution system, fence lighting, steam system, roads, water wells, sewers, sidewalks, and pumps in the fuel station will be turned over to the Post Engineer on or about 1 January 1943.

"All buildings in the Administration area are completed and occupied; in the Shop Area, all buildings are completed and turned over to the using service for their use. The five officers' quarters have been completed and occupied. The filling station is completed and occupied, as are toxic storage Areas No. 1 and No. 2, and the bomb storage Area.

"Work under this (lump-sum) contract is completed, subject to corrections, with the exception of gunniting 14 igloo doors, due to the fact that the Utah Construction Company is using these igloos for living and office purposes at the present time."

This statement, however, did not mean that the job of building the Depot was accomplished as it stands today, even excluding the civilian housing, which came under a separate project. As the need arose for an increase over original estimates of bomb and gas storage capacities so likewise occurred the need to develop additional operating equipment. This became apparent to the Commanding Officer soon after the inception of the project. He was of the opinion that the Depot could not function properly without additional facilities, built as rapidly as possible.

In addition to miscellaneous buildings constructed for the Post Engineers, other additions, including the building of a bachelor officers quarters in two units with accommodations for 30 officers, was sanctioned later in the year 1943. With their construction, the building of Deseret Chemical Warfare Depot was completed.

Thus the two installations, Deseret Chemical Depot and Dugway Proving Ground, came into being to develop into vital cogs of the Chemical Corps. These stations remained as separate and distinct installations until 16 January 1947 when the Secretary of War, in General Orders Number 8, established Western Chemical Center as it was organized up to the start of the Korean conflict.

On 11 July 1943, when it was considered Deseret had attained a full operating status, a formal flag raising and dedicatory ceremony was held. At this time the depot's first Commanding Officer, Colonel E. B. Blanchard, CWS, was in command.

The requirements of World War II caused an increase of manpower needs for the depot to an almost unobtainable proportion, and it became necessary to organize an extensive campaign of recruiting which resulted in labor being brought into the depot from such distant places as Arizona and New Mexico. The Indian reservations of that area came through with flying colors and even to-day many of the Navajos who worked at the installation in the beginning have returned and have proven to be some of the most efficient personnel employed by the Operations Division.

Aside from the main mission of the Depot, a most harrowing and worthwhile experience was during the record snow storms of 1948-49. Worthwhile because of the great part the personnel and equipment of Deseret played in aiding the citizens of surrounding communities—in many instances lives of residents as well as their livestock were saved from death as the result of efforts made by the depot.

The disaster program as established by presidential order saw Deseret join with the other military installations in the Salt Lake, Ogden, Tooele areas on 14 January 1949 to expend a total of 13,439 man hours, of which Deseret was responsible for 4,796 man hours. A total of 257 persons were rescued with Desert Chemical Depot saving 230 of this number. Of the 8,433 miles of roads cleared in the state, Deseret Chemical Depot cleared over fifty per cent of the total—or 5,600 miles. In addition, the depot personnel rescued 175,000 sheep and 2,500 head of cattle. During the entire program, this Headquarters was constantly in touch with the Sixth Army Command and the Office of the Chief Chemical Officer giving periodic reports of progress and receiving instructions. Accidents during this time, which would normally be expected to be extraordinarily high, were held to a minimum insofar as the military was concerned and only 1 death resulted from accident—this being a civilian employee of Wendover Field. Many more facts worthy of mention could be recorded here, but as it is not possible to list all those persons who played such a prominent role, nor to tell of all the great deeds and sacrifices, it is only fitting to say that the depot and its personnel attained a high degree of satisfaction for a job which helped save so many lives and property for its neighboring communities. It is not often an installation has the opportunity to perform such services and it is a rich reward just to know it was possible to help out when needed.

As a community, Deseret Chemical Depot may well be considered self sufficient in most respects. Although the military strength of the depot has always been rather low, the facilities provided have been required due to the isolation of the post and the necessity of being able to supply most of the every day needs of life. The facilities available include excellent recreational and welfare programs. The depot has produced championship baseball, bowling, and basketball teams over the past few years and only this year won the inter-mountain baseball championship for the third time in the past four years. Both the military and civilian population of the command comprise these post teams with the result that quite a spirit of competition is present among local towns and the other military reservations that are on the schedules.

Other facilities available include a small but adequate theater, library, Post Exchange, and Commissary. The commissary not only supplies the residents of the depot but also the military personnel of Tooele Ordnance Depot.

There is a school on the post which provides education for children up to the sixth grade. Students above sixth grade are transported by bus to Tooele. Construction was started on a new school during November 1951, and it is expected that this school will be completed by the next school year. The school is a long awaited improvement and should be a great help in many ways—not only form an educational point of view, but also from a desirability of personnel to be quartered on the post—this, in itself, it is believed will assist in the ever present problem of procuring needed qualified personnel in certain fields.

In conjunction with the school program is the construction of 150 housing units for which contracts have been approved. This housing when completed will be a great incentive to military and civilian personnel alike as it will not only mean reasonable rents but will provide better living conditions for all concerned.

As previously stated, the military strength is not great; however, training facilities, to include rifle ranges, have been established and are currently used to keep the few officers and enlisted personnel qualified as required by directives. Until July of 1951, an extensive training program was in progress while the 7th Chemical Depot Company was training preparatory to Overseas movement. The company departed this station for Europe early in August. Operational efficiency of the Company was considered very high.

In a depot operation of any type, be it Quartermaster, Ordnance, Chemical, or any other Technical Service, the command revolves about the Operations Division which is responsible for fulfilling the primary mission of the depot and as such plays the most important part. In other words, the depot operations is the reason for the existence of the installation.

During the past two years the operations area has grown by leaps and bounds—not in acreage—but in improvements throughout the area. All this has been done in spite of the

(Continued on page 43)

Grenade Bursts during testing of Chemical Munitions

View of Bombs awaiting Renovation

THE SCIENTIFIC APPROACH TO MILITARY PROBLEMS

By Duncan MacRae
Chief Consultant
Chemical Corps Chemical and Radiological Laboratories

DR. DUNCAN MacRAE

In pointing out the virtues of the scientific approach and the scientific method, let us not forget that scientists have no monopoly on sound methods of thought. Lawyers, statesmen, business men, and soldiers have played a greater part in history than scientists. The military mind existed long before the scientific mind. Its influence on science is evident in many ways. Scientists speak of "attacking" a problem. The report of the literature search which often precedes experimental work is much like a general's "estimate of the situation" before a battle. Scientific organizations, among others, borrow the ideas of "staff" and "line" from military organizations. Recently the military concept of the "objective" has permeated both the natural and the social sciences to such an extent that it is often used even when "object" is meant. A paper might be written on military approach to scientific problems.

Nor should we overvalue the scientific method. It is not the best in all situations. Bertrand Russell made this point many years ago in a lecture at the Lowell Institute in Boston. He described a method which a scientist might use to locate a penny. Two lines are constructed in space through the penny. It can then be stated with great certainty that the penny will be found at the intersection of these lines and the scientist can pick it up and put it in his pocket. That is, he could if someone else had not already found it by simpler and less exact methods. The use of the scientific approach in all departments of life is not recommended. The scientist, who baptized one of his twins and kept the other as a control, had much the same outlook on life as the one who proposed to substitute "7.245 km. onward" for the "Half a league, half a league, half a league onward" of Tennyson's "Charge of the Light Brigade."

Yet, we would not go quite so far as Conant* and say there is no such thing as the scientific method. It is easy to appreciate the point that what has been called the scientific method has been misused and that it is presumptuous, to say the least, for scientists to claim that they have the one true method of solving all problems. Nevertheless, the Chemical Corps, almost from its beginning has insisted on an orderly procedure in the development, test, and adoption of its materials and equipment. First, there is the establishment of the need for the item and the statement of its military characteristics. Next comes a review of the literature and a consultation of experts and an analysis of the problem. Then, a series of models is made and each one tested in turn until one has been found which satisfactorily passes laboratory tests. The successful model is then procured in sufficient quantity to demonstrate the feasibility of its manufacture and is tested by soldiers under simulated service conditions before the item is finally declared to be suitable for military use. It will be seen that this "development procedure"—well-known to all the military and civilian "alumni" of the Chemical Corps—has several features commonly included in a description of the scientific method. However, part of that procedure appears to be of very ancient military origin. David, when he was about to encounter Goliath, refused the offer of a sword and shield because he had "not proved them."

In many cases, the development of military equipment does not require the use of scientific knowledge more difficult than that ordinarily acquired in high school. Many simple new items are easy to develop. Minor improvements in existing standard military equipment can often be made without the application of calculus or thermodynamics. "Cut and try" methods may, at times, be very costly, but they often work quite well on simple problems. The time between the conception of the idea and the standardization of the item is seldom consumed to any great extent in making laborious calculations or developing a difficult new scientific theory. Rather, it is delays in authorization, funding, staffing, procurement of materials, design and fabrication of models, testing of those models, and in obtaining various priorities in drafting room, shop, test laboratories, and fields.

The development of simple items and the making of minor improvements often involves administrative rather than scientific difficulties. The case is entirely different with major advances in military equipment. Someone has said that, if development had been confined to minor

*J. B. Conant, "Science and Common Sense," Yale Univ. Press, New Haven: 1951.

improvements in existing equipment, we would now have very efficient bows and arrows; but we would not have radar, the atom bomb, homing and guided missiles, or VT fuses. Nor would we have modern war gases, a gas mask which protects against all airborne toxics, and protective clothing.

The problem of making major advances is not a simple one. It includes the necessity for decisions as to how to get the right brains on difficult problems, how much effort to place on minor improvements, how much on research in the hope of major advances, and how to recognize from all the millions of scientific papers the ones that include observations of potentially great military value. The shadow of a key on a photographic plate was the beginning of the study of atomic energy and the occurrence of a spark in an isolated electric circuit led ultimately to radar. The Chemical Corps doe not expect to make many major advances, even in its own limited field, without outside help. It looks for such help to the Research and Development Board, the Chemical Corps Advisory Council, the American Chemical Society Committee Advisory to the Chemical Corps, to the committees of the Armed Forces Chemical Association, and to consultants and contractors.

In the past the Chemical Corps has successfully conducted long-range research and, in several outstanding cases, the brains have been found to solve problems of more than ordinary technical difficulty. Examples of such problems are given below from each of the three decades from 1919 to 1949.

During the period from 1919 to 1929, emphasis was placed on long-range problems. It was during that period that radical improvements were made in the chemical mortar so as to obtain the increased range of the spinning projectile without losing the advantages of muzzle loading. By 1925, due to the efforts of Colonel MacBride, Mr. Nissen and their co-workers, the 4.2-in. Chemical Mortar, with all its essential features, had been designed and tested. An extensive study of the theory of toxicity, conducted under the supervision of Dr. J. E. Mills, pointed the way to much better methods of determining toxicities. That investigation was among the first in this country to apply the probability theories which are now a part of modern biometric methods. It was during that period that a little-known organic compound was suggested* for use in clothing to protect against mustard gas. That compound has not yet been surpassed in spite of a great deal of work by many of the best organic chemists in the United States and other countries. It was, also, prior to 1929 that great advances in aerosol filtration resulted from the fundamental research on that subject by Dr. Leo Finkelstein.

In the period from 1929 to 1939, the emphasis was shifted from long-range problems to the completion of the development of all the articles then needed to fill the gaps in the list of chemical warfare equipment required by the military establishment. This involved not only the completion of many new items but extensive and relatively costly preparations to produce the best gases then known and to complete all the drawings and specifications needed for the procurement of chemical warfare equipment, as well as the manuals required for proper instruction in its use and care. During that period, however, there was at least one problem in which a knowledge of the physics involved paid dividends. It was that of the development of a chemical mortar shell for light liquids. Preliminary investigation of this problem by Chemical Corps engineers, with the advice and assistance of Mr. R. H. Kent of the Ballistics Research Laboratories, Aberdeen Proving Ground, Ordnance Corps, showed that there was no need for development of a special shell for light liquids. At the same time, it disclosed the means of completing the development of an improved way of mounting the mortar. It, thus, finished one project and pointed the way to complete another with comparatively small expenditure of time and money.

During the period 1939 to 1949, both the rapid development of items of military equipment and long-range research proceeded at a greater rate than ever before. The facilities of the Chemical Corps wer greatly expanded and supplemented by those of the National Defense Research Committee. The valuable results of that period are far too numerous to mention here. However, the development of one item of considerable importance was greatly accelerated by being placed in the hands of exceptionally able scientists. This was the development of a cheap noncorrosive screening smoke.

During the period which has just been reviewed there was also a considerable improvement in the methods of solving the problems of the development of military material within the Chemical Corps. An outstanding example of this was the use of probability theory. It had long ago been applied to gunnery problems by the Ordnance Corps and, as previously mentioned, had greatly improved the methods of determining the toxicity of chemical substances. It was further applied to the planning and interpretation of field tests of chemical munitions and to quality control in the manufacture of chemical equipment.

Probability theory is also said to be the most important mathematical tool of operations research methods.** Operations research is defined by Morse and Kendall as "a scientific method of providing executive departments with a quantitative basis for decisions regarding the operations under their control." They also quote the following definition by Admiral E. J. King: "The application, by qualified scientists, of the scientific method to the improvement of naval operating techniques and material has come to be called operations research." As these two definitions indicate, operations research methods extend the activities of scientists from the laboratory and proving ground to the study of actual combat operations. Those studies supply quantitative information to the field commanders on the results of their operations and permit conclusions to be drawn as to how they may be improved.

Operations research calls to mind the Taylor system of scientific management and the period in which much was heard of "efficiency experts." It is, thus, not an entirely new concept. Nevertheless, its accomplishments are considerable. The new situations to which scientists gave their attention in World War II and the methods of thought which were then used by operations research groups are of great interest to those engaged in the development of military equipment. A number of the promising young scientists, recently added to the technical staff of the Chemical Corps, are studying the results of operations research and displaying a keen interest in the further study of probability and the design of experiments.

The Chief Chemical Officer has recently added to his staff an Operations Research Group. It will do much the same work as the Project Coordination Staff of World War II and, like it, will be under the leadership of Dr. W. Albert Noyes. He fully appreciates what Admiral King had in mind when he included in the definition quoted above, the limiting phrase "by qualified scientists." For the success of methods and organizations, scientific or otherwise, by whatever name they may be called, depend for their success on both the wisdom and the knowledge, of those who use the methods constitute the organizations. That is perhaps the most important thing to remember in the scientific approach to military problems.

*The story is told that Dr. Talbot Albert and Dr. Emmett Reid were one day so exhausted from a long discussion of certain problems of organic chemistry that they both fell asleep at the conference table and that the next day Dr. Albert made this suggestion.

**Morse and Kendall, "Operations Research Methods" John Wiley & Sons, N.Y., 1950.

MATERIALS PROCUREMENT SYMPOSIUM

KNICKERBOCKER HOTEL
WEDNESDAY, OCTOBER 24, 1951

Chicago Chapter
ARMED FORCES CHEMICAL ASSOCIATION

GENERAL BLACK AND PRESIDENT LAWSON

With an attendance of more than 500, the Symposium on Materials Procurement conducted by the Chicago Chapter of the Armed Forces Chemical Association was an outstanding success.

The afternoon session, held in the Grand Ballroom of the Knickerbocker Hotel, October 24th, was opened by Mr. Morton Hague, President of the Chicago Chapter, who introduced Colonel Victor C. Searle, Commanding Officer of the Chicago Chemical Procurement District. Colonel Searle presided over the meeting, introducing the speakers and supervising the discussion periods which followed each phase of the program.

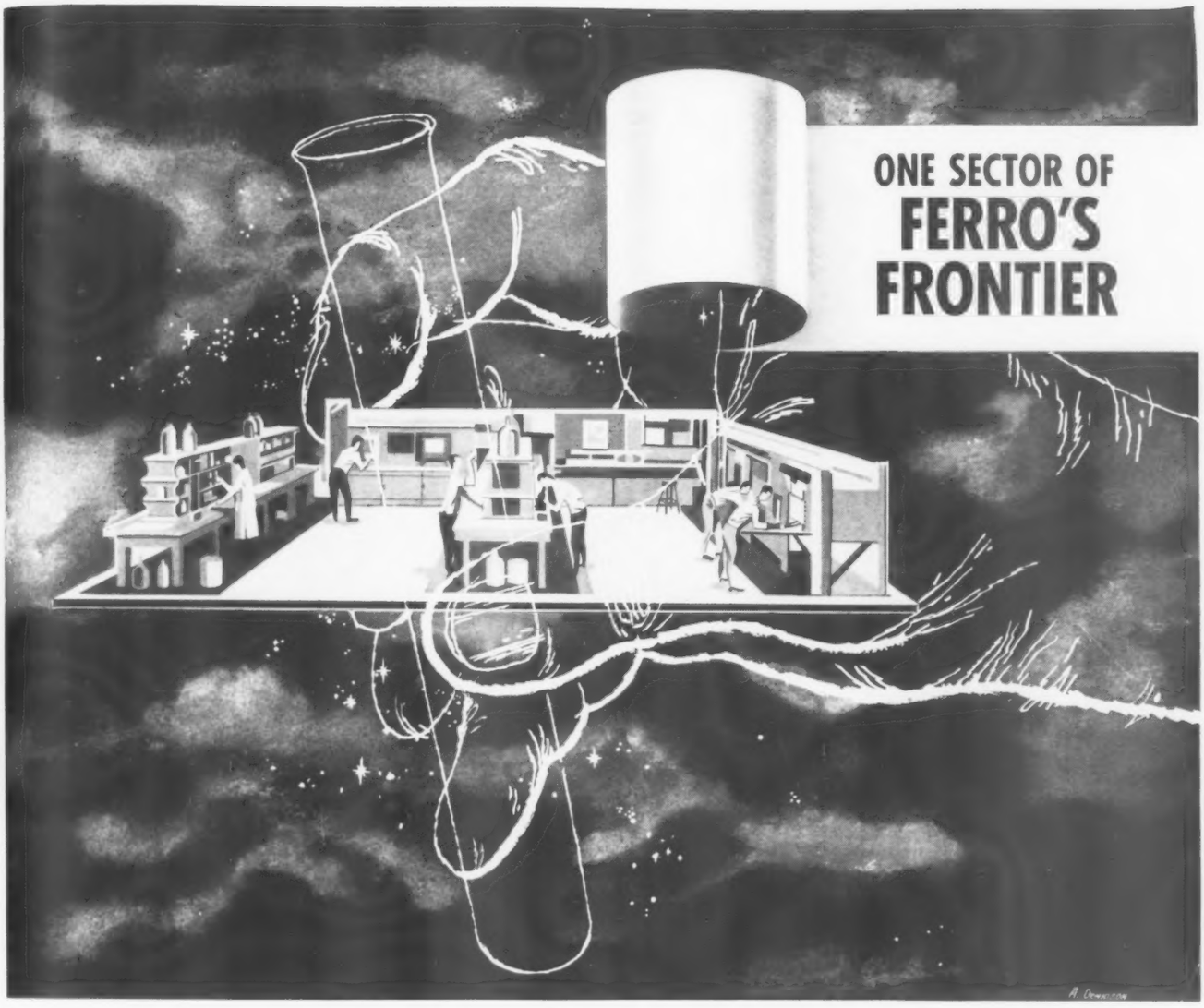
The speakers on the afternoon program were, Brig. Gen. Henry M. Black, Commanding General, Chemical Corps Materiel Command; Mr. Henry Fowler, Deputy Administrator, National Production Authority; Mr. Laurance G. Henderson, Staff Director, U. S. Senate Small Business Committee, and Mr. Glenn Hutt, Vice President, The Ferro Corporation.

Following the Symposium there was reception for the speakers and guests, among whom was Dr. Walter E. Lawson, National President of the Association.

At the Banquet which followed the reception, the address was delivered by Colonel Walter R. Godard, USAF.

The addresses given at the Symposium are reproduced, with some abridgement, on the succeeding pages, with the exception of that of Col. Godard. As the JOURNAL went to press, Col. Godard's talk had not yet been cleared for publication. It is expected that it will be cleared, and published in a subsequent issue.

Colonel Victor C. Searle, Commanding Officer of the Chicago Chemical Procurement District, who presided at the Symposium, opens the meeting. On the left is Mr. Morton Hague, President of the Chicago Chapter.



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THE PROCUREMENT OUTLOOK FOR THE COMING MONTHS

ADDRESS PRESENTED BEFORE THE AFCA MATERIALS PROCUREMENT SYMPOSIUM AT CHICAGO, ILLINOIS, OCTOBER 24TH

By

BRIGADIER GENERAL
HENRY M. BLACK,
COMMANDING GENERAL
CHEMICAL CORPS
MATERIEL COMMAND

I am delighted to be with you today and would like you to know that it is a deep pleasure for me to have been invited to address you on the procurement outlook.

As you know, there are many areas within procurement activity which are not open for discussion. There are matters which I am free to present to you that I trust will be of interest.

My assignment as Commanding General, Chemical Corps Materiel Command, is primarily concerned with the industrial portion of the Chemical Corps' mission. This is deeply gratifying to me, for I feel, and I am sure you will all agree, that America's industrial production joined with supporting our armies in the field is our greatest hope for the future, as it has been in the past.

The majority of you here are representatives of the great industrial system which is keeping America free. Therefore, this opportunity to talk to you is doubly valuable to me.

I would like to review briefly our activities since initiation of the Korean conflict.

Approximately 16 months ago, our country had every hope that the disturbing events abroad would not become a hot war. Unfortunately, it did. The dividing line between freedom, as we understand it, and tyranny was suddenly made clear. The forces of totalitarianism moved against the forces of democracy. As America has in the past, we again arose to meet our obligations to the United Nations and to those concepts which we hold dear.

Under the impact of war-time demands, the Chemical Corps and the chemical industry were again joined in discharging our portion of the support efforts within their respective areas. As a military man, I would like to state now that we deeply appreciate the cooperation we in the Corps have received from the chemical industry in the solving of our problems. Needless to say that such meetings as this aid materially in establishing a better understanding between us.

* * *

October of last year, the Corps was authorized to start extensive procurement operations. Our stockpiles were adequate, but as the Korean conflict continued it was necessary that they be replenished. Immediate value of the procurement planning between the Chemical Corps and industry became apparent. An example of this is that in the Chicago Chemical Procurement District alone 23 million dollars worth of contracts were awarded between December 1950 and September 1951.

Corps-wide, we awarded some 25,617 purchase orders and contracts during Fiscal Year 1951. Dollarwise, these amounted to more than 135 million dollars.

The Chemical Corps will place with private industry contracts amounting to an estimated 192 million dollars during Fiscal Year 1952. More than one-half, 68 percent, of this amount will be allocated to us by the air and sea services for buying chemical equipment and munitions needed by them.

It is anticipated that the methods of army procurement will remain fairly constant. The use of negotiation and formal advertising will be continued. Formal advertising will be used in the following instances:

(1) In the procurement of standard commercial supplies and services.

(2) When the items being procured and the conditions are such that participation by small business can be obtained.

(3) When procurement by formal advertising will expedite the consummation of the transaction or will obtain the required items more rapidly than by negotiation.

(4) When there are no important factors to be considered in making the award, such as time of delivery, etc., other than price, and it is anticipated that the supplies or services can be purchased more economically by formal advertising.

(5) When the list of suppliers to be solicited is extensive, full competition is desired, and purchase by formal advertising will be accomplished more efficiently and expeditiously than by negotiation.

There will be one major change in procurement policy. The Chemical Corps will endeavor to purchase items from industry on an end item basis. However, when an item is to be assembled at a Chemical Corps manufacturing installation, procurement will be on a component basis.

The organization of the Chemical Corps is in the process of being changed by the establishment of a command system. This is a step towards decentralization with policy development remaining in Washington; operations and supervision will be delegated to the Materiel Command in Baltimore. However, it will not be decentralization without proper control. The procuring and manufacturing installations will be directly responsible to the Command. It is anticipated that the decentralization will result in a closer degree of control over procurement. Under most circumstances, procurement processes will be accelerated. This is of utmost interest to industry since the anticipated procurement workload for Fiscal Years 1952 and 1953 will continue at approximately the same dollar volume as existed during FY 1951. A large percentage of the purchase requests of other agencies of the Department of Defense received late in the last quarter of FY 1951 will be reflected in procurement during the current fiscal year. New items under development will enter phases of user test procurement and mass production as standardized items during the FY 1952 and 1953 period.

I think it is important now to touch upon a matter which is of the utmost importance to all of us; that is, the small independent enterpriser — the small businessman, who provides the bed rock of our country. Our policy, as is the policy at every level in the government, is to preserve small business and to encourage its growth and development. Of the 25,617 contract actions in Fiscal Year 1951, 72 percent were made to small business firms.

We have added small business specialists to the staff of each of our procurement districts. These are full-time specialists whose job it is to develop every avenue and bring small business into the military production program. I feel that their services will be useful to big business inasmuch as they can give advice on possible sub-contractors for our large prime suppliers. Actually, a great percentage of the work small firms obtain is in the form of sub-contracts.

* * *

I would now like to touch lightly upon our participation in the Korean action. Organic Chemical Corps troops are in action in Korea. We have a Chemical Corps 4.2 Mortar Battalion in action on the front. Further, the Infantry and Marine Corps both use this Chemical Corps developed weapon as an organic part of their weapons system. The Chemical Corps mortar troops will provide support to United Nations units not equipped with the powerful rifle barrel mortar, which, as you know, packs the punch of an 105 mm Howitzer.

We have Chemical Corps maintenance troops providing front line maintenance service on all items of chemical equipment, including the mechanized and portable flamethrowers, smoke generators, and decontaminating apparatuses. All of these items have played their part in the Korean war. The greatest contribution that the Chemical Corps has made has been Napalm—the powder used to thicken gasoline into a combustible jelly. No munition of the war has proven as effective in stopping enemy armor and in the destruction of the enemy's equipment as Napalm. We, of course, procure Napalm for the ground, air, and sea services. The Marine Corps used Napalm in the same way, while their air arm joins the Air Force and Navy pilots in dropping bombs of Napalm-jellied gasoline on the Communist' forces with devastating effect.

Biological and radiological agents as weapons are as yet unproved in warfare. Chemical Warfare has advanced out of the infancy stage of World War I and evidence indicates that other nations have experimented with new and untried forms of toxic chemical warfare. Consequently, we cannot afford to disregard the potentialities in these fields. We are in a shooting war and we must be prepared to use all of the weapons at our disposal should the need arise.

In the uncertain world of today, we cannot rest on past laurels or relax our vigilance if we are to hope to maintain our country, homes, and way of life. The burden is upon all of us, both in the military and within industry to insure that no practicable steps which could strengthen our positions are left untaken.

The planning you do for your organization and the sacrifices you may be making in helping to arm today may one day prove the deciding factor in maintaining our democratic way of life. Preparedness in both industry and the military is a tangible form of insurance in this highly scientific day and age.

American industry has shown its fitness for the enormous task involved in making this nation the arsenal of democracy. These tasks are being repeated almost daily as we look into the realm of the wonder weapons. We must continue our scientific programs aimed at equipping our forces with the most advanced and superior weapons which can be developed in order that they may overcome the overwhelming numerical advantage of our potential enemies. Based on past experiences, the Chemical Corps and the chemical industry, working together, can discharge their portion of this task.

In conclusion, I would like to repeat again my appreciation for this opportunity to talk to you. It is through this interchange of ideas that we may best become integrated military-industrial team that has in the past proven effective.

MR. HENRY FOWLER

THE CONTROLLED MATERIALS PLAN *WILL* WORK

AN ADDRESS PRESENTED BEFORE THE AFCA MATERIALS PROCUREMENT SYMPOSIUM AT CHICAGO, ILLINOIS, OCTOBER 24TH

By

MR. HENRY FOWLER,
Deputy Administrator,
National Production Authority

In line with the very practical theme of the Symposium, I'm going to address my remarks to three points:

First, the nature and magnitude and duration of the materials shortage which creates the problem that confronts you today.

Second, a summary description of what your government, working in cooperation with producers of these short materials, is doing to alleviate these shortages.

And third, what you can do to fit into that operation and to help in the final analysis with the problem.

This nation of ours is in deadly peril. Our homes and our way of life are in danger. We face an international enemy bent on our destruction who is constantly growing in power. The maintenance of the peace, or an event of further hostilities, our ultimate survival, depends upon our matching that power with an even greater power of our own. It's only the constant daily realization of the truth of those facts that gives logic and sense to the current defense program. If you accept the premise that those facts are true, and measure the soundness of the program against that premise, I think you will find that it makes sense. If you reject the premise, the whole program is meaningless.

We, in the NPA, believe the country at large accepts that premise, not with perhaps the sense of urgency that we would accept it in event of an all-out war. Shortly after Korea Congress enacted the Defense Production Act by an almost unanimous vote. Nothing has intervened since the passage of that act in September 1950 to suggest any alteration in the firm national resolve that was expressed in the declaration of purpose. Rather, acting pursuant to the increasing evidence that the premise was correct, Congress extended the Act at the last session and also appropriated many billions of dollars to execute the defense program as outlined therein. For the first time since the Korean outbreak, we are beginning to get someplace. The flow of military production in really substantial quantities is beginning. The pipe lines of undelivered material in the process of manufacture and assembly is swelling. The consequent diversion from normal, peaceful channels of civilian production is becoming a painful but a comforting reality.

As you all know, the Defense Production Administration recently announced general levels of allocations of steel, copper, and aluminum—the so-called controlled materials for the various general uses that are roughly related to the claimant agencies of the 35-odd operating divisions in the National Production Authority. The announcement of these general allocations shows that even with the screened down direct military requirements, giving them only what they need for the quarter that's ahead at the time they need it, nonetheless, their actual needs are greatly increased over the quantities taken and allocated to the military in the fourth quarter. That means that those increased draw-downs must be compensated by reductions in other sectors of the economy. Around the first of November, these general allocations will be reflected in what we call allotments to the individual companies, not producing directly on a military contract, but for that part of their production which we term B-product production. These concerns must depend for their business operations, where they are de-

pendent on steel, copper and aluminum, upon allotments of these materials under the so-called B-product procedure in the Controlled Materials Plan. To these B-product manufacturers whose market is predominantly the civilian consumer, there will be a sharp realization that defense production is really rolling and a painful but necessary period of short rations for civilian industry. There will be no death sentences to the so-called non-essential industries in the form of prohibition orders that prohibit the use of controlled materials for a so-called non-essential or less essential use. No reenactment of M-7 with its death sentence clause, but the levels of allotments of copper and aluminum for those industries in the less essential or non-essential category will be low indeed. In the order of ten to twenty per cent of their base period use. The steel allotments will be much more substantial, and there will be an effort to compensate for the low level allotments in aluminum and copper by providing extra allotments of steel where steel can be substituted for copper or aluminum, to give the poor producer some better chance at survival.

Mr. Fleischmann, Defense Production Administrator, and Mr. Wilson, of the Office of Defense Mobilization recently said to combined committees of Congress that some of the companies that depend primarily for their business upon the use of copper and aluminum for non-essential or less essential type production may not be able to survive. I shall revert later to some efforts that will be made to minimize the number of business fatalities, but with all of the effort that the government can summon it is clear, and I must be frank and open in my statement to you, that this hour of dislocation is upon us and the principal consolation must be that through a period of pain we are achieving strength.

What's the nature and magnitude of the materials shortage that causes this kind of dislocation, this kind of diversion of materials from one class of consumers to other classes? In other words, why CMP? The briefest answer to that question is contained in the declaration of policy, section 1, of the Defense Production Act, wherein it was stated that the United States was determined to develop and maintain whatever military and economic strength was found necessary to promote peace and oppose acts of aggression. May I recall to you the simple and I believe sensible design of the Defense Production Program and the words of that enactment. It said, "Under present circumstances this task requires diversion of certain materials and facilities from civilian use to military and related purposes. It requires expansion of the productive facilities beyond the levels needed to meet civilian demands. In order that this diversion and expansion may proceed at once and the national economy may be maintained with the least hardship, normal civilian production and purchases must be curtailed and redirected." In other words, Congress saw that in the process of becoming strong, vast quantities of materials would have to be chanelled from their normal uses into the defense effort, and that the government agencies would have to be set up to direct, or if you will, to control that channelling process.

Some of you may have seen the recently issued third quarterly report of Mr. Charles E. Wilson to the President. That report indicates the kind of progress that is being made towards the goals established by the Congress, in this present period. The report indicates spectacular progress toward some of these goals. For example, deliveries of military goods during the July-September quarter of this year were estimated at a total of more than five billion dollars. That is one-third more than in the previous quarter. The levels are stepping up fast. It's more than four times the rate of deliveries a year ago. Counting all the goods in process, which do not show up in the reported statistics as completed deliveries, Mr. Wilson has estimated recently that we are now using materials for military goods at a rate of nearly eight billion dollars per quarter. By a year from now his report indicates that the rate should be reaching ten to eleven billion dollars in deliveries each quarter. The plain and inescapable fact is that these military end products require sizeable quantities of controlled materials, and of certain of the other related metals. You need aluminum for planes. You need brass milled products for ammunition. This is one of the governing factors contributing to the present shortage of materials. It is one that is easily recognized. It's one that you all readily appreciate.

A second requirement for our defense program in the Defense Production Act is the statement that "it requires expansion of production facilities beyond those levels needed to meet civilian demands." We have had to undertake in the past year one of the most spectacular expansions in plant capacity that history reveals. This capacity was needed for two purposes. First, it was needed to provide a safe level of rearmament and adequate capacity for production in the first year of any total war that should occur. We thought to develop plant capacity by 1953 that would be able to turn out, if the need should arise, 50,000 planes a year, 35,000 tanks a year, and 18,000 jet engines a month. Together with all the other products that are necessary for a holding operation in the first year of any total war, for which additional plant expansions have been necessary.

Second, in addition to expanding plant capacity, in addition to a defense construction program directly related to eventual military output it was necessary to expand our basic industrial capacity. What Congress had in mind in directing and making possible that expansion in basic industrial capacity, was two-fold. First, the purpose is again obvious—to provide the greatly increased quantities of materials that would be needed to man and mount a total war effort, should that become necessary. Or, in event the Politbureau played it another way, to try to wait us out into an era of slackness and loss of interest, to expand our capacity to produce raw materials so that we could maintain a fairly substantial level of rearmament and yet alleviate the shortages and provide a level of materials for civilian production equal to pre-war totals. This, I find, is hard for some to appreciate. And only by expanding our capacity to produce large quantities of basic materials in addition to that currently available can we ever work our economy free from these controls. And the vast proportion of us engaged in the defense program, including the speaker, hope we can be rid of the controls as soon as possible.

But the total investment in basic plants, new plants of steel, copper and aluminum that's necessary to work toward that objective is very substantial, because in addition to the level of expansion of the American steel industry, which is projected, (which is equal to the total capacity presently in Great Britain), we have very large programs for expanding aluminum and logically, of course, electric power, petroleum and chemicals among others.

Again the plain and inescapable fact is that if we are going to become strong and if we are going to work our way out of this period of materials shortage within any reasonable period of time, we must make the sacrifices now that are necessary by diverting to these defense construction programs the necessary materials that it takes to build and equip a plant—a steel plant, an aluminum plant.

In addition to these two legs of the program, it was necessary to carry forward the very important stockpiling plan, which had been adoptd and put under way long prior to the Korean outbreak, as a result of the lessons we had learned in World War II, when we were suddenly shut off from our overseas sources of supply of many critical materials. An additional and fourth goal in the present defense program has been the effort of all concerned to maintain a reasonably healthy state in the civilian economy, in as large an area of that economy as was possible, so that if

and when the materials shortages were alleviated, industry and trade could resume something of their normal pattern of production and distribution.

When you take into account the huge requirements of these four legs of this program, I think it's not difficult to understand the nature and magnitude of the existing materials shortage. To measure this materials shortage, as some frequently tend to do, by simple reference to the quantities of steel that go to military end products, is to miss the true true import of this particular defense program. Such an argument fixes the military use of steel at a relatively small percentage of the total supply figures, generally used as 10 per cent, and asks, "why is total allocation necessary if only 10 per cent of steel is going to military end products?" A more accurate index of the shortage consequent from the defense production has been outlined. It's a measure against supply of the total of all demands by all of the official claimant agencies, screend to reflect requirements which each individual claimant believes to be essential to maintain the economy in that sector of the economy for which it is responsible.

These are some of the claimant agencies, in addition to the three Services: The National Production Authority, which claims for all manufacturing industry in the United States; The Atomic Energy Commission; the Defense Transportation Administration; The Maritime Administration; the Defense Electric Power Administration; the Petroleum Administration for the Defense; Bureau of Public Roads; the Office of Education; Housing and Home Agencies; and the Department of Agriculture; and of course the Office of Civilian Requirements, which you might call the Office of Essential Civilian Requirements in the NPA. Would any of these agencies, or would any of those who use the materials that those agencies are claiming for, consider their particular part of this program as something you can just forget? Could they abide by a decision that would simply say, give the military Services the 10 per cent of the steel they need and let all the rest of us just "scramble" for what remains? I don't think that any of us who have reviewed the magnitude of the shortages that come from totalizing these screened demands of the claimants that I described could feel that a 10 per cent shortage, in terms of the extra demand for military end products, was an accurate measurement of the kind of problem we're up against. The demand for carbon steel after the screening, through the Requirements Committee procedure, through the Claimant Screening procedure, for the first quarter of 1952 was about 150 per cent of the available supply. The demand for structural steel was 205 per cent of the supply, and the demand for copper and aluminum somewhere between 170 and 180 per cent, of total supply. In those simple percentages of the relationship of so-called screened barebone requirements, you have the reason why a Controlled Materials Plan is necessary to assure a total across the board allocation to each legitimate claim of those critical materials that a reasonable and rational recognition of the merit of that particular claim would accord.

I think from what I've said you may derive certain conjectures about the duration of the acute shortage. You know that we're going to have to maintain this level of rearmament, and it's going to have to extend all next year and all the year after and all succeeding years until we face this crowd down, and they cease their aggressive posture and attitude.

You know you don't build an 18 million ton steel industry in a day. This steel construction program, the aluminum construction program, the electric power construction program, the building efforts on the part of the various Services to develop through their contractors, the extra capacities to produce military end products, those things take time. A reasonable estimate would be that they will take at least another two years—1952, 1953. In some areas we are approaching the satisfaction of our stockpile goals, while in other areas we are not. So, we must turn to a consideration, if we're looking for relief, to measuring when these new expansion programs of basic materials are likely to begin to plough into the blood stream of our economy—new supplies.

It's going to be a long time, before the development and expansion programs in copper begin to pay off in any substantially increased level of supply. I hope no one here will take any comfort in the hope that however effective we may be in a rapid development of steel and aluminum that ipso facto the same thing follows for copper. That's not true. It's more difficult. We're depending a lot on overseas supplies, upon development in other countries. Substantial relief from the present critical shortage could not be realistically promised in 1952 or 1953, despite the employment of a variety of devices to increase output so far as copper is concerned.

The picture is somewhat more optimistic insofar as steel and aluminum are concerned, due largely to the promise of increased supplies of these materials from the expansion program. Steel production has steadily risen during this emergency from an initial rate of approximately 100 million tons a year to a current rate of approximately 108 million tons.

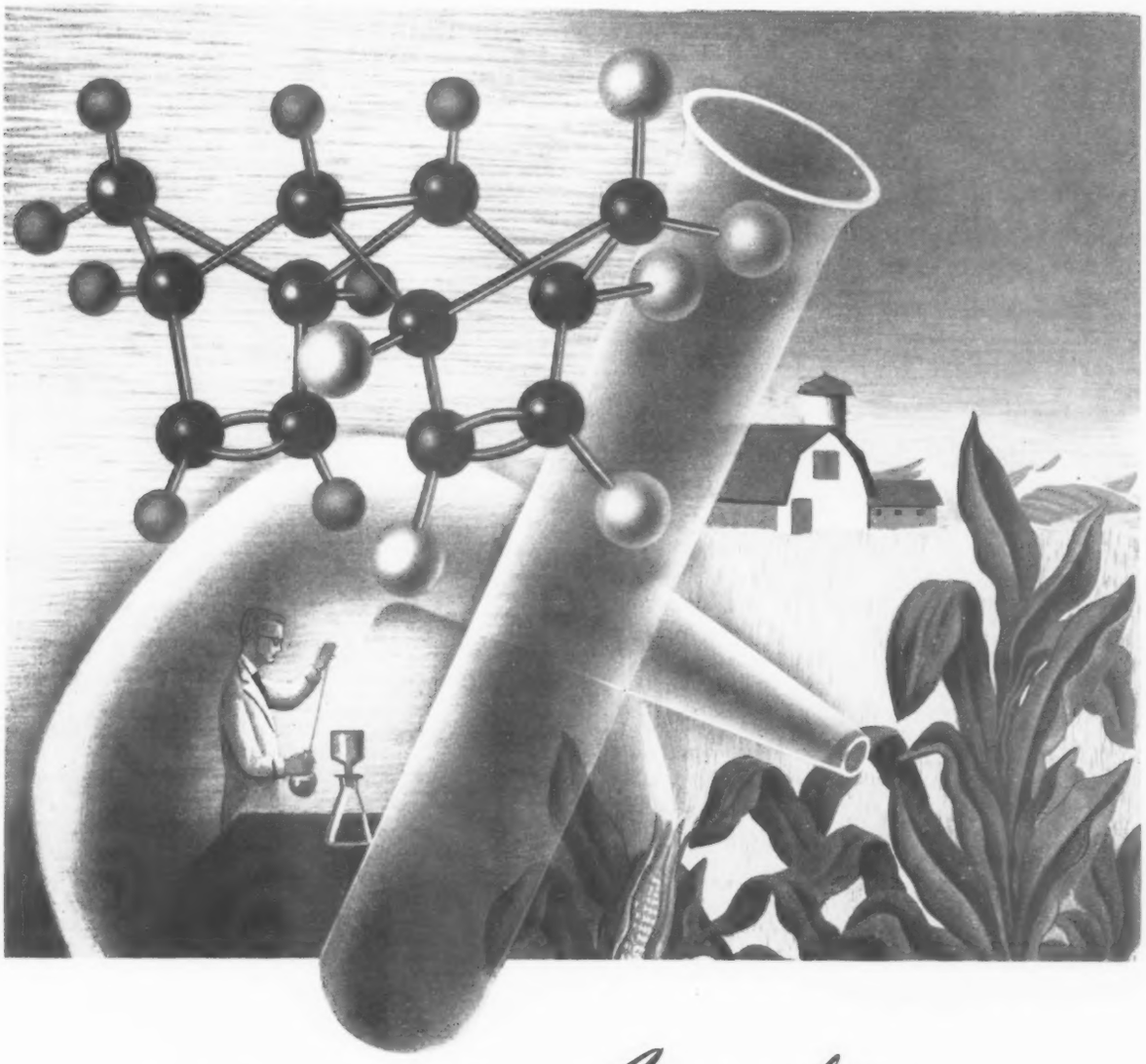
The expansion program that is presently underway, with a few exceptions here and there, is backed up by responsible steel companies who have been granted the necessary tax amortization certificates and who have their plans off of the drawing boards and into the engineering stage. It gives promise that this level of steel capacity will be increased during the next two years to approximately 118 million tons. That's what we feel reasonably sure of. Similarly the half billion dollar aluminum expansion program is now under way and will begin to pay off, we hope, some time around the third quarter, as increased supplies from new installations begin to become available as a part of the Controlled Materials Pool. Yet, for at least the first six months of 1952 the picture on aluminum for those not participating in military end-products production will be at its darkest. Increased drawdowns by the military for aluminum in the first and second quarters of 1952 over fourth quarter levels means a very shary squeeze on those who require aluminum for their civilian production. We're hopeful that to some extent the diversion of additional quantities of aluminum from civilian production can be compensated, as I indicated earlier, by extra allowances of steel. This is despite the fact that the military construction programs are drawing down increased supplies.

Of course, any optimistic picture or outlook for relief in the last half of 1952 or 1953 must be tempered by some thoroughly "ify" assumptions. What are some of those assumptions? That there are no startling developments abroad that make it necessary to inaugurate new programs which will cause increased drawdowns on supplies not presently contemplated. Of course, in event of a total war all bets would be off. And of course, in the case of steel, freedom from any substantial work stoppage is a very important consideration, in the months ahead. There is one more consideration which I hope all of you here will take to mind, because it's part of your responsibility just as it is ours, and that is to maintain the levels of steel production and to increase them in the months ahead—the same is true of copper and the same is true of aluminum—we've got to have the scrap. There is no more single important contribution that any of you can make to the defense effort than to see to it that the scrap mobilization effort is supported—not just by the steel industry but by the end product users who must have substantial quantities of steel scrap lying around the yard and in the plants.

What is your government doing in cooperation with pri-

(Continued on page 48)

= CHLORINE - CARBON - HYDROGEN



another aid for *Agriculture*

In the October, 1951 issue of ARMED FORCES CHEMICAL JOURNAL we described a new insect toxicant provisionally identified as Compound 269 and we exhibited its spatial structure. We are now announcing a related chemical in this series of compounds, namely, Compound 711[1].

Compound 711 (1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-endo-endo-dimethanonaphthalene) is a stereoisomer of the widely used insect toxicant, Aldrin, and is the parent molecule of Compound 269, its exo-epoxide. It is thus related to Compound 269 in the same manner that Aldrin is related to its epoxide, Dieldrin.

Both Compounds 711 and 269 exhibit novel chemical reactivity of interest to the theoretician; but that is a matter we can leave for another time.

Compound 711, in common with certain other chlorinated dimethanonaphthalene derivatives, shows unexpected insecticidal activity. Spectacular in that respect is the effectiveness of Compound 711 against the European corn borer, *Pyrausta nubilalis*. Here, preliminary results indicate, may be one important use for this selective toxicant[2].

Compounds 711 and 269 are unique with Julius Hyman and Company, a post-war chemical organization located at the Rocky Mountain Arsenal, near Denver, Colorado. Further information on these products available upon request.

[1]The designations "269" and "711" are presently to be replaced by common names to be chosen by the Interdepartmental Committee on Pest Control, B.E.&P.Q.

[2]For further details regarding the effectiveness of Compounds 269 and 711 against insect pests, the reader is referred to the paper of Dr. Y. P. Sun, delivered before the annual meeting of the AAEE in December '51, Cincinnati, entitled "A Study of Two New Chlorinated Hydrocarbon Insecticides, Compound 269 and Compound 711."

Julius **HYMAN** *& Company*

DENVER, COLORADO

SMALL BUSINESS IN THE MOBILIZATION PROGRAM

By LAURANCE G. HENDERSON
STAFF DIRECTOR SENATE
SMALL BUSINESS COMMITTEE

MR. LAURANCE G. HENDERSON

AN ADDRESS PRESENTED BEFORE THE AFCA MATERIALS PROCUREMENT SYMPOSIUM AT CHICAGO, ILLINOIS, OCTOBER 24TH

For over a year now, ever since the outbreak of fighting in Korea, the small businessman and his problems have been very much in the forefront of all our thoughts. And rightly so it seems to me, for I happen to belong to that school of thought, and I am sure that most of you do also, which holds that we shall never achieve that maximum degree of defense preparedness which our national safety demands until the productive facilities of our smaller manufacturers are brought into full play.

There are standing in the way of that objective, several hurdles. The utilization of small plants in defense work and in the production of essential civilian items does not occur automatically. It certainly didn't during the last all-out war, and during our present partial mobilization effort the small plant operator is confronted with problems which will require the greatest ingenuity to overcome.

These problems, we all know, are similar in many respects to those which many of you labored to overcome during the last war. Now as in 1942, users of metals find themselves desperately scrambling for a fast diminishing supply of a dozen critical materials. Now, as then, the bank accounts of thousands of small companies simply are not equal to the financial demands of a swiftly-moving mobilization program. And now, as then, the percentage of defense contracts which to date have been funneled to small defense plants has fallen far short of absorbing the available open capacity of these plants.

This is a situation which the Senate Select Committee on Small Business is seeking constantly to remedy. Our Chairman, Senator Sparkman, all along has insisted that a far wider spreading of war contracts is essential if we are to avoid a repetition of that wasteful disregard of small plant facilities which resulted in the forced closing down between 1940 and 1942 of almost one out of every five of our smaller establishments.

So deep has been his concern on this score that in July he instructed the staff of the Small Business Committee to make a study of the concentration of defense contracts since the outbreak of hostilities in Korea. Summary figures not being available from official sources, we sent telegrams to almost one hundred of the largest corporations in the country, asking them to tell us the amount of defense busines they had on hand.

The resulting tabulation more than confirmed our apprehensions that small plants and medium-size plants had once again been left at the post in the race to supply our fighting forces with the weapons and supplies they require. We learned, for instance, that ten, a mere ten, large corporations had received forty per cent of the total dollar volume of prime defense contracts since Korea. Add to these ten, forty more companies to make fifty, and you find this handful receiving 66 per cent of the dollar value of all prime defense contracts. When it is realized that during World War II, 100 top corporations received the same percentage of all war prime contracts, it becomes clear that a marked acceleration has taken place in the concentration of defense work to fewer and fewer companies. Even though we make due allowance for the importance of subcontracting, that these figures constitute a danger signal cannot be denied. They give little comfort to those of us who have watched with concern the growing threat of monopoly power in this country. There are indications that there has not been sufficient vigilance in this field during the past ten years.

The evidence has steadily mounted that healthy small and medium-size companies are, month in and month out, silently disappearing from our economy through mergers and acquisitions by their larger competitors.

In contrast to America, the development of nationalism and socialism in European countries stems almost directly from the fact that foreign capitalism has not been vigorously competitive. Monopolies and cartels developed. It became almost impossible for a major new business to get started. Efficiency sagged. Technological advances were stifled. As a result, there are many areas in the European economy where socialism holds undisputed sway. That must not happen here.

This threat is all the more insidious because the crumbling of the competitive structure takes place piecemeal—gradually—and except to the most attentive, unobserved. That is why the Senate Small Business Committee staff has started an intensive examination of the effectiveness of our anti-trust and anti-monopoly statutes. This study, which will take at least six months, may conceivably become one of the most significant contributions to the general welfare of free independent enterprise yet to be made. The Committee intends to examine what has been done to hold the line for independent business, and at the same time to investigate charges that all that might be done in the field of anti-trust enforcement is not being done.

There are few in the country today better situated to observe the impact of our mobilization program upon our smaller producer units than the members and the staff of the Senate Small Business Committee. No day passes but that there comes to the Committee offices small businessmen who are dependent, even as you are, on a steady flow of steel, copper, aluminum and a

score of other materials which are in critically short supply. These men are never unreasonable in their attitude toward the problem of material shortages. They know there is a war on. They know that there is scarcely enough to go around. For the most part, they simply are seeking to be allowed to continue, even if on a sharply curtailed basis, to hold their companies together until such time as we will either swing into an all-out war effort, or return to more normal patterns of peacetime activity.

What troubles many of the businessmen who come to Washington is a doubt, a doubt over whether the available supply of metals is being apportioned among the various segments of our industrial community and between our defense and civilian production with a fairly conceived realization of the requirements of small producers. One of the most frequent complaints during the third quarter has been that mills and warehouses have either refused to accept orders or have indicated a second quarter of 1952 delivery date. To small plant operators who have spent months and a great deal of money to land a defense contract, the inability to obtain the necessary materials to fulfill that contract is an understandably embittering experience.

The recent announcement that the military had released 20,000,000 pounds of stainless steel for civilian use seemed only to confirm the widespread belief that the services have over-estimated their material requirements. It is axiomatic in the Army that no one has ever been court-martialed for having too much of anything. But in all fairness, it must be conceded that much of the confusion over the control of materials stems directly from our inability to estimate the course of world events. Those planning our military requirements have the difficult task of trying to estimate the needs of our armed forces, and to schedule production against constantly shifting goals. The resulting dislocation is the price we are paying for a partial mobilization, for having to superimpose an expanding military production program upon a civilian economy which we cannot afford to let falter. They must go forward side by side.

Having acknowledged the difficulties and having made all due allowances, however, the fact that the Department of Defense overestimated its stainless steel requirements for the fourth quarter by an amount which is seven per cent of our total supply of stainless steel for that quarter, certainly raised a question with regard to the accuracy of military estimates on other metals.

Be that as it may, however, there are very few, if any encouraging aspects of the materials picture as seen through the first half of 1952. It was in an effort to dispel some of the fog that has enveloped material shortages and to learn the true state of affairs from the small businessman's point of view that the Senate Small Business Committee two weeks ago joined with the House Small Business Committee and the Banking and Currency Committees of both the Senate and the House to invite Charles E. Wilson and Manley Fleischmann to put the cards on the table so far as the first two quarters of 1952 are concerned.

These mobilization officials were nothing if not frank. Mr. Fleischmann said, that the first six months of next year would be, to use his word, "dismal," but that thereafter it would probably be possible for material allocations to be increased. "The cuts we have made," he added, "will mean, that there will be localized unemployment, loss of profits to many manufacturers of non-essential civilian goods and the actual closing down of plants which cannot operate on the limited supplies of aluminum, copper or steel which will be made available to them. We have hoped to hold such unhappy developments to a minimum, but there is no dodging the fact that many will be hurt. Military production is now climbing towards the goals which we have been preparing for over the last year or more. Military items are now chewing up the materials upon which the civilian economy depends for normal operations."

Here, in brief, is a run-down on the steel, copper, and aluminum situations as presented by the men charged with the very heavy responsibility of allocating scarce materials: STEEL: Non-military users of steel, who have been getting 58 per cent of their base period supply, will find their first quarter allotment slashed another 11½ per cent. Reason: the demand for carbon steel is about 156 per cent of supply and the demand for structural shapes 205 per cent of the first quarter supply. The military is taking a 400,000-ton bigger bite in the first quarter than it did in the fourth quarter. Although it is hoped that first quarter production will add an additional 1,000,000 tons over the amount available during the last quarter of 1951, the steel pinch will still be felt. Production of all consumer durables will be curtailed. Automobiles production will be forced down from 1,100,000 in the current quarter to 930,000 units in the January-March period. Steel for other consumer hard goods will be held to between 50 and 60 per cent of requirements. Ninety-six thousand tons of carbon steel and 22,800 tons of structural shapes will hold the school construction program to about 50 per cent of the recommended construction goal.

ALUMINUM: Civilian users already limited to 46 per cent of pre-Korean consumption will be cut an additional 17 per cent in the first quarter. Direct military requirements will absorb 40 per cent of the aluminum supply including over two-thirds of primary aluminum. With the demand for aluminum about 175 per cent of the supply, Fleischmann forecast that many users will have to struggle along with mere "token deliveries" of about 15 per cent of what they received in their best years. In again denying that a "death sentence" for small aluminum fabricators is contemplated, Wilson hoped that those faced with 15 per cent allocations will be able to "turn around . . . and make substitutions of steel which is getting a freer supply. . . . This gives him a chance to swing over. . . . I do not think they are going out of business. They are too ingenious for that, thank God." Fleischmann further stated that extra steel would be made available to any hard-pressed aluminum fabricators who could use it.

COPPER: With the first quarter military and civilian demand for brass mill products between 170 and 180 per cent of supply, almost 80,000,000 pounds higher than in the current quarter, civilian users of copper, held to 54 per cent of requirements in the fourth quarter, will find their supply reduced by 30 per cent in the first quarter. Least essential copper items will be allotted in the neighborhood of 15 per cent of their base period use. It was estimated that there would be substantial increases in the supply of steels and aluminum sometime before there was an improvement in the critical copper supply situation.

NICKEL, MAGNESIUM, COBALT and other miscellaneous metals are being claimed by military production at rates of betwen 60 and 100 per cent of available supplies.

On the brighter side, however, all indications point to a definite softening of the steel grey market. The highway robbery prices of a year ago have slumped off to a degree where some brokers are having to unload steel at prices well below what they paid for it. For the past two weeks the Small Business Committee has had investigators in the Pittsburgh area and they report that by and large the steel industry is doing a good job of policing its shipments to keep them out of the hands of unnecessary middlemen. The United States Steel company, for instance, has a former F.B.I. man with two assistants whose job it is to keep track of its shipments so that they stay in the normal channels of trade.

Nickel has been tight and will continue to be so, although since June, slightly larger amounts have been made available to producers of consumer items. As a result of Small Business Committee public hearings in Detroit and Washington, it is to be hoped that the considerable tonnage of nickel anodes which flowed into the grey market through loopholes in the price ceiling regulations will be redirected into legitimate channels.

This much we discovered in our study of the nickel situation as it affects small users:

There is an undeniable shortage of nickel, the burden of which is borne disproportionately by small businessmen.

Established distributors of nickel have loose understandings with their jobbers that all users of nickel shall receive an equitable share of available supplies, and that this generally is construed to mean 50 per cent of any user's base-period allotment.

These "gentlemen's" agreements are not strictly enforced. The record shows that small-businessmen who appeal to the major distributors for more equitable treatment are often referred back for relief to the very jobbers who are withholding from them their rightful share of nickel.

This withheld portion of nickel, in the case of anodes for plating, is diverted into the grey market and priced out of reach of the small users.

In place of anodes, some small platers have been sold inferior grades of nickel scrap at five times the market price.

Prime anodes have been slipping out of the distribution back door and into the grey market "daisy chain" at successively higher prices until they are offered to large corporations, which are able to pay premium prices, or these off-color anodes are offered to desperate small businessmen whose only alternative to bankruptcy is to avail themselves of this under-the-counter merchandise.

In the opinion of our Committee, these practices reflect credit on no one concerned. From the standpoint of those who divert the metal into the grey market, it is a vicious system of profiteering which no leniency can condone.

We are of the opinion that the executive agencies of jurisdiction, namely the Office of Price Stabilization, the National Production Authority, the Department of Justice, and the Bureau of Internal Revenue, should lose no time in taking vigorous action, wherever such action is reasonably indicated, against any persons or companies which have contributed to the metal-pricing abuses set forth in this report. I think I can point out to you one basic reason why small business has found it increasingly difficult to sell to the Government in 1951. Beginning about last January, there was a pronounced shift in the buying procedures of the military from formal, advertised bidding to the negotiation of contracts.

Under the competitive advertised bidding procedure, as you know, smaller firms had been fairly successful in finding out exactly what the Government was buying, when it was being bought, and through which procurement office. Those who, utilizing this information, sold their goods to the Government, did so only because they were able to be competitive in quality, price and delivery with the larger concerns. Any business that came to them resulted from the exercise of real business acumen and not because they were small business.

When, for security and other reasons, the military switched over to negotiating 90 per cent of all contracts let, small companies more often than not, found that they experienced the greatest difficulty in finding out what contracts were being negotiated until they had already been let. Like the papoose, they saw the contract only after it had gone by.

By taking a specific example, let us briefly examine how negotiation works out in actual practice. Last March, the Ground Equipment Unit of the Air Force Procurement Division at Wright Field made a total of 72 awards. Seventy-one, or 98.7 per cent, were accomplished by negotiation and covered an expenditure in excess of thirty-million dollars.

Only one award representing 1.3 per cent of the procurement actions was made under advertised bidding procedure and it was for an amount of $1,561. Of the 71 contracts negotiated, one source was utilized in each of 53 awards, two sources were utilized in each of five awards, three sources were used in one award, five sources were used in two awards and more than ten sources were used in ten awards. On the other hand, in the one award by competitive bidding, 287 companies were sent invitations to bid. In April, purchasing records show that only 4 per cent of all contracts dollar-wise were awarded by competitive advertising.

I think you will agree with me that this contrast between the two methods of purchasing amply illustrates that it is only through the maximum use of open, advertised bidding that we can hope to broaden our base of supply for military goods and services. At the same time, any of you who have submitted bids on advertised procurements realize that even this procedure for the small company does not, in any sense, guarantee smooth sailing. There are procedural complexities which often made it difficult for small companies with limited resources to bid successfully.

Businessmen have often complained to me, for instance, that delivery schedules seemed unreasonable; that they frequently are unable to obtain specifications and blueprints in time to submit their bids; that large procurements often are not broken down into sizes which permit handling by small companies and that they are often not given sufficient time to arrange financing satisfactory to the contracting officers.

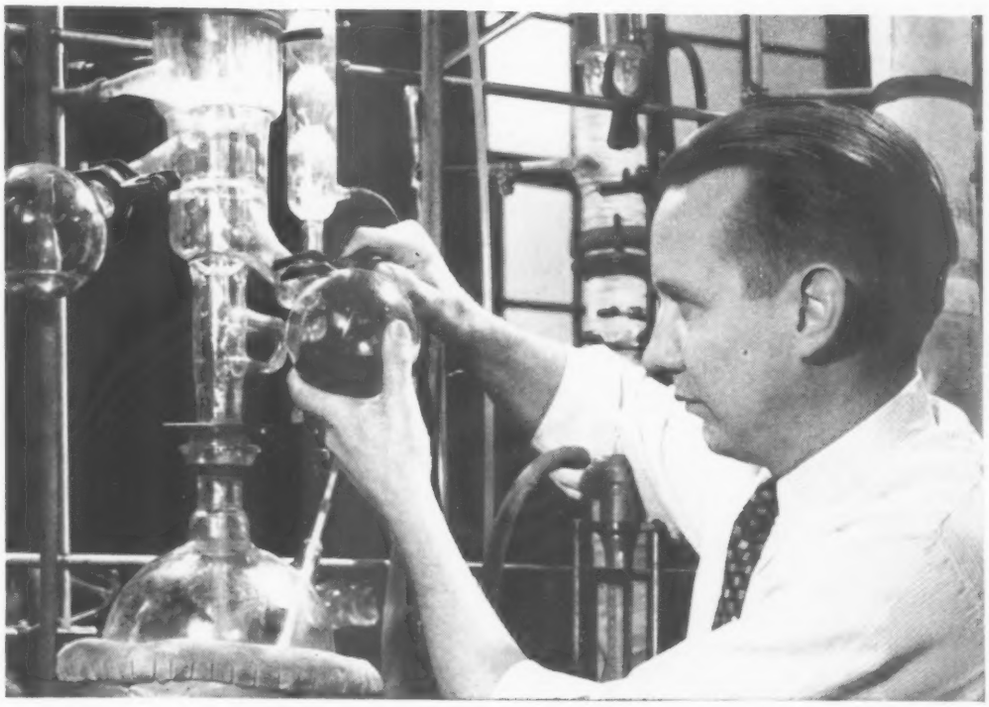
Our Committee has strongly urged that contracts should be negotiated only when valid security questions are involved or when the items to be thus procured are so urgently needed that time is the desired factor. When it is imperative to use the negotiation process, the Committee feels that a report should be made public, showing the number of new sources utilized in each procurement action. This recommendation is obviously made to curtail the number of so-called "sole-source" procurements in favor of expanding the base of industrial supplies. Toward this same goal, the military has been requested to increase the number of split or multiple awards when large contracts are negotiated. This, of course, ties in with our belief that, so far, too little emphasis has been placd upon encouraging the formation of war production pools of small facilities.

In all the major small business problem areas, including contracts, prime and subs, materials, and problems of financing, there is good reason to believe that more attention will soon be given to small business as an entity. You all know, I am sure, that in passing the Defense Production Act of 1951, Congress included in this legislation what is known as the Sparkman-Patman small business amendment. This amendment establishes a separate agency of Government named the Small Defense Plants Administration. The sole and single purpose of this organization is to see to it that every and any small businessman gets a fair and equal opportunity to participate in our war or essential civilian production.

A capable executive, General Telford Taylor, has assumed direction of this new independent small business agency. I am confident that the time is near at hand when our smaller producers will have unmistakable evidence that they have, in the Small Defense Plants Administration, a powerful advocate in the councils of Government. They will have a friend upon whom they may call, not for special favors, but for a balancing of the scales for the elimination, in short, of the accrual of advantages based on size alone. As

(Continued on page 52)

to serve you better . . .



Research

Research is never satisfied! Belief in research creates the vision and unceasing activity that has guided the chemical industry to vast new discoveries, to the new and better products which serve so many.

In 1915, Dow research made it possible to extract the light weight metal *magnesium* from the brine pumped from Michigan brine wells. And in 1941, when Dow began extracting magnesium from the inexhaustible supply in the ocean, the most important single part used in the extraction process was the electrolytic cell . . . developed as the result of *28 years* of continuous research. Today, thousands of engineers design and build everything from airplanes to trucks with magnesium, the lightest of structural metals.

Dow chemists developed Dowtherm, a heat transfer medium, whose use in industries such as nylon, plastics, food and many others makes possible better end products. Research developed the Dowicides—industrial germicides and fungicides which enable industry to reduce production stoppages. The many Dow agricultural chemicals which insure the health of America's "breadbasket" were developed and improved by constant research. In fact, all Dow chemicals—over 600 of them—owe a debt to the research which made them possible.

Dow research is comprehensive and continuous. Nothing is too small to examine . . . nothing too large to explore. It is Dow's sincere conviction—borne out by over 50 years of experience—that the company can best fulfill its function of usefulness by searching for *more* ways to serve *more* people!

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MIDLAND, MICHIGAN

DOW

CHEMICALS

INDISPENSABLE TO INDUSTRY
AND AGRICULTURE

HOW WE HANDLE GOVERNMENT CONTRACTS

AN ADDRESS PRESENTED BEFORE THE AFCA MATERIALS PROCUREMENT SYMPOSIUM AT CHICAGO ILLINOIS, OCTOBER 24TH

By GLENN A. HUTT, Vice President
Ferro Corporation

MR. GLENN A. HUTT

It is a pleasure to be here today on this all important Materials Procurement Symposium. I find there is a definite lack of information on procurement and this probably leads to many extra headaches and difficulties for you men in the District Procurement Offices.

To illustrate my point . . . two weeks ago, a Vice President in Charge of Sales of one of the largest metal fabricating plants approached me in Washington and asked this question: "If we at Ferro thought this emergency was to be taken seriously and if we further thought it would last for any great length of time." Here you see just how confused some of the executives of larger companies can be. You, in the Procurement Offices, surely know the answer to this question and probably think it is a little absurd.

REVIEW OF WORLD WAR II

I would like to review the history of our company starting back 10 years ago—before World War II. In 1941 our sales were approximately $4½ million. At that time we had one plant in Cleveland, Ohio, plus 7 plants in the foreign field: England, Holland, France, Canada, 2 in South America, 1 in Australia, plus sales offices in other important countries.

In 1941 our main product was porcelain enamel finishes for stores, refrigerators, washing machines, bath tubs, and so forth. We also made colors in a small way and were just entering the high baked synthetic field (paint). We had 2 engineering divisions—one for the procelain enameling field and one for the pottery and clay fields.

At the start of World War II we had absolutely no facilities that could be used for war work. Things looked very gloomy for Ferro right after Pearl Harbor and, at that time, several of our younger fellows joined—and, I am proud to say, several in the Chemical Corps and the other services, because we felt that the war work coming to Ferro would be meagre and, to keep positions intact for the older men, we made these enlistments.

The important thing we did then is the same thing we are doing during this defense period; that is, we went out and looked for work and looked for the impossible things to do.

Swinging from peace-time production of porcelain enamel and synthetic finishes in 1941, at the end of World War II we were making the following materials:

(1) Millions of pounds of NAPALM, plus the research to produce this material.
(2) Loading the 500 lb. GOOP BOMB.
(3) Making a large percentage of the SMOKE MIX for loading smoke pots.
(4) Loading SMOKE POTS.
(5) Grinding MAGNESIUM.
(6) Producing a deadly poisonous gas—ARSENIC TRICHLORIDE.
(7) Loading plastic cups with white phosphorus.
(8) Producing millions of pounds of THERMIT.
(9) Varied Research Contracts.

We had 9 different plants working on these projects; at the same time our two engineering divisions were working on furnaces and kilns to be used by prime and sub contractors.

BEGINNING OF KOREAN WAR

June 1950—when the drums of war started to rumble—Ferro did not wait for the services to come to us . . . we immediately started action to fight Communism and do everything possible in our small way to get the job done and get it done in a hurry.

In June 1950 we were in the same position as at the start of the war—1941. We had no facilities for manufacturing munitions or materials of war.

The first thing we did was to form a MOBILIZATION COMMITTEE made up of a Chairman, President of the Company, Director of Research, Assistant Director of Chemical Research, Manager of New Products Division, Director of Purchases, Executive Vice President and Manager of our Nashville Plant. With this committee we started to formulate our plans, set up our objectives and line up a program. The first thing we did to sell Ferro to the service was to publish this Manual on Industrial Mobilization which gives a very comprehensive picture. We took this Manual to the different services and contacted all District Procurement Offices trying to find some place where we could start to produce defense materials. One thing that I want to point out here is that in a 10-year period our sales had grown by leaps and bounds and in June 1950 our sales were running about $35 million per year. With this tremendous growth we have a problem of high overhead and personnel to be taken care of, if and when the cut came in peacetime production.

When you stop to analyze the total procurement for the defense effort and where it goes, it is most amazing and poses a problem to companies such as Ferro. General Black has told you that the Chemical Corps can use only 10 per cent of peacetime products produced by U.S.A. in its total procurement program. From a report prepared by National Conference Industrial Board on where defense orders are going, we find that for the period July 15, 1950 to

(Continued on page 53)

CHEMICAL CORPS KEY PERSONNEL

OFFICE, CHIEF CHEMICAL OFFICER, WASHINGTON 25, D.C.

Chief Chemical Officer, Major General George Egbert F. Bullene

Deputy Chief Chemical Officer, Brigadier General Charles E. Loucks

Executive Officer, Lt. Col. Timothy C. Williams

Comptroller, Lt. Col. John J. Hayes

Legal Advisor, Lt. Col. Herbert K. Greer

Chief, Personnel Division, Col. John R. Burns

Chief, Materiel Division, Lt. Col. Claude J. Merrill

Chief, Plans, Training and Intelligence Division, Col. Hugh W. Rowan

Chief, Research and Development Division, Col. William J. Allen, Jr.

Chief, Safety Office, Major Ned S. Weathers

CHEMICAL CORPS BOARD, ARMY CHEMICAL CENTER, MARYLAND

President, Col. Ralph C. Benner

ARMY CHEMICAL CENTER, MARYLAND

Commanding General, Brigadier General William M. Creasy

CHEMICAL CORPS RESEARCH AND ENGINEERING COMMAND, ARMY CHEMICAL CENTER, MD.

Commanding General, Brigadier General William M. Creasy

Chemical Corps Chemical and Radiological Laboratories, Army Chemical Center, Md.; Commanding Officer, Col. Fred J. Delmore

Chemical Corps Medical Laboratories, Army Chemical Center, Md.; Commanding Officer, Col. M. W. Bayliss

Chemical Corps Engineering Agency, Army Chemical Center, Md.; Commanding Officer, Col. C. L. Sayre

Edgewood Proving Ground, Army Chemical Center, Md.; Commanding Officer, Lt. Col. John W. Fitzpatrick

Camp Detrick, Frederick, Md.; Commanding Officer, Col. Montescue T. Moree

Dugway Proving Ground, Tooele, Utah, Commanding Officer, Col. Donald E. Yanka

CHEMICAL CORPS MATERIEL COMMAND, BALTIMORE, MARYLAND

Commanding General, Brigadier General Henry M. Black

Pine Bluff Arsenal, Arsenal, Arkansas; Commanding Officer, Lt. Col. Harrison S. Markham

Rocky Mountain Arsenal, Denver, Colorado; Commanding Officer, Col. Crawford M. Kellogg

Edgewood Arsenal, Army Chemical Center, Md.; Commanding Officer, Col. David Armitage

Deseret Chemical Depot, Tooele, Utah; Commanding Officer, Col. Kenneth A. Cunin

Midwest Chemical Depot, Arsenal, Arkansas; Commanding Officer, Lt. Col. E. A. Limbaugh

Eastern Chemical Depot, Army Chemical Center, Md.; Commanding Officer, Col. John P. Youngman

Atlanta Chemical Procurement District, 114 Marietta St., N.W., Atlanta, Ga.; Commanding Officer, Capt. Alvin H. Bowles

Boston Chemical Procurement District, Boston Army Base, Boston, Mass.; Commanding Officer, Col. W. E. R. Sullivan

Chicago Chemical Procurement District, 226 W. Jackson Blvd., Chicago, Ill.; Commanding Officer, Col. Victor C. Searle

Dallas Chemical Procurement District, 114 Commerce St., Dallas 2, Texas; Commanding Officer, Lt. Col. Hans S. Bendixen

New York Chemical Procurement District, 111 E. 16th St. New York City; Commanding Officer, Lt. Col. J. F. Escude

San Francisco Chemical Procurement District, Oakland Army Base, Oakland 14, Calif.; Commanding Officer, Col. George W. Dorn

Chemical Corps Procurement Agency, Army Chemical Center, Md.; Chief, Lt. Col. James H. Batte

Inspection Equipment Agency, Army Chemical Center, Md.; Chief, Capt. John Marrero

CHEMICAL CORPS TRAINING COMMAND, FORT McCLELLAN, ALABAMA

Commanding General, Brigadier General Leonard J. Greeley

Chemical Corps School; Commandant, Col. Ragner E. Johnson

Chemical Replacement Training Center; Commanding Officer, Lt. Col. Lucius F. Lincoln

CHEMICAL CORPS OFFICERS WITH THE ARMY FIELD FORCES

Hqs. First Army, Governors Island, New York:
Chemical Officer, Col. Walter A. Guild

Hqs. Second Army, Fort George G. Meade, Md.:
Chemical Officer, Col. Raymond T. Beurket

Hqs. Third Army, Fort McPherson, Georgia:
Chemical Officer, Col. R. D. McLeod

Hqs. Fourth Army, Fort Sam Houston, Texas:
Chemical Officer: Col. Donald Grothaus

Hqs. Fifth Army, 1660 E. Hyde Park Blvd., Chicago 15, Ill.:
Chemical Officer: Col. H. B. Bramlet

Hqs. Sixth Army, Presidio of San Francisco, Calif.:
Chemical Officer, Col. S. E. Whitesides

CHEMICAL CORPS OFFICERS RESERVE CORPS INSTRUCTORS

FIRST ARMY AREA:

Major Gordon W. Davis, NY ORC Instructor Group, Hqs. First Army, Governors Island, N.Y.

Major Robert G. Lynch, Office of Sr. State ORC Instructor, Kearny Shipyards, Kearny, N.J.

SECOND ARMY AREA:

Major Raymond O. Manker, Delaware ORC Instructor Group, Wilmington, Del.

THIRD ARMY AREA:

Major E. Escudero, South Carolina ORC Instructor Group, Broad and Chisholm Sts., Charleston, S.C.

FIFTH ARMY AREA:

Major John M. Kapp, Illinois ORC Instructor Group, Chicago, Ill.

Capt. G. E. Allard, 310 Federal Office Bldg., Third Ave. and Washington Ave., S., Minneapolis, Minn.

Capt. V. Deptula, Sr. Army Instructor ORC, 463 Federal Bldg., Detroit 26, Mich.

SIXTH ARMY AREA:

Major Gilbert J. Foster, California ORC Instructor Group, Los Angeles, California

CHEMICAL CORPS OFFICERS ROTC INSTRUCTORS

Canisius College, Buffalo, N.Y.:
Lt. Col. Andrew M. Dunn
Major John A. Cassidy

Georgia Institute of Technology, Atlanta, Ga.:
Lt. Col. Lewis A. Duerner
Capt. John J. Connor

Idaho State College, Pocatello, Idaho:
Lt. Col. David V. S. Kirkpatrick
Lt. Col. Warren T. Hunt
Major Edmund W. Lewandowski

Massachusetts Institute of Technology, Cambridge 39, Mass.
Lt. Col. Woodrow W. Reagan
Major Nat Giambelluca

Ohio State University, Columbus 10, Ohio:
Lt. Col. M. A. Peerenboom
Major Bruce M. Whitesides
Purdue University, Lafayette, Indiana:
Major Leon A. Kief
Major Ernest L. Knoll
St. Peter's College, Jersey City, N.J.:
Major Eugene J. Farrell
Major Thomas A. Isaacs
Capt. Joseph G. Rock
Texas A.&M. College, College Station, Texas:
Lt. Col. Leslie S. Moore
University of Delaware, Newark, Delaware:
Lt. Col. Chester Dombrowski
Capt. Richard B. Elliott
Vanderbilt University, Nashville, Tennessee:
Major Kenneth W. Copeland
Capt. Robert P. Blackmore
Wake Forest College, Wake Forest, N.C.:
Lt. Col. Joseph S. Terrell, Jr.
Capt. Albert E. Vernon, Jr.

THEATER CHEMICAL OFFICERS:

EUROPEAN THEATER: Col. Thomas H. James, Chemical Division, Hqs. EUCOM (Rear), APO 403, c/o Postmaster, New York, N.Y.

FAR EAST COMMAND: Col. Jacquard H. Rothschild, Chemical Section, GHQ, FEC, APO 500, c/o Postmaster, San Francisco, Calif.

PACIFIC THEATER: Lt. Col. James R. Champan, Chemical Officer, U. S. Army Pacific, APO 958, c/o Postmaster, San Francisco, Calif.

CARIBBEAN THEATER: Col. George R. Oglesby, Fort Amador, Canal Zone.

HQ. U. S. ARMY, ALASKA: Lt. Col. Claude W. White, APO 942, c/o Postmaster, Seattle, Washington.

GROUP AND SUSTAINING MEMBERS

OF THE ARMED FORCES CHEMICAL ASSOCIATION

Abbott Laboratories, North Chicago, Ill.
Aerial Products. Inc., Elkton, Md.
Affiliated Gas Equipment, Inc., Cleveland, Ohio.
Air Reduction Company, Inc., New York, N. Y.
Allen Manufacturing Company, Inc., Nashville, Tenn.
Allied Chemical & Dye Corporation, New York, N. Y.
American Aniline Products, Inc., New York, N. Y.
American Cyanamid Company, New York, N. Y.
American Stove Company, St. Louis, Mo.
American Zinc, Lead & Smelting Company, St. Louis, Mo.
Armstrong Cork Company, Lancaster, Pa.
Atlas Powder Company, Wilmington, Del.
Baker & Company, Inc., Newark, N. J.
Bastian-Blessing Company, The, Chicago, Ill.
Bastian-Morley Company, Inc., LaPorte, Ind.
Bechtel Corporation, San Francisco, Calif.
Bird Machine Company, South Walpole, Mass.
Blaw-Knox Construction Company, Pittsburgh, Pa.
Blickman, S., Inc., Weehawken, N. J.
Bolta Company, The, Lawrence, Mass.
Bowser, Inc., Chicago, Ill.
Bridgeport Brass Company, Bridgeport, Conn.
Bristol-Myers Company, New York, N. Y.
Brown Company, Berlin, N. H.
Buffalo Electro-Chemical Company, Inc., Buffalo, N. Y.
Canfield, H. O., Company, The, Bridgeport, Conn.
Casco Products Company, Bridgeport, Conn.
Celanese Corporation of America, New York, N. Y.
Central Foundry Company, The, Newark, N. J.
Chamberlain Corporation, Waterloo, Iowa
Chicago Electric Manufacturing Co., Chicago, Ill.
City Chemical Corp., New York, N. Y.
Continental Oil Co., Ponca City, Okla.
Crown Can Company, Philadelphia, Pa.
Curtis Industries, Inc., Helene, Chicago, Ill.
Dexter Company, The, Fairfield, Iowa
Diamond Alkali Company, Cleveland, Ohio
Dow Chemical Company, Midland, Mich.
Dunham, C. A., Co., Chicago, Ill.
E. I. duPont de Nemours & Co., Inc., Wilmington, Del.
Eaton Manufacturing Company, Cleveland, Ohio
Empire Stove Company, Belleville, Ill.
Ethyl Corporation, New York, N. Y.
Evans Research & Development Corp., New York, N. Y.
Federal Laboratories, Inc., Pittsburgh, Pa.
Ferguson, H. K., Company, The, Cleveland, Ohio
Ferro Corporation, Cleveland, Ohio
Firestone Industrial Products Div., Fall River, Mass.
Fisher-Price Toys, Inc., East Aurora, N. Y.
Fisher Scientific Co., New York, N.Y.
Fluor Corporation, Ltd., The, Los Angeles, Calif.
Foster-Wheeler Corporation, New York, N. Y.
Fram Corporation, Providence, R. I.
Fraser & Johnston, San Francisco, Calif.
Fuller, W. P., & Company, San Francisco, Calif.
Gasket, Packing & Specialty Co., Inc., New York, N. Y.
Gates Rubber Co., The, Denver, Colo.
General Aniline & Film Corporation, New York, N. Y.
General Dyestuff Corporation, New York, N. Y.
General Tire & Rubber Company, The, Wabash, Ind.
Glyco Products Company, Inc., Brooklyn, N. Y.
Goodrich, B. F., Chemical Company, Cleveland, Ohio
Goodyear Tire & Rubber Company, Akron, Ohio
Gray Stamping & Manufacturing Co., Plano, Ill.
Green Colonial Furnace Company, Des Moines, Iowa
Greer Hydraulics, Inc., Brooklyn, N. Y.
Grote Mfg. Co., Bellevue, Ky.
Gulf Oil Corporation, Pittsburgh, Pa.
Haertel, Walter, Company, Minneapolis, Minn.
Hamilton Manufacturing Corporation, Columbus, Ind.
Handy & Harman, New York, N. Y.
Harshaw Chemical Company, The, Cleveland, Ohio
Harvey Machine Co., Inc., Torrance, Calif.
Heil Company, The, Milwaukee, Wisc.
Hercules Powder Company, Wilmington, Del.
Heyden Chemical Corporation, New York, N. Y.
Hooker Electrochemical Company, Niagara Falls, N. Y.
Howell Company, The, St. Charles, Ill.
Hyman, Julius & Company, Inc., Denver, Colo.
Industrial Rubber Goods Company, St. Joseph, Mich.
International Nickel Co., Inc., New York, N. Y.
International Silver Company, Meriden, Conn.
James Manufacturing Company, Ft. Atkinson, Wisc.
Jefferson Chemical Company, Inc., New York, N. Y.
Kellogg, M. W., Company, The, New York, N. Y.
Kold-Hold Manufacturing Company, Lansing, Mich.
Koppers Company, Inc., Pittsburgh, Pa.
Kwikset Locks, Inc., Anaheim, Calif.

LaBelle Industries, Inc., Oconomowoc, Wisc.
Lambert Pharmacal Company, St. Louis, Mo.
Line Material Company, Milwaukee, Wisconsin
Little, Arthur D., Inc., Cambridge, Mass.
Mason, L. E., Company, Hyde Park, Mass.
Mathieson Chemical Corporation, Baltimore, Md.
McInerney Spring & Wire Co., Grand Rapids, Mich.
Merck & Company, Inc., Rahway, N. J.
Metal Hydrides, Inc., Beverly, Mass.
Metal & Thermit Corporation, New York, N. Y.
Milwaukee Stamping Company, Milwaukee, Wisc.
Monarch Aluminum Mfg. Co., Cleveland, Ohio
Monsanto Chemical Company, St. Louis, Mo.
Mundet Cork Corporation, New York, N. Y.
National Can Corporation, New York, N. Y.
National Fireworks Ordnance Corp., West Hanover, Mass.
Nesco, Inc., Milwaukee, Wisc.
Niagara Alkali Company, New York, N. Y.
Niagara Blower Co., New York, N. Y.
Nopco Chemical Co., Inc., Harrison, N. J.
Olin Industries, Inc., East Alton, Ill.
Oronite Chemical Company, San Francisco, Calif.
Parsons, Ralph M., Company, The, Los Angeles, Calif.
Pemco Corporation, Baltimore, Md.
Penick, S. B., & Company, New York, N. Y.
Pennsylvania Salt Manufacturing Co., Philadelphia, Pa.
Pfister Chemical Works, Inc., Ridgefield, N. J.
Pfizer, Chas., & Company, Inc., Brooklyn, N. Y.
Philco Corporation, Philadelphia, Pa.
Phillips Petroleum Company, Bartlesville, Okla.
Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.
Pittsburgh Plate Glass Company, Pittsburgh, Pa.
Rau Fastener Co., The., New York, N. Y.
Reel, Benjamin, Products Inc., Cleveland, Ohio
Rheem Manufacturing Company, New York, N. Y.
Rohm & Haas Company, Philadelphia, Pa.
Rowe Manufacturing Company, Whippany, N. J.
Rudy Manufacturing Co., Dowagiac, Mich.
Shell Development Company, Emeryville, Calif.
Sheller Mfg. Co., Dryden Rubber Div., Chicago, Ill.
Sherwin-Williams Company, The, Cleveland, Ohio.
Shwayder Bros., Inc., Denver, Colo.
Smith, Kline & French Laboratories, Philadelphia, Pa.
Snell, Foster D., Inc., New York, N. Y.
Sprague Electric Company, North Adams, Mass.
Standard Oil Company (Indiana), Chicago, Ill.
Standard Oil Development Co., New York, N. Y.
Standard Products Company, The, Cleveland, Ohio
Stauffer Chemical Company, New York, N. Y.
Stewart Die Casting, Chicago, Ill.
Sun Oil Company, Philadelphia, Pa.
Tennessee Eastman Corporation, Kingsport, Tenn.
Texas Company, The, New York, N. Y.
Toledo Steel Tube Co., The, Toledo, Ohio
Ultra Chemical Works, Inc., Paterson, N. J.
Union Carbide & Carbon Corp., New York, N. Y.
Unique Art Manufacturing Co., Inc., Newark, N. J.
United Carr-Fastener Corp., Cambridge, Mass.
United States Rubber Company, New York, N. Y.
United States Testing Co., Inc., Hoboken, N. J.
Universal Match Corp., Ferguson, Missouri
Victor Chemical Works, Chicago, Ill.
Vulcan Copper & Supply Co., The, Cincinnati, Ohio
Wallace & Tiernan Products, Inc., Newark, N.J.
Washburn Co., The, Rockford, Ill.
Westvaco Chemical Division, New York, N. Y.
Witco Chemical Company, Chicago, Ill.
World Steel Products Corp., New York, N. Y.
Wyandotte Chemicals Corp., Wyandotte, Mich.
Zaremba Company, Buffalo, N. Y.
Zenite Metal Corporation, Indianapolis, Ind.
Zenith Plastics Company, Gardena, Calif.

Companies listed in bold face letters are Sustaining Members.

DESERET

(Continued from page 25)

tremendous task of filling chemical requirements to the Pacific.

These improvements have been the result of vigorous planning and energetic thinking on the part of the command to accomplish a difficult and tedious task. Curtailment of funds has hindered in part the plans to replace canvas covered storage and construct permanent type storage sheds of aluminum, but at this time 15 25′ x 300′ sheds with removable tops, which permits cranes to pick up bombs with a minimum of time and effort expended, have been built at an estimated life expectancy of 20 years each compared with 4 years that canvas covering is considered serviceable. In addition, 104 sheds have been built which are 18 feet in length and 110 feet in width and 24 which are 18′ x 250′. The 25′ x 300′ sheds will each hold 33 carloads of bombs.

When completed, it is hoped that there will be 300 permanent structures erected with an estimated savings of $5,000,000 for the first ten years alone,

Depot personnel in general, and the operations staff in particular, are proud, as they may well be, of the records which have been established—not only for the great strides made in bettering the operations but in fulfilling the mission of the depot. Since the start of the Korean conflict each port call has been filled on time. This alone is an enviable record. It has taken a great many man hours, both military and civilian, to accomplish such a feat but the feeling of knowing we here at Deseret have done our part in the prosecution of the conflict in Korea is worthy of individual pride.

Deseret does not have an extensive history due to the few short years of its existence, but in the little time it has been in operation, many happenings have proved its worth to the Chemical Corps and to the public in general as an installation necessary to the defense of our country—be it during a period of peace or war.

ESTIMATING "KNOW-HOW" AND "CAN-DO" IN PROCUREMENT CONTRACTING

By Colonel
ALMON N. BOWES, CC, USAR
Manager, Process Industries Division,
The Cornell Machine Company

With a heavy defense program under way in an emergency without full war time control, with emphasis on formal bidding, with requirements differing in amount and urgency, the Contracting Officer has problems.

Production is one of these problems. It is considered that for each important item to be procured there is needed:

1. Sufficient related information to provide a base and insight to support the procurement procedure to be used whether by formal bids or negotiation.

2. Thereafter for negotiated awards[1] means to determine which contractors are qualified sources for production.

3. And for negotiated awards means to determine by forecasting which of the selected sources can meet production requirements.

When this problem combines urgency requiring some measure of specialized production (i.e., not a peace-time item or one not previously produced in such quantities or at such required rates, or both) the justification for the decisions and awards requires yardsticks using applicable and correlated data which are pertinent and definitive. Unfortunately, while the policies, laws, regulations and procedures state the desiderata in and resulting from the contract, the difficulties of these phases of the problem are the particular personal concern and responsibility of the Contracting Officers[2].

It is proposed that Knoeppel's seven M's, particularly the first six M's, properly extended and implemented, be used as a pattern for this problem. Knoeppel, an industrial engineer concerned with improving efficiency and decreasing waste for manufacturers in private industry, broke down all such manufacturing:—organization—operations—requirements—into seven fundamental factors:

1. Materials
2. Men
3. Machinery
4. Methods

Plant and Production

5. Management
6. Money
7. Markets

Knoeppel emphasized the value of balance in these M's in operations with the responsibility on Management for preventing or overcoming deficiencies and excesses. A serious or continued deficiency in *any M* distorts the company's operations, costs, output and profit. (It is not likely that an excess in any M will be a major source of difficulty under current conditions). As will be noted hereafter, it is Management that provides "Know How."

Thus in applying Knoeppel's M's for evaluating prospective contractors (*including their important sub-contractors*) and their proposed productions, the Contracting Officer can set up for determination or estimating and modify before, during and after negotiation as may be pertinent:

1. Minimum requirements and time allowable to obtain, organize for production ("make ready") Materials, Manpower, Machinery (tools and equipment), and Methods.

2. Adequacy and relative competence of low bidders among a group in negotiation (add Management and Money to the first four M's.)

3. Specific deficiencies and how to obviate them to the extent necessary and in allowable time, (Forecasting).

Some of the obvious deficiencies *to be expected in contractor's proposals* apart from gross blunders are:

Inability to secure firm commitments from reliable sources for specific Materials, Machines or tooling and equipment. (How much or how many, from *whom*, *where*, and *when*.)

Unrealistic estimating in labor recruitment and training.

Unrealistic estimating of "make ready"—the time required for the physical organization of the plant or parts of it to be used for material reception and storage, in-plant transportation, setting up production lines, inspection stations, packaging and storage areas, etc.

Unrealistic estimates of unit operations such as output per machine or per unit operation per hour or per shift.

Optimism on unproven Methods for meeting required production rates.

Failure to estimate tool wear, spare tooling, down-time, and special maintenance problems.

Unrealistic estimates in money and time to obtain dies, jigs, fixtures and gauges.

Failure to properly and thoroughly check sub-contractors including over-commitments.

Failure to provide adequate inspection stations, special test equipment and competent personnel.

Failure to realize the need for and to obtain on time necessary specialists for supervision of production and inspection, and for the Management staff. (These are already in short supply.)

It is of interest in looking for deficiencies to note what contractors write themselves out of a possible contract by being too conservative. It is the enthusiastic optimist who tends to promise too much too soon. To this extent, a qualified proposal may, on analysis and what the C.O. *knows*, be the better one for the Government.

Hence, for his yardsticks, particularly for Materials and special Machinery, equipment and tools, the Contracting Officer needs a very good picture indeed of the sources of supply for these essentials and which *sources* can deliver the quantities within the time required. (This for some critical materials may reach into components for products which the Materials producers themselves cannot control or lack certainty.)

Since the Contracting Officer is not Superman himself (regulations and procedures to the contrary) he cannot personally set up these yardsticks for minimum requirements or as detailed check lists for probing each M in the necessary breadth and depth.

Such an operation for a heavy or urgent item or program is a staff (group) operation. A temporary group with a chief may be organized from the Procurement Division and the Procurement Planning Division as qualified personnel are available.

Much necessary data is obtainable from Procurement Planning (District), from other Procurement Districts, and by direct calls on Industry.

If it is contended that too much "pick and shovel" work is involved, the rebuttal is that the burden is eventually more onerous on a Procurement District in trying to get out delayed production from and increase the output rate of a delinquent contractor.

For new "rush" items, where the formal Procurement Planning becomes a current Procurement activity, such team work is mandatory. Perhaps Superstrong, Inc.[1] is agreeable and available. Even so, recalling something from W.W. II, this situation needs some probing. Sometimes the Superstrongs make mistakes, take too much for granted, and if well-loaded with defense work may be spread out too thin in spots in the lower echelons affecting production. It is certain that it is always to be our contract that has the rough going!

The evaluations thus far largely resolve into checks of or probing into along with some arithmetic and the calendar, the particular whats, hows, from whom, where, and when of the first four M's, and those of the cures, if any, for these deficiencies.

For smaller companies the evaluation of Management as it is affected by intangibles can present some difficulties.

It may be conceded that what any contractor is doing, or may have done in producing one item, is no warranty that he will do better or worse on another item, or for that matter, on more of the original item. To paraphrase Lord Nelson—"In a sea fight, something must always be left to chance." So in this type of contracting "Some factors can not be fully measured or guaranteed." The problem would seem to resolve into degrees of adequacy and risk measured against the procurement objective.

As to Management, any company worth considering can provide a certified financial statement, usually a credit rating, a brief factual history of the company's activities and accomplishments, risks taken and rewards therefrom. These can be checked with banks, customers and suppliers. Likewise, to be expected is the business or professional background of the key personnel which also can be checked.

It was ably pointed out in a recent discussion of this phase of the subject that when Management needs credit for its enterprises, Credit, apart from the calculated business risk, is a tangible reflection of Character. To push it further, character in business may be defined as the intangible profit or loss resulting from risks taken and difficulties overcome. It has been well said, "There is nothing so timid as a million dollars."

To illustrate with two examples: In '42 a prospective contractor in presenting his business history showed prior to the Depression a good growth. The Depression forced this company into reorganization (77B) after which the company again made progress. The D & B report noted that this company following the reorganization voluntarily repaid every dollar lost by every creditor by the reorganization. It isn't difficult to go along with a company such as this.

In contrast, in '44, a program having been worked out with Small War Plants Corporation, one rejected contender complained to a Congressional Committee that he had not received proper consideration. As the S.W.P. was carrying the financing load (working capital and expensive machine tools) the decision to reject had been theirs. The letter in reply to the Committee's secretary was in substance ". . . . the record of this company's management shows a poor *moral* and financial risk." (Squawk squelched.)

There are other supplementary methods of estimating Management which require a high degree of professional competency. One is a report on the plant in its current operations—working conditions, housekeeping and maintenance, quality of machinery and equipment, accident rate and record comparable with others in same work. Another is an estimate of the added work load resulting from the contract, the number and capabilities of the Staff and operating personnel under Management and their ability to carry this load.

Another, requiring expert appraisal, is Labor Relations, currently and with a forecast thereof.

It is difficult to consider Management without Money as an essential material for a specific contract. It is considered as fundamental that any Company which cannot sustain some losses and still provide in stride ample working capital should supply on request a budget estimate of anticipated expenditures and receipts. The Army loan policies and procedures properly implemented can provide needed extra working capital for many good contractors.

It is recalled that one persistent sales manager seeking a proposed contract was asked for such a budget. The Treasurer, accordingly presented one well broken down on how much, for what, and when. From detailed discussion it was agreed that an Army Advance Payment up to 20% of the contract value would be necessary before payment on the first shipment could be made. Also the production forecast was moderately revised, substituting some cold realism for warm enthusiasm.

"Know How" in the Knoeppel pattern is a possession of Management. The writer has some dislike for the expression, not because it doesn't exist in large quantities in many organizations, but because it is used too loosely. A reasonable basis for assigning "Know How" to a Management as a substantial factor is deemed to be:

a. A previous record of satisfactory production of the item in question at a similar rate, or

b. Previous or current record of production at the same or higher rate of an item equally complex and precise.

Short of *a* or *b* there are elements of risk which on probing may be bearable. It is recalled that one modest but urgent item early in '42 was awarded on the "Know How" of one man, no organization, excellent credit and business character, insufficient working capital, no plant. He rented a thoroughly adequate plant for two shift operation, obtained a labor allotment, an advance payment loan and did very well on his production and in time. There was considerable savings as against other informal bids. If this one and only key man had had an accident, then what? Such awards are not commonly recommended if the Contracting Officer is to get some sound sleep and avoid ulcers.

There is a lot of potential "Know How" to be recognized in Managements' willingness to risk much to profit relatively little. What one manufacturer has done may very well be done equally well or better and perhaps for less by another. This has been true on occasion by manufacturers who were, and some who were not peacetime competitors. The production records of W.W.I and W.W.II are full of accomplishments by manufacturers who took on the production of items entirely foreign to their regular business. "Needs must when the Devil drives" is one answer, the better one is that heavy defense programs offer many companies an opportunity to operate on a scale which their normal markets do not require. When Management multiplies the possible risks by three, then cuts the possible profit by two and still says yes, the odds, after probing, may well be in the Contracting Officer's favor. For such prospective contractors the critical factors may be the availability and cost of special machinery or equipment, special personnel, and the timing involved. (Products requiring highly specialized equipment, methods, and related materials for their processing should rate and receive preferential negotiation). Otherwise, the requirement may well be split to develop a second or third source if necessary or advantageous to the Government.

If it is conceded that "Know How" needs tangible evidence of its existence, something else is needed to summarize the desired productive capacity. Hence, "Can Do"

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BIOLOGICAL WARFARE

(Continued from page 18)

such conditions should be easy to reproduce. By utilizing atomizers or other disseminating devices, even greater concentrations of infectious clouds could be produced. Relatively simple equipment which could be carried in an ordinary suitcase would be sufficient to enable a saboteur to contaminate the air of any enclosed space where people congregate, and could cause an attack-rate of disease as high or higher than that observed in the laboratory epidemics which periodically occur.

These same principles apply, only on a larger scale, to the use of aerosol clouds over cities. Specially designed bombs, shell, or other types of disseminating devices discharged from enemy aircraft or from warships offshore could create large clouds. Under not too uncommon weather conditions, such clouds would remain close to the ground and, like pollen, diffuse with the wind over wide areas and for many miles, or, like smog, hang over a city for hours.

With disseminating devices of a reasonable size, relatively small amounts of material could establish very widespread clouds of high concentrations of agent. The problem of dissemination would appear to be one of practical technical development rather than one requiring any new or undiscovered scientific principles. It would seem entirely possible that the percentage of casualties among those exposed to such a cloud attack might approach that which could be produced from the overall contamination of a building by sabotage.

Our long familiarity and understanding of epidemics caused by contaminated water and food supplies makes it easy for us to understand how a purposeful contamination could occur. We had long and bitter experience with typhoid fever until our standards of purity and maintenance of safe water supplies were universally established. The amoebic dysentery epidemic in Chicago during the Century of Progress exposition is merely another example with which we are all familiar of the hazards presented by a relaxation of our safeguards against such diseases.

The intentional introduction of a relatively small volume of a highly concentrated suspension of a pure BW agent could effectively contaminate a large part of a water distribution system. The principles of back-siphonage are so widely known that any plumber or person with a minimum of sanitary engineering training could introduce with ease such a mixture at many points along a water distribution system. The exact point of the introduction might be exceedingly difficult to locate. Of course, a greater number of casualties would be expected than would occur in accidental waterborne infections because of the greater dosages of agent which would be received by consumers.

In a like manner, foodborne epidemics are well understood. These usually result from the contamination of certain types of warm or moist foods that provide adequate growth conditions for the BW agent. While the number of organisms may be small to begin with, the final concentration in the food actually eaten may be tremendous because of the opportunity for growth in the meantime. In several reported foodborne epidemics of typhoid fever, a majority of the persons consuming the contaminated food were affected. This indicates that high concentrations of bacteria could overcome much of the natural resistance which the normal population may have. We can readily see that a saboteur might inject a high concentration of certain infectious agents into the right food at the right time, and could almost certainly produce results with high attack rates among those who consume it. In the field of sabotage our potential enemies have capabilities not shared by ourselves and our allies.

One's imagination is almost unlimited when one considers the wide variety of possibilities and potentialities of this

form of warfare. The only limitations of consequence result from the accessibility of such food and water supplies to a subversive agent and the limited distribution of any single food or water supply.

It should be noted that such sabotage methods would not necessarily be limited to the use of living agents. Certain bacterial and vegetable toxins or any of a wide variety of chemical poisons might be used. Biological agents, however, have certain distinct advantages from a saboteur's point of view since the incubation periods of the biological agents vary from days to weeks, and would enable him to "Do His Business" and disappear, leaving few clues. The more immediate effects of the chemical poisons might make his chances of detection too great.

Our best method of assuring that this or any other new concept will not be used against us is for all our real or potential enemies to know that *as a minimum* we are capable within the limits of scientific knowledge of defending ourselves adequately.

One of the best defenses against a bacteriological attack is a quick, reliable detection system so that appropriate public health organizations may swing into action promptly and initiate antibiotic, chemotherapeutic and other appropriate control measures. Clearly, the initiation of such widespread control procedures will be no small task. Until recently, standard procedure for detecting these organisms in water required four days. However, the chemical corps recently completed development of a revolutionary detection device around which a workable defense can be built. It consists of a very thin filter which will trap bacteria, permitting their identification within 15 hours, or one-sixth the time previously needed. There is still a need to develop more and speedier specific tests for all potential biological warfare agents. Both the chemical corps and the public health service are vigorously pushing such development.

An enemy attack which would create a long-range effect, compared with the more immediate ones produced by infecting the human population, might be directed toward infecting our domestic animals with exotic diseases not now present in the United States and, as a result, cutting down our meat supply. The damage that such overt or covert attack might produce is indicated when one considers the cost of bringing the recent outbreak of foot-and-mouth disease in Mexico under control. This outbreak resulted in the loss of more than one million animals and produced a joint economic loss of two hundred million dollars to Mexico and the United States. This disease and the equally dangerous rinderpest are highly contagious and would spread rapidly from herd to herd. The answer to this threat lies in strengthening our existing animal disease control organizations. There is a continuing need in the veterinary field to develop new and improved vaccines; many agencies are currently cooperating in such development.

Our crops may be similarly vulnerable to attack by exotic biological agents not now a problem in the United States. Enemy aircraft or saboteurs could introduce destructive plant diseases and pests into our corn and wheat belts, which might be difficult, if not impossible, to bring under control before the year's crop was ruined. Here, too, the answer to the threat lies in strengthening our existing organizations for the control of plant diseases so outbreaks may be promptly reported and control measures initiated. The development of additional disease-resistant plant varieties is one facet of the defensive picture which is receiving the attention of many cooperation agencies.

I have attempted to present to you a few highlights of factual information about biological warfare, unadorned by sensationalism or exaggeration. Its possibilities are great—let no one be misled on that score—but they are frightening only if we give way to panic or if we fail to insure that we are ahead of any other nation in knowledge and preparedness in this field.

CONTROLLED MATERIALS PLAN

(Continued from page 34)

vate industry that produces these critical materials to meet the situation today? I have already described what is being done to provide a real and lasting solution—that's to increase production and supply, to provide the additional metallics, the basic material smelting and refining and refinishing facilities that go into the complex of manufacturing steel in its various product forms, copper in its forms, and aluminum likewise.

In addition to this long term solution which your government has aided in various ways, through the inducements of the tax amortization program and through utilizing the allocation mechanism to see that steel goes to steel companies to produce more steel. In addition to that approach to the problem, the government and the producers of these controlled materials are working together to develop and perfect a system that will distribute or allocate these materials, in the face of this shortage, so that they are produced and delivered in the shape and forms and at the time and to the point that will best meet the defense needs, and serve the public interest. That scheme and that system is, of course, the Controlled Materials Plan. It was developed in World War II when we found then as we found again this year, that a reliance upon priorities would be inadequate. Fundamentally it's a system of complete allocation. Many have asked "Is it necessary?" To that the answer is an unqualified affirmative. It was the considered judgment that you could not rely on priorities to effect the huge distributive task at hand.

What is the Controlled Materials Plan? The show of hands earlier indicated that it would be a little redundent for me to attempt to describe it here in general terms to those of you who are familiar with its details, so I will pass it except to answer what I know is a question in most of your minds. Is it going to work? Is it failing badly? Is it flagging? Will it improve in the months ahead? I can give you the opinion of a man who, I think has more of a feel, more experienced, in this area than any other single man in the country today and I refer to Manley Fleischmann, the Defense Production Administrator and the Administrator of the National Production Authority. Mr. Fleischmann told the Joint Session of the Senate Banking and Currency Committee, and the Senate Small Business Committee and the House Small Business Committee:

"The fact that we knew we were going to reach a period like this is the principal reason why we introduced the Controlled Materials Plan. All of us who lived through the World War II experience in installing comparable systems for controlling distribution of critical materials knew that CMP could not be introduced and become fully effective overnight. We anticipated that the initial quarter of operation (the third quarter) would be confusing in many ways. The transition from a simple priority system to a plan of controlled allocations could not but be difficult. Nevertheless in our judgment the step had to be taken to get ready for the kind of situation we face in the coming quarter—the first of 1952. We had to install the machinery that would channel materials according to decisions dictated by the urgency of the mobilization effort. I take satisfaction in reporting that progress in making CMP an effective mechanism for distributing scarce materials has been much more rapid than in World War II. The third quarter was full of difficulties, as we expected. Many of these have now been cleared out of the way. The old priority-authorization authority has been washd out of the system. We anticipate that in the fourth quarter the number of unplaced orders reported by those who hold CMP allotments will rapidly diminish. I cannot promise you that every CMP allotment will find a place in the schedule in the fourth quarter, but we will more closely approach that objective

in a very substantial way in the first quarter. Against this background (says Mr. Fleischmann) I am confident that in the first quarter of 1952, CMP will be a fully effective system for distributing materials. Allotments issue will be in balance with the abilities of the mills to ship. We will have a working tool for seeing to it that materials go where they are needed to achieve the goals of the mobilization program."

I'll not pause to outline the details of how CMP works to help you as an A-product producer nor how CMP helps the so-called B-product producer, or how it works to provide adequate maintenance, repair and operating supplies. I do want to touch, however, on how CMP helps to serve the small manufacturer. The small manufacturing enterprises of this country, of course, have the roughest going in a time of shortage such as this. They are the ones most likely to be cut short in the race for supplies. All of us in NPA are convinced that without the CMP mechanism for the allocation of basic materials, smaller concerns would be left at the post. The steel mills are able to continue the production of their regular product mix, this regulation makes available to the small producer the same steel supply which he customarily found that his warehouse supplied. CMP regulations provide for self-certification. The quarterly limitation on the self-certification privilege makes it small, but it does provide for the requirements for a surprising number of firms. An important feature is that it avoids paper work for the small manufacturer. We have also provided for the handling of the 105 field offices of the Department of Commerce of the so-called small cases, which under the present arrangements call for 100 tons of steel, 4,000 pounds of copper, and 1,000 pounds of aluminum. I'm happy to tell you that this small case procedure may be broadened to make it possible for many more of you to transact your business here in Chicago at the field office or regional office, rather than have your paper processed through Washington. That enlargement between the cut-off between the Washington operation and the field, will not be available for the first quarter but we hope it will be for the second.

In conclusion, let me say that hard and painful as this all may be to you individually in your business, we still must bespeak your understanding of what your government and country as a whole is trying to achieve. Without this understanding we are fearful that as the bite of this defense effort begins to hurt, if the international scene should appear to become a little bit more placid, there will be a tendency toward a letdown in this defense program. It would be nothing short of tragic to slacken off and lose the ground we have gained. No matter what happens abroad, we are committed to at least the minimum goals of this program.

We depend very heavily upon you business leaders and your committees to understand in addition to what is happening to you individually, the objectives of the total program, to appreciate, when the sacrifice is asked of you, that there is a good reason for it and that when controls are applied that it is for a good reason. I can assure you that nobody will be happier than Mr. Wilson, Mr. Fleischmann and many of the others of us associated with them, when this period of controls can be over. But we do depend upon you to understand that in something as huge as this defense production program, there are bound to be mistakes, there is bound to be a great deal of confusion and that that does not necessarily prove that the program is being run without efficiency or without sense. We all have a great deal at stake in the program, and I don't think it's asking too much to grit our teeth and take this temporary time of shortage and strain, try to survive it somehow, and have the hope that sometime in the not too far distant future that we can live again in well-being and in confidence and in some degree of peace.

KNOW-HOW AND CAN-DO

(Continued from page 45)

is offered, defined as a summation of desirable "Know How," competent Management with adequate Money, Machinery, Methods, Man-power, and Materials, all on hand or available in time.

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[1]The extent, if any, to which the lowest bidder on formal bid procedure may be checked and probed, and the use of such resulting determinations as a cause for rejection will probably require approval by higher authority in advance.

[2]This "headache" has been wryly described as "distinguishing" between all black cats and all white cats with black markings (not so easy); between gray cats with white areas and white cats with gray areas (tough). The assumption in the simile is that the lighter colored cats will jump quicker and farther when prodded. (It seems the other C.Os get all the pure white cats).

[3]Fictitious.

CIVIL DEFENSE

(Continued from page 14)

sponsibility which, as has been stated, is to "——provide necessary *coordination* and *guidance*——" as well as "——necessary assistance——" to States and their political subdivisions.

In order then to actually contribute something which will be of practical value to the Civil Defense organizations which are being set up at all levels; State, county, municipal—and aimed particularly at the Engineering Services, the Federal office has undertaken to prepare a series of Manuals which will explain what should be done in each of the several areas of responsibility in order to properly handle their assigned task.

At present, we have in course of preparation, the following Manuals:

1. Protection of Storage Facilities for Chemicals, Gases and Flammable Liquids in Disasters
2. The Utilization and Control of Streets and Highways Under Disaster Conditions
3. The Emergency Clearance and Repair of Streets and Highways Under Disaster Conditions
4. The Emergency Repair and Operation of Water Facilities in Disasters
5. The Emergency Repair of Hospitals, Community Facilities and Dwellings Following Enemy Attack
6. Sewage and Waste Disposal in Disasters
7. The Emergency Restoration of Power Facilities
8. The Emergency Restoration of Gas Utilities
9. The Emergency Repair of Air Transport Facilities Under Disaster Conditions
10. The Emergency Repair of Railroad Facilities in Disasters
11. Emergency Repair of Piers and Terminal Facilities

The specific titles of the listed manuals are subject to change. It seems indicated that manuals will be prepared covering additional areas of operations of Engineering Services.

The Engineering Services Division at the Federal level fully realizes that it would be impossible to prepare these manuals if limited to using only the knowledge and experience of its existing staff.

It is therefore both wise and necessary that we reach out and secure the assistance and advice which groups and associations such as AFCA are in a position to render.

The various fields of activity that constitute our vast industrial and

utility empire, are each competent and capable of meeting and solving contingencies affecting their own enterprise. It is important therefore that such organizations be not disturbed with respect to the conduct of their own affairs.

It is quite conceivable that the assignment of an individual or task group to a factory or utility to perform an act of restoration or repair might, by reason of unfamiliarity with the contents and operations, do considerably more damage and endanger the lives of more people than it would do good.

We might use a chemical plant or a utility as an illustration.

A chemical plant may, and usually does, have a variety of chemicals, gases, and acids that are "temperamental" in their reaction to certain types of exposure or handling. The uninformed person has no business in or around a devastated or partially devastated plant. Using chlorine gas as a product of a factory to illustrate;

Only employees of a chmical plant should undertake the emergency repair of damages for they are familiar with the hazards of chlorine gas. Chlorine is a safe chemical when it is confined. It is not flammable or explosive in itself, but when it escapes or is allowed to expand in rooms it IS dangerous. The hazards, therefore, from its nature and characteristics demand that intelligent precautions must be taken to safeguard against further destruction of plant facilities and even to safeguard the community itself.

Similarly; power facilities that contribute so much to our essential day-to-day living, can produce many hazards in times of catastrophe. The danger of high voltage or "live wires" is widely recognized. Lower voltages can be fatal even at 110 or less. A number of cases are on record where contacts with 60 to 65 volt circuits of 25 and 60 cycle frequencies have resulted in fatalities.

While "turbines," "generators," "transformers," "batteries," are words familiar to every enlightened citizen, only the trained employee or engineer should attempt the restoration of power in emergencies.

These instances are cited only as a reminder that all other facilities, utilities, factories and industries have similar contingencies in case of distress and that all should plan and prepare for any eventuality within their own limitations and in co-operation with the rest of the community.

Engineering Services fully realizes the necessity of having all plans for the emergency repair of any and all facilities, encompass the total resources of the facility itself and placing them under their own direction in all exigencies. It is only when the individual resources have reached their maximum capacity or been exhausted that Engineering Services is likely to be called upon to come to their aid with equipment and manpower, and then preferably under the direction of personnel from the facility affected.

This clearly implies the necessity for all facilities to have designated engineers at the control centers working and planning, hand in glove, each with the other and in close co-operation with local Civil Defense Engineering Services. This will assure that proper assignments of personnel and equipment will be dispatched to the place where needed, and function under the direction of men who know their job and are accustomed to meeting contingencies within their own normal field of operation and are acquainted with its hazards.

The foregoing suggested method should be regarded as a two-way street for it not only establishes the procedure by which a plant or utility can RECEIVE help, it at the same time sets up the necessary machinery for our organized forces to GIVE help.

To effectuate this modus-operandi it is necessary to have manuals or guides for each field of endeavor in order that an over-all, integrated, operational plan can be developed to enable all elements to cooperate for a common cause.

In the preparation of these manuals we believe that to be practical they should be prepared by men who know their subject. With this in mind panels are formed from industry, within each field of activity, to compile the manual applicable to their own industry.

Panels are now working or being formed in the following fields: Chemical, Gas, Docks and Harbors, Inland Waterways, Power, Water, Railroad, Airports, Sanitation, Hospitals, Highways. All, of course, directed at meeting exigencies under disaster conditions.

Utilization is made of National and local Associations and Societies in finding and securing recognized leaders in each field, willing to aid in this work. Coming from the field, as they will, two basic things are accomplished:

First, the manuals or guides will be authoritative;

Second, they will find acceptance in the field because of their authorship.

In this connection the author would be ungrateful indeed if mention were not made here of the valuable and generous contribution being made by AFCA, by its Panel on the preparation of the Manual on "Protection of Storage Facilities for Chemicals, Gases and Flammable Liquids." Your President, Dr. W. E. Lawson; Colonel J. B. Fischer; Mr. H. A. Campbell; Mr. Reuel

C. Stratton; Colonel Harry A. Kuhn; and Mr. F. G. Wilson are giving of their talents and time in harmony with a preachment made by your President when he wrote editorially,"—we pledge ourselves to work for the betterment of human understanding and human relationships. If progress is to be made we shall need from each of you a helping hand." Our gratitude cannot adequately be expressed for the valued services being rendered by AFCA.

We are encouraged to believe, regardless of the consequences of war or the removal of the threat of war, that the various panels will, in the end, strive to perpetuate their activities and continue their services in a type of co-ordinated effort comprised of all the various fields of interest and activity. This has already been suggested by men, high in industry, who foresee the need of a "Panel of Panels" to keep alive mutual interests in perpetuating the free enterprise or capitalistic system as well as being ready to meet emergencies created by catastrophic conditions.

One of the areas of Civil Defense is that which concerns itself with protection against the threat of Atomic, Biological, and Chemical warfare. This is the A-B-C element. It is in this area that the knowledge and experience of the Armed Forces Chemical Association can be of tremendous influence.

Your Association is concerned with the study and development of chemicals from the standpoint of use both offensively and defensively, while Civil Defense concerns itself with the defensive phase. We look to individuals and Associations for assistance and guidance in our efforts to promote and publicize methods by which the incidence of loss and damage can be minimized.

It is foreseeable that mutual interrelationships continued on the basis of interdependence and friendly understanding of problems common to all, would accomplish much in solving many problems that seem, from time to time, to vex or confuse our people.

SMALL BUSINESS

(Continued from page 38)

American citizens our opportunities are equal; as American businessmen, they should be no less so.

Occasionally we all encounter people who profess not to believe in Federal aid to small businessmen. Loudly proclaiming their rugged individualism, they are apt to rant against what they term "spoon feeding" and "coddling." This is a point of view upon which we are all free to place our own evaluation. But I can say to you without reservation that I have yet to talk with a small businessman who wanted preferential treatment simply because he employed fifty men instead of 500.

Equality of opportunity, yes; favoritism, no.

It seems to me that the point to bear in mind, when speaking of small business, is that we are not merely concerned with a fractional segment of our national economy. More than 90 per cent of our commercial and industrial enterprises are classified as small. These form the broad base of our national economic structure. Just as the towering spires of Manhattan rest on the bedrock beneath, so our industrial and commercial giants, to like extent, depend on the solid foundation composed of thousands upon thousands of small manufacturers, distributors, retailers and the services trades.

In any showdown of industrial strength with the forces of Communism, pulling together they can be invincible.

CHICAGO ANNUAL MEETING

(Continued from page 21)

autos, of fire engines and of railroad engines—and a mammoth minature railway.

Most of the exhibits are designed to be operated by the visitor. Press a button and a cutaway model of a new jet engine—the kind we're flying in Korea—commences operation. Kids, young and old, climb up into the cab of a modern railway locomotive and see and feel the controls they have long yearned to handle.

What Wall Street is to finance, the Merchandise Mart is to wholesaling. The Mart was built 20 years ago by Marshall Field and Company as a warehouse and mammoth central showroom where buyers could inspect the latest products of manufacturers and jobbers. Since most of the U. S. is only overnight from Chicago—all of it is less than eight hours by air—the idea was a buyer's and seller's dream. They moved in so fast Marshall Field was quickly squeezed out and today the place is stuffed to the rafters with acres of display rooms containing 1,200,000 separate items—gifts, household appliances, personal and home furnishings, toys, games, ceramics, glass and silverware. Buyers come from as far away as South Africa and India to see what will be selling in stores three weeks or six months hence.

Another interesting hour can be spent watching the bulls and bears operate in the grain market in the Board of Trade, about a five minute walk from anywhere in the Loop. During market hours visitors are welcomed to the gallery to watch the noisy pandemonium of trading in the six pits below.

GOVERNMENT CONTRACTS

(Continued from page 40)

June 1, 1951 . . . of a total $23,800,000—50 companies had over half, or a total of $15,230,000.

Further analysis shows General Motors had a total of $3,500,000; Ford—$1,000,000; Boeing Aircraft—$960,000,000.

An analysis of these 50 companies shows that the majority of these contracts are in the aircraft field. This is indeed a grave problem to us, since we do not have facilities for working metal in any shape or form. At our T&K operations in Chicago we make heating elements for domestic and commercial use. This is highly specialized and would take a complete rehaul of the equipment and additional new equipment to handle any of these contracts.

During the year 1950 the Mobilization Committee had regular meetings (3 to 4 per month). In these meetings all of the problems were thoroughly discussed and every angle to defense procurement was pursued.

Briefly summarizing just what we have done up to the present time . . .

(1) Appointed a mobilization committee which includes officers of the company who have authority to make decisions. We have found this committee really to be the key to our whole method of attacking this defense work. If you do not have a committee and delegate this work to one single person, you will find the job is being slighted and management not giving it the attention they should.

(2) Inasmuch as Ferro does not have facilities to produce on prime or sub contracts for metal components, it has been our theory to tackle those jobs that no other company wants. In other words, we take the impossible!

(3) We carefully screen all our costs and turn in a bid that is highly competitive. It is very important to have a good cost system so you know what your price is.

For the present we have many different types of contracts which include both research, educational and production. We always like to take an educational contract because it gives you the foundation for a future prime contract. Fortunately, we are set up excellently to handle both research and educational contracts. We have an excellent research and engineering staff—this is one of the biggest assets in our defense work. We also have an excellent sales and service technical organization from which we can draw management personnel for the defense contract when we receive it.

General Black has told you that all procurement has been decentralized from Washington and placed in the District Procurement Offices and has said not to bother the Office of the Chiefs of Services in Washington for contracts. We agree with him wholeheartedly, but about a year ago we questioned the advisability of having a Washington Headquarters. It is surprising, when you check with other companies, the number that have permanent Washington offices and representatives. We decided to set up a semi-permanent headquarters on a month-to-month basis and up to this time we have kept it operating continuously. The prime purpose of this office has been to contact NPA, DPA, DMPA, DMA, OPS and many of the other government services. We find we get first hand information and much better service, as well as a quicker solution to our problem by going direct to these offices. We still contact the District Procurement offices of the services and do not bother the Washington offices except on rare occasions.

I would like to say here that it has paid off for us in the past year on two important items. If we had not set up the mobilization committee and gone out on an aggressive campaign, we would not have turned up these items which I believe will mean much to the future of our company.

This gives you a picture of how we handle defense work at Ferro. In closing, let me show you a small ash tray finished in porcelain enamel, bearing this motto on the front —"Illegitimos non-carborundum". I have several of these trays here and you can see the translation on the reverse side. You might call this our motto at Ferro.

ERGS, IONS AND SALT WATER

(Continued from page 11)

masks." He then warned all men in the director to get their masks on, and donned his own. They had just enough time to settle the masks and get accustomed to the instruments viewed through the eye-pieces when the Captain roared up from below, "Commence Firing."

As far as the action went, it was like shooting fish in a barrel! Seventy-two eight-inch guns deal enormous damage in a matter of seconds, and all guns on all ships bore, the range and bearing were perfect, the enemy course and speed had been accurately solved, and there were hits on the first salvo. In eight minutes the enemy main body was a scattered and blazing group of wrecks. Not a ship escaped that awful devastation. In the midst of it the enemy rear destroyers tried valiantly to mount an attack, but long before they reached torpedo range the secondary batteries of the cruisers killed them. It was complete and total victory. Through it all the third ship in the cruiser division was under a heavy pall of stack smoke. Even some of the spaces below were harassed and in many of them men wore their gas masks. Guns, directors, hoists, and maneuvering were all accomplished by men in masks. The ship shot as well as the others and carried out her mission without flaw. She was included equally with the others in the Task Force Commander's, "Well Done." Afterwards, when all the reports were in, there were special letters of commendation to the commanders of the two ships which had been third in their respective divisions that night. And Lee got a letter, too, as well as a very nice Bronze Star.

Many days later, on a sunny morning in the South Pacific, with the ship idling along on a mirror sea, Lee had completed a report to the skipper on the bridge. The Old Man recalled the action to the young Gunner and expressed himself in extensive recollection of his past experiences. Then, "You went through Chemical Warfare School in 1928, did you not? You don't recall it, I am sure, but I was in that same class. I remember that you rather sweated that one out. I was married, and my wife and kid were in Baltimore at a hotel. I used to shove off directly after class, and we saw little of each other. I've had several experiences since then in which C. W. had a part. Just last year, before I got this command, I was in a staff job. I was over with MacArthur. We made a landing down there and I went in with the first wave,—Marines. We used four point two's with H. E. and some white phosphorus. The old training served me well, and I found I hadn't forgotten as much as I had thought. The boys had flame-throwers, too. Not like the old ones. A far better design. Thing developed in Hawaii, I believe. Fellow named Unmacht. One of the best. An evil machine, the flame-thrower. Sickening to use it, or see it used, but damned effective. And, come to think of it, not much more sickening than killing by burning ships with armor-piercing projectiles. As to gas at sea—I don't know. It might be, but it seems far-fetched. I will say this: we have no defense,—no defense at all. Probably mostly because we don't think it will be used. Calculated risk, they call it. I hope our estimate of the situation is correct!" He turned and went below. After a time Lee followed.

BOOK REVIEWS

CHEMICAL THERMODYNAMICS. Frederick D. Rossini. John Wiley & Sons, Inc., New York, N. Y. 1950. 514 pages. $6.00.

This book is the result of several years devoted to research and lectures in the field of chemical thermodynamics. A good knowledge of physical chemistry and some understanding of calculus is required for an intelligent use of this text, in which emphasis is placed "on the practical application of the laws and principles of thermodynamics to actual physical and chemical systems." The author has organized his presentation in a logical order of topics rather than in historical sequences of the development of these topics; thus, from the standpoint of instruction, one topic leads to the next in an orderly fashion. There are 35 chapters in the book, the first five being devoted to background material such as definition of terms, temperature, fundamental constants and conversion factors, and the calorie and the joule. The next 25 chapters cover the whole subject of chemical thermodynamics in a very complete manner, and the last five chapters are concerned with applications, typical calculations, and data sources. There are 167 problems to test the reader's grasp of the subject.

ADVANCED ORGANIC CHEMISTRY. Reynold C. Fuson. John Wiley & Sons, Inc., New York, N. Y. 1950. 669 pages. $8.00.

Professor Fuson of the University of Illinois, who is well known to many members of our Association, has had more than 25 years' experience in teaching students of organic chemistry. This advanced treatise is the outgrowth of lectures, research, and broad study in the field of modern organic chemistry, and a most ingenious method of presentation is employed. Instead of following the conventional organization of the subject matter usually found in elementary texts, Professor Fuson has chosen to concentrate on essential theories and facts rather than to impart an extensive knowledge of the various fields of organic chemistry. Thus he has used type reactions with numerous examples of synthetic value, with emphasis on those reactions which appear of greatest interest in the current literature. While the book is intended for advanced university students, it is also a very useful reference work. The subject index is excellent.

ORGANIC REACTIONS. VOLUME VI. Edited by Roger Adams. John Wiley & Sons, New York, N. Y. 1951. 517 pages. $8.00.

The sixth volume of this series, which has been described as the most important and valuable contribution in English to the literature of preparative organic chemistry, contains the following chapters: The Stobbe Condensation, The Preparation of 3,4-Dihydroisoquinolines and Related Compounds by the Bischeler-Napieralski Reaction, the Pictet-Spengler Synthesis of Tetrahydroisoquinolines and Related Compounds, The Synthesis of Isoquinolines by the Pomeranz-Fritsch Reaction, The Oppenauer Oxidation, The Synthesis of Phosphonic and Phosphinic Acids, The Halogen-Metal Interconversion with Organolithium Compounds, The Preparation of Thiazoles, The Preparation of Thiophenes and Tetrahydrothiophenes, and Reductions by Lithium Hydride. Reliable information covering the above important organic reactions is given in these chapters; each reaction being critically reviewed by a specialist. Laboratory procedures are given in practical detail and any anticipated difficulties are discussed. The bibliography contains more than 1500 references.

AN INTRODUCTION TO THE CHEMISTRY OF THE SILICONES. Eugene G. Rochow. John Wiley & Sons, Inc., New York, N. Y. Second Edition. 1951. 213 pages. $5.00.

The rapidly expanding industrial applications of the silicones, and the new knowledge of these compounds that has come to light in recent years, have necessitated a complete revision of the First Edition, which was published in 1946. New chapters on the carbon-silicon bond, synthesis or organosilicon compounds, and the physical chemistry of silicones have been added, and data on the properties of all known organosilicon compounds ("as far as one man has been able to collect them") are included. The book discusses the non-mineral compounds of silicon with respect to their chemical behavior and potential usefulness. Silicone lubricants, rubbers, resins, bouncing putty (for golf-ball centers and automatic leveling devices for table legs), invisible water-repellent films, and protective coatings are described, and the production of the silicones is discussed in considerable detail. Professor Rochow is known as the man who made silicone history and has been active in this field since 1938, being the author of numerous papers and 40 patents pertaining to the silicones. Both chemists and engineers will find this new edition of Rochow's treaties to be a comprehensive and authoritative reference.

RADIOACTIVITY APPLIED TO CHEMISTRY. Edited by Arthur C. Wahl and Norman A. Bonner. John Wiley & Sons, Ins., New York, N. Y. 1951. 604 pages. $7.50.

Twelve scientists, who are specialists in this field, have contributed to this very comprehensive treatise. Part I of the book is divided into ten chapters covering the following subjects: Isotope Exchange Reactions, Radioactivity Applied to Chemical Kinetics, Radioactivity Applied to Structural Chemistry, Radioactivity Applied to Self-Diffusion Studies, Radioactivity Applied to Analytical Chemistry, Behavior of Carrier-Free Tracers, Radioactivity Applied to the Discovery and Investigation of the Newer Elements, Chemical Phenomena Accompanying Nuclear Reactions (Hot-Atom Chemistry), Emanation Methods, and Radioactivity Applied to Surface Determinations. Part II contains nearly 200 pages of tables containing data published from the time radioactivity was discovered through 1949. These tables were compiled from more than 1500 published papers and books, and will serve as a most useful source of factual data for everyone interested in radiochemistry.

ION EXCHANGE RESINS. Robert Kunin and Robert J. Myers. John Wiley & Sons, Inc., New York, N. Y. 1950. 212 pages. $4.75.

Ion exchange has many applications in agriculture, biology, medicine, and chemistry. Although the phenomenon has been known since the middle of the last century, only in the last few years has there been much interest in its applications except in the fields of soil technology and water purification. The authors, who are both employed by Rohm & Haas, which has been one of the outstanding pioneers in the development of ion exchange resins, have written a very interesting book which covers the theory underlying the phenomenon, the usefulness of the resins, engineering data, and methods employed in industry and in research. This is the first book to correlate the voluminous literature on the subject, and to provide the chemist and engineer with a ready reference to the practical applications of these unusual resins.

ORGANIC CHEMISTRY. Frank C. Whitmore. D. Van Nostrand Company, Inc., New York, N. Y. Second Edition 1951. 1005 pages. $12.00.

The first edition of the late Frank Whitmore's monumental one-volume reference-text for organic chemists was published in 1937 and went through ten reprintings; a fine tribute to the usefulness of this book. At the time of his death in June 1947, Dr. Whitmore had finished the revision of the aliphatic section of the book. His friends and former students decided to finish the revision, which was accomplished under the supervision of a committee made up of twelve members from the academic world and six members from industry. The revision reflects many changes in organization of the subject matter of the first edition, such as the transfer of the sections dealing with metal alkyls, phosphorous compounds, and organo-metallic to the end of the book. Complete revision of the material pertaining to aliphatic and heterocyclic compounds was necessary because of the rapid advances which have been made in these areas since the first edition was published. Another significant change is the rearrangement of the subject index to conform more nearly to the style employed by *Chemical Abstracts*. In order to give you some idea as to the scope of the subject matter covered, approximately fifty thousand index slips were employed in preparing the subject index. This is the most complete reference work on organic chemistry under one cover which has come to your reviewer's attention.

BOOKS RECEIVED FOR REVIEW

Selective Toxicity, with Special Reference to Chemotherapy, Adrien Albert. Methuen & Co. Ltd., London, England, and John Wiley & Sons, Inc., New York, N. Y. 1951. 228 pages. $1.75.

The Military Instructor. Edward E. Pickard. The Military Service Publishing Company, Harrisburg, Penna. 1951. 369 pages.

Command Voice. Richard W. Sharretts. The Military Service Publishing Company, Harrisburg, Penna. 1951. 110 pages.

Legend into History. The Custer Mystery. An Analytical Study of the Battle of Little Big Horn. Charles Kuhlman. The Stackpole Company, Harrisburg, Pa. 1951. 250 pages and folding map and chart. $5.00.

Principles of Weed Control. Gilbert H. Ahlgren, Glenn C. Klingman, and Dale E. Wolf. John Wiley & Sons. Inc., New York, N. Y. 1951. 368 pages. $5.50.

Statistical Methods for Chemists. W. J. Youden. John Wiley & Sons, Inc., New York, N. Y. 1951. 126 pages. $3.00.

Organic Syntheses, Volume 31. R. S. Schreiber, Editor-in-Chief. John Wiley & Sons, Inc., New York, N. Y. 1951. 122 pages. $2.75.

The Theory of Isotope Separation as Applied to the Large-Scale Production of U235. Karl Cohen (Edited by George M. Murphy). McGraw-Hill Book Co., New York, N. Y. 1951. 165 pages. $2.00.

RECENT LITERATURE OF NATIONAL DEFENSE INTEREST

Abstracted in *Technical Data Digest* (1951). published by Central Air Documents Office (Army-Navy-Air Force), Dayton 2, Ohio.

MOULDING IN NYLON; PLASTICS (London) June '51 (Mthly); pp 155-156; 5 illus.

While nylon is now a household word throughout the five continents as a synthetic filament for the production of fabric, bristles, fishing line, and rope, it is almost completely unknown to the public as a molding material. Yet to the molders who have studied its characteristics and have produced molded units from it, and, one should add, to the users of such units, it opens up still newer fields to our industry than any of the older plastics in their turn and time ever did. In nylon we possess a thermoplastic with exceptional toughness, strength and hardness, resistant to abrasion and torsion, and excellent stability at high temperatures—the normal nylon molding powder will withstand distortion up to 200°C. Furthermore, it is light in weight, resistant to dilute acids, and highly resistant to both weak and strong alkalis. It is quite non-inflammable, possesses good electrical properties, has an exceptionally low coefficient of friction and high elongation without change in tensile strength at high temperatures. The works of Punfield and Barstow (Mouldings), Ltd., are described, and the various nylon molding methods are discussed.

BREEDING GROUND FOR NAVY'S FIREPOWER; STEEL 11 June '51 (128-24 Wkly); pp 79-81; illus.

The "mission" of the Naval Gun Factory along the Anacostia river in Washington, D. C., is to design, develop, manufacture, assemble, inspect, and test ordnance equipment, including guns and mounts of all calibers and types, aviation ordnance, torpedo tubes, rocket launchers, projectiles, fire control equipment, optical devices, cartridge cases, spare parts, tools and accessories, and other naval materiel as directed by the Dept. of the Navy's Bureau of Ordnance. It also serves as a source of prototypes of new weapons; overhauls, maintains, and stores ordnance materiel; operates the naval ordnance gage laboratory, and administers the final acceptance gage program. Beyond that, the NGF provides technical consultation service on ordnance to private industry and maintains laboratory facilities for examination, development, test and standardization of materials and techniques for ordnance purposes. Actually it represents a continuing "hard core" of technical research and skill in the building of the Navy's firepower, facilitating the rapid expansion of manufacturing effort when the heat is on.

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