

ARMOR



ARMOR
RECEIVES AN
AWARD

[See page 4]

NOVEMBER-DECEMBER, 1952

85 CENTS





The United States Armor Association

Continuation of
The United States
Cavalry Association
(Established 1885)

Honorary President

MAJ. GEN. GUY V. HENRY, Ret.

President

LT. GEN. WILLIS D. CRITTENBERGER

Honorary Vice-Presidents

GENERAL JACOB L. DEVERS, Ret.

LT. GEN. ALVEN C. GILLEM, Ret.

LT. GEN. GEOFFREY KEYES

LT. GEN. EDWARD H. BROOKS

MAJ. GEN. ERNEST N. HARMON, Ret.

Vice-Presidents

MAJ. GEN. HOBART R. GAY

MAJ. GEN. ALBERT S. JOHNSON, NG

COL. HERBERT H. FROST, USAR

Secretary-Treasurer

MAJ. WILLIAM GARDNER BELL

and

MAJ. GEN. BRUCE C. CLARKE

MAJ. GEN. JOHN H. COLLIER

MAJ. GEN. I. D. WHITE

BRIG. GEN. WILLIAM J. BRADLEY

BRIG. GEN. PAUL D. HARKINS

BRIG. GEN. JOHN C. MACDONALD

BRIG. GEN. PAUL M. ROBINETT, Ret.

BRIG. GEN. HARRY SEMMES, USAR

COL. CREIGHTON W. ABRAMS

COL. HENRY T. CHERRY

COL. JAMES O. CURTIS

COL. WELBORN G. DOLVIN

COL. BRIARD P. JOHNSON

COL. HENRY CABOT LODGE, JR., USAR

COL. JAMES H. POLK

ARMOR

The Magazine of Mobile Warfare

Continuation of THE CAVALRY JOURNAL

EDITOR

Major William Gardner Bell

CIRCULATION MANAGER

M Sgt Lester B. Smith

SHIPPING DEPARTMENT

M Sgt George W. Yankovich

ASSOCIATE EDITOR

Major William H. Zierdt, Jr.

BUSINESS SECRETARY

M Sgt J. William Joseph

BOOK DEPARTMENT

Sfc Michael E. Kekker

Volume LXI NOVEMBER-DECEMBER, 1952 No. 6

CONTENTS

LETTERS TO THE EDITOR	2
RECONNOITERING	4
MOBILE ANTITANK WEAPONS IN ARMORED WARFARE	6
By Colonel Welborn G. Dolvin	
A SOLDIER'S READING	10
By Beatrice Ayer Patton	
TANKS IN POSITIONAL WARFARE	12
By Lieutenant Colonel Charles W. Walson	
EDITORIALS	16
TANK IDENTIFICATION FOR TRAINING	18
By Lieutenant Colonel Victor B. Fox	
SUM AND SUBSTANCE	20
By Lt. Col. Leon Albin, Capt. S. F. Broyles, Capt. W. R. Thompson, Capt. E. A. Hinton, Capt. L. S. Haynes, Capt. E. S. Waddell, and Capt. J. L. Stilwell	
LIDDELL HART: ONE VIEW	25
By Colonel Robert J. Icks	
THE STORY OF SOVIET ARMOR: ASSAULT GUNS	28
By Garrett Underhill	
THE ARTILLERYMAN IS THE THING	39
By Major Eugene V. Brigham	
THE ARMY'S ATOMIC GUN: A PICTORIAL FEATURE	40
THE NEW ARMORED DIVISION ORGANIZATION	42
By Major General Bruce C. Clarke and Brigadier General L. L. Doan	
ARMOR ASSOCIATION NOTES	45
HUMAN ENGINEERING—A TOOL FOR ARMOR	46
By Captain John T. Burke	
THE REPLACEMENT SYSTEM	50
By Major General Charles L. Scott	
SOME EARLY THOUGHTS ON ARMOR	54
By Heinz Guderian et al	
SOME THOUGHTS ON DISCIPLINE	58
By Major James J. Mullen	
NEWS NOTES	60
FOR GARRY OWEN AND GLORY	63
By First Lieutenant James L. Morrison, Jr.	
WHAT WOULD YOU DO?	66
FROM THESE PAGES	69
OBSOLESCENCE OR RENAISSANCE?	70
By Major Lamar McFadden Prosser	
THE BOOK SECTION	73
DIVIDED WE FOUGHT	73
A review by Dr. George Tanham	
INDEX TO VOLUME LXI, 1952	78

ARMOR magazine is published under the auspices of the United States Armor Association, and is not an official publication. Contributions appearing herein do not necessarily reflect official thought or indorsement. Articles appearing in this publication represent the personal views of the author and are published to stimulate interest in, provoke thought on, and provide an open forum for decorous discussion of military affairs.

Publication and Editorial offices: 1727 K Street, N.W., Washington 6, D. C. Copyright, 1952, by The United States Armor Association. Entered as second class matter at Washington, D. C., additional entry at Richmond, Virginia, under the Act of March 3, 1879, for mailing at special rate of postage in Section 34.40, Act of October 30, 1951. Terms: Domestic subscriptions, including APO's, \$4.75 per year. Foreign, including Canada & Pan America, \$5.50 per year. All subscriptions payable in advance. Single copies, 85c.

The Great Frontier

by

Walter Prescott Webb

The Great Frontier presents a new theory of the history of the Western World since 1492 when Columbus opened the frontier lands to a static European society. For Mr. Webb the "Frontier" comprises all the exploited, habitable areas revealed by the explorations of the fifteenth, sixteenth, and seventeenth centuries. Owing to these discoveries, the modern era began; the accepted patterns of life were outgrown, and the Boom Era of four hundred years began. The problems which have staggered the world since 1912 are explained as the agonies of readjustment inherent in the ending of such an era.

\$5.00

LETTERS to the EDITOR

The Seelow Operation

Dear Sir:

This letter will be a bit late, but it takes ARMOR a long time to reach Berlin, and still longer before it comes into my office; but after reading the article "The Seelow Operation" (ARMOR, March-April 1952), I must write this letter to congratulate the author for the perfect reconstruction of the operation.

I was a member of the Volksartillery Corps 408 at that time, and was through the Seelow battle from the beginning to its bitter end. However, as there seem to have been some difficulties in explaining the complete failure of the German artillery, I shall try to clear up a few points.

After the first Russian attack on March 22nd, the 10.5 and 15cm guns had been withdrawn behind the ditch as shown in Sketch No. 2, and had moved into positions on the open field where they could easily be spotted; consequently, they were put out of action in the second attack on April 14-15 without having a chance of doing much harm themselves. The heavy artillery consisting of 21cm Mörsers and long range guns, which had been so effective in helping to destroy the first tank attack (the 16th Battery of 21cm guns alone knocked out 5 Russian tanks), and which had had their positions near Seelow, were withdrawn to a rather ineffective position west of Seelow from where they were unable to give a fire curtain along the ditch, their range being limited to 18 kilometers at the utmost. Besides this they were not allowed to change their positions freely for want of petrol. Although cars held 20 liters and trucks 40 liters in "iron reserve," special permission had to be obtained from the Corps Commander for every can of gasoline. The supply of ammunition was very poor; shots could be fired on orders of the Corps Commander only, who also could not act independently, since the Volksartillery Corps were not under sectional Army Com-

mand. So batteries were often reported "ready to fire," and at the same time did not fire as the daily ration of shells had been used up. For the same reasons, I also very much doubt that tanks were allowed to act as freely as the author of the article presumed.

The second most vital point of the failure of the artillery was the complete lack of experienced personnel. The Volksartillery Corps had been built up in the fall and winter of 1944, and were supplied with new guns and first class material, but the gunners had come from different reserve depots, and had in most cases never seen a 21cm gun before. They were trained and instructed over a period of about 10 to 21 days after which they had acquired a superficial knowledge only and completely lacked team spirit. As for officers, it remains to be said that the OC I/C of a battery mostly was a lieutenant 2nd class with little field experience. The observation officers also were Lieutenants 2nd Class or staff sergeants, and although fairly well trained to direct the fire, they entirely lacked field experience, the officers coming from war school being about 19 to 20 years of age, and the sergeants being either overage or physically unfit men who had spent most of the war in orderly rooms, Q stores or such positions. (When, for instance, no answer was received from the observation post of the 18th long range battery for 12 hours, it was found that the lieutenant and his men had been killed in a surprise raid of a small Russian group. No guard had been sent out and the men were caught completely unprepared, their arms lying in the adjoining room.)

Such was the position, and although I am convinced that the outcome of the battle had still been the same if the artillery had been more effective, I hope that these facts help to explain the inefficiency of the artillery in the Seelow Operation.

Berlin, Germany

HEINZ RAUSCH

ARMOR is published bimonthly by the United States Armor Association.

Copyright: ARMOR is copyrighted 1952 by the United States Armor Association.

Reprint Rights: Authorized so long as proper credit is given and letter of notification is forwarded to Editorial Office. Two copies of the reprinting would be appreciated.

Advertising: ARMOR is the professional magazine of the United States Armor Association; a nonprofit, noncommercial educational publication. We DO NOT accept paid advertising. Such advertising as does appear in ARMOR is carefully selected by the Editor and concerns only those items which may be considered an adjunct to a professional career.

Manuscripts: All content of ARMOR is contributed without pay by those interested in furthering the professional qualification of members of the Armed Services. All manuscripts should be addressed to the Editorial Office, 1727 K Street, N.W., Washington 6, D. C.

Change of Address: All changes of address should be sent to the Editorial Office in time to arrive at least two weeks in advance of publication date of each issue, which is the 25th day of the odd month of the year: i.e., Jan. 25 for the Jan-Feb issue, Mar. 25 for the Mar-Apr issue, etc.

Rates: See bottom of contents page.

New Weapon!

Dear Sir:

Lt. Col. Leon F. Lavoie knows whereof he speaks (ARMOR, Sept.-Oct.). All Marines in Korea recall with appreciation the artillery support rendered by the "Gung-ho" soldiers of the 92nd Red Devils.

But, there still is a little matter that rears its ugly head when the SP-towed controversy develops; i.e. a valuable and much needed gun is put out of action because a fuel line becomes clogged or an oil pump quits working.

One of the best yarns that circulated in Korea during the reign of "Daddy Devil" Lavoie was of an incident involving a soldier of the 92nd. I wish Colonel Lavoie had added this bit of humor to his excellent and informative article "Armored Artillery is the Thing."

On the morning of 24 April 1951 and prior to the furious action that the Colonel describes it is told that a soldier of the 92nd had occupied one of the "four-holers" which was located on the edge of the battalion perimeter. While so disposed he observed several Chinese soldiers moving toward him in the tall grass. Being unarmed and temporarily immobilized, his situation was most delicate. Thinking quickly, he grabbed the nearby roll of toilet tissue and gave it a heave. The CCF, thinking it was a grenade, hit the deck and awaited the detonation. Our hero lost no time, however, in streaking back into the perimeter, shouting the alarm and alerting the local security. It is not recorded just when he managed to get his pants back up.

CAPT. J. M. McLAURIN, USMC
I-1, 2d 105mm How Btry
Jackson, Miss.

An Oversight

Dear Sir:

I enjoyed your article on pages 4-5 of your splendid September-October issue, the "Reconnoitering" column devoted to the trade journals of war, and the comment on the Walter Millis column.

We are sorry the Military Police Association was not mentioned. Organized in April 1951, we now have 18,000-plus members. Our publication, *The Military Police Journal*, circulates throughout the world to members of all services. We publish for all who are interested in police and crime prevention work in the Armed Services.

LT. COL. RALPH E. PEARSON
Editor
Military Police Journal
Augusta, Ga.

• ARMOR hastens to correct an omission which was based on a strict interpretation of publication format. Publications listed were those of formal magazine type. MPJ is a newspaper style publication, but still qualifies as an Army branch journal from an Association.—ED.

The Trade Journals

Dear Sir:

I was very interested in "Reconnoitering" in the last issue of ARMOR. The "trade journals of war" are of very great importance to military librarians, too, as we strive to locate essential information for students and instructors.

Unlike the journals of other special groups, there was no index covering military journals, so Air University Library undertook the task of making one in October of 1949. Each member of the reference staff indexes certain magazines, and these are incorporated into the *Air University Periodical Index*, which is an alphabetical index by subject to about forty military journals (including ARMOR). It is published quarterly, cumulated every three years, and is on distribution to all libraries interested in receiving it.

We hope that the *Index* is making needed information more quickly available.

I am inclosing a recent issue for your information.

FLORINE OLTMAN
Reference Assistant
Air University Library
Maxwell AFB, Ala.

The Course of Empire

by Bernard DeVoto

Bernard DeVoto has written the story of the men who explored and, bit by bit, conquered this continent. He shows their impact on the wilderness, but more than that, the impact of the wilderness on them and consequent gradual emergence of a new people in a new world. In doing so, he has been able to relate the almost inevitable procession of human events on this continent to the pattern of land forms and water-courses that have been both the background and the shaping force of our history, and to show that the existence of a continental empire is implicit in the map of North America.

\$6.00



When in 1951 ARMOR ran a story on its winning of an award in the Magazine Show of 1951 sponsored by the American Institute of Graphic Arts, there was little thought that the very issue running the details would itself become a winner in the Magazine Show of 1952. Thus ARMOR's cover for a second time spotlights an award. Although not so intended, with a little stretch of the imagination it is possible to conceive that the spreading of the news has been delegated to that top soldier, our grand American tanker.

ARMOR has won another award!

Commendable excellence on three counts is the story as ARMOR receives a Certificate of Excellence in the Magazine Show of 1952, sponsored by the American Institute of Graphic Arts.

The Institute inaugurated its annual Magazine Show in 1950. ARMOR has been entered and has won an award in each of the two years of publication under its new name and new style. The January-February issue of 1951 drew the honors in the 1951 Show. (See ARMOR, November-December, 1951, page 4.) This year the award goes to the November-December, 1951 issue.

In this Third Annual Magazine Show, issues of magazines produced in the United States or Canada between July 1, 1951 and June 30, 1952 were

eligible. For purposes of this exhibition, a magazine is considered to be a periodical publication, other than a newspaper, issued at regular intervals at least four times during the calendar year, and with at least 50 per cent of its net circulation paid for either by individual subscription or newsstand sales.

There were 563 entries in this year's show. Basis for the judging centered on six categories of excellence: (1) Layout and Design (2) Illustration and Photography (3) Typography and Lettering (4) Editorial Visual Presentation (5) Cover Design and (6) Printing Craftsmanship.

In his Charge to the Jury, Irving B. Simon, Chairman of the Show, specified that "While editorial content *per se* is outside the scope of your

MAGAZINE SHOW 1952

Certificate of Excellence

Awarded by The American Institute of Graphic Arts to
THE UNITED STATES ARMOR ASSOCIATION

for contributing to the publication of an outstanding magazine

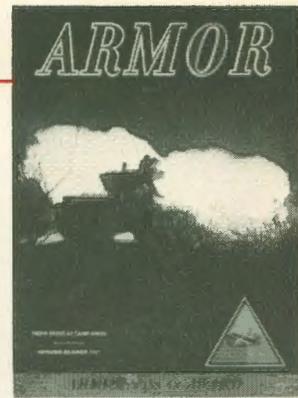
ARMOR — NOVEMBER-DECEMBER 1951

THE PRESIDENT OF THE AMERICAN INSTITUTE OF GRAPHIC ARTS

Stella Domin Payne

CHAIRMAN OF THE COMMITTEE FOR THE MAGAZINE SHOW 1952

Irving B. Simon



At right is the cover of the Jan-Feb issue of 1951, which tags an award while winning one. At left is the spread, pp. 12 and 13, that joins the cover to comprise ARMOR's 1952 Magazine Show award display.

judging, you are enjoined to consider the success with which a magazine has met the problems posed by its editorial approach in the physical execution of the finished product. You are asked to consider the separate features and departments of a magazine, but the distinction of award should reflect the commendable excellence and unity of the publication as a whole."

Once again a distinguished panel of judges comprised the Jury whose responsibility it was to select those magazines reflecting "the highest standards of contemporary magazine design and production." The members included Dr. M. F. Agha, Consulting Art Director; Jess Gorkin, Editor of *Parade*; Richard Ellis, Typographic Director of Curtis Publishing Company; Daniel D. Mich, Editor of *McCall's Magazine*; James Boudreau, Dean of the Art School of Pratt Institute; and F. E. Church, Production Operations Manager of Time, Inc.

In the judging, ARMOR's November-December, 1951 issue produced commendable excellence in three of the six categories considered—Cover Design, Illustration and Photography, and Printing Craftsmanship. The Jury selected the front cover and pages 12 and 13 as exhibit material. It was noted that "while exhibits are limited to a page or two, or a cover, the appraisal and notations of excellence were made on the magazines in their entirety."

The formal showing of the selected entries came with the opening of the Magazine Show 1952 at the new quarters of the American Institute

of Graphic Arts at 13 East 67th Street in New York City, on October 15th. On exhibit were 149 magazines selected from among the 563 entries. One hundred and nine different publications were represented in this selection, with thirty of these appearing more than once in the exhibit. A check of the catalog of the Show indicates that 112 of the selections were printed by letterpress, five by offset and 32 by rotogravure.

Needless to say, we are very much pleased with this reaffirmation of the quality of the graphic presentation of ARMOR. It is an inspiration to note the pair of editorial categories commended for excellence. And once again our thanks are due our printers, Garrett & Massie, Inc., of Richmond, Virginia, for their fine mechanical reproduction of our editorial efforts, which secures the third category of excellence.

The attractive catalog of the Magazine Show 1952 notes some interesting points. For example, Walter Dorwin Teague, President of the Institute, in his message calls attention to the fact that "the balance of aesthetic value has shifted decisively from the advertising to the editorial pages of these publications." Again, the Jury remarked on "a general improvement in layout and design, picture presentation, use of photography and more intelligent use of white space."

The significance of this award will be evident in the treatment accorded it on the front cover and in this column. It serves as the stimulation behind what we feel is one of the most effective covers to appear on ARMOR. And we're happy that the word is being spread by our great American tanker. For after all, this is his magazine.

The Editor



M10 Tank Destroyer.



All Photos U. S. Army

Mobile Antitank Weapons . . .

by COLONEL WELBORN G. DOLVIN

MOBILITY has been a prime consideration in the development of our ground force weapons. Ever since the introduction of the internal combustion engine we have experimented with the vehicular mounting of weapons ranging from the machine gun to the atomic artillery piece.

Recoilless weapons have been no exception. There has been much speculation in the postwar period concerning their use. In the attempt to make them mobile we have seen them mounted on jeeps, tank re-

trievers, weasels and Bren gun carriers. Several years ago an article in another service journal applied them to a light tracked armored infantry carrier labelled the JARP.

By virtue of its size and weight the recoilless rifle is readily adaptable to mounting on a lightly armored highly mobile tracked vehicle such as the Bren gun carrier. Such vehicles could be produced relatively cheaply. Recoilless projectiles are effective against enemy armor. Would a vehicle of this type be the answer to the masses of tanks available to our potential enemies? Are we coming around to a tank destroyer complex once again?

Proponents of this type of vehicle have made certain claims based upon theoretical performance. Assuming that a practical light armored vehicle

mounting a recoilless rifle could be produced, what would be its employment? How would it fit into our present tactical concepts?

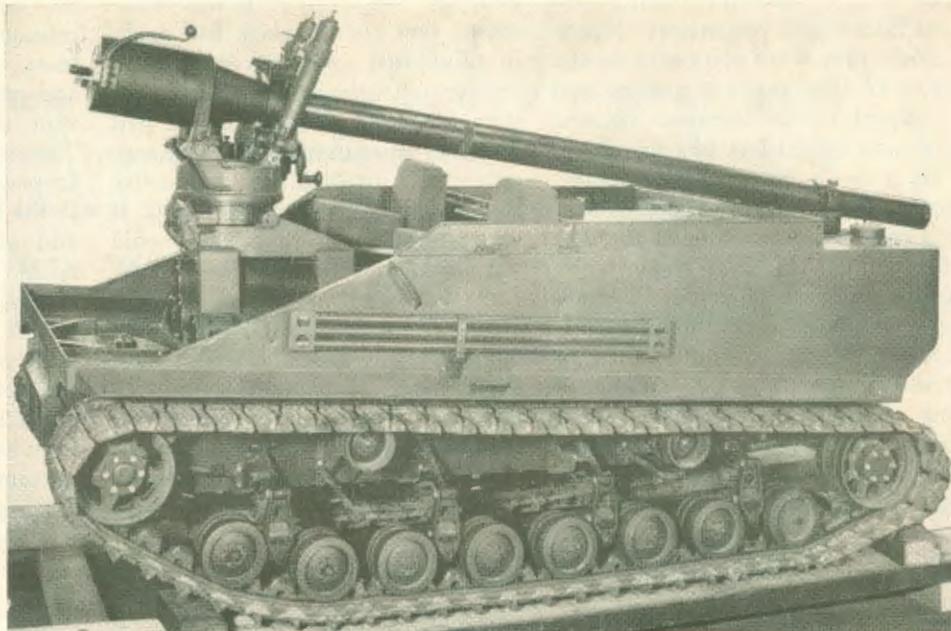
There are those who believe that this kind of vehicle is not only the answer to antitank defense, but also that it could perform the missions presently assigned to tanks. They ask what a tank could do that such a vehicle as this could not do. This group visualizes masses of these vehicles being employed on the offense as well as the defense, using hit-and-run tactics. There are others who see them plugging a gap in our present antitank defenses. They feel that these weapons could provide valuable protection for front-line elements in defensive situations. In other words, they would take over one of the missions currently per-

COLONEL WELBORN G. DOLVIN, *Armor*, served with the 756th and 191st Tank Battalions in North Africa and Italy during World War II, and commanded the 89th Tank Battalion in the early months of bitter fighting in Korea. He is now assigned to the Combat Arms Section of Research and Development Division, Office of the Assistant Chief of Staff, G4.

The tremendous effectiveness of tanks has produced a great amount of study on the subject of how best to combat them. Their tremendous cost has inspired an



M3 Tank Destroyer.



105mm Recoilless Gun on Bren Gun Carrier.

. . . *In Armored Warfare*

formed by tanks. We should, therefore, carefully examine this subject to ascertain whether developments along this line would warrant a change in basic tactical concepts, and, if not, where would mounted recoilless weapons fit into our present concepts.

It may be well to go to the early days of World War II to refresh our memories on development of equipment and tactics, similar to that mentioned above. We all remember the early phenomenal success achieved by German armor. Poland and France were quickly overrun. Everyone was seeking an answer to the problem of antitank defense. In general there were two schools of thought on this subject. One group felt that a tank was the best antitank weapon. Another group felt that a system of antitank guns should be given the mission of defeating enemy armor, leaving the tank free to accomplish its primary mission of elimi-

nating the machine gun and enemy personnel. As we well know, the group which advocated the system of antitank guns carried their point with the result that first antitank and later tank destroyer units were organized.

It is interesting to note that the change in name from antitank to tank destroyer was made by General McNair who constantly insisted that antitank units be used more aggressively. He felt that the new name savored more of the offensive. The Tank Destroyer School, at Fort Hood, Texas, under command of Major General A. D. Bruce, insisted on aggressiveness. The motto of the Tank Destroyers was "Seek, Strike and Destroy." Tank Destroyer units trained according to this doctrine saw action in the early days of the North African fighting.

Reports from early actions were unfavorable. General McNair made the following remarks regarding ag-

gressiveness of tank destroyers in this early action:

Since the tank must advance, the tank destroyer need only to maneuver for a favorable position, conceal itself thoroughly and ambush the tank. It is correct to think of the tank destroyer as acting offensively, in that it does not sit passively, on the chance that a tank may come its way, but on the contrary seeks out the tank and places itself where it can attack the tank effectively. However, the destroyer would be foolish indeed to act offensively in the same manner as the tank, for such tactics would place the destroyer at a disadvantage, and would sacrifice unnecessarily the advantages which the destroyer has by the very nature of things. . . . The trouble in North Africa was that the tank destroyers, instead of firing from concealed positions, maneuvered too freely during combat. Instead

equal amount of effort to find an effective and less expensive substitute for them. We must not let an antitank-cost complex undermine our sound doctrine.

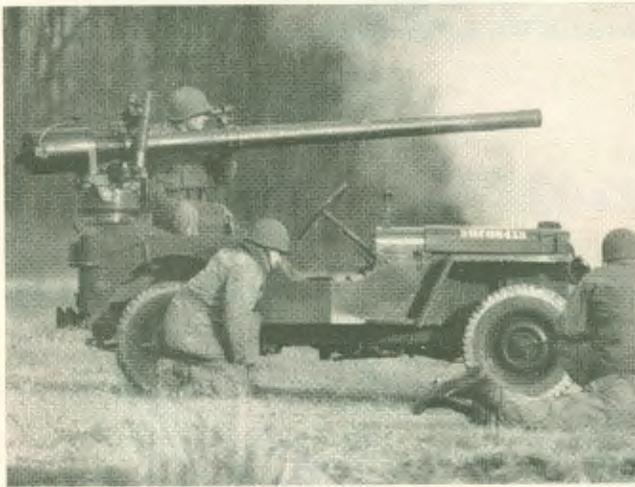
of being aggressive in their reconnaissance and preparatory dispositions, they were aggressive in the face of the tanks themselves, and suffered severe casualties because of their virtual lack of armor.*

As a result of this early employment, Allied Forces Headquarters, in a memorandum, restated the doctrine of tank destroyer employment, putting emphasis on rapid reconnaissance, thorough concealment in prepared positions, and avoidance of premature fire. This new concept of tank destroyer tactics with minor changes was followed during defensive phases for the remainder of the war. In offensive operations it was

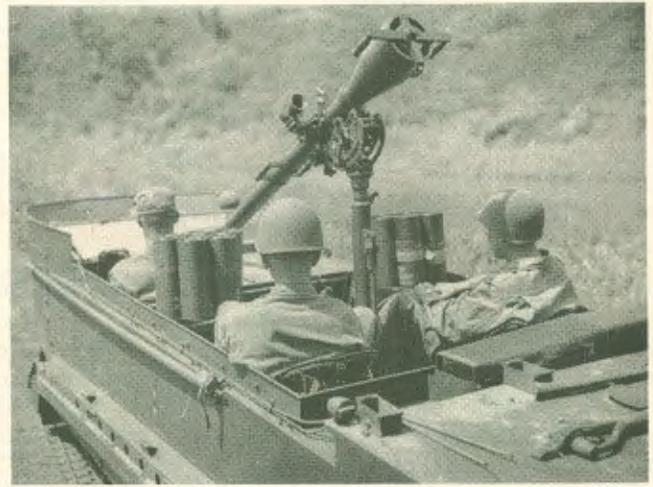
weapons. In addition, it was determined that the Russians had tanks in substantial quantities which had demonstrated their ability during the war. Since any decision on our part to match Russian armor on a quantitative basis involved high productive capacity and very high unit costs, it was natural that all concerned should start looking for a cheap way to defeat the large masses of Russian armor. It is also natural that developments along this line would have a great deal of popular appeal. In fact, they have so much appeal that the hard-learned lessons of World War II may be forgotten, especially by those who have not had extensive

the enemy. In accomplishing this mission, as part of the infantry-tank team, tanks eliminate those weapons and personnel which attempt to prevent the infantry from advancing. They use their great armor-protected firepower, mobility and shock effect to the maximum. During the attack and after the objective has been taken, tanks use their cannon to eliminate enemy armor which attempts to prevent the accomplishment of the mission of the team. In the defense, tanks provide antitank protection, reinforce the fires of the front-line battalions and participate in counterattacks.

Divisional and Corps tank units



105mm recoilless gun mounted on a jeep. Limitations are a shorter range than tanks, no armor, and wheels, not tracks.



75mm recoilless gun mounted on a Weasel. Limitations here are the open top and special purpose nature of the vehicle.

common practice for the tank destroyers, utilizing their bigger guns, to overwatch the tanks' advance.

Following World War II it was decided that the proper solution to the tank-tank destroyer problem was to place a gun on the tank capable of defeating enemy armor and have the tank perform the mission formerly assigned to tank destroyers. In other words, it was decided that, considering both offensive and defensive combat, the tank was in fact the best antitank gun.

During the period following World War II economic conditions resulted in more than doubling the cost of armored equipment as well as other

combat experience.

Comparison of the probable characteristics of a light vehicle mounting a recoilless gun with the tank destroyers of World War II fails to reveal any new capabilities which would permit them to seek, strike and destroy enemy armor. Such vehicles maneuvering in the open would be easily destroyed, just as tank destroyers were during the early days of World War II. Thus the proper employment for this type of weapon still is to engage enemy armor from well-prepared concealed positions.

If such new vehicles were to replace tanks they must be capable of performing the missions assigned to tanks. In offensive operations this mission is to close with and destroy

give depth to the antitank defenses and provide a strong armored element for counterattacks launched at that level. In delaying actions tanks utilize their firepower to inflict the maximum damage on the enemy and to force him to deploy prematurely. This must be done at relatively long ranges in order to withdraw to another position without becoming heavily engaged.

In order to perform these various functions the tank must possess not only effective antitank capabilities at relatively long ranges but also great personnel-killing power. It must have enough protection to permit it to live on the battlefield and to allow it to close to within effective range of the enemy without being de-

*From U. S. Army in World War II, the Army Ground Forces.

The military writer is an accepted figure in a world familiar with global warfare. His books, columns and articles are read well beyond the military area, just as his writings overlap into such related fields as geography, foreign affairs, history, politics and science. Here is a story on one who is perhaps as widely read and quoted as any on today's international scene.

Liddell Hart: One View

by COLONEL ROBERT J. ICKS

FEW military writers of our own time or any other are better known or as often quoted as Basil Liddell Hart—and none is or has been so controversial a figure. The military thought of our time throughout the world has been influenced by him. Whether that influence has been good or bad depends upon the viewpoint of each individual or nation but that it exists cannot be denied. Perhaps it is time for a re-evaluation of the man and his doctrines.

Liddell Hart occupies an undisputed position as a leading military historian. As a writer and journalist his copy always is current and readable, but whether he is a military theorist of note or a false prophet is where opinions on him diverge, often violently.

Regardless of one's views concerning him, and those views vary from blind devotion to violent disagreement, it is his very articulateness which causes one to take a stand con-



U.S. Army
B. H. Liddell Hart on the occasion of a recent address at the Armored Center, a stop on his lecture tour.

cerning him. He has the gift of making even complex military problems simple to understand and at the same time presents them in relationship to the larger aspects of their impact on national and international situations.

But are his theories and opinions valid or merely plausible?

What sort of individual is Liddell Hart? First, the man. He was born in Paris on October 31, 1895, and was educated in England at St. Paul's School and then at Corpus Christi College, Cambridge. He served in the King's Own Yorkshire Light Infantry, going to France in 1915. He was severely wounded in 1916 and this led to his beginning to write on military matters. These writings attracted attention and some of his proposals were officially adopted. The ideas concerning armor which General Fuller propounded after World War I fused with his own and he began to propound theories of a "New Model Army."

Invalided out of the Service in 1924, he began writing in earnest about tactics and warfare, and then was appointed military correspondent of the *Daily Telegraph*, a position he held for some ten years. Following that, he held a similar position with *The Times*.

Such a background would have been commonplace except that his writings were bold, frank, prolific and thought-provoking in their impact not only in England but elsewhere in the world. Sweden, Denmark and Switzerland consulted him on internal

COLONEL ROBERT J. ICKS, Ordnance, Reserve, is a recognized authority in the field of armor. Author of the book *Tanks and Armored Vehicles* (1944), he has carried on a correspondence with B. H. Liddell Hart over the course of many years and is well acquainted with the man and his works.

military problems and his own country did likewise. Such responsibilities were bound to result in controversies regarding him. In England he had to suffer the consequences of political involvements on several occasions and internationally came in for criticism for his influence in the international Disarmament Conference, and in other ways thereafter. The French were incensed over his criticism of their military theories as well as by his influence, real or imagined, on British commitments for a BEF in the event of war.

War Ministry Advisor

He was essentially a patriot and he feared French military capacity. He felt that a conventional BEF would only be ensnared on the Continent. The British government itself fluctuated in its views toward armament during this critical period. Eventually Liddell Hart became associated with an advisor to Hore-Belisha when the latter became War Minister in 1937. He unquestionably contributed greatly to the program of modernization which Hore-Belisha introduced. But both faced fierce opposition by the Imperial General Staff and later by the Cabinet.

Then the two began to have differences of opinion and the relationship was dissolved. Controversy with the Director of *The Times* over a complete reversal of policy by *The Times* caused him to leave because he felt there was a need to apply the spur of public criticism to governmental policies. For a time in 1939 he was associated with Churchill but resigned because he felt Churchill's bellicosity and attitudes were premature in the existing state of Britain's defenses. Controversy over the value of his contribution, illness from overwork and hurt through the adverse criticism he sustained, as well as the fact that he could not tell the truth in wartime, caused him to isolate himself for a time. Curiously enough, the British public continued to believe that he remained an advisor to the War Office even after the war began. It is odd too that his views on defense from 1938 on and for which he was so severely criticized then and still is, after all were the fundamental views of the British people, traditionally reliant on their navy rather than on their army and air force.

His theories of dynamic defense in 1939 represented a belief that it was necessary to buy time but the offensive view won out officially to the point where England, when in doubt, appeared ready to attack in all directions diplomatically with little military might to back up such a decision.

In 1941 he began writing for the *Daily Mail* and covered the war critically and analytically. Since World War II he has written a great deal on military subjects. His writing today perhaps lacks the great fire he once displayed. He has become more of a military philosopher but nevertheless he still is a potent figure on the international scene.

It was in the field of tactics that Liddell Hart became best known and which originally drew attention to him. He publicized mechanization constantly and consistently from the twenties on, and arguments raged over him because his tactical theories were considered radical and impractical. Soldiers frequently talk about the lessons of war but Liddell Hart continually harped on the point that they seldom used the scientific approach in studying and applying those lessons.

A New Model Army

His staff paper on the "New Model Army" written in 1922 and later published in the *Army Quarterly* in 1924 outlined his belief in tanks associated with infantry transported in armored carriers; in self-propelled artillery; in the close cooperation of aircraft with such an army; in the use of paratroops. Later, his proposals regarding guerrilla warfare and psychological warfare were added. He clung to these theories and gained a following both in and out of England, adopting as he did an intermediate position between the extreme views of Fuller and those of the conservative military faction. Criticism occurred again when the Germans almost won World War II by following his precepts. Later the Russians, and to a much lesser and later extent the Allies, defeated Germany by following them. These principles of his had been there for years for anyone to study or embrace and although the Germans gave him credit for their near victory, the Allies never have admitted his influence on their final victory.

Perhaps on this score one of his

earlier remarks could well be quoted—"Originality is the most vital of all military virtues as two thousand years of war attest. In peace it is at a discount, for it causes the disturbance of comfortable ways without producing dividends, as in civil life. But in war, originality bears a higher premium than it can ever do in a civil profession. For its application can overthrow a nation and change the course of history in the proverbial "twinkling of an eye."

Penetrating Comment

Another early and penetrating comment of his which was acid and devastating and which hit at false sentiment in war and its conduct was that concerning the use of poison gas. "The unconscious object of the sentimentalists who are striving to maintain the prohibition on gas is to preserve for the battlefields of the future, the beneficent effects of high explosive, which shatters the limbs, tears flesh into pulp and gives the stricken but one chance in three of recovery—a weapon which, unlike gas, cannot be used in a non-lethal form, and destroys not only life but property. Devastated areas are not the least of the evils of war and the development of air bombardment promises to increase the destruction of factories, dwellings and communications. High explosive, in fact, destroys the economic foundations of the subsequent return to peace."

How prophetic were both statements!

His influence was recognized in the realm of tactics and war generally by the thirties, and then he began to move into the field of national and international strategies at a time when theories of geo-politics developed and extremes of nationalism showed signs of a resurgence. The war clouds were rising and he was among the first to recognize that war was coming. His writings began to have a new quality, a groping toward truth in a larger and more nationally significant field.

Liddell Hart has always had a global concept of war and always has held strongly against striking along the path an enemy expects one to take. There were reasons why he held so tenaciously to the views he propounded in the late thirties when he was so closely associated with the

British government. He has consistently criticized the very human tendency of complacently clinging to comfortable prejudices rather than facing unpleasant truths. As he once said, "In my comments on contemporary affairs, I criticize conditions, not persons" but sometimes when "conditions" obviously resulted from the influence of specific "persons," his criticisms of them just as obviously involved those specific individuals and did not endear him to them.

The military generally, not only in England but elsewhere, could hardly be happy over his comment that "There are over two thousand years of experience to tell us that the only thing harder than getting a new idea into the military mind is to get an old one out"; his remark that "The philosophic historian may deduce that truth emerges as ambition recedes"; or the comment which hit diplomat and soldier alike—"When a man has climbed by hard effort to a ridge from which he gets a fresh vista—if only of further ridges beyond—he will usually find, when he tries to tell of it, that those who have remained contentedly in the valley insist that there is nothing beyond what they can see"; or "Unless we are honest about our past and alertly critical about our present, the odds are heavily against any improvement in our future—at our next test."

Strategy and Grand Strategy

His human outcries against human failings so often angered people that they were blinded by their emotion to much of the incisive understanding he has of principles and long term effects. For example, "Too commonly in peace it is a case of tactics all the time, in bland forgetfulness that strategy takes precedence over tactics and that strategy is based on supply." And in the same vein but expanded was his "While the horizon of strategy is bounded by war, grand strategy looks beyond the war to the subsequent peace. It should not only combine the various instruments but so regulate their use as to avoid damage to the future state of peacefulness, secure and prosperous. Unlike strategy, the realm of grand strategy is for the most part still awaiting exploration and understanding." And going still further—"The enemy of today is the customer of tomorrow and often

the ally of the future. To inflict widespread and excessive destruction is to damage one's own future prosperity and, by sowing the seeds of revenge, to jeopardize one's future security."

Prophetic? Yes, but based on cold reason, as was his prediction that Soviet Russia would become the ascendant power after another European war. His later statement that "An aggressor who has overstretched himself in the spread of his conquests is particularly liable to suffer a spreading handicap as a result of his very success," is a prediction that at least brings some hope to a troubled world today.

Postwar Criticism

He has been criticized for his postwar attitude toward the Germans. He is accused of being lenient and too forgiving but all of us have seen forced upon us a change in our national attitudes from that of disdainful victor to wooing swain, while Western Germany's position has changed from crushing humiliation to one of coy and clever bargainer on the international scene.

Still, for all the brilliant tactical theories he has conceived and all the thought-provoking comments he has made on strategy and on grand strategy, and for all his scientific analyses of famous military personages and campaigns, he has been wordy, and his great truths sometimes have been buried under an avalanche of language, interesting to read, perhaps, but more entertaining than scholarly. In many ways this has been unfortunate because it gave his opponents material with which to discredit him. Yet, as a journalist, such voluminous but sometimes pointless writing was to be expected.

He has another fault in his habit of lifting parts of old essays or repeating them in their entirety. Some of his writings thus are a combination of "dated" beliefs and of fresh viewpoints. Another criticism which justifiably could be made is his "what might have been" comments. Hind-sight is better than foresight and no one likes to be reminded of mistakes. To many it is galling to be so reminded. Lessons from the past, yes. Destructive criticisms, no. And lastly, for all his scientific approach to military and national problems, he himself is not always free of emo-

tional thinking which at times colors his almost unique and creative reasoning ability.

Yet he appears to possess a phenomenal memory, coupled with an ability to isolate and to sort out problems, state them clearly and suggest solutions, together with a scientist's passionate devotion to the determination of facts and their interpretation.

Why this strange paradox? I do not know but I suspect that the abattoir which was the Western Front in World War I has made him a true pacifist. He strikes out against mass slaughter conducted as though it were war and masquerading as military art. His is the mind of the thinking soldier who abhors slaughter because he has experienced it but who pleads that if war is to continue as an instrument of national policy it be conducted thoughtfully as an instrument and not degenerate into slaughter for its own sake.

His conclusions sometimes may be inconsistent; he sometimes may contradict himself; he may be a false prophet; but at least he is thinking seriously about problems to which so many others give lip service but are dishonest about for political expediency or for some other reason. He hopes to avoid war but if it comes he wants to fight it with a minimum of losses and to anticipate the achievement not only of victory but of a planned peace to follow.

Issues and Honesty

He deals with dreadful and vital issues and thinks deeply and honestly about them. Try as any man will, he cannot completely divorce his emotions from facts as he sees them. But so far as it is humanly possible, I believe Liddell Hart tries with honesty. His criticism may be severe but it is always intelligent and to the point. If he has written too much and some of his original thinking is buried in a mass of extraneous words, that is only human and, in his case, a concession perhaps to economic necessity.

His ideas may not always be palatable but he hopes to make others think, to spark other minds to think, negatively or positively, but to think.

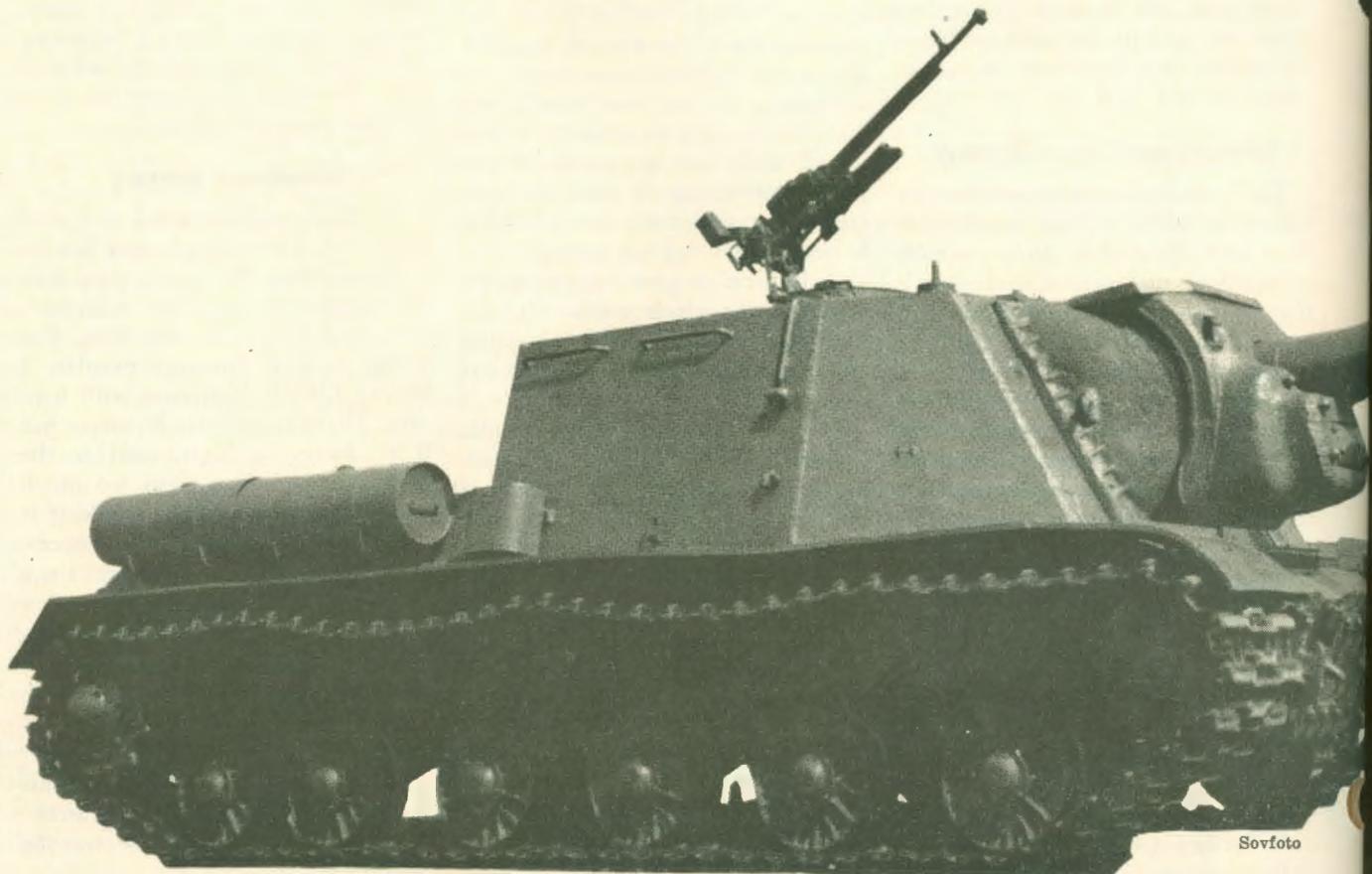
One is either for him or against him. One cannot remain neutral—and that appears to be the way he would have it.

Western guesstimates of Soviet armor masses have been made in terms of turreted tanks. An expert tells us here that our figures must be revised—upwards—by at least a third. The reason—the Soviets' big and powerful assault guns, the SU's

THE STORY OF SOVIET ARMOR

"SU's": Assault Guns and Self-Propelled Artillery

by **GARRETT UNDERHILL**



Sovfoto

IF the free world's tankers and infantrymen should ever have to face current-type Soviet armor, most likely it wouldn't be the now famous T-34 and Stalin tanks which would give them the most trouble. It would be the powerful "SU's": the big Soviet assault guns which so many Americans so often—and so mistakenly—call "self-propelled artillery."

By the U.S. Army's military dictionary definition—and by past and present definitions of Army Ordnance, these SU's class as *tanks*. They are track-laying combat vehicles, with good cross-country performance. Their crew space is completely armored in. In fact, they are very much like the little-known U.S. 100-ton tank of 1944, built (too late) to break the Siegfried Line. This U.S. tank, instead of mounting its long 105mm gun in a turret, carried it low down in the sloping frontal plate of the hull armor. In this respect, both the U.S. monster tank and the Soviet SU's resemble the line of assault guns begun by the Germans in 1939. Soviet SU development actually has been strongly influenced by German assault guns, both as to design and general concepts.

Like the Germans' assault guns, the Soviets' SU's grew to loom large



Jean Raeburn

GARRETT UNDERHILL served as Chief Editor of the Military Intelligence Division of the Army during World War II. A Reserve officer, he was recalled to duty after the outbreak of the Korean conflict, and has just completed an active tour. A recognized expert on the Soviet Armed Forces, his military writings have appeared in many national publications.

These facts are not to be passed over lightly. They tell the West that people who counted only turreted tanks in their reckoning of Soviet armor masses, must radically revise their reckoning. *They must increase by at least a third the number of pieces of Soviet shock armor the West has to worry about.*

The numerical strength of the SU's would alone demand far more attention for them than they have re-

ceived in the West to date. When their armament and tactical roles are considered, the SU's become of even more vital interest to the free world's military.

Americans have worried about the heavy Stalin tanks, with their 122mm guns. They have gone to some trouble to develop a 120mm "heavy gun tank," which (it is said) "can outslug" any other tank in the world—including the Stalin. But American fears (and remedies for those fears) fail to take into account the fact that Western armor must meet heavy-gun SU's, as well as heavy-gun Stalins.

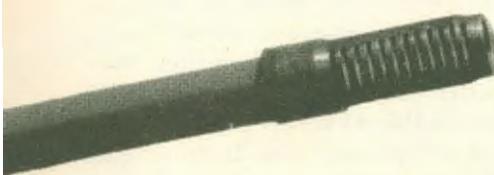
If the U.S. Army definition of tanks is followed, the Soviets have long had in the SU armor category two "heavy-gun tanks," one of which deserves far more Western attention than the Stalin. For it is the faster SU-100 (with a more efficient armor-fighting 100mm gun than the Stalin's 122mm) which since World War II has come to be the prime Soviet Army antitank weapon.

The other heavy-gun SU isn't a good antitank weapon, but it can certainly slug. To deal with infantry field fortifications and fortified towns and villages, this JSU-152 fires high explosive shells weighing over 95 lbs. It thereby brings medium artillery support down to the tank company level. Despite its slow rate of fire, this JSU-152 is supposed to engage armor with armor-piercing shell and shot weighing even more than its HE—and to get in its opening rounds at phenomenal ranges.

These facts have an unpleasant significance for the West, too: they warn that *the Soviets have not one, but three standard "heavy gun" tanks in wide use.*

Soviet tactical employment of SU's makes obvious just why this armor should be of such vital interest to Western tankers and infantry. The main job of the SU's is to provide *over-watching fire* for the fast-moving mediums (and on occasion heavies) which lead off both types of Soviet assaults: *armor-shock* (in which armor is dominant, and infantry largely for protection of armor), and *tank-supported infantry* assaults.

Indeed, the important role of SU's in the latter type of attack is likely to be somewhat obscured by the term "tank-supported." For the wave of Soviet medium tanks leading off such



in importance in World War II fighting. Since the war, the trend towards emphasis on SU's has continued. As a result, SU's are now a permanent part of the "armored regiment" setups of postwar-type Soviet divisions. *This means that there is roughly one powerful heavy-gun SU to every two or three turreted medium or heavy tanks.**

*Only in the Mechanized Division's so-called Mechanized Regiments (actually motorized infantry, each with a tank unit approximating U. S. company size) are there significant armor units without their own SU's.

The Story of Soviet Armor has appeared as a staggered series in this magazine. The section entitled "Early Years" was published in the issue of Jan-Feb 1949. The second section, titled "The Middle Ages" (the 1930's) ran in the May-Jun 1949 number. A complementing article, "Backlight on Soviet Armor: Russian War Industry Through the Ages," appeared in Nov-Dec 1949. In the issue of Mar-Apr 1950 began the section titled "The War Years," with the coverage of The Tank appearing in that issue and the following number of May-Jun 1950. In carrying along "The War Years," there appears now the section devoted to SP's. Coming serials will round out the series with something on tactics, people, armored cars and trains. —ED.

an assault has usually relied mainly upon speed and shock—upon mobility for surprise, for protection, and for shock action. (“Shock” is often literal: they like to overrun, ram, and crush as well as shoot.) These medium T-34’s move as fast as the terrain permits, firing on the roll; not from halts.

Thus this initial medium tank wave employs *assault* (marching) fire, while the SU’s—following by bounds from one hull-down firing position to another—supply the *aimed* fire. The SU’s advance within the infantry formations following the tanks, gaining their protection both from the GIVans and use of cover, as well as from their armor.

So if the Western infantryman is confronted by a Soviet tank—probably it’ll be charging at him like a mad bull, firing all its armament—85mm gun and cal. .30 machine guns (coaxial and bow). If he keeps in shelter to avoid the spray of tank fire, and to keep from being overrun—the tank will roll on through. The Russian rifleman (running to keep up with the tank wave) will be right upon him.

If he opens fire with a recoilless weapon, the speed of the tank (the Soviets hope) will make it a difficult target for low-velocity bazookas and recoilless guns. And whenever the over-watching SP crews see recoilless weapon flashes—and these weapons’ muzzle-and-backblasts—they will deal out 100 and 152mm high explosive shells at high velocity.

Such fire is likely to be delivered at ranges embarrassingly great for low-velocity recoilless weapons. The present SU’s are the product of a long Soviet-German contest to get a range advantage in both the *armor vs armor*, and *armor vs antitank weapons contests*. Hence it is not surprising that even in World War II the SU’s were trained to use direct-laid fire up to 3,000 meters (3,300 yards). A prime reason for the introduction of the SU’s large-caliber guns was to obtain an HE burst easily spotted (and hence more easily adjusted) at maximum direct-fire ranges. The Soviets also wanted to get an HE round big enough to make things really rough for weapons crews in the vicinity of a shellburst, either from concussion or fragments.

For the Soviet armor was always confronted by increasingly formidable German antitank defenses. These included plenty of the “cheap” variety of antitank weapons: *Panzerfauste* (shaped-charges able to hole 8 inches of armor, and fired to 100 yards or better by throw-away launchers—issued to troops as needed, like grenades); 3.46-in. bazookas (R.Pz.B. 43’s, of 1943, similar to the U.S. 3.5-in. introduced in 1950); and shaped-charge shells for all kinds of artillery. But the German defenses normally were based upon formidable flat-trajectory guns, like the hyper-velocity 88mm *Pak 43* (firing tungsten-carbide-core shot at a muzzle velocity of 3,705 ft. per sec. up to 2,620 yds. in direct fire; and AP shell at 3,280 f.p.s. to 4,370 yds.—as compared to the U.S. 105mm shaped-charge recoilless gun of 1950, which has been publicized as a fairly low velocity weapon designed to knock out any tank at 1,500 yds. This 88 fired shaped charges, too—to 2,730 yds., at 1,968 f.p.s.).

If the SU’s are likely to make it hot and heavy for hostile infantrymen trying to fight off Soviet armor, these same SU’s are intended to make it really rough for hostile armor. The Western tank seeking to engage attacking Soviet mediums, probably will find the latter (as in World War II practice) withdrawing to a flank, or back through the SU’s. The SU’s will take over the *armor vs armor* battle, although the mediums will try to intervene on the hostile flanks and rear. Naturally, SU’s which were built to gun-down 88’s of the *Pak 43* variety are tough nuts—for they were also built to gun-down German tanks and assault gun/tank destroyers mounting the same model of hyper-velocity hole-puncher: 88mm *Kw.K.* of the Royal Tigers add the similar *Stu. G.* of Hunting Tigers. (It is heartening to note that, while the Soviet tank-SU combination of medium and heavy gun tanks could usually “snow” antitank defenses, well-handled—even if materially inferior—German armor often proved to be the combination’s nemesis.)

When the use of SU’s in the attack is understood, it is easy to understand that—in mobile warfare—SU’s may prove even more important than in assaults on prepared positions, and in fighting hostile armor acting as



International

The Soviet 76mm self-propelled infantry howitzer was on a six-wheeled truck.

antitank. As Soviet forces work into and through hostile positions (the "combat in the depths of the enemy defenses"—always extremely critical to Soviet-type troops), and as they break out into the open, they find quick reactions to combat conditions increasingly essential to continuing success. They find shock action as valuable, on the same ascending scale. Hence it takes little imagination to understand how World War II experience caused the Soviets progressively to hand over the job of armor support to SU's—how, as the attack progressed, these SU's increasingly assumed the role of indirect-fire field artillery. Tanks didn't have to depend for support on called indirect-artillery fire; they had it—often without asking—from over-watching, direct-laid, flat-trajectory, heavy-caliber SU guns.

Indeed, it would appear that the striking development of SU's—which coincided with the development of Soviet offensive action in World War II—has been in no small part an effort by the Soviet armor arm (the Tank and Mechanized Troops) to find its own solution to the shortcomings of Soviet field artillery. For despite all the hoopla and propaganda, Soviet World War II field artillery was notoriously inflexible in its conduct of fire. Consequently, as attacks developed and situations arose which were not covered by pre-planned artillery fires, Soviet armor either had to provide its own support, or do without.

As a matter of fact, with Soviet Infantry it was the same: the Artillery, in order to furnish adequate support against targets of opportunity and to assure destruction even of previously identified targets during an attack, went in a big way for direct-laid towed guns. Numbers of the lighter of these weapons—usually the 57mm and 76mm guns—tried to keep up with the Infantry assault. But naturally towed or man-handled guns couldn't keep pace with armor, nor supply support of sufficiently large caliber. Hence SU's

The Soviets have made much of their past and present emphasis upon this use in the attack of direct-fire artillery support—both with towed pieces and with SU's. But though there may be certain things to be said for such a weapons system, the fact

Terminology Note

The West's failure to appreciate the *shock armor* importance of SU's appears to derive from poor handling of terminology—on the part of Soviets and Westerners alike.

The Soviets call their assault guns "samokhodniye ustanovki": literally, self-propelled mounts." Abbreviated as "SU" ("CY" in the Cyrillic alphabet the Soviets use), the term is pronounced like "Sue." Assault guns using the chassis of the Joseph Stalin tank are called "ISU" ("Eeee-Sue"). Individual vehicles are designated by using "SU" or "ISU" plus the gun caliber, as in "SU-100." The whole development receives as a generic term "SU," and sometimes "SAU"—the "A" being for artillery, giving this term roughly the pronunciation of the English for a female pig.

It would appear that many Westerners have gotten a confused idea of the role and vital importance of SU's, simply because they took over the Soviet terms and translated them literally. Hence the common use of SP's (self-propelled guns) for SU's.

Unfortunately, the mass of the U.S. military appear automatically to think of SP guns as self-propelled field artillery—like U.S. armored artillery today; or else as tank destroyers or flak. *They do not think of SP guns as assault guns more properly classed as tanks.*

This error of attitude—consequent upon faulty handling of terminology, and upon failure to examine the tactics and technique of the foreign weapon, and then apply a term meaningful to U.S. troops—only repeats World War Two's American failure properly to designate and appreciate the great force which was German assault artillery. It can only be said that, while the Germans did give their assault guns' tactical role in their designation (Sturmgeschütze), there is nothing in the Soviet "SU" to indicate that the Reds mean *formidable shock armor*, instead of armored field artillery designed primarily for indirect fires.

remains that it was (and-is) by and large an expedient to cover up for the deficiencies of artillery indirect fire techniques, and the apparent inability of Soviet field artillerymen to attain the proficiency of Westerners.

(Americans, both civilian and military, may search far and wide for a point of vantage over Soviet Russia's army masses—but actually, if they knew well the respective forces, they'd know where our most fantastic advantage lies and has long lain: in the factory producing military miracle-men cheap, at Fort Sill, Oklahoma.)

It is important to understand that the SU crews do not intend to match their skills against those of the slide-rule wizards from Sill. The SU's job is direct-laid fire through telescopic sights. They may infrequently undertake indirect-fire missions, but only observed fire—and that up to the limit of observation, which the Soviets have long figured to be about 5,000 meters (5,500 yards, as compared with the U.S. Artillery's limit of 5,000 yards). Past and current-model SU's have not been built with the on-carriage fire control to fire off maps. Moreover, the very limited traverse of all SU's is a great handicap in indirect fire. They are not like our Shermans with 105mm howitzers in their turrets—as used in U.S. Armor's assault gun platoons. Anyway, like the Germans, the Soviets do not approve of using assault guns for indirect fire—except in exceptional circumstances. Apparently the Russian likes to find his target, with his own eyes, get the gunner's scope on it—and pour in the fire, in the great Russian close-combat tradition.

Though the SU's are now a prime piece of Soviet armament, and are handled according to doctrine as rigid as the Koran's, the fact is that they—and their doctrine—are like Topsy; they just grew. They did not spring full-armed from the brain of Generalissimo Stalin, complete with sets of Field and Technical Manuals to give the Word to the awestruck black-covered multitude. As in the cases of so many military developments within and without Russia, the SU's were the product of unforeseen wartime needs; of interne-cine strife and service empire building; of making the most of extant industrial capacity, and of a host of other factors—none of which could be

said to include remarkable foresight.

When armor was developing in the 1930s, the Soviets apparently thought that tanks—turreted tanks—should themselves provide much of the artillery-type support for shock action and mobile operations. To this end, they fitted their first “wave” of armor with cannon especially powerful for the day. In so doing they were merely following the concept worked out by the Western Allies in World War I, in that the Red infantry-accompanying light tanks at first mounted either a 37mm (later 45mm) gun or machine guns; their mediums, a howitzer of light field artillery gun caliber (76mm). Thus the infantry-accompanying T-27s of the 1931-3 period were merely modernizations of the original British World War I “male” and “female” tanks, and of the French light Renaults (which the Reds copied in 1920 as the Russki Renos). They just put infantry battalion (machine gun, and 37 or 45mm AT guns), or regimental (76mm howitzer) weapons, in armor. Nevertheless, it was thought that this armor would be able to drive through the “entire depth” of enemy positions, and take out hostile field artillery as well as infantry weapons. The 45mm gun was also the main armament of mobile warfare armor—of the BT’s of around 12 tons, with Christie suspension like the T-34’s. The job of the BT’s was to sweep through or around the enemy’s position, take out his artillery, his rear area installations—and, as part of the Soviet “armored division” of the day (the “Moto-Mechanized Corps”), effect entrapments. Of course, the Soviets also thought that attack aircraft would be able to take over artillery roles in mobile warfare—a fallacy which the Germans were also guilty of at the time. And, for that matter, America after World War II.

Although in the late 1920’s Germany’s Guderian (then a major) and America’s Chaffee (then a lieutenant colonel) foresaw the need for not just tanks and armored infantry—but for *armored forces* (including *armored artillery*), evidence is lacking that Soviet armor authorities had equal foresight. The Russians were going great guns in arming, and spending immense sums and industrial effort. Yet the only known at-



Presse Hoffman

A KV-II tank being examined by Germans whose 37mm AT fire only scarred it.

tempt at self-propelled artillery—as opposed to tanks—was the development of an SP 76mm howitzer. This SP was merely the infantry regimental cannon—the 76mm M1927, firing projectiles similar to the 76mm light field artillery guns—on a 6-wheeled GAZ-AA truck. The piece was mounted on the rear of this Russian Ford Model A; it had a splinter-proof shield attached to its top carriage, so as to rotate with it, like a naval destroyer gun shield. Since the 76’s 13.6-lb. shell was fired to a maximum range of only 9,350 yards, it was hardly an adequate armored artillery weapon.

Some of the prewar Soviet equivalents of armored divisions—the “Moto-Mechanized Corps”—had a battalion of 12 of these 76’s in each of their two “Mechanized Brigades.” Their real field artillery—two batteries of 122mm hows and one of 76mm guns—was truck-drawn, not SP or armored. It was organized in the Motorized Rifle Brigade. There wasn’t a medium (152mm) how or medium (107mm) gun in the whole outfit.

In fairness to the Soviets, it must be said that other military men then seemed to think that armored formations could get away with such seemingly inadequate artillery support. The contemporary U.S. 7th Mechanized Cavalry Brigade, up till the formation of the Armored Force in 1940, stuck to towed 75mm cavalry howitzers. However, it started out in 1935 with 2 battalions of 105mm gun-hows for artillery support (24

hows in all), hit France in 1940 with 12 150mm medium gun-hows added to their organic armament. True: the German artillery then wasn’t armored either, being towed. But the Germans intended that it should be armored, when their rearmament could hit a level which would permit it.

The Soviets, who were always far ahead of the Germans in arming before and during World War II, still have to establish that they even had a glimmer of appreciation of the need for armored artillery. That they didn’t is indicated by the fact that they never said that they wanted to armor their mobile troops’ infantry, artillery, engineers, or other components. Before, during, and after World War II, the artillery of mobile formations was towed by trucks in which the crews rode; the infantry was sardined into trucks or rode the tanks. These elements of the mobile arm were very definitely *motorized*—a term which seems to have meant to the Soviets (as it did in many armies before the war) *mechanized*. The tanks were the *armor* part of the mobile arm, the “Armored-tank and Mechanized Troops.” Outside of some British Lend-Lease Bren Gun (Universal) Carriers, the Soviets used no armored troop and weapons carriers until they showed off with great pride “armored transporters” in the 1951 Moscow May Day Parade. These are merely open-topped plated boxes on six-by-six ZIS trucks, reminiscent of that old lemon of pre-Pearl

Harbor days—the U.S. M3 Scout Car.

That the Soviets relied heavily upon direct-laid tank fires for armor's fire support is borne out by the Soviets' introduction of especially powerful armament in the wave of armor introduced as World War II began. The T-34 (which the Soviets claim was actually mocked up in March, 1937 as the T-111, or T-46-5), was armed with what was then a long 76mm gun—a tank gun proper. The T-34 was, and is, the prime "mobile warfare medium," and also the main infantry-accompanying tank. It represented a big change, with its 30 tons and 1.8-inch armor. The previous main infantry-accompanying tank (T-26), and the Christie BT mobile war tank, each had only a 45mm gun, armor around .59 to .87 inches, weight from 10½ to 15 tons.

But most peculiar—if the Soviets intended to rely on tank fires for armor action—was the lack of appreciation of fire efficiency shown in the T-34 layout. As in the T-26 and BT's, the turrets held only two men. The tank commander doubled as gunner, and was aided by a loader. His ability to pick up targets and observe fire was greatly restricted. The Soviets introduced and kept this turret, although by the end of 1938 (when the T-34 was being finalized) the German Panzer III's and IV's were out, with their three-man turrets with commander's cupola. Only after war experience did the Soviets change. They ended up with the present cupolaed 3-man 85mm gun turret, which came into service in 1944.

In contrast was the contemporary KV. This "heavy" tank mounted the same gun as the T-34, but used a four-man crew, with three in the turret—like the present U.S. Patton T48. Just why this slow-moving "breakthrough" tank (for assault on fortified positions) should have a good gunnery layout—and the "armored force" mobile war tank a bad one, so far remains a mystery. It is not that the Red technical devices (periscopes, telescopes, episcopes and other vision gear) weren't deluxe for the day. The appreciation of practical gunnery problems was just plain poor. The degree of the Soviets' lack of appreciation of the Soviets' problems can be understood only when it is realized that the T-34s (like the T-26's and BT's before them) were supposed to attack at *maximum speed consistent with terrain—and meanwhile take targets under fire without halting!*

The theory that Soviet armor intended to rely mainly on direct fires for support, and to furnish such fires with their own tanks, is further bolstered by the evidence of the KV-II—a modification of the 76mm KV. This tank had the hull of the 76mm KV, but mounted an Empire State Building of a turret, fitted with a M1938/40 152mm short tank gun 20 calibers long. The 12-ton turret caused an excessively high silhouette of 13.7 feet, as against 8 ft. 9 in. for the 76mm gun KV. It brought the weight up from 48 to over 57 tons. The projectiles were those of the corps artillery 152mm hows and gun-hows, but the ammunition could be

loaded fixed. Two men (for a total of six) were added to the crew to handle them. The gun had low velocity compared to the M1937 corps gun of the same caliber, but the Soviets say that the KV-II proved quite successful against the Mannerheim Line's permanent fortifications, against which it fired anti-concrete shells. Since the KV's were produced at the big Kirov Plant in Leningrad and were coming out in the latter part of 1939, the II's were ready for use in the late February, 1940 steamroller that ended that famous "Winter War."

If the KV-II's were a success in positional warfare assaults, they were a notorious failure in the mobile campaigns fought against the Germans in the summer of 1941. Right away the II's showed up all over the place—at least as early as the third day of the German attack (29 June) at Soposkinie in Poland. One KV-II nearly had the 6th Panzer Division of Hoepfner's Group on the ropes. Soviet armor counterattacked this division as the Panzer division was getting a bridgehead on the Dvina River in Latvia. A KV-II broke through without any infantry escort, and got among the division artillery. Nothing bothered its rhinoceros-hide armor. Even an anti-aircraft 88 got potted, when its crew tried to get into position to knock the II off its stand on a key road. But since it just sat there and did nothing, the Germans soon got the best of this unsupported monster by guile—if not by fire power. A favorite method of neutralizing both the 76mm and 152mm KV's was to put an AT round through the gun tube: 37mm guns would hole that, though they'd hardly nick the armor.

What the KV-II's would have accomplished, if they had operated effectively as team with KV-I's or T-34's, must remain an unanswered question. They disappeared after the first summer of the German attack; they were never reported in action again.

Tank Destroyers

When the German panzers erupted over Europe in 1939-40, a tremendous clamor arose for means to halt them. If the panzers were the acme of mobile war, many argued, then mobile antitank was the answer to



The SU-85 is a T-34 tank chassis and an M1939 85mm anti-aircraft gun mounted.

them; only the antitank should be lighter and more mobile than the panzers, if it were to outmaneuver and gang up on the German tanks.

In America, this theory gave rise to the now-defunct tank destroyers, and the Tank Destroyer Command. Americans maintained that it was not the tank's job to fight other tanks—a concept abandoned after the war, when the Russian concept was adopted. The Russian concept has from the start been that a tank is the best tank fighting weapon (although now it appears modified in that an SU piece of armor heads the list of armor-fighters).

The 45mm gun armament of Russia's 1930's wave of tanks gave these tanks the same advantage of the German 20mm and 37mm armed Panzer II's and III's, as the same 45mm Rheinmetalls gave Russian infantry AT units over their 20mm and 37mm Rheinmetall-armed German opponents when it came to fighting armor. This advantage grew when the Germans continued to produce panzers with the same popguns, while the Russians in their 1939-40 wave of mediums and heavies went over to long 76mm guns. As for the advantage these new Russian tanks had over American models being introduced in 1939, it was positively phenomenal. The U.S. vehicles mounted nothing heavier than a U.S. version of the 37mm Rheinmetall. As late as the Louisiana Maneuvers in the fall of 1941—when the Russian forests and steppes were swarming with T-34's, the U.S. had in service just

two companies of the General Lee M3 medium, with 75mm in the right front of the hull (hardly well-positioned to fight armor). The characteristics of this Lee weren't even specified until 13 July 1940—after the German blitz of Flanders. At that they were dictated by the Infantry.

Since the Russians believed in tank-vs-tank combat, and had two excellently armed and armored tanks for the day (T-34 and KV), they don't appear to have been tempted to seek some cheap solution to the problem of battling German armored divisions on the prowl. Stalin knew that what he wanted was more tanks.

But he also depended upon towed guns—plenty of them, of which during the war he was ready to lose one per tank knocked out. These guns soon got to be organized in the greatest depth. There were corps and even army antitank pools, both to give depth to antitank defenses, and to thicken up organic antitank gun defense of divisions. The towed guns included "battalion" 45mm guns of 1932 and 1937 models; the 57mm of 1941 (comparatively heavy), and later of 1943 model—at which time it was mounted on the same tubular-trail carriage as the 76mm M1942 light field gun. This latter piece, like all Soviet field artillery light guns, was intended to double as heavy antitank. Until the M1942 went into super-mass production, the 76's available were the M1939 (with same tube as the M1942), the even more powerful M1936, as well as original Czarist 76's of 1902 and souped-up

ones of 1920/30 model.

These 76's (particularly the M1942, as it flooded the World War II Red Army) were organized in *tank destroyer regiments*. This confusing title was applied, although these units were only fully motorized. The regiments appeared within the Red mobile divisions—tank and mechanized "corps," and cavalry divisions; also in independent "tank destroyer" brigades, which often were part of artillery divisions. Such emphasis on towed antitank (and the use of the term "tank destroyer" for such towed units) has persisted to this day.

Organization of large independent pools of towed antitank, and dependence upon large well-fortified antitank "zones" to channel panzer attacks, was well established as the German 1941 offensives drew to a close. Such zones, the Russians found, could help them to dictate directions of German attack—thereby creating opportunities for Soviet armored counterattacks on flanks and rear.

A favorite use of the heavy KV—being slower than medium tanks both Russian and German, was in tank ambushes. Once hostile armor had been lured in, the KV's would attack from one or both flanks, with faster mediums helping to effect complete encirclement of hostile armor—if possible. Having at this time comparative invulnerability as well as heavy fire power, the KV's could afford to step in and slug it out with German armor.

Evacuation of many of European Russia's tank-producing facilities (Kharkov, Stalingrad, Leningrad), and the great tank losses to German armor in the first summer of the Russo-German War, brought about a shortage of both medium and heavy tanks—in the Russian view.

Hence the Russians did turn to "tank chasers" as temporary ersatz for well-armored and gunned armor. They had available as a tracked motor carriage the little Konsomolets armored tractor. This 4.4-ton vehicle had light armor, mostly on an armored box up front. This box housed the driver and machine-gunner (who had a standard 7.62mm DT gun in ball mount). On the rear over the gasoline 4-cylinder motor, it had two back-to-back benches, each seating a total of 3 men—with no weather



The SU-76, a lightly armored open top job, appeared in 1943, has been in Korea.



U. S. Army

The SU's are very much like this U.S. 100-ton T28 heavy tank built in 1944.

protection other than a canvas hood.

The idea was roughly that of the successful French Renault chenillette: the Konsomolets would tow heavy infantry weapons (45mm guns and 76mm infantry cannon) with their limbers, ride their crews. When the pieces went into action, the tractor would run back and forth on resupply missions—secured by its armor from small arms fire and artillery fragments. It could make 26 m.p.h., compared with 32 for a T-34.

Sometimes the Soviets made a fully armored tank destroyer out of the Konsomolets by mounting the standard 45mm tank gun turret (of the 1930's wave of tanks) on the rear. TD's of this type certainly must have been unsatisfactory, for that turret was intended for tanks of at least 10 tons. Such TD improvisations were captured by the Germans and Finns when they overran Viipuri, in retaking the Karelian Isthmus the Finns had lost in 1940. Another Konsomolets TD version mounted the M1941 57mm gun, just behind the crew compartment. This type was noted for resisting the German drive to Stalingrad and the Caucasus in mid-1942. Having only the normal gunshield, the gun crew had very unsatisfactory protection even compared with contemporaneous German SP antitank improvisations.

The Soviets made use of other similar improvisations, pieced together from odds and ends of matériel captured when they took over Poland and the Baltic states in 1939-40. None were regarded as at all sat-

isfactory. They tried out a KV-II with an 85mm gun replacing the 152; this may never have seen action, for the Germans never reported it.

The Lend-Lease matériel ordered at this time from the U.S. wasn't considered satisfactory either. The Russians took 650 of the SP 57mm gun T-48—a 57 on an armored half-track. They took 52 of another early U.S. "TD," the M10, using an M4 Sherman chassis and an adapted 3-in. AA gun. By the time the 76mm M18 came along, the Reds were no longer interested in U.S. "TD's"; took only 5 for tests. These U.S. TD's were not, like the heavy Russian SU's, completely armored in.

However, the Russians did go in for a very widely-used SU which was both lightly armored, and open at the top. This was the SU-76. It mounted the gun upon which the Russians placed the greatest production emphasis—the M1942 76mm light field artillery piece. The chassis was that of the T-70 light tank. The T-70 belonged to the light tank class, which was supposed to be built insofar as possible from commercial automotive components. Hence the SU-76 used the T-70's two coupled water-cooled straight eights for motive power. These were nothing but Russian pre-World War II versions of the Hudson 110-HP passenger car engines. Like the T-70, the SU-76 violated late Soviet armored vehicle design practice, in that it had the drive sprockets and transmission up front. It also used gasoline instead of Diesel power. As with simi-

lar German motor gun carriages, in the SU-76 version of the T-70 tank chassis the driver, engine, and fuel tanks were all moved up front, so the gun crew could stand on the bottom of the rear of the hull. This arrangement kept the silhouette down to a little more than that of the T-70 tank. The overall length was greater, an extra bogie being added to the suspension.

The armor was of simple thin welded plates—no castings. Frontal armor ran to 1.38-inches, with only .39 to .63 inches on the sides. While the driver's compartment and engine had an armored top, the fighting compartment for the gun crew was open on the top, and in the rear from waist height on up—again like similar German SP antitank guns. In an early version of the SU-76, the rear had two folding plates of armor, which provided both access and protection as high up as the sides and front. On this version, the radiator was located over the track on the right side center—instead of to the right rear, as on later models.

The SU-70 from the start mounted a practically unchanged artillery 76, with the characteristic German-type double-baffle muzzle brake of the M1942 model. The gun was served by a crew of two, the gunner being to the left (in normal field artillery position). There he had field-artillery type on-carriage fire control: Schneider 1917-type range quadrant and mount graduated for various projectile types as well as in meters, and a panoramic for the panoramic telescope, the head of which protruded above the compartment armor. The only noteworthy change over the towed artillery 76 was that the gunner had both elevating and traverse wheels to hand. In the SU-76 the "chief of section" doubled as SU commander; he stood at the right, where he had a standard tank-type episcopes to observe targets and fire, and could work the radio—the buggy whip aerial of which was mounted on the outside right. He also had a vision port in the frontal armor; the gunner another episcopes. The gun itself wasn't rebuilt for armor use; its vulnerable hydro-pneumatic recoil mechanism was protected by a large welded armor casing.

From many aspects, the SU-76 was a poor makeshift as a tank de-

stroyer. The fire control gear, the armor layout and thickness, and the speed (which ran under that of a T-34, and of the Panzer III and Panther—and was about that of a Panzer IV), all were against the SU-76. But it seems to have been a matter of capitalizing on available production facilities, especially after the T-70 tank proved a failure and was dropped completely from production in the fall of 1944.

The SU-76 actually appeared in 1943, at the same time that the Germans were coming out with similar re-designs of their by-then-obsolete light tank chassis (to be used as anti-tank and infantry cannon motor gun carriages). During 1942, the Soviets did not do as did the Germans, and produce or adapt great numbers of light tanks as tank destroyers simply by slapping shielded guns atop the un-redesigned tank chassis. This apparently was for very good reasons: the Soviets had lost immense numbers of their old tanks, and they didn't want to waste precious production facilities on such poor adaptations—which would have had too high a silhouette in addition to being relatively slow and highly vulnerable to many types of weapons.

By the time the SU-76 was out in numbers, the Soviets had gained the strategic initiative; they were on the offensive. The call was more for an infantry support weapon than for tank destroyers. Moreover, since the

German 88mm Tiger and super-long 75mm'd Panther were also out (as well as a Panzer IV with a powerful 75) by the time the SU-76 was, the SU-76 lacked any advantage in firepower over the then common German tanks. In order properly to engage contemporary German armor, the 76's had to use super-velocity "arrowhead" shot—what is variously known as armor-piercing subcaliber, or HVAP. With 76's, this meant holding fire for relatively short ranges and sure kills—say, 550 to 440 yards. Hence it was natural that the SU-76 was often relegated to infantry-support roles—which work it has done in Korea as well as in the postwar Soviet forces, however ill-fitted it may be for the job.

Even on the Soviet side, the SU-76 was outclassed as a tank destroyer before birth by the SU-85—the M1939 85mm antiaircraft gun, mounted low in the front plate of a turretless T-34 tank chassis, like most other SU's. Appearing during the summer of 1943, the SU-85 frankly took after the line of German assault guns. The previous summer these German assault guns had developed to combine both infantry direct support and tank destroyer functions, thanks to the substitution of a high velocity 75 for the older short 75 of 1940. With the SU-85 and the slightly later German *Jagdpanther*, German and Soviet design coincided remarkably: both vehicles had a

smooth sloping front plate and sloping side, and a lower silhouette as well as a larger gun than the turreted tank version of their basic chassis.

The Soviets have stated that for anti-tank and assault-gun infantry support work, they preferred and prefer the SU's lower silhouette and larger gun. The silhouette affords greater security through concealment—enabling surprise action. It also offers less target in armor-vs-armor fights, and less of a target to lay on at maximum ranges. The gun affords greater hitting power at those maximum ranges, as well as more devastating HE effect against infantry weapons.

In this the Soviets go down the line with the view of the older German arms—the Infantry and Artillery, although not with armor leaders like Guderian. Like the Americans, these tanker Germans have preferred turreted tanks to assault guns, since the latter's limited traverse and lack of mobility to secure all around fire renders them unfit for use within enemy positions on their own. The assault guns absolutely require infantry or tank cooperation.

It will be seen how the Soviets in general have followed these principles in their design and armament of SU's and turreted tanks.

Unlike the SU-76, the SU-85 was a proper piece of armor. The crew of four was lodged together up front, in a completely armored-in box. The armor was roughly that of the T-34 hull—a little less than two inches. The re-designed 85mm M1939 flak gun hadn't any recoil mechanism protruding forward of its ball mount (which gave it only a few degrees traverse); nor had it any muzzle brake.

The SU-85 was usually organized in artillery "regiments," of which the mobile troops—the Tank Corps and the Moto-Mechanized Corps—had one each. The term "regiment" makes the array of SU-85's sound more formidable than it was. Actually there were only 20 of them (two companies per "regiment") plus a T-34 command tank. They supported the tanks as do the SU-100's today, and fought armor according to the same tactics. And they had SU-152's to help out, too.

Although the SU-85's did yeoman service thanks to their mobility, and



The SU-100, a medium tank chassis mounting a 100mm gun, fought in WW II.



Sovfoto

The SU-100 gun is powerful and has high velocity. It is the Red armor-fighter.

held the edge in gun-power over the most common German assault gun-tank destroyers, the SU-85's were from the start outclassed by the heaviest contemporaneous German tanks and assault guns. The 88mm gun Tiger tanks (which first appeared on the Leningrad Front in November, 1942) had heavier armor for slugging matches; so did both the Panther tank and Jagdpanther assault gun which appeared the same year as the SU-85's. Luckily the German designs had bugs in them, and weren't pushed for such large-scale production as the T-34 chassis of the SU-85.

Morosov's creation of an 85mm turret for his T-34 soon doomed the SU-85. His T-34 with an 85 in its turret went into production in 1943—the very year the SU-85 was going into action. The T-34/85 itself went into action in the Spring of 1944, although up to the end many T-34 76's were made and used. The primacy of the SU-85 as a tank destroyer was also eclipsed by the development of the KV heavy tank into the Joseph Stalin series. For Kotin wasn't satisfied with an 85mm KV, which went into production in the Spring of 1943. That very year he obsoleted that tank development by radically altering the KV into the 122mm Stalin.

With the 122mm Stalin (its gun adapted from the corps artillery 122), the Soviets had a tank which regained

both gun and armor supremacy from even the best new German armor. It was natural, then, that the heavy-gunned and armored JS should take over not only heavy-tank "break-through" roles against fortified positions, but also the over-watching fire and antitank missions of SU's. However, the Stalins remained in pools to beef up divisions when they were needed. The SU-85's remained the organic light assault artillery of the mobile divisions—the Tank Corps and the Moto-Mechanized Corps. They were faster, more mobile than the much heavier Stalins, which used the same V-12 Diesels.

With the advent in late 1944 of the SU-100, the tank-SU relationship was returned to that regarded as normal by Soviet-German concepts. By substituting the new 100mm gun (adapted from the prewar naval 100/56 high-velocity dual purpose gun) for the 85 of the SU-85, the SU version of the T-34 got far more firepower than its turreted counterpart. Thus in the T-34 series there was a T-34 turreted tank with 85mm gun, and an SU with 100mm gun. In the Stalin series, a turreted tank with a 122, an SU with a 152.

The SU-100 looks much like the SU-85. The long guns have no muzzle brakes, and the ball mounts are similar. The SU-100's commander's cupola, added to the left side of the crew compartment, is the main distinguishing feature. The cupola top

is the same as used on the T-34/85, as is the driver's hatch with its two vision ports.

As with the SU-85, the gun is laid with a tank-gun type telescope; no panoramic telescopes and artillery-type sights are provided. No machine gun is mounted, even for anti-aircraft. In this respect the SU-100's and 85's follow the T-34's. Close-in protection is afforded by a PPS tommy gun, which is the Russian version of the German MP 40 Schmeisser (of which the M3 "Grease Gun" is the U.S. adaptation). It can be stuck through pistol ports to the right and left of the 100mm gun, on the right side behind the cupola, and on the opposite (left) side from the cupola.

The SU-100 has always had both intercom sets and radio. The intercom was more necessary on wartime SU's than on the early T-34 medium tanks, for the SU-100 drivers were separated from the vehicle commanders. In the T-34 with 76, both commander and driver were on the left; the commander could use foot signals on the driver's shoulder. In the SU-100 and SU-85, the commander is off to the right; on the SU-76 there's the engine between commander and driver.

The radios were equally necessary for the SU's. Even the smallest units (platoons) have always been worked by radio, the platoon commander assigning targets and controlling movement of his SU's by that means. Radio contact with the supported tanks hasn't been so essential, though prescribed. Soviet practice has been for SU's to pick up for themselves the targets bothering tanks and infantry. Those which they miss may be designated by tracer fire from tanks, infantry, and direct-laid towed artillery accompanying the infantry and tanks.

To pick up such targets and to note visual signals, the SU-100 commander was from the start provided with a periscope in the front half of his hatch lid. Periscope and lid both rotate. There is another rotatable periscope in the left front half of the split hatch lid behind the driver. This periscope has been normally used by the gunner to observe his sector of terrain. His aiming telescope provides only a restricted field of vision, further limited by the very slight traverse of the gun.

These vision devices mark a big change to simpler devices for all-out wartime production. The earlier SU-85 had for the commander the type periscope used on the KV and early T-34 tanks. This was a complex device, replete with gadgets and graduations to aid in observation and fire control. The SU-85 also had fixed episcopes (armor hooded on the sides and in back) on the left and right sides, and on the right front. In this fitting the SU-85 also followed the 1939-40 wave of tanks. The SU-122 (how), SU-152, and SU-122 (gun) assault guns were similarly fitted. But with the Stalin and T-34/85 tanks, and the SU-100 and JSU series of 152 and 122 (gun) assault weapons, the switch was made to universal use of a very simple periscope as used on the SU-100. It replaced the fixed episcopes and the fancy periscope. The driver uses the T-34's driver's hatch with double episcopes. Since the periscopes are not edge-mounted like the episcopes, and don't stick up as high as the old periscope, the 100's appear relatively blind compared to the SU-85's.

Relative blindness is not the only apparent defect of the SU-100. It is obviously cold as the North Pole in winter. Crews were noted during World War II wearing Shubas—thick sheepskin coats. Also, the ear-flapped Army ersatz pile cap seemed to be preferred to the padded tank helmet for cold weather. Just how that cap could be worn with headphones is a mystery. The latter are built to button into the tank helmet ear flaps (not to ride on headpieces, over which a pile cap could be pulled). An additional discomfort must be the trouble from powder fumes, when the breech is opened. A double-domed ventilator vent was fitted to the rear of the cupola (with slots in the sides, and dimples on the top); but during the war there was no forced evacuation of fumes.

The exterior of the SU-100 has normally carried on each side towards the rear the extra two fuel drums so characteristic of the T-34. Night marches can be illuminated by a single auto headlamp mounted on the left over the track. Seven extra track links usually have been bolted on front, along with a long wire towing cable. In action, the rear of the chassis behind the crew compart-

ment was usually piled with wooden ammunition boxes, and bags of gear for the crew. The short buggy-whip aerial may be folded to the rear along the side, getting mixed up with this junk. Observers may therefore wrongly conclude that such a be-decked SU-100 has no radio.

The main defect of the SU-100 is not apparent from the outside. This defect derives from the Soviet attempt to combine a big, hyper-velocity gun (capable of vieing with the 3,000-ft. sec. muzzle velocity of the 88mm Pak 43), firing a large and easily-spotted shell of around 35 lbs.,—with a fast medium tank chassis, fair armor, and low silhouette. The

of the T-34/85) SU-100. The latter thus has the advantage in speed and lightness of foot.

These are among the obvious reasons why the SU-100 has become the main Soviet armor fighter. The Soviets like its gun-power, its low silhouette, its mobility, its armor (only slightly less than that of the turreted T-34 tank on the same chassis). The silhouette deserves emphasis, for even more than the German; the Soviets have insisted on the tactical advantage of lowness. They say it enables easier concealment, use of cover; hence enables both greater surprise and security—offers a target hard to hit, compared to a tank.

These SU-100's, which represent the acme of Soviet wartime anti-tank development, today are to be found teamed with T-34/85 tanks in rifle divisions. It is proudly displayed in the main Soviet shock outfit—the Tank Division (formerly Tank Corps), and in the armored blitz mass of the old-line Soviet mobile warfare outfit—the present-day Mechanized Division (formerly Mechanized Corps). Naturally, it is also available for assignment to that division's infantry components if needed.

But while the SU-100 has displaced the SU-85, it has not displaced the Stalin. Those formidable tanks are mixed in right with the other prime armor fighters. The SU-100's and Stalins actually have been teamed in exploitation of breakthroughs and in pursuit of an enemy. Points have been composed of a platoon of the SU's, to a platoon of Stalins—as nasty a hand of two pairs of armored aces, as a Soviet opponent could well meet in any meeting engagement game.

Americans who have been greatly heartened by the performance of their armor in Korea should bear in mind the formidable SU's—and their use in Soviet tank-SU teams. The powerful SU's have never been used in Korea, nor has the tank-SU team. The only SU encountered there has been the makeshift, weak-gunned SU-76, which usually it has been used in its post-World War II infantry accompanying gun role. Stalin definitely has been keeping up his sleeve what he appears to consider his armored aces—which include the great JSU-152's, as well as the Stalin tank and the SU-100's.



thing that had to go (as in all Soviet SU's) was ammunition stowage—which is very slight.

Nevertheless, the SU-100 has several advantages as compared to the Stalin (which as to ammo is even worse off). Its 100mm gun was adapted from a successful prewar Navy piece, designed for very high velocities and for rapid fire. The Stalin's 122 was adapted from a corps artillery piece, designed for slower fire—and with semi-fixed ammunition harder to handle and yet not as powerful as the 100. The big 122 has a muzzle brake, which the 100 does not. And while the Stalin can get around nicely despite its 50-ton weight, the fact remains that the same Diesel has powered both it and the much lighter (around the 35 tons

The ArtilleryMAN is the Thing!

by MAJOR EUGENE V. BRIGHAM

A NUMBER of articles have been published in various service journals expounding the merits of armored artillery. This type of artillery is very versatile. However, I feel it is a weakness of these articles that they consistently compare the armored artillery with towed artillery to the general disparagement of the towed type.

It seems to me that the weakness in the statement of the case lies in the inclination to stress certain characteristics of equipment while failing to place enough weight on the man operating it. Examples supporting armored artillery imply almost without exception that the only reason towed artillery has been overrun in combat is because it was towed rather than self-propelled. I do not think that is true.

The net result of disadvantageous comparison of the towed artillery with self-propelled has been to inspire among many young artillerymen the profound hope that they will never be assigned to a towed outfit. This in turn might well affect efficiency in towed units.

Lt. Colonel Leon F. Lavoie's article on this subject of towed versus self-propelled artillery (*ARMOR*, September-October, 1952, page 10) was highly interesting. Yet, it appears to support the thesis that the primary reason for the overrunning of several of our units in Korea was

because it was towed and was, therefore, more difficult to handle and maneuver. The article brought out many of the advantages of self-propelled artillery, about which this writer is equally enthusiastic, along with the tactics used by the Red forces and the defenses and tactics required to defeat them. There are examples of SP units in action. But this is only a part of the story, one side of it.

For example, the 61st Field Artillery Battalion and its sister artillery units in the First Cavalry Division acquitted themselves most creditably in Korea. The 61st, a towed unit, was hit several times and on each occasion turned in a fine job and came out of the fight with a minimum number of casualties and minimum loss of equipment.

On one occasion, for which a Distinguished Unit Citation was received, an estimated regiment of Chinese Communist troops attacked the entire 61st Battalion, and succeeded in penetrating to within 100 yards of the perimeters of the individual batteries, attempting to cut off and destroy the battalion and set up a road block behind friendly forces further to the north.

Each battery deployed all available personnel as infantry in a tightly knit area defense. The gun crews were left intact to service their howitzers. By means of direct fire by the howitzers, supported by all small arms and automatic weapons available, the battalion stood off the Reds for six hours. In addition to maintaining its own integrity and accomplishing a final withdrawal in an

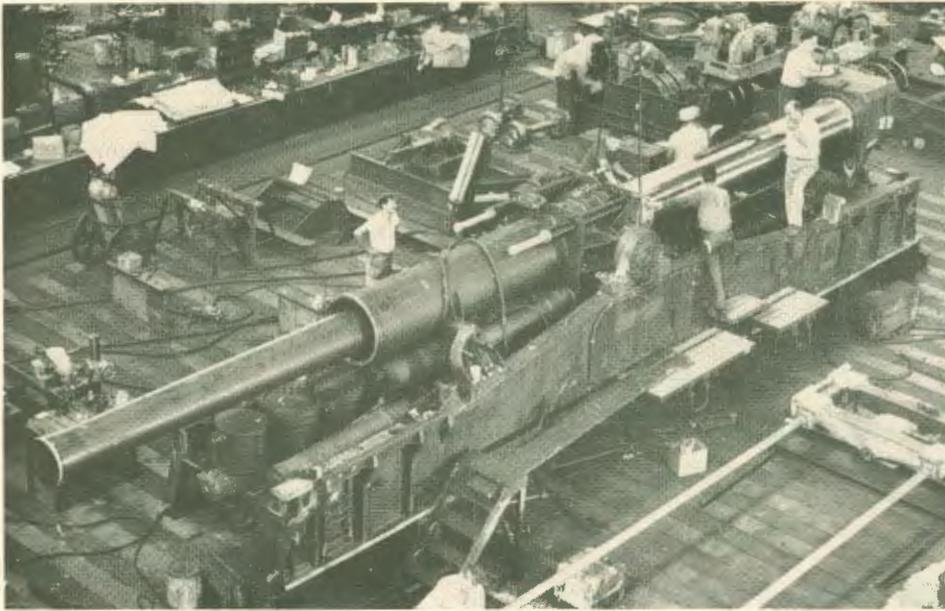
orderly manner, the battalion contributed substantially to the larger action of friendly forces.

The success of any unit in action, whether towed or self-propelled, in the final analysis is due to training, discipline, *esprit de corps*, an adequate and planned defense, and forceful and competent leadership. The 61st had all of these. It had carried on an intensive training program coincident with an intensive combat employment. In addition to the normal training for a field artillery battalion, such things were covered as emplacement of outposts and main defenses; warning systems; coordination of defenses between batteries; proper emplacement of automatic weapons; scouting and patrolling and the defense; and other infantry subjects. The results were assured. Any battalion, whether towed or self-propelled, can do these things.

Even though towed artillery is somewhat more difficult to handle and is somewhat less mobile than SP, with proper preparation in all respects no enemy will overrun it, and if a withdrawal is necessary it can be executed under enemy fire with minimum loss of personnel and equipment.

As with SP artillery, towed has many capabilities. Unless they are brought out and recognized we may place a psychological weight against towed artillery which will create a lack of confidence in our artillery personnel assigned to towed units, who need only be assured that it is not the gun that does the job, but the *man* behind it.

Major Eugene V. Brigham, Artillery, served in Korea for fifteen months with the 61st Field Artillery Battalion, First Cavalry Division. He is now Army Advisor with the 696th Armored Field Artillery Battalion, Trenton, New Jersey.



The 280mm gun under production at the Pittsburgh plant of Dravo Corp. The 38½ foot carriage requires 8200 feet of welding. Nearly 2200 separate blueprints govern its assembly. Accuracy of machining is held to one-thousandth of an inch on critical dimensions.

Dravo Corporation



A complete battery of atomic artillery consists of trucks. One of these is a shop truck, while two tow the gun for the gun operations and four tow conventional

The Army's ATOMIC GUN

The United States Army recently unveiled its new atomic artillery piece, a 280mm gun designated the T131. In a special presentation demonstration at Aberdeen Proving Ground on October 15th, Army Ordnance Corps personnel put the formidable piece of military equipment through its paces for a distinguished observer group which included Secretary of the Army Frank P. Rowland and Army Chief of Staff General J. Lawton Collins.



U. S. Army
Detached from its transporters, the gun rests on a turntable where a socket and ball arrangement allows balance and a 360 degree traverse. Three jacks with wheels riding a track around the turntable provide ease of traverse and levelling for uneven terrain.



Projectile and powder charges are loaded by means of a hydraulic power rammer. Loading may also be done by hand.



United Press Photo

of two 280mm guns and nine supporting tow the generators which supply power onal trailers. A captain is battery CO.



United Press Photo

Boasting complete mobility, the 280mm unit, weighing 85 tons, can travel up to about 35 mph on the road and, for its weight and bulk, can negotiate rough terrain. It can cross present Army division-load bridges and will fit into an amphibious landing ship.

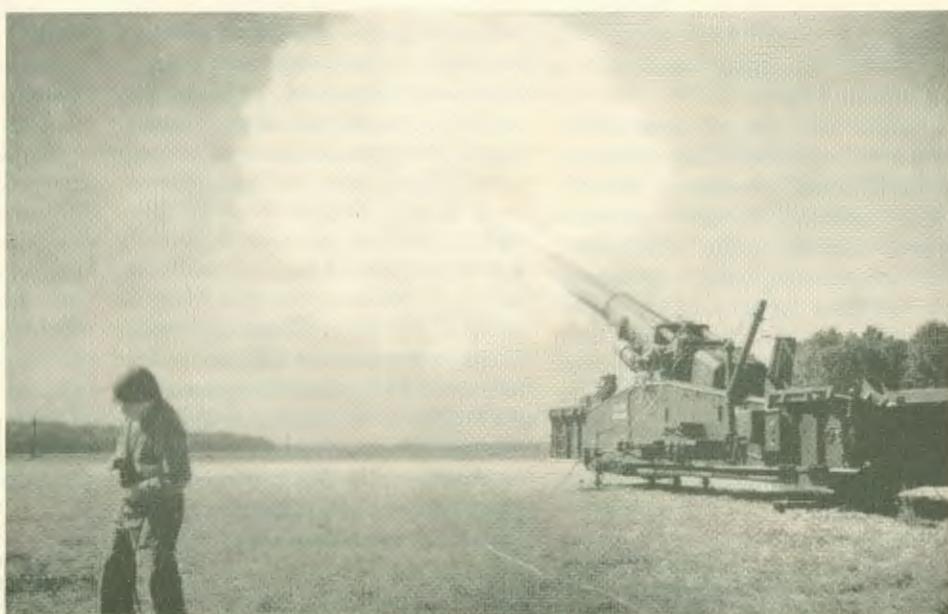
A battery of two guns was moved from a wooded area over typical terrain to the demonstration position on an Aberdeen range. Crews took the battery from march formation into firing position in 20 minutes. Conventional ammunition was used. Atomic shells will be fired in tests still to be announced by the Army. Both Secretary Pace and General Collins emphasized that this gun was only a part of a broad program of atomic weapons development.

The new gun is a product of the Army-industry team. Some half-dozen Ordnance installations in as many States and a like number of prime contracting firms have contributed to the project from design through production. With guns now in being, Field Forces and tactical testing will enter the picture. Meanwhile, a new Combat Development Agency has been set up at Army Field Forces to coordinate the testing, organization and doctrine.



United Press Photo

are loaded into the breech rammer. This operation variation is 0 to 55 degrees.



U. S. Army

The range of the atomic artillery gun is "about 20 miles." It can deliver an atomic shell on target in all kinds of weather, day or night, unlike the air-delivered atomic bomb. It is considered four times more accurate than conventional artillery at longer ranges.

Although we have had plenty of opportunity in Korea to battlefield-test the organization of our smaller armor units, the testing of our armored division organization has been limited to maneuvers. Here is an important analysis by two armor experts of the current organization of our major mobile instrument

interest of the tank formations. It is an organization of tremendous shock effect, having high tactical and strategic mobility. It aids the Infantry Divisions in advancing the line forward by deep penetrations, without regard to exposed flanks, in order to strike deep into the enemy's vitals, thereby paralyzing a large section of the front holding up the advancing infantry formations. In the defense it aids the infantry in maintaining the continuity of the line by adding depth to the battlefield, counterattacking, destroying enemy armor, and making counterthrusts.

"Working together in the corps framework, supported by corps units, these divisions constitute a powerful offensive and defensive team. So teamed together they provide an economical, flexible organization."

The armored division is designed to fight primarily in two flexible, organized combat commands. Each is commanded by a senior officer who has a staff adequate for handling operations in fast-moving situations and trained to work under mission-type, fragmentary orders. The third, or reserve command, normally provides the means for rotating battalions into the other two combat commands so that maintenance and rehabilitation is a continuous process in combat. When circumstances require it, the reserve command may be used as a fighting force for short periods of time.

In Exercise LONG HORN the first mission assigned to the 1st Armored Division was that of acting as the covering force for the corps in a withdrawal. The division was to have relieved one of the infantry divisions of the corps across a front of some thirty-five miles. The 1st Armored Division's plan was to employ both combat commands and the reserve command abreast with one or two reinforced tank battalions held in division reserve and the reconnais-

sance battalion utilized to protect flanks and the rear areas of the division, particularly against airborne attack. Unfortunately the play of the problem was such that the 1st Armored Division was forced on the defensive in their originally assigned assembly area and had no opportunity to put the plan into effect. A similar disposition to that outlined above did exist in the assembly area, however, and was successful in defending the assigned area. No Aggressor unit larger than a platoon was able to make any penetration nor was any 1st Armored Division company or larger unit surprised or overrun by Aggressor at any time. The new armored division has great capabilities in a defensive role because of its power, mobility and communications.

In the offensive phase, higher headquarters directed that the division advance in two widely separated zones. On the left, one combat command, consisting of a tank battalion, an armored infantry battalion, an armored field artillery battalion and an armored reconnaissance company, supported by an armored engineer company, an armored ordnance company and an armored medical company, and with an infantry regiment from one of the infantry divisions attached, constituted the south force. On the north, the division, less the combat command on the south and with another infantry regiment attached, initially planned to attack with CC "A," which included two armored infantry and two tank battalions as its main striking force, supported by the reserve command and the remaining division troops. However, intelligence indicated early that the Aggressor was deployed in a thin line with little reserve, so the reserve command was brought up in the interval between CC "A" and CC "B" and assigned an axis of advance parallel to CC "A." Since this was to be a short

maneuver, the reserve command was committed at every opportunity for training. The reconnaissance battalion was used to maintain contact between the north and south forces and to protect the flanks. The attached infantry was used to seize bridgeheads and to organize key terrain as successive phase lines were reached. The plan contemplated that the reserve command would revert to a reserve role after bridgeheads were established across the Colorado River, which was the division's final objective.

During the Division Tests preceding Exercise LONG HORN and during the maneuver, several changes of formation assignments of units to combat and reserve commands were made. The organization of the division proved to be as flexible in practice as it was in theory and these shifts were made expeditiously and without confusion, even during periods of radio silence and in blackout. On one occasion all battalions were moved to new combat and reserve commands during a night withdrawal without difficulty or incident.

The signal communications in the division were excellent throughout the maneuver. By habitually locating combat command and division command posts on high ground, continuous FM radio communication was maintained. CW radio was used for intelligence and administrative channels, permitting FM channels to be used exclusively for operations and command. Heavy use of about 25 FM radio nets by umpires caused trouble, but neither they nor the Aggressor jamming equipment were able to blanket out our FM radio communications. Simple map coordinate and voice codes were used on the FM channels.

The supporting elements of the division all proved reasonably adequate to perform their missions. Such changes as were recommended follow-

ing the maneuvers were generally minor recommendations concerning equipment. No changes were suggested to be made in the basic organization of any of the supporting units.

The division artillery considered its organization as suitable and adequate to accomplish its missions. As might be expected, in armored action, the artillery defended itself against Aggressor tanks and other elements by direct fire in several instances. Throughout the maneuver, the artillery units advanced as rapidly as the tank elements and were able to provide continuous artillery support.

The bulk of one armored infantry battalion was equipped with the T-18 armored personnel carrier. These vehicles were received just as maneuvers began, so that little preliminary training was possible. These vehicles proved to be more mobile than any other vehicle on the battlefield. They accompanied the tanks in the assault in numerous cases, delivering their cargos of infantrymen on the objective immediately behind the tanks. This close follow-up placed the infantrymen at the critical points at the most critical time so that they were able to take full advantage of the Aggressor confusion caused by tanks overrunning them. With their overhead cover, the armored infantrymen were protected from both their own and enemy proximity fused artillery fragments; and had there been tactical atomic bursts, they would have been protected measurably from the blast and other effects. The armored personnel carrier proved to be a very suitable vehicle for the armored infantry. Infantry soldiers admitted that while riding in them there was a high noise level and vibration; nevertheless, they expressed emphatically their preference for the armored personnel carrier to the half-track for moving rapidly in the assault. A few changes will enable the armored personnel carrier to fill its place in the armored division tactical team.

The heavy tank battalion is organized into 3 tank companies of 4 platoons each—22 tanks per company. This organization was adopted to make the heavy tank company and battalion the same wherever found and was the organization desired in the infantry division. The 4 Com-

pany-3 Platoon organization would be preferable in the heavy tank battalion, armored division. The heavy tank unit in the division has been trained and employed in exercises and maneuvers to operate generally in company-sized units attached to combat commands to over-watch and back up the medium tanks. The "family of tanks" concept is well exemplified and is economical and effective in the new armored division organization.

In the armored engineer battalion we still lack a suitable assault bridge. Development and standardization of a scissor-type bridge transported on an armored vehicle which can quickly bridge up to a 30 to 35 foot gap under fire is urgently needed. Availability of this type of equipment might result in some changes in the organization of the armored engineer battalion, but these changes would not be significant. The tactical concept of employing units of the division requires such equipment.

Supply Requirements

In the quartermaster battalion, consideration must be given to the problems that are arising as a result of the increasing weight of our guns and vehicles. Ammunition and POL requirements are rising rapidly. Perhaps the best solution will be to go to a larger-capacity truck for cargo use rather than increasing the number of trucks in this battalion.

One more important aspect of the maneuvers was the atomic warfare play. Although completely theoretical, it was obvious that Armor is a branch of the service well adapted to atomic warfare. It has a large measure of protection for the individual constantly available. Armor mobility and communications permit it to operate over a widely dispersed area. Its communications permit complete control, even though widely dispersed, and its mobility permits rapid assembly to employ mass when needed, with subsequent rapid dispersal after the mass has been employed. Again, its mobility and protection for its personnel make it a most suitable force for rapid exploitation of our own tactical atomic attacks.

During Exercise LONG HORN, the 1st Armored Division was the only division which did not receive a theoretical atomic attack. This was

because its mobility and communications permitted it to remain so widely dispersed that it did not at any time provide a profitable target. In addition, the division staff was split into two parts so that if Division Forward had been hit, staff officers at Division Rear were continuously briefed and prepared to step into the key spots under the Chief of Staff, as temporary Division Commander. This split placed G-2, G-3 and the Division Commander in an operations group forward and the rest of the staff under the Chief of Staff in a logistics group in the rear. An additional advantage of splitting the headquarters was gained in that the number of vehicles with the Forward Command Post was reduced by half. This permitted the Forward Command Post considerably more freedom of movement and reduced the area needed to set up the Command Post. As a result, the Forward Command Post moved frequently and was able to maintain continuous communications with its major commands. In retrograde movements the Division Commander could leapfrog from Forward CP to Rear CP and be in continuous control forward and in contact with Corps.

Last, but far from least, is the Army Aviation Section of the division. The light planes were employed throughout the daylight hours to provide continuous air cover for the division. They provided prompt and continuous information of Aggressor movements. Through their radio reports, which all commanders monitored, they were kept continuously informed of the front-line situation. They performed an invaluable service to the division. They fill a vital need both on offense and defense.

In summary, the current organization of the armored division fulfilled every expectation. The concept of the organization has proved to be sound. The combat command-separate battalion principle permits the commander full freedom in his choice of composition of forces to meet the changing situations. Every unit of the division, from the quartermaster bath unit and the replacement company on through the major commands, justified their place in the organization. The basic design of the division is well abreast of the modern broad-front, fluid-situation, tactical-atomic-weapon type of warfare.

ARMOR ASSOCIATION NOTES

Executive Council Meeting

Armor Association members will be interested in a number of matters which were discussed at a special meeting of the Executive Council held on September 18th at the Army and Navy Club in Washington, D. C.

Primary purpose was to lay plans for the 64th annual meeting of the Association. The tremendous success of last year's meeting set the pattern for the coming event. Fort Knox and the Home of Armor were selected as the site. The date is January 30th, the fifth Friday of the month.

A Nominating Committee composed of three members was appointed to prepare a slate of proposed candidates for the governing body for 1953, to be presented to the membership at the annual meeting.

Another item of discussion was the move of Association headquarters from 1719 to 1727 K Street, N.W., in Washington. The old building has been torn down in favor of providing additional parking space in our desirable section of the Capital city. The new space next door at 1727 K Street, the entire 3d floor, is a more practical setup and more appropriate for our fast-growing organization. The move was made on September 30th.

A forthcoming change in Secretary-Editorship was reported with the assignment of Major William H. Zierdt as Associate Editor. Effective with this issue of ARMOR, he takes his place on the staff and the masthead.

Also discussed at the special meeting was the annual ROTC award made by the Association, an engraved certificate presented to the outstanding senior cadets at the 14 institutions with Armor courses. Some discussion had been reported favoring a medal award, since Infantry and Artillery cadets were receiving this type from their Associations. The Council decided to continue the certificate as being suitable for display by the recipient. It was felt that there was no obligation to follow others in presenting a medal, which was an expensive item not authorized for wear with the uniform.

Also considered was the establishment of Council Advisory Boards for

the Far East and European Theaters, to serve as extensions of the Executive Council. Association Chapters were considered and it was decided to put this to a limited tryout.

The Council also reviewed developments attending the reopening of the subject of a merger of the Armor Association and ARMOR, still desired by the Association of the U. S. Army and its *Combat Forces Journal*. Lieutenant General Geoffrey Keyes, Chairman of an Armor committee, reported upon developments resulting

from several meetings with representatives of that organization and the Antiaircraft Association. A full discussion of the entire history and background of the subject led to the unanimous views expressed editorially elsewhere in the magazine.

Nineteen officials of the Association were present at the Council meeting, representing the top level of the mobile warfare field. The entire membership can well be proud of the attendance and guidance of the distinguished governing body.

Armored Division Associations Support Armor Association

Over the course of the last six months a number of the Armored Division Associations, organizations of veterans who served with the various divisions during World War II, have been holding their annual reunions around the country. Out of the many gatherings have come strong expressions of support of the U. S. Armor Association, in the form of resolutions passed at the respective division association business meetings. The Armor Association has received copies of these resolutions from a number of groups, including the 1st, 5th, 6th, 7th, 10th and 11th Armored Division Associations. The resolution passed by the first of these is presented here as an example of inspiring support:

August 30, 1952.

To the Editor of ARMOR:

WHEREAS the highly specialized art and science of modern armored warfare has developed its own unique requirements of tactical theory and doctrine, and

WHEREAS the only existing professional medium for the continuing exposition, development and current study of armored theory, technique, and philosophy is the periodical publication of the United States Armor Association entitled ARMOR, and

WHEREAS the superior editorship and professional excellence reflected in the pages of ARMOR has won that publication international renown and acceptance as pre-eminent of all military publications devoted exclusively to the advancement and perfection of the art and science of mobile ground warfare, upon which the effective defense of our nation so largely depends;

NOW, THEREFORE, BE IT RESOLVED by the members of the First Armored Division Association in plenary session assembled, that the United States Armor Association be commended for its exclusive devotion to the concentrated study and refinement of existing theory, doctrine, history, and techniques of armored warfare, and

BE IT FURTHER RESOLVED that the officers and staff of the United States Armor Association be congratulated upon their serious efforts and notable contributions toward preserving and perpetuating the identity and distinction of an armored force as an idea and a concept deserving of specialized and independent treatment within the field of periodical military literature.

BE IT FURTHER RESOLVED that the United States Armor Association and its publication ARMOR should receive the continued support of the Department of Defense and it is directed that the Secretary-Treasurer transmit copies of this resolution to the President of the United States, the Secretary of Defense, the Secretary of the Army, the Chairman of the Combined Chiefs of Staff, the Chief of Staff of the Army, the Chief of the Army Field Forces, the President of the United States Armor Association and the Editor of ARMOR.

Human Engineering — A Tool for Armor

While the human body is one of the most versatile of all machines, its relation to the weapons of war requires a high degree of engineering to produce maximum operational effect. The placement of radio, steering, ammunition and gun equipment in the turret of a tank is important—even more so than is the spotting of the stove, refrigerator and garbage unit in a functional kitchen

by CAPTAIN JOHN T. BURKE

IT has been said that the medium tank is the basic ingredient of armored warfare. Be that as it may, the medium tank, of and by itself, is nothing more than one of the most complex and expensive terrain features ever devised. Armored warfare is not the tank, but the tank and its crew, the man-machine team, wedded into a harmonious whole.

Human engineering has a unique contribution to make in the marriage. Before discussing human engineering as such, however, it might be well to analyze a peculiar disease which often afflicts the world of machines and mechanical engineers. For lack of a better name, we will call this affliction "machinitis." Those suffering from this malady hold to several unscientific doctrines (although perhaps unconsciously), and conduct their operations accordingly.

First among these notions is the concept of machines "doing" things, including fighting wars. The logical

correlate of this concept is the belief that the operator will be capable of adjusting to almost any design, and that he can easily be added after the tool is built. This belief results in the mad and merry building of machines, without the slightest concern for the nerves, muscles, and receptors that will later operate them.

The second symptom of "machinitis" is a complete faith in what is termed experience, or "common sense" observation. By virtue of this faith, the design of machines for human use offers no problem to the diseased one. The design of controls, panels, dials, exits, entrances, and other equipment, as well as their location in the apparatus, is simply a question of a little meditation and "trial and error" by the mechanical engineer.

Finally, when after a great deal of time and expense, the equipment is found to be inefficient and difficult to maintain, the "machinitic" jumps to one or all of three conclusions: (1) The machine is structurally weak; (2) Some extreme physical condition, such as heat or cold, has brought about the damage; (3) The operator was improperly or inadequately trained.

It seldom occurs to this individual that the difficulty might be inherent in some characteristic of the machine

to which the average operator cannot adjust. His obsession with machines has blinded him to the possibility of unique human operational characteristics.

It would appear that armor has not completely escaped this machinitic scourge. The malady calls for the services of a specialist, an individual trained to diagnose and treat man-machine illnesses. It is as such a specialist that the human engineer has some valuable services to offer.

Subject Matter, Method, and Scope

Historically speaking, two trends operated to produce the human engineer. First, there was the constantly increasing complexity of the machine age. It soon became evident, particularly to industry, that the advancement of machines was outstripping the capabilities of the human operator. The result was a loss of efficiency in terms of fatigue, morale, and injury. Secondly, scientific psychology advanced its knowledge of man, and was rapidly taking many aspects of human experiences and behavior from the realm of guesswork.

Originally, the machine designer considered human behavior unpredictable in engineering terms, and the problem envisioned was one of training the operator to an already

CAPTAIN JOHN T. BURKE, Armor, is a graduate of the U.S. Military Academy, Class of 1945. His psychological schooling includes a Master's Degree from Vanderbilt University. He has recently completed an assignment as Research Assistant in the Psychology Department of the Army Medical Research Laboratory at Fort Knox, and is now assigned in the European Command.

existent machine. Scientific studies were made of the distribution of effort in time and of particular motion patterns best suited to the performance of a given job. These investigations were titled "time" and "motion" studies. In the early part of the century, Frank ("Cheaper by the Dozen") Gilbreth gave impetus to the time and motion field with some notable achievements in greater industrial efficiency.

It soon became apparent to the machine world, and to the psychological scientist particularly, that the cart had been placed before the horse. Why build a machine and then concern oneself with making the operator fit it? Why not study the operator and build the machine so as to encourage his most efficient operation?

With the latter notion came one of the basic principles of modern machine psychology: The machine and the operator are not two systems, but one. Man is an indispensable element in the total control system. As such, he must be considered at the conception of the machine, not after its birth.

Human engineering is thus experimental psychology as applied to man's work and machine environment. Its method is essentially the controlled experimental technique of the physical sciences. In the operation of natural laws, there are always two or more elements—one or more causes operating so as to produce one or more effects. Unless one is able to "control" these variables, cause and effect become hopelessly confused. By controlling one possible cause, preventing its operation, one is able to observe the specific effect of the other.

Consider, for example, a possible "type" problem for the human engineer. What is the effect of gun blast on the accuracy of ranging with the stereoscopic rangefinder? The answer to this question might well be important in terms of training and equipment design. The problem might appear to be a simple one in "common sense" observation. To the human engineer, it is not so simple. First there are the obvious associated questions: Are we referring to gun blast in general, and its effect on ranging in general? Or is the question one of a specific gun, a specific tank, and a specific rangefinder? Under what environmental conditions, as de-

scribed by speed of the tank, type of ammunition, terrain characteristics, and firing rate? What is meant by "gun blast"? Is it to include the sound, in terms of amplitude and frequency, the vibration of the tank with gun recoil, the fumes following the blast, or some combination of these components?

Then there are the not-so-obvious questions. To what type of gunner does the problem refer? Is he to be the average gunner we would expect under, say, mobilization conditions? What is the state of his mental and physical conditioning? Is he to be given some protection from the blast, such as ear wardens? What are the criteria of accuracy with the rangefinder in terms of speed of operation, distance to the target, and type of target?

These are not impossible questions. They merely indicate the complexity of the experimental task. It is almost impossible to solve a problem such as this in terms of experience, or "common sense" observation. The causes and effects are so involved that only precise experimental methods, usually coupled with complex but sound statistical procedures, can give a reasonable and useful answer.

Human engineering, then, is the science of man-machine relations. Its method is that of modern experimental psychology. Its purpose is a practical one—that of obtaining the greatest

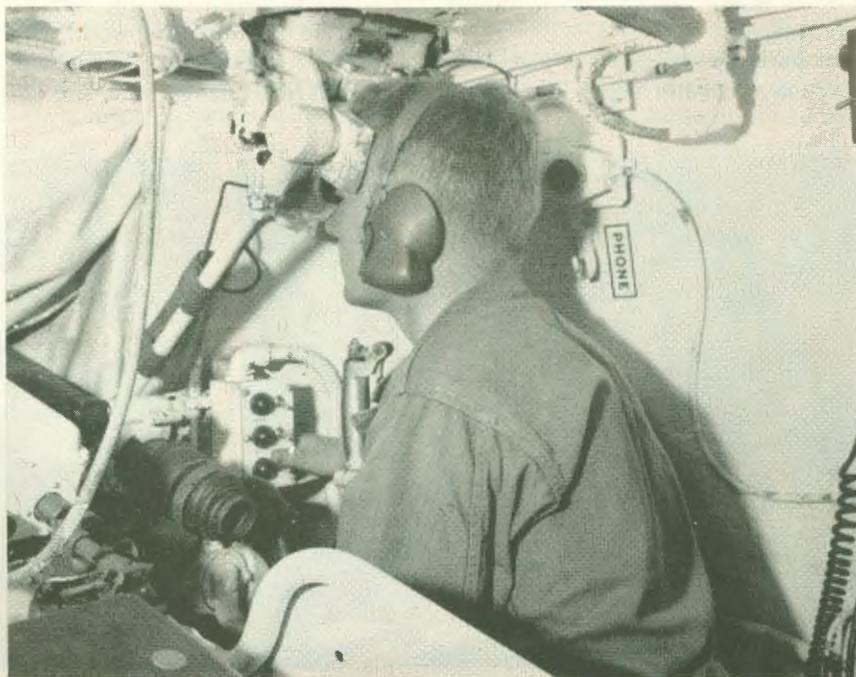
possible efficiency from the man-machine team. Its scope includes: the application of principles of human operation to machine design; the determination of scientific principles for machine operation and operator training; and the study of already-existent machines for improvement, where possible, of human operation.

Past Contributions

The value of human engineering to Armor can perhaps best be discussed in terms of contributions in other fields that are a matter of record. Rather than labor through specific studies, it might be more profitable to consider some general findings and their applications.

As has been stated, time and motion principles were among the earliest contributions. A man's body is not automatically completely adaptable to a given work situation. It works more efficiently with one pattern of motions, following a certain sequence, than another. It also works more efficiently if work is distributed systematically in terms of time. Assembly line production has been known to more than double as a result of simple alterations in work time and methods, yet with no increase in total time or effort.

Various environmental factors have been found to be closely related to the efficiency of human performance. Sound, for example, often has a sys-



All Photos U. S. Army
Human engineering in the tank results in maximum crew efficiency in combat.

tematic effect on performance, sometimes helpful, sometimes detrimental, depending upon the sound characteristics. The same holds true for variations in the intensity and color of light. At some time in the unrecorded past, the maritime world asked itself, "What color light can best be seen at night?" "Machinitis" was a rather common malady in those days, and the seafaring men leaped to the conclusion: *red*. After some time the psychologists informed them of a very interesting phenomenon: the human eye undergoes changes in the dark. There is a "shift" of perceived brightness, and green, blue, or blue-green can be seen at greater distances than can yellow or red!

Some of the human engineer's most valuable and interesting findings have been in the field of perception. He has shown a doubting machine world that perception is not "seeing," as such, but is rather the more or less simultaneous interpretation of what is received by the eye or other receptor. This interpretation of data by the human is extremely intricate and difficult to predict. Consider, for example, the problem of airplane dials and panels for a pilot. For efficient use, certain principles of dial placing, numeral size, and numeral interval apply; and serious mistakes have been traced to faulty design. The principle of simplicity is important, yet at times an operator has been given a dial which he could not read, when a simple "on-off" flash would have sufficed.

Similarly, the efficiency of machine operation is greatly dependent upon

the design and placing of levers and other controls. Slight differences in the length of a lever, the circumference of a wheel, the position and friction of a knob, and other apparently non-consequential factors have been found to be quite important. In some instances, an operator has been required to differentiate by touch for his operations, in terms of the size of a knob. Yet a simple experiment will show that he can recognize more *shapes* of a given size, and do so more accurately.

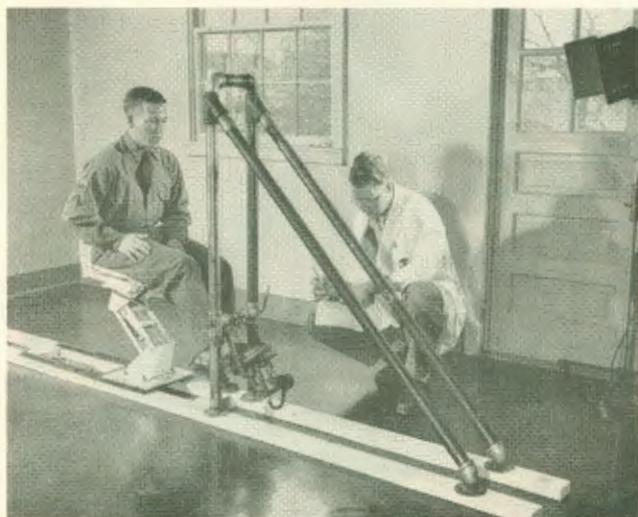
World War II saw a tremendous increase in the complexity of war machines and the forces they exerted. The demands of the Air Force and Navy for data concerning human characteristics became so great that it became necessary to establish high level panels of experts and extensive laboratories. The naval and air men had a lot of questions to ask: How much could the average man stand in the way of heat and cold, pressure, vibration, gross movement, sound, and work in general? What were the best work periods for various jobs? What effect did a multitude of forces have on the operation of various precision devices, such as radar and sonar? Where should controls be placed, and how should they be designed? What effect did submarine duty have on the sleeping cycle, and what should be the color of submarine walls?

The above are only a few of thousands of contributions by the human engineer to the machine world. In the field of audition he contributed to the efficient design and use of

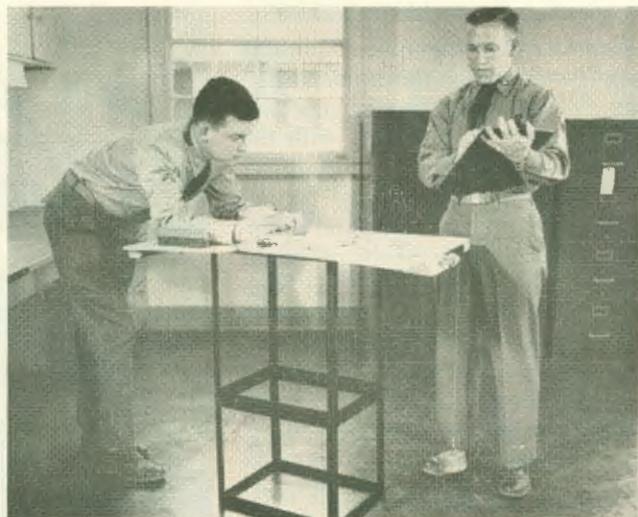
communications equipment. He has had a beneficial effect on the design and use of complex optical devices, ranging from the electronic microscope to the most powerful telescope. Again in the field of visual perception he revealed that the efficiency with which man reads is dependent upon a host of complex factors, including the intensity of light, the contrast of backgrounds, the size and spacing of type, and various visual deficiencies. He has studied the effects of physical forces on man, to include sound, vibration, atmospheric variations, motion, and odors. In brief, he earned the title of "doctor of machines," indispensable in the machine age.

Human Engineering in Armor

The human engineer is making, and has made in the past, some significant contributions to armor development. For various reasons, however, this activity has been very limited as compared to that in other elements of the Armed Forces. In the past, armor equipment has not posed the problem of human operation in the emphatic terms it does today; while in such agencies as the Navy and Air Force more complex apparatus made scientific research of this nature a necessity rather than a luxury. One indication of the importance of human engineering to the Navy is shown by the increased emphasis on scientific psychology in naval training. In the spring of 1947, a group of distinguished psychologists were invited to give a series of lectures at the Naval Postgraduate School.



Apparently minor points such as application of footpressure to pedals from a tank seat are carefully tested.



In this operation two technicians are testing the degree of motion and wrist strength as applied to tank operation.

Armored warfare is preeminently machine warfare. But no machine drives itself, or arms itself, or maintains itself, or aims itself. The concept of machines taking ground is a snare and a delusion, a sort of military schizophrenia which indicates "machinitis" in an advanced stage of development. It can be avoided by visualizing man and machine as one, never as independent elements.

The definitions and examples cited above no doubt suggest in themselves the application of human engineering to the advancement of Armor. The possibilities for profitable research are numerous, and they logically commence with the machine that is at once Armor's right hand and Achilles heel, the tank. In this respect, the general problem reveals itself in two activities; the more or less original design of a tank, and the redesign of an existing tank or its components.

Consider for a moment a few of the numerous problems in tank design that are logically the domain of the human engineer. There are knobs, levers, buttons, pedals, seats, panels, latches, hatches, grips, triggers, and springs. Within the limits demanded by military characteristics, where will they go? What will be their over-all design in terms of size, shape, weight, color, direction of movement, span of force, and grouping with each other? Then there is the tank's reason for existence, the heavy armament. What forces from the gun can the crew tolerate without too great a loss of efficiency?

An even more basic problem arises in the decision as to whether to use a certain piece of equipment at all; or if it is a necessity, the question often arises as to what fundamental scientific principle it should employ. A possible example is clothing for tankers. Will the gunner operate more efficiently with one type of glove or helmet than another? If he will, and this is shown in an experimental way, then the expense and other difficulties associated with the procurement of special equipment are justified.

The logical implication of all this is the need for coordination between the mechanical engineer, the ordnance expert, and the human engineer. This coordination cannot be accomplished in a hit-and-miss fashion, but only by an intimate exchange



The space limitation in a tank turret is a challenge to the human engineer.

of information throughout the design, redesign, and training process.

As has been stated, the design of equipment from the operator's viewpoint is only one of the skills of the human engineer. The operator can generally operate a given piece of equipment in one way better than another in terms of time and motion. He also learns machine operation more effectively when certain training procedures are employed, and the specific procedures are often variable from one piece of equipment to another. Then there is the problem of selection. Some men are simply not adaptable to the operation of a certain machine, while with another they have little difficulty. These human peculiarities point out the need for scientific job analysis, aptitude test construction, and time and motion study. While the tank has been emphasized throughout this discussion, the principles described apply to any and all of our equipment.

Of course the design of armor machines will inevitably call for compromise. Certain military characteristics are essential to the nature of the equipment, and they more often than not collide directly with characteristics most desirable from the human viewpoint. Here compromise becomes a necessity, and the point of compromise should be partially diagnosed by the human engineer.

In this respect, we encounter in

engineering psychology what the economist is the "law of diminishing returns." It states, in brief, that there is a point beyond which further investment fails to yield proportionate returns. Likewise, there is a point at which increases in the complexity of the machine and the forces it exerts are so great that theoretical improvements fail to yield a proportionate return on the battlefield. Through scientific research, the human engineer can predict this point with a fairly high level of confidence.

In summary, then, it would appear that increased application of scientific psychology to the machine problems of Armor is economically and militarily desirable. The logical need for an emphasis on this approach is obvious when one considers the tremendous cost in money, time, and material of armor equipment and the training of personnel.

The technical advancement of machines must be accompanied systematically with an increased knowledge of the men who must operate them, and who are an indispensable element in the control system. Otherwise we flirt with "machinitis," a disease which brings us to perceive machines as taking ground and winning battles. Inefficiency, lost lives and battles; these are the fruits of an illusion which can make the "Arm of Decision" a pious hope on the field of battle.

THE REPLACEMENT SYSTEM

by MAJOR GENERAL CHARLES L. SCOTT

DURING World War II, I made numerous efforts to find out what system was being followed in the various theaters for estimating needs and for handling and assigning replacements. It was difficult to get a clear and definite picture of the work.

After several readings of replacement data I came to the conclusion that, rather than a definite over-all system, a hit or miss procedure was followed, tailored to suit the ideas of each theater. I agree with the Patch Board that the replacement system in the war was a failure due to poor estimates, poor handling and misassignment of personnel, not to poor training in the United States. Certainly this was true of Armored Force replacements.

In World War I, I was in the Remount Service of Quartermaster Corps, where I purchased, trained, conditioned and issued horses and mules for the Army. I feel sure that five classes of animals—riding, draft and pack horses, and draft and pack mules—were far more efficiently handled in that war than were human replacements for the arms and services in World War II. The Remount System put horses and mules, by class, where they were needed and when they were needed at the front, and far more effectively than the Replacement System did for personnel in World War II. The remount organizations in the States and overseas were similar in operation. They talked the same language and kept in close contact with each other. The understanding and teamwork in all animal matters such as estimates, organization and operation, did not exist in the personnel replacement system in World War II.

In the late war all of my service

was spent in the Replacement System for the Armored Force. In my commands the training and issue of more than a quarter million men was either conducted or thoroughly inspected. The opinions expressed here are based upon this work and this source of information.

I am convinced that replacements should be trained and handled from the training center to the front line by the arm or service requiring them. The most demoralizing sight I have ever seen occurred early in World War II at Shenango, Pennsylvania, where combat replacements for Infantry, Artillery, Armor, etc., were being handled by the Service Command. Efficiency and morale were restored at once when Army Ground Forces took over this work at Fort Meade, Maryland, and Fort Ord, California.

In stating that the failure of the replacement system of World War II was due to misassignments and poor estimates, and not training in the United States, I am *sure* this is true of Armored replacements. At *no time* was there *any* complaint of lack of training of *Armored Force* replacements. There are on record numerous commendations, official and personal, from many sources, as to the efficiency of this training. The first one received was from the North African Theater early in 1943 (General Camp's report as observer in this theater). This report stated in effect that "the Armored Force replacements were the only ones sufficiently and properly trained and were not only efficient as armored replacements but also as infantry unit replacements."

This fact is mentioned not because other arms did not later give as good training as Armor but to stress the following important points which I

believe were essential to assure good training. They are not revolutionary, but are just based on common sense.

First: Upon assuming command of ARTC in August of 1942, I got authority from General Devers, then commanding the Armored Force, to hold over training battalions not needed at this time as replacements and to give them two weeks of *field training* not then given to replacements.

Second: Upon initiating this field training, a whole day was spent testing and questioning each trainee on all subjects given in previous training and finally in getting his ideas on training. This test revealed these extremely important matters: That the company clerks were keeping the paper record of a man's training but there were no steps taken to assure that this record conformed with actual training. As a result, some men carried as tank driver had not driven, while others carried as gunner hadn't fired, etc: That the soldier himself didn't know what subjects should be covered in training, how he had been rated in the ones covered, or what his MOS was: That he had never been asked for any suggestions or any opinion on training: That men absent or sick for a week or more rarely ever made up the training they had missed but were issued at the end of training period just the same.

Third: To correct these conditions I decided to bring the trainee as fully as possible into his training and to give him some check on the main instruction he should receive. Therefore, he was issued a small durable card, similar in size to a driver's license or identification card. This card showed the small arms training, the machine guns to be fired, vehicles to be driven, and tank weapons to be

fired, and opposite each was a space for rating the proficiency attained. The men carried these cards to training in their wallets and the instructors entered their rating thereon after the completion of each subject. Finally, at the end of training the company commander entered the job the man was best qualified for such as "tank driver," "tank gunner," "rifleman," etc., assigned his MOS and signed it. Very few lost these cards and they were easily replaced in training. Men called them "our diplomas" and they *kicked* if any training was omitted. These cards at first got through to Fort Meade, Maryland, where they were reported most useful, and then to units receiving men in the active theaters. Unsolicited reports praised them highly as just what was needed to show training of men and to help in proper assignment. However, after six months they were taken up and destroyed at embarkation points as "violating security measures" and "as unnecessary paper work."

Fourth: Men of each battalion, before being shipped out, were questioned on their training and were asked for suggestions. They contributed many valuable ideas as to where time was too long or too short, where instruction was most effective and where it was poor. A surprisingly large number desired manuals and reading material on tanks, gunnery, etc. As a result, a book store was established where as many as 10,000 training manuals were purchased in a training cycle. Also, the Armored School provided free for this purpose a number of very valuable pamphlets on driving, motor maintenance, gunnery and tactics. They were simple, profusely illustrated, and far more readable and understandable than the dry, finely printed, complicated government-issue literature. Invaluable as training aids, they were issued free. This leads me to state here that sometime I think in our training methods and procedure we forget that we have highly intelligent soldiers the majority of whom know how to read and write and so can instruct themselves for military duties just as they do for school work.

Fifth: Most of the subjects taught at this time (August, 1942) were in the company where an NCO was struggling to put over 26 *subjects* to 12 men. This can no more be done

in instructing an individual in the Army than it can be done in high school, college or in officer education. So each training regiment was required to conduct training by committees in 5 sections, namely: 1. General subjects; 2. Small arms; 3. Vehicle driving and maintenance; 4. Tank gunnery; 5. Field training. It was the unanimous opinion of everyone, officers and soldiers alike, that instruction under the committee system was far better and more thorough than by company. It also was most economical in equipment. (For example, training by company at one period of the war would have required 1,



MAJOR GENERAL CHARLES L. SCOTT is a former commander of the 2d Armored Division, 1 Armored Corps, the Armored Force Replacement Training Center and the Armored Command.

800 tanks in ARTC; by committee only 1,000—savings 800 tanks worth \$80,000,000!)

Sixth: Based on my observation of tank units in battle in the Middle East with the British Eighth Army, the following (not then taught in RTC) were introduced into training: Overhead fire with the machine gun and tank cannon; simple fire problems for tank crews and for tanks within the platoon; booby traps; mine laying and removal. All important subjects previously taught were reviewed and tied in at this training. Men questioned for a year rated this period of field instruction as the best of all instruction given, regardless of the hardships suffered when it was carried out in bad weather, heat or cold, rain or shine.

Seventh: The Armored School

greatly assisted in this work, as officer candidates and specialists such as radio operators, mechanics, etc., were able to participate, thus greatly reducing the overhead in instructors and specialists. It also gave this school personnel practical experience in the field—certainly, too, overseas replacement depots receiving men with this amount and character of training should not require much overhead to carry on effective training.

Eighth: Fortunately the Armored Replacement Training Center was receiving a steady flow of one battalion (1000 trainees) per week. Therefore, I directed that any man missing more than five days of training (which couldn't be made up as a rule) would be transferred to a following battalion. This was a temporary loss of strength to the battalion making the transfer but in the end it was evened out by receipt of men from preceding battalions needing to make up training. This assured *complete training for all men*.

The foregoing eight steps, to my mind, assured turning out a replacement trained in the prescribed subjects and prevented any complaints of lack of training from overseas theaters. It set up a check of his own training by the trainee himself, and he took this seriously, too. Prior to instituting these steps the administrative preparation of records was the all-important work before shipment overseas. These steps made this paper work a *true report of training* and not just good administrative paper work.

In the Armored Replacement Training Center a start was made with competent overhead personnel. As manpower grew short the situation became worse and depots were subjected to numerous changes in policy. "Keep and use over-age men;" . . . "ship over-age men and use 18-year-olds;" . . . "use 4F's, ship 18-year olds;" . . . "ship best of 4F's, keep worst, and use men rotated from active theater." The only trouble then was that all rotated men were being discharged on the point system. I officially recommended the adoption of a new class for overhead "U.U.—utterly useless." Certainly at the start of a major war efforts to conserve personnel serving in U. S. installations and fit for combat duty should begin at once. Retired personnel and over-age and physically defective but mentally ca-

pable individuals should be used first: then wounded and men rotated from active theaters. I found no objection to this work on the part of personnel returned from active theaters except where they, too, were misassigned (for example, an infantryman assigned as an armored instructor).

Early in the war some instructors were obtained from hospitals after being returned from the North African and Italian theaters. Most of them were Regular Army men and were obtained through personal contact (not official action of G1 or AGO). They were our top instructors. Some had lost an eye, an arm or a leg. They taught motor maintenance, tactics, and gunnery. Trainees called them "The Purple Heart Club."

The morale factor in training, I found was invariably tied in directly and almost exclusively to instruction. Poor instruction meant poor morale—high class instruction, high morale. American boys drafted in wartime know a poor instructor from a good one at once. Poor instruction is resented as a waste of time and as a failure in providing a fair chance to exist in battle, and these opinions are all too true.

In the Armored Force, up until November, 1943, all specialist training for clerks, radio operators, mechanics, and specialists of this nature was conducted at the Armored School *after the trainee had his full course of instruction as a fighting soldier and tank crewman.* This I think was correct procedure. Eight weeks of basic training and a nine-week specialist

course at Replacement Training Centers to my mind did not produce a good soldier and provided only a "ham" mechanic and half-way specialist. At one time the ARTC conducted a six-week course for NCO's. The product was highly complimented in the United States and overseas in combat units. "These men are just what we need . . . Up to date in all new equipment and technique, especially good in instructional methods" were the comments received. This instruction was discontinued just before the invasion of Europe when these men were most needed. I believe AFF schools should train all specialists and also some NCO replacements and that replacement centers should have 17 weeks of training for the individual, to include his work within the platoon.

Officer candidates, as a whole were, I believe, quite satisfactory. They furnished a large part of the leaders for the company in combat. They defeated the two enemies—Japan and Germany—who were supposed to be exceptionally well led in battle. Of course, this type of officer lacked instruction in mess management, court martial procedure and other administrative duties because the seventeen short weeks allowed to make them into officers was primarily and properly spent on combat duties and leadership in battle. Therefore, if our nation wants better officers in wartime it should provide more time (and money) to select and instruct reserves in peacetime and for OCS in wartime. I have no patience with the

postwar criticisms of our officer personnel (and "brass hat") so popular in the press, in Congress, among ex-GI's, and elsewhere. It is neither fair nor justified. I think, too, that this is the time to point out the loyalty of the commissioned personnel towards constituted authority and to the *men under them.* This loyalty comes at a time, too, when loyalty is at a low ebb in business, in labor and in politics. Officers might have come back at enlisted men, too, and pointed out that there were some bad and worthless "GI's." However, it is to their everlasting credit that they did overlook this failure of a few men under them and did remain loyal to the vast majority who were exceptionally fine soldiers.

Until all of the complete data of our World War II replacement system is thoroughly studied and digested, I doubt that all of our military agencies will fully appreciate the terrific waste and the other terrible effects occurring from inaccurate and uneconomical estimates for personnel for active theaters and from careless misassignment to arms and services. I point out below some ill effects which I believe occurred for armored personnel.

a. According to my best information from many, many sources, scarcely 50 per cent of the tank replacements of World War II were ever assigned to a tank company. At Fort Knox, 1,000 medium tanks, worth one hundred million dollars, were provided to train them; millions and millions of rounds of 75mm, 90mm, and 105mm and other ammunition—needed, too, in combat—were fired in training them. Millions of gallons of gasoline—needed everywhere else—were also used. And so go the other costs involved in this training. Much of it was wasted by misassignment!

b. Reports from hundreds of sources show that tank replacements issued to other arms were actually needed in armored units; maybe not on the day or in the week when they were misassigned, but within a relatively short period. Having misassigned the armored replacements this error was compounded by sending, to fill armored needs, infantry and other replacements. These men had to be



Infantry replacements on the way to 45th Division at Nettuno, Italy in WWII.

trained, frequently in combat, adding more to the cost and providing, at best, only a makeshift replacement. Thus the fighting efficiency of combat units was invariably lowered by misassignment.

c. I've never seen a soldier thoroughly and properly trained for one arm who didn't prefer service in that arm. Misassignment, therefore, does more than any other act can do to lower morale. The soldier looks upon his basic arm training and his time as being wasted and, furthermore, believes his chances to survive in combat are lessened by his misassignment. I believe the widespread misassignment of personnel is responsible to a large degree for the resentment and criticism which has been evinced by former World War II soldiers toward the Army and their officers.

d. Finally, we do not know how many, but certainly some men were killed for lack of training in one arm when they would have survived if properly assigned.

To me it is most surprising to see that the War Department abdicated in matters pertaining to estimates, organization and operations of a replacement system in a war where replacements, instead of divisions in reserve, were depended upon for continuity of action. As a result, we see that the Army Ground Forces, the Service Command, the Air Force and each theater operated in no coordinated manner, but under different systems and, in many cases, in my opinion, not on any careful estimates, but on *over-estimates* and poor guesses. Of all the high commands, it is also my opinion, that only AGF gave the replacement system a place in its plans and operations worthy of its importance and at the same time made conscientious efforts to keep overhead down and to get proper estimates. Any of its suggestions or recommendations for active theaters received scant if any consideration; thus teamwork was completely lacking, in my opinion.

I believe the following things essential to an effective replacement system for the Army in a major war:

First: A definite, prescribed system and organization for all arms and services are required in order to secure accurate estimates and uniformly



Replacement tankers undergoing instruction near the front lines in Korea.

efficient methods for handling and issuing replacements. The system and organization in the United States and in each theater must be similar in principle.

Second: Arms and services should handle the training and issue of their own replacements in depots in the United States and in each theater. To train by arm and service in the United States and then to have men mixed up overseas and finally issued like sheep out of a chute is a complete and inexcusable waste of everything essential to winning a war.

Third: Where replacements become the main reliance of a theater commander for keeping his armies in continuous operation they assume an importance equal to that of the armies. Therefore, correct estimates, by arm and service, organization of replacement depots, correct issues, etc., become a *major command responsibility* which cannot be delegated to an AGO, to a G1, or to a Service Command.

Fourth: Everyone in the chain of command, everywhere, in peace and in war should be required to study the past inefficient handling of replacements and to understand thoroughly the inexcusable waste of manpower, training efforts and national resources and other ill effects that occur through misassignment and poor estimates.

Fifth: Greater care needs to be exercised in starting replacement depots in the United States so that they have

competent personnel not required in combat and are not continuously disrupted by changes in personnel policies. At the start, therefore, use should be made of retired personnel, over-age for combat personnel, and men with physical defects. Officers and men wounded and rotated home from combat should be utilized as rapidly as possible.

Sixth: We have a highly intelligent class of soldier. Our equipment is becoming more complicated in each war. The vast majority of our men can read and write and, thank God, do some thinking for themselves. If furnished proper reading material and manuals they can instruct themselves in study periods in many ways, thus saving time and overhead, and probably getting better instruction, too.

Seventh: In line with the sixth paragraph, above, I believe we need to radically revise our individual instructional methods for the trainee as pursued by most training depots in World War II. His training as an individual by a corporal in a company is no longer possible. His teamwork in the company will come after the individual training and this individual training, in the future, should follow more closely the individual instructional procedure pursued in our civilian school system and in our officer schools. This means the committee system of instruction by subject, and with personnel expert in the subject taught and in the best instructional methods.

Some Early Thoughts on Armor^{*}

Germany's Minority Spoke Out Against Opposition in 1937

Tank Attack by Fire and Movement

THE layman, when thinking of a tank attack, tends to envisage the metal monsters of Cambrai and Amiens as pictured in the war reports of that period. He thinks of vast wire entanglements being crushed like so much straw; he remembers how the tanks crashed through obstacles, smashing machine guns to splinters beneath their weight; he recalls the terror that they inspired as they ploughed through the battlefield, flames darting from their exhaust pipes, and how this "tank terror" was described as the cause of our collapse on the 8th of August, 1918. Such steam-roller tactics are one—though not the most important—of the things tanks can do; but the events of the last war have so impressed themselves on the minds of many critics, that they have built up an entirely fanciful idea of a tank attack in which vast numbers of tanks massed together roll steadily forward to crush the enemy beneath their tracks (thus providing a magnificent target for artillery and anti-tank fire) whenever and wherever ordered by the high command, regardless of the condition of the ground. The fire power of the tanks is underestimated: the tank is thought to be both blind and deaf: it is denied the ability to hold ground that it has captured. On the other hand every advantage is ascribed to antitank defense: it is alleged that the defense will no longer be susceptible to surprise by tanks; antitank guns and artillery always find their mark regardless of their own casualties, of smoke, fog, trees or other obstacles and ground contours; the defense, too, is always located exactly where the tanks are going to attack; with their powerful binoculars they can easily see through smoke screens and darkness, and despite their steel helmets they can hear every word that is said.

As a result of this picture it follows that tank attacks have no future. Should tanks therefore be scrapped and—as one critic has suggested—the tank period be simply by-passed? If this were done all our worries about new tactics for old arms of the service could be scrapped at the same time and we could settle down comfortably once again to positional warfare as practiced in 1914-15.

^{*}Excerpt from *Panzer Leader*. Copyright 1952 by E. P. Dutton & Co., Inc.

Only it is not very sensible to leap into the dark if you have no idea where you are going to land. *It follows that until our critics can produce some new and better method of making a successful land attack other than self-massacre, we shall continue to maintain our belief that tanks—properly employed, needless to say—are today the best means available for a land attack.* But in order to make it easier to judge the prospects of tank attacks, here are some of the significant characteristics of tanks today.

All tanks intended for serious action are at least sufficiently armored to be impervious to the fire of antitank guns. For fighting against antitank weapons and enemy tanks, such protection is insufficient; therefore the tanks so far ordered by the so-called victorious nations of the World War are considerably more strongly armored. For example, to penetrate the shell of the French Char 2C a gun of at least 75mm caliber is required. If an army can at the first blow commit to the attack tanks which are invulnerable to the mass of the enemy's defensive weapons, then those tanks will inevitably overcome this their most dangerous adversary: and this must lead to the destruction of the enemy's infantry and engineers; since the latter, being shot at by tanks and with their defensive weapons eliminated, can easily be mopped up even by light tanks. However, should the defense succeed in producing a defensive weapon which can penetrate the armor of all the attacker's available tanks, and should he manage to deploy such weapons at the right time and in the decisive place, then the tanks will have to pay heavily for their successes or may even fail altogether if the defense is sufficiently concentrated and sufficiently deep. The struggle for mastery between missile and armor has been going on for thousands of years, and panzer troops have to reckon with it even as do fortress troops, sailors and, recently, airmen. The fact that such a struggle exists, with results that continually vary, is no reason for denigrating tanks as a land weapon: for if we do, we shall be reduced to sending men into the attack with no more protection than the woollen uniforms of the World War which, even then, were regarded as insufficient.

Movement

It has been said, "only movement brings victory." We

ARMOR—November-December, 1952

Fifteen years ago the theory of the use of mobile armor in ground combat was a difficult one to get across. The concept was appreciated by only a small group of visionary soldiers in several countries. In Germany, Heinz Guderian and a few others, in order to offset the vocal opposition to armor, prepared an article expressing the views of the exponents. It appeared in the journal of the National Union of German Officers in the Fall of 1937. Guderian has included it in his memoirs as a part of the chapter on the creation of Germany's armored forces. In view of the singularly interesting parallel with some of today's thinking, ARMOR reprints it with kind permission of E. P. Dutton & Company, Inc., publishers of PANZER LEADER.—ED.

agree with this proposition and wish to employ the technical means of our time to prove its truth. Movement serves to bring the troops in contact with the enemy: for this purpose one can use the legs of men or of horses, the railways or—recently—the automobile and the aeroplane engine. Once contact with the enemy has been made, movement is generally paralyzed by hostile fire. In order to permit the relaxation of this paralysis, the enemy must either be destroyed or made inoperative or driven from his positions. This can be done by employing fire power so superior that his powers of resistance collapse. Fire power from fixed positions has an effective range corresponding exactly to the observed range of the mass of the weapons employed. That is as far as the infantry can make use of its covering fire; when that point is reached the heavy weapons and the artillery must change their position in order to permit a further advance under cover of their fire power. Vast numbers of weapons and an even vaster quantity of ammunition are needed to fight this sort of battle. The preparations for an attack of this sort require considerable time and are difficult to conceal. Surprise, that important element of success, is very hard to achieve. And even if the original attack does catch the enemy unawares, the moment it is launched the attacking force will have shown its hand, and the reserves of the defense will converge on the point of attack and block it; since reserve forces will now be motorized, the building up of new defensive fronts is easier than it used to be; *the chances of an offensive based on the timetable of artillery and infantry cooperation are, as a result, even slimmer today than they were in the last war.*

Everything is therefore dependent on this: to be able to move faster than has hitherto been done: to keep moving despite the enemy's defensive fire and thus to make it harder for him to build up fresh defensive positions: and finally to carry the attack deep into the enemy's defenses. The proponents of tank warfare believe that, in favorable circumstances, they possess the means for achieving this; the skeptics, on the other hand, say that since the element of surprise can no longer be produced as in 1918 "conditions for a successful tank attack can no longer be anticipated." But is it true that a tank attack can no longer take the enemy by surprise? How then does it happen that surprises have been achieved in warfare regardless

of whether new or old methods were employed to bring them about? In 1916 General von Kuhl proposed to the High Command that in order to make a breakthrough primary importance must be attached to the element of surprise in launching the attack, and yet at that time he had no new methods or weapons at his disposal. As a result of surprise achieved, the March offensive of 1918 was outstandingly successful, despite the fact that no new types of weapons were employed. If, in addition to the normal methods of achieving surprise, new weapons are also employed, then the effects of the surprise will be greatly increased; but the new weapons are not a prerequisite to those effects. *We believe that by attacking with tanks we can achieve a higher rate of movement than has been hitherto obtainable, and—what is perhaps even more important—that we can keep moving once a breakthrough has been made.* We believe that movement can be kept up if certain conditions, on which the success of a tank attack today depend, exist: these include among others, concentration of force in suitable terrain, gaps in the enemy's defense, and an inferior enemy tank force. When we are blamed because we cannot successfully attack in all and any conditions, because we cannot storm fortifications with tanks armed only with machine guns, then we can only say that we are sorry and point out that other arms of the service possess in many respects even less attacking power than we do. We do not claim to be omnipotent.

It has been maintained that a weapon only achieves its maximum effectiveness while it is new and before it need fear defensive countermeasures. Pity the artillery! It is already hundreds of years old. Pity the air force! Age is creeping up on it in the form of anti-aircraft. We believe that the effectiveness of any weapon is a relative quality, depending on the effectiveness of the counter weapons employed against it. If tanks run into a superior enemy—whether in the form of hostile tanks or of anti-tank weapons—they will be beaten; their effectiveness will be reduced; if conditions are reversed, then they will achieve startling success. Every weapon is dependent not only on the strength of the opposition but also on its own willingness to make immediate, maximum use of the latest technical developments and thus to remain at the summit of its period. From this point of view

the tank will not admit that it has been surpassed by any other weapon. It has been said: "The shells of the defensive artillery travel faster than the tanks that are attacking that artillery." Nobody, up to now, has questioned this fact. Yet as long ago as 1917 and 1918 hundreds of tanks could be moved up to a concentration area immediately behind the front lines of the infantry: could penetrate in their swarms the enemy's line of defensive fire: could clear a way for dozens of infantry and even of cavalry divisions: and what is more could do all this without any preliminary artillery bombardment, that is to say in the teeth of an intact enemy artillery. It is only in unusually unfavorable conditions that the hostile artillery can have any serious effect on the movement of tanks: and once the tanks have succeeded in breaking through to the gun lines, the batteries will soon fall silent and will thus be no longer capable even of hurting the following infantry. Even the immutable artillery tactics of having guns registered on all localities of possible danger proved a failure in the last war. The defensive fire will throw up columns of earth, dust, smoke and so on and this will limit the vision of the tank crews; but such limitation is not intolerable; even in peacetime we have learned how to overcome that. In fact tanks can now advance through night and fog on compass bearings.

In an attack that is based on a successful tank action the "architect of victory" is not the infantry but the tanks themselves, for if the tank attack fails then the whole operation is a failure, whereas if the tanks succeed, then victory follows.

Fire

Armor and movement are only two of the combat characteristics of the tank weapon; the third and the most important is fire power.

Tank guns can be fired whether the tank is stationary or on the move. In both cases the gun is laid by direct observation. If the tank is stationary range can be quickly adjusted and the target destroyed with a minimum expenditure of ammunition. When the tank is in motion the recognition of targets becomes harder owing to difficulties in observation, but this is compensated for to a certain extent by the fact that the gun is situated comparatively high above ground, which is particularly useful if the terrain is overgrown; thus the high silhouette, which has been so frequently the cause of adverse comment as presenting the enemy with an easy target, is not without a certain advantage for the tank gunner. If it is necessary to shoot while in movement the chances of short-range accuracy are good; they decrease with longer range, higher speed and when travelling over uneven ground.

In any event, in land battles the tank possesses the unique quality of being able to bring its fire power to bear while actually advancing against the enemy, and it can do this even though all the defense's guns and machine guns have not been silenced. We do not doubt that guns fired from stationary positions are more accurate than guns fired in motion; we are well able to judge this, since we are capable of both types of engagement. However: "Only movement brings victory." Now should a tank attack be envisaged simply as a means of steamroll-

ing a path through thick and deep defensive positions held by infantry and artillery fully equipped with anti-tank weapons, as was done during the battles of *matériel* of the last war? Certainly not. A man who would attempt this would be thinking purely in terms of the infantry tank, a weapon whose sole function was the closest cooperation with the infantry, a weapon adjusted to the foot-soldier's scale of time and space values. This was a concept which we hung on to for far too long. We neither can nor wish to devote weeks or even months to reconnaissance; we have no desire to rely on an enormous expenditure of ammunition; *what we do want to do is, for a short length of time, to dominate the enemy's defense in all its depth.* We are well aware that with the limited fire power of our tanks we cannot mount a "planned artillery preparation" or achieve a "concentrated artillery bombardment"; our intention is exactly the contrary, it is to knock out our targets with single, surely aimed shells. For we have not forgotten how during the war week-long barrages by the most powerful artillery on earth failed to enable the infantry to achieve victory. *We have been taught by our enemies to believe that a successful, rapid tank attack, in sufficient width and depth to penetrate all the way through the opposing defense system, can achieve more towards ensuring victory than the system of limited advances as practiced in the World War.* Our shells, being aimed at specific targets, will not whistle over the enemy's heads as they did during those costly though pointless creeping barrages: rather if the attack is carried out with sufficient concentration, width and depth we shall destroy recognizable targets as they present themselves and thus drive a hole in the enemy's defenses through which our reserves can follow more speedily than was possible in 1918. *We want these reserves to be available in the form of Panzer Divisions, since we no longer believe that other formations have the fighting ability, the speed and the maneuverability necessary for full exploitation of the attack and breakthrough.* Therefore we do not regard the tank force as an additional means for winning battles, which on many foreseeable occasions could, in cooperation with other weapons, help the infantry to advance. If that were all that tanks were for, the situation would be the same now as in 1916; and if that were true then one might as well be resigned to positional warfare from the very beginning and give up all hope of quick decisions in the future. But neither the alleged superiority in armaments of our enemy in any future war, nor the increased accuracy and range of guns of all calibers, nor the technical advances made in the employment of artillery suffice to shake our beliefs. On the contrary! In the tank we see the finest weapon for the attack now available: we will not change our minds until such time as the technician can show us something better. We will in no circumstances agree to time-wasting artillery preparation and the consequent danger of losing the element of surprise, simply because the old maxim says that "only fire can open the way to movement." We believe, on the contrary, that the combination of the internal combustion engine and armor plate enable us to take our fire to the enemy without any artillery preparation, provided always that the important conditions for such an operation are fulfilled: suitable terrain, surprise and mass commitment.

Reviews
Best Sellers
Magazines
Ads and Notices
Directory

THE BOOK SECTION

A Service to You!

10% Discount: On orders of
\$10.00 or more

PREPAID POSTAGE: When pay-
ment accompanies order.

SPECIAL PREPUBLICATION
PRICE ADVANTAGES

A PICTORIAL RECORD OF THE WAR BETWEEN THE STATES

DIVIDED WE FOUGHT. By Hirst Milhollen, Milton Kaplan and Hulen Stuart. Editor: David Donald. New York. The Macmillan Company. 452 pp. \$10.00.

Reviewed by
DR. GEORGE TANHAM

This is at once a courageous but hazardous undertaking to present in one volume the story of the American Civil War in pictures and contemporary drawings. It was not intended for the professional historian nor the serious student of military affairs, although both will find it interesting, but for the average citizen who may be interested in one of his country's most difficult periods. There can be little dispute over the advantages of this pictorial method of education and historical presentation. A picture often serves as a thousand words. But at the same time there are serious drawbacks.

It is difficult, if not impossible, to pictorially present issues, personality and character, and strategy. Without a clear notion of these factors a history of the Civil War is less meaningful and perhaps even inaccurate. A narrative does to some extent mitigate these disadvantages but never completely overcomes them. This volume, due to the great care and knowledge of the editors, illustrates the many advantages and is not greatly plagued by the inadequacies of the pictorial method.

The production of a one-volume account of an event of such scope

The Authors

Hirst D. Milhollen has been associated with the Library of Congress for 26 years. He is author of "Old Virginia Courthouses" and co-author of "Presidents on Parade."

Milton Kaplan has been with the Library of Congress for ten years. He compiled the catalogue "Pictorial Americana" and is co-author of the book "Presidents on Parade."

Hulen Stuart assisted Mr. Milhollen and Mr. Kaplan in the selection and compilation of the pictures and in assembling caption material for "Divided We Fought."

David Donald, who edited the text of "Divided We Fought," has been a teaching fellow at the University of North Carolina and assistant professor of history at Columbia University.

The Reviewer

Dr. George Tanham is a graduate of Princeton University. He served as an artillery officer with the 7th Armored Division in World War II. Holding M.A. and Ph.D. degrees from Stanford University, he is now in England on a one-year fellowship at Oxford University, on leave from his regular post of assistant professor of history at California Institute of Technology, where he teaches European history and a course on the history of modern war.

and duration as the American Civil War presents two serious problems. With photographs covering only certain portions of the war, and, because of the technical limitations of the period, none of action, the editors were faced with the difficulty of presenting a full and complete coverage of the war. The solution arrived at—omission or very limited coverage of those parts of the war of which few pictures were available and the use of drawings by contemporaries for the action pictures—although at times giving an unbalanced impression, seems satisfactory. A second problem was to present an accurate and well proportioned account of the war which would at the same time explain and correspond with the pictures. Here the device of quoting from participants and contemporary observers is mainly used. Since the written portion is very limited and these quotations are often wordy and not exactly to the point, it might have been better to write a concise narration to fit the selected pictures. It is a worth-while plan to have the war explained by this method, but if the intended reader is not familiar with the basic historical facts it may tend to confuse rather than enlighten him.

It seems strange that in a pictorial history the editors have not included one visual aid to geography, namely a map. In this popular account a few clear maps, not necessarily geographically detailed or militarily precise, would have made the strategy and maneuvering of the armies more understandable to the layman unfamiliar with the geography of Virginia and the other battle areas. The dissection of the Confederacy, includ-

Illustrations from DIVIDED WE FOUGHT



COMMAND. Grant (leaning over bench) in council of war at Bethesda Church, '64.



BATTLE. Forbes' sketch of Custer's capture of South's guns at Culpeper CH.



DEATH. The stone wall below Marye's Heights, Fredericksburg, on May 3, 1863.

ing Sherman's famous march to the sea, would be much clearer, as would McClellan's and later Grant's advances towards Richmond. The raids of Stonewall Jackson up the Shenandoah Valley and Lee's thrusts into the north could be revealed so vividly by a map.

The Civil War was well photographed, due to the efforts of Matthew Brady and his assistants, but certainly not as well as World War II, as the publisher claims on the jacket. Even with the thousands of photographs available there were gaps in the coverage of the war. The editors made trips to the south to obtain pictures of the Confederate Armies which were not so well attended by photographers as the Northern, and whose records in defeat were not so well kept. In spite of every effort and the collection of thousands of photographs, the western campaign could not be well covered, the pictorial role of the navy was only partially available, and photographs of certain leaders were not obtained. From the great collection the editors selected nearly five hundred for inclusion in this volume. David Donald, assistant professor of history at Columbia University, is general editor and author of the text.

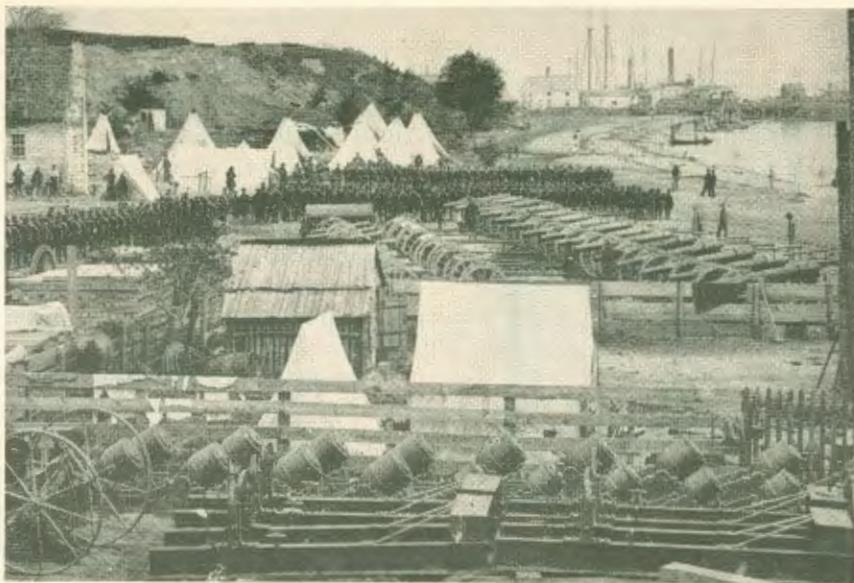
The book in general satisfies the reader that all possible aspects of the war are covered. However, the viewer is given too many opportunities to try his skill at the game of judging the character and intelligence of leaders by their photographs, and there are many obscure Civil War generals pictured. There are approximately one hundred and twenty-five single portraits, almost all of generals, many of whom played minor roles or distinguished themselves only briefly. It seems a little out of proportion to devote nearly one-fourth of the pictures to such individuals, thus tying the narrative to them. Although portraits probably dominated the collections, many could perhaps have been omitted in favor of other aspects of the war. The public will certainly want to see the leading generals of both sides, and a few of the lesser ones, but not every general who slightly distinguished himself, and some who hardly did that.

The life of the soldier of both sides is shown in its many aspects. He is pictured in full dress uniform, on

parade, in battle, in fortifications, at rest, and in training. His everyday thoughts as well as his feelings in battle, defeat and victory, are revealed by the quotations from men on both sides. The average soldier of the Civil War in many respects was like his twentieth-century counterpart. He liked to name his miserable huts or holes in the ground, just as the "GIs" did in World War II. With no language barriers there were occasional opportunities in quiet sectors for short conversations and some bartering between the soldiers of the Blue and the Gray. At times informal agreements were made as to when the sharpshooters would shoot and when they would not, similar to arrangements between the French and the German troops in World War I on duty near the Swiss border. The dullness and inactivity of war is shown, and the soldier, then as now, solved this boredom with a little whiskey, some poker, "bull sessions," and a great deal of healthy grumbling.

There is a good chapter on the naval aspects of the war. An excellent picture on page 259 shows with simplicity and stark reality the end of most of the blockade runners. The crew of the *Monitor* are shown in their untidy daily garb, and six United States Marines are shown in all the splendor of that corps. Amphibious operations are described, but unfortunately there are pictures only of the forts and cities which opposed these landings. Inter-service rivalry then as now appeared and, with the exception of General Sherman, the navy was dissatisfied with the army generals and felt, justifiably the editor feels, that the army took too much of the credit and glory for the landing operations. In the narrative the crucial role of the navy is explained and its successful accomplishment of its assignment is fully stated.

The drawings and sketches are particularly good and very useful in the understanding of the battles. There is a good one of the Union position at Spotsylvania, another of the battle of Chickamauga, and a wonderful panorama of Gettysburg. The drawing of the wounded soldiers escaping from the burning forest at the Battle of the Wilderness shows the terror on the faces, and the hopeless position of some of the more



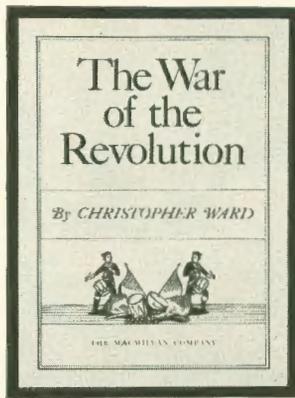
LOGISTICS. Union ordnance ready for transfer from the port of Yorktown.



NAVY. Effect of fire from C.S.S. Virginia on the turret of the U.S.S. Monitor.



DESTRUCTION. Ruins of rolling mill and train on Georgia Central Railroad.



by Christopher Ward

2 Volumes—Boxed—40 Maps

Comprehensive and alive with incident and colorful detail, Christopher Ward's THE WAR OF THE REVOLUTION is a remarkable account of the military aspects of the American Revolution. Here are graphic portrayals of the fortifications, the terrain over which the battles were fought, the part the Indians played, the technology of gunnery and the hundreds of details that go to make up the broad scope of the War of the North, the War of the South, and the War of the Border.

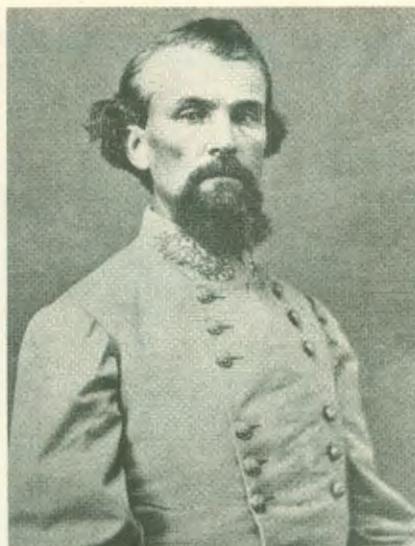
\$15.00

severely wounded. The charge of Brigadier General Francis Barlow's men at Cold Harbor reveals the confusion of battle, and shows how much dispersion modern weapons have effected in battle action. The great area covered by a Civil War army and its means of supply is clearly shown by the sketch of Sheridan's supply wagons which, with their white tent covers, extend as far as the eye can see.

The book includes some of the minor but fascinating episodes of the war. Dr. Lowe's balloon in which he ascended to observe for the northern forces is a picturesque forerunner of the present-day army's light avia-

tion. Further wars and for realism, there are pictures of dead and wounded, of leveled villages, and of the whole pattern of military destruction.

In a more constructive sense the excellent engineering work of General Haupt, often forgotten, in repairing and maintaining the vital railroads of the north, is shown and described. There are personal interest stories such as the one not always related about Grant, that he was not anxious to bring up his artillery to slaughter the fleeing mass of Confederates at Appomattox. The overall strategy and some tactics are interspersed with the general narrative while the significance of such battles



LEADER. Gen. Bedford Forrest.



LEADER. Gen. J. E. B. Stuart.

tion. The lovely actress Pauline Cushman, who served so successfully as a Yankee spy, is shown in the only portrait of a woman in the book. "Silver Spoon" Butler, sent by Grant to threaten Lee by landing on the James River below Richmond, was "hermetically sealed" at Bermuda Hundred, and his subsequent grandiose defense schemes are described in a comic vein.

The coverage in this volume is so broad that some aspect should interest every reader. Besides the pictures of soldiers performing their duties, there are sketches and photographs of places where battles took place and one knows just what Bull Run looked like at the time of the war. For those who feel that the horrors of war should be used to discourage

as Antietam is explained in a military and diplomatic sense. The home fronts are not forgotten and the role of public opinion is pointed out. Both North and South should be pleased with the objective accounts of battles as well as the appraisals of men.

Divided We Fought serves well its purpose, to give the American people an interesting and accurate pictorial account of the Civil War. The narration is sound and, in spite of some lack of proportion, due to the necessity of staying with the pictures, presents an accurate account of the war. The technique of quotations adds flavor at some expense to explanation. The book requires time and leisure. A second perusal will not prove disappointing.

New Books for Christmas

SECRET TIBET

by Fosco Maraini

The savage mountains of Tibet, the shrines, the fierce (and foul-smelling) tribesmen are all here, and with them a great deal about the way Tibetans live and think, about their arts and ships and their jobs\$6.50

KOREAN TALES

by Lt. Col. Melvin B. Voorhees

Personal observations on the Korean War throwing light on personalities and accomplishments of the generals, the conduct of the press, the South Koreans, the political confusions, the thoughts and feelings of the fighting men, and the problems of the various U.N. units \$3.00

SOVIET OPPOSITION TO STALIN

by George Fischer

Two important facets of the Soviet resistance to Stalin are examined: one, the group of Soviet citizens and soldiers who followed Andrei A. Vlasov, after their capture by the Germans; and two, general resistance, passive and active, to Stalin \$4.00

THE TURBULENT ERA:

by Joseph C. Grew

The memoirs of a career diplomat, based on his full diaries, speeches, letters, and other documents. He gives so complete an account of his various diplomatic posts as to make this virtually a source book for future historians. 2 vols.\$15.00

THIS I BELIEVE:

The Personal Philosophies of 100 Thoughtful Men and Women by Edward R. Murrow

Including Pearl Buck, William O. Douglas, Fulton Oursler, Sister Elizabeth Kenny, Eleanor Roosevelt, and others, with a brief biography of eachPaper \$1.00, Cloth \$3.00

FREE INDIA IN ASIA

by Werner Levi

India's position and relations in Asia carefully documented. Based on personal observation and contact with Indian leaders by the author of "Fundamentals of World Organization" \$2.75

GEORGE ROGERS CLARK:

Soldier in the West

by Walter Havighurst

Combines thorough knowledge of frontier life with real literary merit, and thereby brings to life the exploits of this early campaigner and explorer in Kentucky and the Northwest\$3.00

SWORD AND SWASTIKA

by Telford Taylor

A history of the internal strife, dirty politics, and opportunism that transformed the German military staffs from the proud professional warriors of 1918 to the greedy and power-mad incompetents of 1940\$5.00

RUSSIA: A History

by Sidney Harcave

Russian culture, economy, religion, politics and warfare from the appearance of the first Slavs on the Russian Plain to our own day ...\$7.50

ETHICS IN GOVERNMENT

by Paul Douglass

A very timely book in this election season\$2.50

THE WAR SPEECHES OF WINSTON S. CHURCHILL

A three-volume set of Churchill's speeches, beginning with a warning in May, 1938 through World War II to the final victory\$15.00

THE TAMING OF THE NATIONS

by F. S. C. Northrop

Other aims of our foreign policy, the author believes, must be subordinated to demonstrating that many cultures can exist side by side in harmony\$3.75

TOWN FATHER:

A Biography of Gamaliel Painter by W. Storrs Lee

Revolutionary soldier, sheriff, judge, industrialist, and founder of Middlebury College and of the town of Middlebury, Vermont, Gamaliel Painter was colorful representative of the Yankee. The humorous and lively biography of a man and a town\$3.75

JANE'S FIGHTING SHIPS -1952-53

by Raymond V. Blackman

The 54th edition of this valuable reference book. Much new material has been added, with photographs, drawings, and statistical data, including recent developments in the principal world navies\$22.50

A MIRROR FOR AMERICANS

Social and cultural life in America from 1790-1870 as seen through eyes of travelers is described vividly in these three unusual volumes: "Life in the East," "The Cotton Kingdom," and "The Frontier Moves West." Taken from actual eyewitness accounts, this unique portrait of daily life in America is richly varied and well illustrated. Each Vol., \$5.00; 3 Vols., boxed \$14.50

THE WHITE RABBIT

by Bruce Marshall

The true story of Wing Commander Yeo-Thomas and his work during World War II behind German lines organizing French Resistance \$2.75

THE YUGOSLAVS

by Z. Kostelski

A clarifying picture of the Yugoslavs who for many centuries have defied all invaders\$4.75

TROOPERS WITH CUSTER

by E. A. Brininstool

A revised and expanded edition, with many new illustrations, of a small book entitled "Trooper with Custer," by the same author. .\$.50

THE FORGOTTEN REPUBLIC

by Clarence A. Manning

An insight into the three Baltic Republics, Latvia, Estonia and Lithuania\$2.75

DEVELOPMENT OF THE GUIDED MISSILE

by Kenneth W. Gatland

All available facts on the evolution of guided missiles up to the present time and their possible future development\$3.75

MANIFEST DESTINY

by Stringfellow Barr

The author contends that our present foreign policy has failed us and we focus too much on U.S.-Russian Affairs\$3.50

THE NEW BREED

by Andrew Geer

The story of the U.S. Marines in Korea in 1950-51 vividly told by a Marine field officer. Not only a history but human pictures of privates, lieutenants, colonels, their experiences and reactions\$3.50

I DREAMT REVOLUTION:

by William Reswick

A Russian-born American correspondent, who spent more than twelve years in his native land after the revolution, reveals inside information about the battle for power after the death of Lenin\$4.50

BIRTHDAYS OF FREEDOM

by Genevieve Foster

This volume, the first of two, opens with the Declaration of Independence, then goes back to trace freedom from the beginning of history to 500 A.D.\$2.75

ABRAHAM LINCOLN

by Benjamin P. Thomas

The best one-volume life of Lincoln. By destroying many of the accepted legends about Honest Abe, it makes him a real man and in our opinion, a greater man\$5.75

Armor Magazine Index — Vol. LXI, 1952

AUTHORS

	No.	Page		No.	Page
Albin, Lt. Col. Leon	6	20	Pickett, Lt. Col. George B., Jr.	4	34
Breisky, 1st Lt. William J. No. 3, p. 46	5	46	Plummer, Capt. Frederick A.	4	21
Brigham, Maj. Eugene V.	6	39	Prosser, Maj. Lamar McF. No. 1, p. 20	6	70
Brown, Maj. Jack G.	5	34	Raley, Capt. J. T.	4	21
Broyles, Capt. Stewart F.	6	20	Reagor, Lt. Col. Elmer C.	2	20
Bruce, Capt. A. D., Jr.	2	28	Rigg, Lt. Col. Robert B.	4	23
Burke, Capt. John T.	6	46	Roth, Sgt. Conrad J.	5	22
Burns, 1st Lt. Robert L.	5	38	Ryan, Col. John L., Jr.	2	30
Byorum, Lt. Col. Henry M.	2	19	Ryman, Col. Dean E. No. 4, p. 39	5	51
Carey, Lt. Col. M. L.	3	54	Scott, Maj. Gen. Charles L.	6	50
Catherell, Capt. Robert S.	5	56	Shaw, Dr. Roger No. 2, p. 37	5	40
Clark, Maj. Gen. Bruce C.	6	42	Smith, Capt. James C.	5	6
Cleveland, Lt. Col. Edward K.	4	20	Smith, Capt. Lloyd E., Jr.	4	22
Cogswell, Sgt. John N.	5	23	Stilwell, Capt. James L.	6	20
Collins, Gen. J. Lawton	1	6	Stockton, 1st Lt. Thomas W.	1	36
Collins, Sgt. Melvin R.	5	20	Streiff, Capt. Richard W.	4	38
Doan, Brig. Gen. L. L. No. 1, p. 30	6	42	Tanham, Dr. George	6	73
Dolvin, Col. Welborn G. No. 2, p. 6	6	6	Thompson, Capt. William R.	6	20
Evans, Lt. Col. Holly H.	2	17	Throckmorton, Lt. Col. J. M.	2	21
Fait, Sgt. Thomas G.	5	22	Traber, Lt. O. W., Jr.	1	42
Falls, Cyril	1	51	Turner, Lt. Col. Charles G.	2	19
Fox, Lt. Col. Victor B.	6	18	Underhill, Garrett	6	28
Fox, W. T. R.	4	61	von Quast, August-Viktor	3	24
Freedman, Capt. Sam	5	24	Waddell, Capt. Edward S.	6	20
Frost, Col. Herbert H.	2	49	Walson, Lt. Col. Charles W.	6	12
Fuller, J. F. C.	1	50	White, Maj. Gen. I. D.	5	28
Greear, Col. William H.	4	28	Wischnesky, Sgt. Albert H.	5	20
Guderian, Heinz, <i>et al</i>	6	54	Woods, Lt. Col. John O.	2	18
Haynes, Capt. Luther S.	6	20	Wyatt, Lt. Col. William O.	2	15
Hinton, Capt. Edgar A.	6	20			
Icks, Col. Robert J.	6	25	TITLES		
Kohlmeier, L. B.	4	46	Address before the U. S. Armor Assn., Collins..	1	6
Lavoie, Lt. Col. Leon F.	5	10	Adjustment to Atomic War, The, Prosser.....	1	20
Lord, Dr. Francis A. No. 3, p. 34	4	51	Armor Association:		
McFalls, Lt. Col. Carroll, Jr.	1	28	Annual Report of Sec.-Treas.-Editor (Year		
Marquand, John P.	3	4	Ending 1951)	1	16
Mason, F. Van Wyck	3	57	Award to Armor ROTC Cadets	3	19
Merrill, M Sgt. James D.	2	42	Constitution and By-Laws	1	18
Miller, Sgt. Dale J.	5	21	Report of 63d Annual Meeting	1	12
Montross, Lynn	5	59	Notice of 64th Annual Meeting	6	17
Morrison, 1st Lt. James L., Jr.	6	63	Resolutions in Support of	6	45
Mullen, Maj. James J.	6	58	Armor Officer Candidate, The 1952, Kohlmeier..	4	46
Munzel, Oskar	1	22	Armored Artillery is the Thing! Lavoie.....	5	10
Norman, Lt. Col. Brooks O.	3	54	Armored Engineer Support (Sum and Substance)		
Ogorkiewicz, Richard M. No. 3, p. 10	5	16	Albin, No. 6, p. 20; Broyles, No. 6, p. 21;		
Olmsted, Maj. Gen. George H.	3	20	Thompson, No. 6, p. 21; Hinton, No. 6, p. 22;		
Pace, Frank, Jr.	3	40	Haynes, No. 6, p. 23; Waddell, No. 6, p. 23;		
Patton, Beatrice Ayer	6	10	Stilwell	6	24
			Armor's Military Stakes	2	46
			Armor's New Forge for Leaders, Rigg.....	4	23
			Artilleryman is the Thing, The, Brigham.....	6	39
			Atomic Background, The	4	6
			Atomic Gun, The Army's, Pace	3	40
			Astro-Frankenstein, Shaw	5	40

	No. Page		No. Page
Book Reviews:		Patton, 48, The	4 14
"Cross-Channel Attack," Fuller	1 50	Pictorial Feature:	
"The Lorraine Campaign," Falls	1 51	Battlefield Tank Recovery in Korea	1 28
"Legend Into History," Frost	2 49	Tank Rebuild in Japan	2 28
"Rag, Tag and Bobtail," Mason	3 57	New M47 Medium Tank Ready for Armor	
"Panzer Leader," Fox	4 61	Troops	3 32
"George Washington" (Vol. V), Montross...	5 59	Battlefield Bunker Busting	4 32
"Divided We Fought," Tanham	6 73	Armor's Amphibious Mobility	5 32
Breakthrough at Bely, August-Viktor	3 24	Army's Atomic Gun	6 40
Bunker Destruction by Tank Cannon, McFalls..	2 10	Preventive Maintenance—A Command Respon-	
Combat Tank Driving (Sum and Substance):		sibility, White	5 28
Collins, No. 5, p. 20; Wischnesky, No. 5, p. 20;		Reconnoitering:	
Miller, No. 5, p. 21; Roth, No. 5, p. 22; Fait,		The Association Presidency	1 4
No. 5, p. 22; Cogswell	5 23	Recipe for ARMOR	3 44
Combat Training for the Tank-Infantry Team,		A Fissionable Matter	4 4
Ryan, Jr.	2 30	"The Trade Journals of War"	4 5
Conduct of Fire Trainer	3 56	Another Award	6 4
Cooperation in Counterthrust, Stockton	1 36	Reichswehr and Republic, Traber	1 42
Cowboys in Khaki, Breisky	5 46	Replacement System, The, Scott	6 50
Development of Joint Operations Plans, Greear	4 28	Security for the Free World, Olmsted	3 20
Editorial:		Soldier's Reading, A, Patton	6 10
Let's Not Lose Division Vision.....	2 4	Some Early Thoughts on Armor, Guderian, <i>et al</i>	6 54
Writing American Military History	2 5	Some Thoughts on Discipline, Mullen	6 58
Armor—Characteristically American Arm... 4	18	Soviet Armor Tactics, Munzel	1 22
The Ground Soldier	5 14	Soviet Armor Tactics: Seelow Operation, The	
On an Army-Wide Association and an Army-		(Anonymous)	2 24
Wide Magazine	6 16	Story of Soviet Armor: Assault Guns, Underhill.	6 28
Officer Candidate School	6 17	Tactical Employment of Light Aviation With	
18,000 Engineers, Breisky	3 46	the Armored Division, Smith	5 6
Extracts From Early Issues of This Magazine:		Tankers at Heartbreak, Freedman	5 24
No. 1, p. 49; No. 2, p. 41; No. 3, p. 53; No. 4,		Tank Identification for Training, Fox.....	6 18
p. 13; No. 5, p. 15	6 69	Tank-Infantry Teamwork (Sum and Substance):	
Federal Recruiting and Drafting in the Civil War,		McFalls, Jr., No. 2, p. 16; Evans, No. 2, p. 17;	
Lord	4 51	Woods, No. 2, p. 18; Turner, No. 2, p. 19;	
Garry Owen and Glory, For, Morrison, Jr.	6 63	Byorum, No. 2, p. 19; Reagor, No. 2, p. 20;	
Gas Turbines for Tanks? Ogorkiewicz	5 16	Throckmorton	2 21
Human Engineering: A tool for Armor, Burke..	6 46	Tank-Infantry Teamwork in Korea, Norman and	
Inquiry Into the Military Mind, Marquand.....	3 4	Carey	3 54
Liddell Hart: One View, Icks	6 25	Tanks in Positional Warfare, Walson.....	6 12
Little Things That Count, Merrill	2 42	Tanks in the Infantry Division, Dolvin.....	2 6
M47 Medium Tank, The Army's New.....	3 30	Task Force Crombez at Chip 'Yong-Ni,	
Mobile Antitank Weapons in Armored Warfare,		Pickett, Jr.	4 34
Dolvin	6 6	Task Force Hazel to Ch 'Unch'on, Brown	5 34
Mobile Artillery in the Team (Sum and Sub-		Ten Ages of Tank, The, Ogorkiewicz	3 10
stance): Cleveland, No. 4, p. 20; Raley, No. 4,		Three Civil Wars, Shaw	2 37
p. 21; Plummer, No. 4, p. 21; Smith	4 22	Top Command in Europe, The	3 42
New Armored Division Organization, The, Clark		Top Command in the Far East, The.....	2 22
and Doan	6 42	Training Tank Crews, Doan	1 30
News Notes: No. 1, p. 40; No. 2, p. 44; No. 3,		Training the Tank Crew Replacement, Burns... 5	38
p. 48; No. 4, p. 42; No. 5, p. 44	6 60	Trends in Armor (Armored School Presentation)	1 33
Non-Judicial Punishment for Minor Offenses,		Turkey's Armored School, Wyatt	2 15
Ryman	5 51	U. S. Military Academy: Class of 1952 Armor	
Obsolescence or Renaissance? Prosser	6 70	Graduates	3 9
Officer And a Gentleman, An, Ryman	4 39	What Would You Do? (Armored School Presen-	
Operation Fleaborne, Streiff	4 38	tation), No. 1, p. 46; No. 2, p. 34; No. 3, p. 50;	
		No. 4, p. 58; No. 5, p. 48	6 66
		You Need Tanks to Train Tankers, Cutherell..	5 56