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CENTRAL INTELLIGENCE AGENCY
WASHINGTON 25, D. C.

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MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : MILITARY THOUGHT (SECRET): "Antinuclear Protection of Troops in Disposition Areas", by Colonel V. Zakharov and Engineer-Designer Ya. Ioffe

1. Enclosed is a verbatim translation of an article from the SECRET Collection of Articles of the Journal "Military Thought" published by the Ministry of Defense, USSR, and distributed down to the level of division commander.

2. For convenience of reference by USIB agencies, the codeword IRONBARK has been assigned to this series of TOP SECRET CSDB reports containing documentary Soviet material. The word IRONBARK is classified CONFIDENTIAL and is to be used only among persons authorized to read and handle this material.

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Richard Helms
Richard Helms
Deputy Director (Plans)

Enclosure

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cc: The Director of Intelligence and Research, Department of State

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The Director for Intelligence, The Joint Staff

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Following is a verbatim translation of an article entitled "Antinuclear Protection of Troops in Disposition Areas", which was written by Colonel V. Zakharov and Engineer-Designer Ya. Ioffe.

This article appeared in Issue 5 (60) of 1961 of a special version of the Soviet journal Military Thought which is classified SECRET by the Soviets and is published irregularly. Issue 5 (60) was sent to press on 25 August 1961. [redacted]

[redacted] Comment: Military Thought is published by the USSR Ministry of Defense in three versions, classified RESTRICTED, SECRET, and TOP SECRET. The RESTRICTED version has been issued monthly since 1937, while the other two versions are issued irregularly. The TOP SECRET version was initiated in early 1960. By the end of 1961, 61 issues of the SECRET version had been published, 6 of them during 1961.

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Antinuclear Protection of Troops in Disposition Areas

by

Colonel V. Zakharov

and

Engineer-Designer Ya. Ioffe

The development of the means of armed combat has always been accompanied by corresponding changes in the forms, methods and means of troop protection on the field of battle.

To a large extent the success of combat operations under modern conditions depends on the ability to keep personnel unharmed and combat and transport equipment intact before and during operations. In this connection, the providing of adequately reliable protection for troops in their disposition (concentration) areas from enemy means of mass destruction constitutes one of the important problems of modern military art.

The positive solution of this problem requires complex employment of various methods and means of troop protection; as is known, among the basic ones are: proper troop dispersal, periodic and sudden changes of areas occupied by units and large units, the full use by troops of the natural protective and concealment characteristics of terrain, and the engineer preparation of main and alternate troop disposition areas in short periods of time.

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The dispersal of troops within the areas they occupy must be such that not more than one motorized rifle company or an equivalent subunit can be put out of action by one nuclear warhead with a yield of 8 to 10 kt. To meet this requirement it is necessary that the distance between adjacent companies be equal to at least two effective casualty radii for exposed personnel and to the mean deviation of a missile (bomb) from the point of aim.

According to general conclusions, light combined injuries inflicted upon unprotected personnel by a shockwave, penetrating radiation, and light radiation from ground and surface bursts of nuclear charges with an 8 to 10 kt yield usually take place at distances of 1.4 to 1.6 km from ground zero (center) of the burst. At the same time, the mean probable deviation of a guided missile from the point of aim, e.g., that of a "Corporal II", is approximately 300 m. Consequently, under conditions which we are discussing, such subunits as a company must occupy disposition areas which are at least 3.5 km apart from each other.

Calculations show that this condition can be met only if the disposition (concentration) area of a division equals 750 to 800 km^2. However, the size of disposition areas designated for a division in the course of exercises in most cases is 250 to 450 km^2. A greater dispersal of motorized rifle and tank divisions would seriously hamper the control of combat operations of units and subunits and should be employed as one of the methods of their antinuclear protection only within tactically permissible limits.

Besides, dispersal alone is often not enough to protect troops from nuclear /missile weapons of the enemy. For example, if three nuclear strikes of 100 to 500 kt are delivered simultaneously by the enemy against a division disposition area of approximately 250 km^2, the shockwave alone can cause a loss of up to 50 percent of the division's personnel. Counting combined injuries, these casualties will be even higher. It is evident that the dispersal of division units in this size area for the purpose of protecting army and front troops from enemy nuclear/missile strikes has to be supplemented by other measures.

Periodic and sudden changes of the areas of troop disposition is another such measure and, as shown by the experience of a number of large-scale troop exercises, it is quite effective. However, this maneuver is still seldom used by units and large units. In our opinion, the main reason for this is that the existing forms and methods of engineer preparation of the terrain during the preparation of an offensive or defensive operation, as a rule, permit large units and units to outfit only one disposition area each. Therefore, when they suddenly leave these areas, troops are compelled to settle in areas which, from an engineer point of view, are either insufficiently prepared or not prepared at all. As was stated above, this is very risky in view of the modern means of destruction.

In this connection, it is now more necessary than ever before to carry out engineer preparation of main and alternate troop disposition areas within the shortest possible periods of time.

On the basis of experience gained from World War II and from postwar troop exercises, it is

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known that the time required for engineer preparation of the terrain in the disposition areas of units and large units is influenced mostly by the following factors: the conditions of the combat situation, the protective and camouflaging characteristics of the terrain, weather conditions; the time of the year and day; the types of engineer structures used for the concealment of personnel and for combat and troop transport equipment; and the degree of mechanization of the principal engineer work.

Each of the above-mentioned factors has a different influence upon the nature and the length of time needed to complete engineer preparation of the terrain in troop disposition areas. For example, the manpower and equipment requirements for identical engineer preparation of troop disposition areas may differ by as much as 1.5 to 3 times, depending on the natural protective and camouflaging characteristics of the terrain, on the nature of the ground, and on time of the year. The manpower and equipment requirements for the engineer preparation of disposition areas for large units and operational formations may vary considerably depending on the types of engineer construction used in building shelters for personnel and for combat and transport equipment.

Table 1 presents our comparative data on the labor force, in man/days, and the engineer equipment in machine/shifts, which are required to prepare dug-out shelters for combat equipment; the following categories of engineer equipment are used for personnel: I - slit trenches; II - blindages of unjointed construction; III - shelters of unjointed construction; IV - shelters made with manufactured components (KVSU, FVS, and others); and, looking somewhat ahead, V - using organic armored carriers of large units and units as shelters for the bulk of personnel.

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Table 1

Objects of engineer preparation	I man days	I machine shifts	II man days	II machine shifts	III man days	III machine shifts	IV man days	IV machine shifts	V man days	V machine shifts
	Various types of engineer preparation									
Disposition zones of four motorized rifle divisions	23160	1578	56640	1578	79440	2210	37160	2210	16760	1440
Disposition zones of two tank divisions	11520	820	26240	820	35200	1112	17660	1112	8840	732
Siting area of operational tactical missile brigade	710	34	1390	34	1850	47	990	47	431	47
Siting area of an AA missile regiment	530	45	1250	45	1738	58	904	58	526	58
Combat positions and disposition area of an army artillery regiment	550	33	1470	33	2100	46	940	46	940	46
Combat positions and disposition area of a tank-destroyer brigade	1330	72	3660	72	5690	122	2420	122	1820	107
Army control points	1140	27	1140	27	1140	27	1140	27	210	16
Disposition areas of army special units and large units	9600	730	23400	730	32700	1030	15300	1030	6500	930
Total (in round figures)	48600	3340	115200	3340	[illegible]	4650	76500	4650	38000	3380

The degree of mechanization of the basic work has a very strong bearing on reducing the time required for the engineer preparation of troop disposition areas, and in some instances may reduce it by several times. For example, it is known that in the engineer preparation of terrain in connection with the construction of shelters for tanks, armored carriers and trucks, an average of approximately 45 percent of all mechanized earth-moving means are used. Therefore, by insuring the full intrenchment of the main combat and transport equipment of troops through the use of detachable bulldozing equipment, with which all tanks and artillery prime movers are now being outfitted, it will be possible to achieve almost a twofold reduction in the amount of time required for the engineer preparation of troop disposition areas. It follows from the above that in order to reduce sharply the time for the engineer preparation of terrain and simultaneously improve the protection of troops in areas occupied by them, it is necessary, first of all, to strive for an even further improvement in the shelters used by the troops and to increase considerably the degree of mechanization of the basic engineer work.

Table 1 shows that the use of personnel shelters made from manufactured components allows approximately a twofold reduction in the time required for the engineer preparation of troop disposition areas. However, it should be remembered that the preparation of such structures and the transporting of them when the troops move require a considerable expenditure of manpower and means.

Calculations show that in order to provide reliable protection from modern means of destruction for all the personnel of a motorized rifle division in its disposition area, it is necessary to erect approximately 850 shelters; to transport the structural components of these shelters may require as many as 450 trips by a ZIL-151 type vehicle. In addition, about the same number of trips will be required to transport a second set of shelters, without which, according to the experience of a number of exercises, it is practically impossible to prepare in good time a new divisional disposition area, from an engineering standpoint. Obviously, such a number of motor vehicles could not be spared.

Besides this, no adequate protection is provided for personnel during the fairly long period of time needed for the construction of shelters out of manufactured components and while they are on the march.

Obviously, there is a need for fundamentally new types of shelters which would provide protection for personnel against the modern means of destruction, not only at disposition sites, but while on the march. At the same time, the erection of such shelters in troop disposition areas should require a minimum amount of time.

Analysis of ways of practically solving this problem leads to the conclusion that modern armored carriers may be considered as sufficiently reliable protection from the enemy means of mass destruction for the personnel occupying them.

These functions can be assigned to armored carriers for a number of reasons. In the first place, because the postwar development of ground troops has been characterized by a sharp increase in the number of armored carriers in combined-arms large units and units. Thus, a Soviet motorized rifle division has 365 armored carriers and a tank division has 352, and they can accommodate a significant part of the personnel of a large unit. A similar development is also evident in foreign armies: an American infantry division has 196 and an armored division has 604 armored carriers; West German divisions have 223 and 464 respectively; French divisions

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have 257 and 773; and British brigade groups have 278 and 181 armored carriers.

Secondly, because the postwar development of armored carriers has been proceeding primarily along the line of improving their roadability, increasing their armor protection, installing closed bodies, and providing hermetically sealed hulls to ensure buoyancy (Table 2).

Table 2

Army	Types of armored carriers	Basic data			
		Passenger capacity	Armor thickness in mm	Body Type	Amphibious
USSR	BTR-50PK	22	10	closed	yes
	BTR-152K	15	13	closed	no
	BTR-49	16	13	-	yes
USA	M75	12	12 to 30	closed	no
Great Britain	"Saracen"	12	19	closed	yes
France	"Hotchkiss"	7 to 12	20 to 40	closed	no

Thirdly, as shown in Table 3, armored carriers disposed in open trenches may be compared to shelters of light construction so far as their resistance to destruction and damage from the shock wave of a nuclear burst is concerned. Special protective camouflage coverings installed over armored carriers would provide even more reliable protection for the personnel from the main destructive factors of a nuclear burst.

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Table 3

Degree of damage	Radius of destruction from nuclear burst in meters.					
	8 kt		30 kt		150 kt	
	Surface burst	Air burst	Surface burst	Air burst	Surface burst	Air burst
Armored carriers disposed in open trenches.						
Total destruction......	200	170	300	260	470	470
Partial damage	300	380	480	580	750	975
Slight damage	525	550	800	875	1400	1450
Shelters of light construction						
Total destruction.....	200	160	350	280	550	440
Partial damage	350	280	550	440	950	780
Slight damage	400	320	600	480	1000	800

Thus, armored carriers with closed bodies protected from penetrating radiation by protective camouflage covering and equipped with filter-ventilation installations represent a good means of transportation and of protection of personnel from modern means of destruction. Use of such armored carriers as the basic cover for personnel will permit a sharp reduction in the time required and a radical change in the forms of engineer preparation of troop disposition areas. Thus, the use as shelters of armored carriers with closed bodies permits a reduction by 4.5 times in the manpower requirements for engineer preparation of disposition areas for army troops.

Besides, it is known that the most important consideration for troops in disposition areas is the ease and speed with which they can be moved forward to appropriate lines to conduct combat operations. For this reason, it is most advisable to locate units and subunits in columns along prearranged routes, thus eliminating the extra time which would otherwise be spent in forming the columns, and reducing possible casualties from enemy means of mass destruction by approximately 1.5 times. The use of armored carriers facilitates to a large degree the linear disposition of troops immediately next to the routes within disposition areas.

Calculations show that all the engineer preparation within a motorized rifle division disposition area may be completed within 5 to 6 hours if the organic armored carriers (with closed bodies) are used as shelters for the division's combat personnel, and if shelters for the rest of the personnel are made from flexible covers and if detachable bulldozing equipment and high-productivity excavating machines are used for digging trenches. Meanwhile, the bulk of personnel of the division will be provided with adequate protection within the first two or three hours.

On terrain high in protective and camouflaging features, shelters for armored carriers may be located so as to be protected by natural cover without additional intrenchment. Thus, adequate protection from enemy modern means of destruction will be provided for the troops immediately upon their arrival at the new disposition area.

Under modern conditions it is most important not to allow troops to remain in the same areas too long. For this reason it is now important to prepare for each unit one or two alternate disposition areas in addition to the main area. The high mobility of troop operations in a nuclear/missile war requires that a given task be accomplished within the shortest possible time, estimated at 2 to 3 hours.

To ensure the intrenchment of army troops in their disposition areas within 2 to 3 hours and to carry out the amount of work shown in Table 1 (3380 machine/shifts) will require about 16,500 bulldozers (or sets of detachable equipment) and excavators with a productive capacity of 50 to 60 m^3 of earth per hour. In reality however, an army of present-day organization has approximately 300 units of this type of equipment; and in addition it may get up to 114 units of similar mechanized equipment from the composition of engineer-siting (inzhenerno-pozitsionnaya) units of the front. With this amount of mechanized equipment the earth-moving work in a disposition area of army troops will take as long as 8½ to 9 calendar days, this is totally unacceptable under present-day conditions.

In order to carry out the earth-moving work in a troop disposition area within the required time, it is necessary either to have appropriate detachable buildozer equipment for every 3 or 4 combat and transport vehicles in army units and large units or to increase sharply the productive capacity of the mechanized earth-moving equipment of army engineer large units and units.

An increase in the amount of detachable equipment for transport and combat vehicles obviously would lower the maneuverability of the large units and units on the whole, as well as individual combat (transport) vehicles. At the same time, the work which has been going on for many years to develop a sufficiently effective detachable operating component for intrenchment for basic types of motor vehicles and armored carriers has not yet produced any satisfactory results.

In the past years, new machines for digging various types of trenches have been made available to engineer troops. For example, the MDK-2 and MDK-3 machines have a productive capacity of 500 to 1000 m^3 of earth per hour. With the help of one of those machines, shelters for one or two tank companies can be dug within one hour. This means that ten excavating machines of the MDK-3 type are capable of digging shelters for all the tanks of a division in one hour, while a detachment of twenty such machines can complete all the earth-moving work in the disposition area of a division within 9 to 10 hours.

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However, even these periods of time for carrying out earth-moving work in troop disposition areas are still too long. They can be shortened up to 2 or 3 hours either by employing larger numbers of earth-moving machines of the MDK-3 type, or by designing special machines with higher productivity for use by engineer units.

In our opinion, the latter method is the most suitable for the conditions of preparing and conducting modern operations. At the same time, the latest achievements of our science and technology make it fully possible to design excavating machines with a productive capacity of 10 to 15 thousand m^3 of earth per hour. For example, an excavator with a productive capacity of three thousand cubic meters of earth per hour was built at the Novo-Kramatorskiy plant in 1960.

The possibility of making excavating machines with an hourly productive capacity of more than 10 thousand m^3 has been substantiated theoretically and proven by experiments. Let us examine the basic methods of solving this problem.

The first method is by rapidly loosening the soil by a simultaneous, uninterrupted, and very vigorous working over of the entire surface of the area to be excavated (zaboy). The second method is based on the principle of collapsing the earth; and on this basis to develop machines which ensure an uninterrupted undercutting of the lower portion of the excavation area, forcing the entire mass of earth to collapse and fall directly onto the conveying device of the machine, and then discharging it in a dump (breastwork).

The most productive, compact, and reliable operating component which can serve as machines of the first type is a frontal-type cutter-borer (freza-bur lobovogo rezaniya). The principal advantage of such an operating component is an uninterrupted cutting of earth by each blade in a spiral with a pitch corresponding to the feed. While the blades of a cylindrical cutter cut into and disengage from the earth with each revolution, thus having only 20 percent of all the knives doing the work simultaneously, a cutter-borer does not have this deficiency. It can work at higher speeds, permits a more compact design of a drive system for application of a high torque of power and axle feed, and is easily fitted to a personnel carrier and to the device for cutting frozen ground. In consideration of these and several other advantages, we consider a cutter-borer to be the most suitable operating component for excavating machines designed for high-speed digging of shelters.

The task of excavating frozen ground may be accomplished by using steam-cutting operating components built as a system of knives cutting into frozen ground by the combined action of feeder force and rocking, facilitated by softening of the ground by steam released from openings in the cutting knives. In this way, the frozen layer of ground is divided into strips 1 to 1.5 meters wide by the steam-cutting knives and then broken up into separate chunks by the forward movement of the machine. The performance of a steam-cutter used on frozen ground was checked by us experimentally under appropriate conditions. Those experiments fully corroborated the theoretical calculations and produced highly satisfactory results.

The machines of the second type, based on the principle of forcing the earth to collapse along the entire width of the excavation area, differ favorably from the machines of the first type in that they make the undercut ground collapse under its own weight. This creates a large flow of earth passed directly to the conveying devices of the machine.

Experiments which we conducted while studying conditions of collapsing the soil proved that an uninterrupted undercutting action of the machine creates an overhang in the soil which collapses every time the angle of repose characteristic for the given type of soil is exceeded. Simultaneously, it was established that the operating components of machines of this type, in addition to an uninterrupted powerful advance against the front of the excavation area and leveling off of the bottom surface of the area, must also ensure an uninterrupted undercutting of the base of the area along its entire width, a rapid removal of the lower supporting layers (front and side slopes of the area), and an uninterrupted intake and removal to the dump of the collapsed masses of earth.

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On the basis of the above-stated findings we have come up with three feasible versions of construction design of an excavating machine with a productive capacity of not less than ten thousand m^3 of earth per hour.

The first version of such a machine (Sketch 1), in addition to the principle of collapsing the earth, also ensures the loosening of the earth along the entire width of the excavation area. Digging of shelters would be accomplished by an uninterrupted undercutting of the base of the excavation area by a powerful conveyer equipped with special teeth for loosening and picking up the soil. The conveyer is divided along its width into sections of 1 to 1½ m. Installed on hinged posts above the conveyer along its entire surface are powerful rocking, cutting, double-action "jaws". The posts and the "jaws" are installed at the front end of the conveyer to permit the face of the excavation area to be worked over. The machine keeps moving by means of its caterpillar drive against the face of the excavation area and keeps undercutting its base. As a result, the overhanging mass of earth collapses directly onto the conveyer, on which it moves to a disc-like ejecting device and is piled in breastworks, one on each side of the shelter being excavated.

The productivity of a machine of this type is mostly limited by the capacity of the conveyer. The operational speed of the conveyer, 1.5 to 2 m. per second, fully ensures the removal of 10 thousand cubic meters of earth per hour. The diesel engine required for this machine must have approximately 700 hp.

In the second version of an excavating machine (Sketch 2) of the boring-ejecting type, the operating component is a rotor frontal thrust cutter-borer. The borer is equipped with seven radial blades attached to the central bushing and connected by a single ring along the perimeter. Special pulverizers (rykhlitel) are attached to the blades of the borer in a staggered pattern; thus, instead of a cutting action, there is a shearing of the earth along the line of least resistance. The diameter

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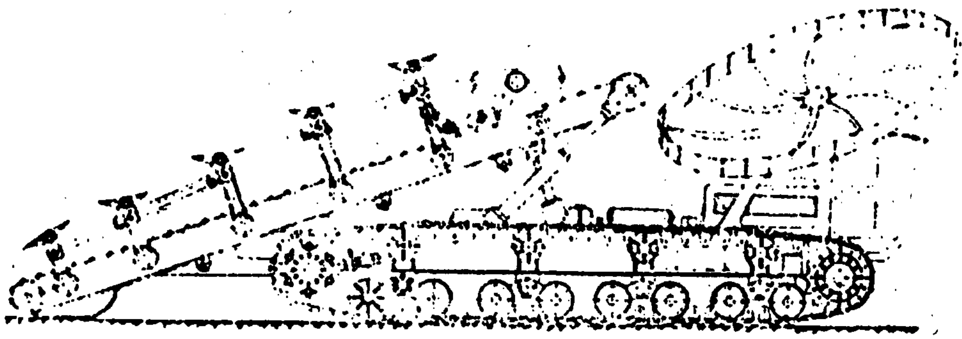
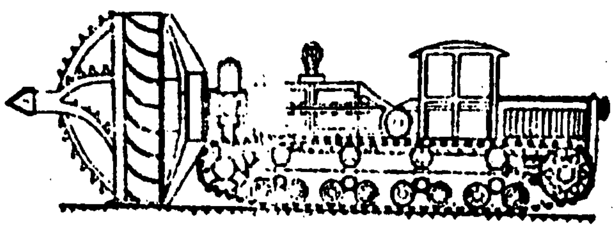


Sketch 1.



Sketch 2.

of the cutter-borer is 3.5 to 4 meters. Being rotated by the main drive shaft and simultaneously feeding [3 or 4 words missing] of the machine, the borer penetrates the earth to a prescribed depth. At the same time, each pulverizer continuously shears the earth along the spiral at a prescribed pitch. Under the pressure of the wall of the excavation area, the earth which is sheared off by the knives is thrown back, where it catches the blades of the ejecting device and is thrown by centrifugal force onto the breastwork. The distance the earth is thrown is up to 7 to 10 meters, and the earth is evenly distributed along the breastwork of the shelter. When necessary, the distance the earth is ejected may be regulated by turning the control lever. The operating components of the machine (borer, ejector, and gear box) may be lifted or lowered by two hydraulic jacks.

The combination of borer and ejector without an intermediate conveyer in this version considerably simplifies the design of the machine and reduces its dimensions, allowing the machines to be used in pairs when necessary. When used in pairs, the frames of the two machines are coupled together by powerful high-speed universal joints. The machines are equipped with push-button control from the cab. A 750 hp engine is required to ensure a productive capacity of ten thousand m^3 of earth per hour.

The third version of an excavating machine is of a boring-shearing type (Sketch 3). This machine removes soil simultaneously on two horizontal levels (under winter conditions, 1.5 to 2 m thick from the upper frozen layer and 1.5 to 2 m thick from the unfrozen lower layer). The lower layer of earth is removed first, thus making an undercut approximately half of the height of the excavation area. In order to regulate and force the collapsing of the earth, the machine is equipped with a system of powerful teeth which effectively break up the overhanging ground. This same system is also designed to remove the frozen layer which is first broken up into chunks by the combined action of the pressure of the moving machine and the cutting of the steam-cutting teeth.

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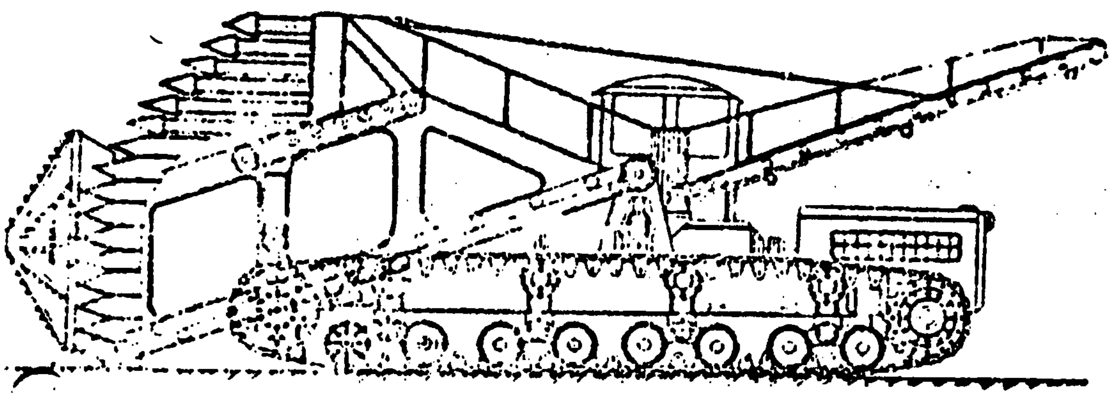

Sketch 3

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The system of separate processing of the two levels, which is necessary under winter conditions, is easily incorporated into a single universal construction design. Therefore, the operating components of this version are equally suitable for work under difficult winter conditions, as well as for the forced collapsing of the upper, overhanging layer of the excavation area in the summer, in which case it collapses quite readily even under its own weight.

The operating components for cutting the lower level comprise two rotor cutter-borers installed in front on a swivel frame. The borers with a frontal thrust action are equipped with 7 to 10 radially installed blades, to which are attached in a staggered pattern the same type of pulverizers as are on the second version. Borers are activated by caterpillar tracks and by the slow forward movement of the entire machine. The main shaft of the borer protrudes forward somewhat and comes to a drill point: this ensures its centering, the cushioning of the shock when the borer hits rock, and the processing of the soil along the diameter of the hub of the borer. The earth is thrown upon the conveyer belt by the pressure of the earth of the excavation area (zaboy) pushing the cut up earth back while the machine presses forward.

Removal of the processed earth of the upper and lower levels is accomplished by two independent conveyers from which the soil moves onto the ejector and is thrown onto the breastwork of the trench. The ejector can rotate in either direction, thereby permitting the earth to be piled on both sides of the shelter.

The machine has an engine with 700 to 1000 hp. While in operation the machine moves along the floor of the shelter; thus, it fits well in the shelter and does not protrude above the surface of the ground. The machine can move on field roads at approximately 25 km p/h. Its specific pressure of 0.5 kg per cm^2 permits it to move over completely roadless terrain in the worst of weather conditions.

All the aforementioned types of high-productivity machines may be utilized in the large-scale construction of various dug-out shelters for combat and transport equipment during the preparation of troop disposition areas. When conditions are favorable, they may also be used for making concealed routes for the movement of troops inside the area or from one area to another.

Considering that troops are disposed in their areas by subunits in columns along the routes of their movement, it seems to us that the principal type of shelters to be used for combat and transport equipment should be group shelters for 2 or 3 vehicles each. When building these in main and alternate troops disposition areas removed 50 to 100 km or more from the front lines, the total volume of excavation work is reduced considerably without affecting in the least the degree of protection that combat and transport equipment have from enemy nuclear strikes.

Thus, when digging a shelter for a medium tank it is necessary to remove 58 m^3 of earth; when digging a group shelter for two tanks, 100 m^3 ; and when digging a shelter for a tank platoon, 140 m^3 of earth (an average of 50 and 47 m^3 per tank respectively). When digging shelters for an automobile or an armored carrier, it is necessary to remove 58 m^3 of soil for one vehicle, 80 m^3 for two vehicles, and 120 m^3 for three vehicles. These figures show that group shelters reduce the volume of excavation work by 30 percent in comparison with single shelters, and at the same time facilitate a more effective use of high-productivity excavating machines. A detachment of 7 or 8 such machines is capable of completing the entire excavation work in the disposition area of a motorized rifle or tank division within two hours.

If a front, instead of having the present inadequately equipped engineer-siting brigades and the engineer works directorate (upravleniye inzhenernykh rabot-UIR), had one engineer-siting brigade with 48 to 50 units of the aforementioned high-productivity machines, it would be possible, using the manpower and means of such a brigade, to carry out the engineer preparation of one main or alternate disposition area for the troops of an entire army every two hours.

The method of using engineer-siting units equipped with high-productivity excavating machines may vary.

The idea has often been stated in the press that, because of the extreme importance attached to troop maneuver in modern warfare and because of the decisive role this maneuver can often play in reducing casualties among troops from enemy nuclear missile strikes, it is necessary to prepare in advance along the routes used by large units and units for the maneuver an adequate number of shelters for personnel and for combat and transport equipment. It therefore follows that in conducting a modern offensive operation, as a rule, troop disposition areas must be prepared along the routes and be outfitted from an engineer viewpoint in advance, primarily by the forces and means of engineer units and subunits.

Calculations show that in a disposition area of one motorized rifle (tank) division the overall volume of excavation work carried out in digging shelters for personnel and for combat and transport equipment represents approximately 165 thousand m^3. Completion of such an amount of work within $1\frac{1}{2}$ to 2 hours would require 11 or 12 high-productivity machines. Even with a daily rate of advance of 80 to 100 km, this amount of machines along the principal axes of advancing troops would make it possible to prepare, from an engineer standpoint, at 15-20 km intervals, disposition areas which could accommodate one motorized rifle (tank) division. Thus, the necessary prerequisites will be created for periodic changes by troops of their disposition areas, and at the same time the task will be accomplished of preparing routes used by troops in regard to antinuclear protection.

Besides, this type of engineer preparation of disposition areas will make it unnecessary for combined-arms units and large units to have in their composition a large amount of various engineer machines and attachment-type equipment, which lower the mobility of troops. At the same, favorable conditions will be created for periodic changes by troops of their disposition areas, a factor which is extremely important.

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In addition to digging trenches when necessary (in areas where the terrain lacks sufficient natural protective and camouflaging features), high-productivity machines may also be used for rapid preparation of concealed routes of movement of separate units and large units between main and alternate troop disposition areas.

Specifically, a trench 3.5 to 4 m wide and 2.5 to 3 meters deep, with a reinforced tread roadway, can serve as such a route. The tendency to utilize such trenches as concealed routes for the movement of subunits was started back in the days of World War II. For example, troops of the Soviet Army used trench-routes (rov-put) for maneuvering in the Sandomir base of operations and in the area of the Mius River; and German troops used them in the area of Mga Station on the Leningrad front.

Can such trench-routes provide the necessary protection against the damaging effect of nuclear weapons for units and subunits while they are moving? Calculations and appropriate experiments show that trench-routes of the aforementioned dimensions do offer a sufficiently high degree of protection. Thus, troops moving along the bottom of a trench at the moment of a nuclear burst would not be subjected to the effect of the velocity head. Overpressure in a trench reaches its maximum point more gradually than it does on the surface of the ground. Because of this, the destructive effect of the shock wave in the shaded area is almost twice as weak (when the faces of the trench run at about a 90 degree angle to the line of direction of ground zero of the burst). In order to prevent the shock wave front from moving along the trench-routes for any appreciable distance, the latter must be dug in a zig-zag pattern.

The dose of penetrating radiation at the bottom of a trench-route is approximately 12 to 40 times less than on the surface of the ground. The damaging effect of light radiation on troops moving along the bottom of the trench-route will also be considerably less than on the surface of the ground, since they will be shielded from it to a great extent by the breastwork and by the slope of the trench. A trench-route can considerably weaken the principal damaging factors of a nuclear burst and, when necessary, can ensure the concealed movement of units and subunits in separate sectors of their itineraries.

The use of armored carriers with closed bodies and equipped with filter-ventilation installations as the principal shelters for personnel and the extensive employment of high-productivity excavating machines for the digging-in of combat and transport equipment will allow the complete engineer preparation of disposition areas for large units and operational formations to be carried out within the periods of time required by modern conditions, and thereby provide adequately reliable protection for troops from the means of mass destruction. Besides this, it provides broad opportunities for highly maneuverable troop combat operations. At the same time, during any maneuver of large units and units, their personnel is provided the same protection against all enemy modern means of destruction as when disposed in an area of concentration which is well prepared from an engineer point of view.

The employment of armored carriers with closed bodies and filter-ventilation installations sharply increases the capabilities of troops to cross at high speeds large zones of radioactive contamination with high levels of radiation.

Thus, the combination of employing armored carriers with closed bodies as personnel shelters, the use of high-productivity excavating machines, and the tactically permissible dispersal of troops in areas occupied by them permit a successful solution of the problem of reliable protection of troops in disposition areas, and facilitate the execution of periodic changes of these areas, depending on the specific conditions of an operational situation.