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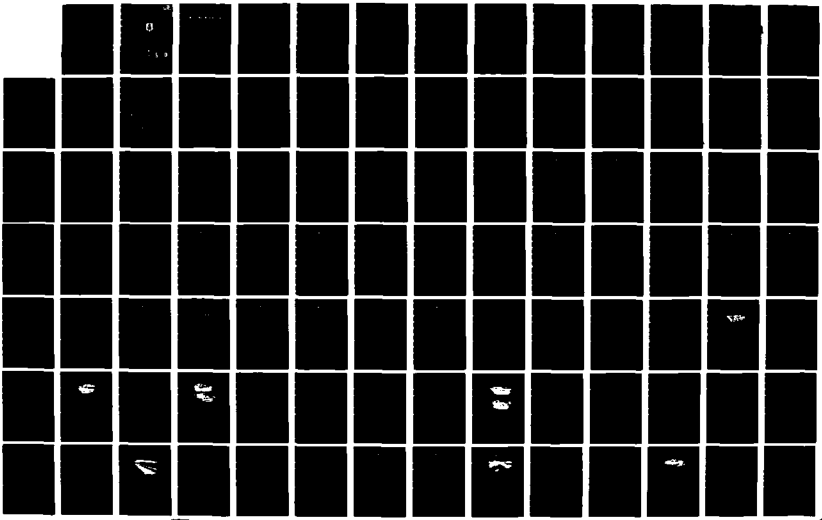

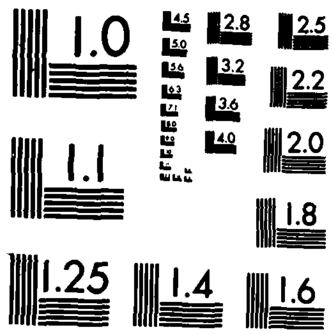

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FOREIGN TECHNOLOGY DIVISION

AIR FORCE SYSTEMS COMMAND

ENGINEERING PROVISION OF ASSAULT CROSSING OF RIVERS

by

I.F. Lysukhin

FOREIGN TECHNOLOGY DIVISION

UNEDITED MACHINE TRANSLATION

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ENGINEERING PROVISION OF ASSAULT CROSSING OF RIVERS

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U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*<u>ye</u> initially, after vowels, and after ъ, ь; <u>e</u> elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

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ENGINEERING PROVISION OF ASSAULT CROSSING OF RIVERS.

Docent, candidate of military sciences Colonel

I. F. Lysukhin.

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In the book are opened the content and the methods of the execution of basic engineer support missions with assault crossing of rivers on the move, with deliberate preparation/training and in the special conditions. Are given practical recommendations regarding the organization of the engineering provision of assault crossing rivers. Are given the short characteristics of ferrying means/facilities and their use/application under the contemporary conditions.

In King is also shown the value/significance of rivers as obstacles are presented the views of the command element of the army of the USA on the use of water obstacles in the defense. In the applications/appendices are placed reference data with respect to the engineering provision of assault crossing rivers.

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Introduction.

The troops/forces in the course of combat operations are forced to overcome rivers, channels, estuaries, lakes and other natural barriers/obstacles. Under the contemporary conditions when limit of advance of units and subunits increased and the rates/tempos of offensive combat increased, for the troops/forces it is necessary considerably during the Great Patriotic War, to more frequently than overcome water obstacles.

Assault crossing rivers is one of the most complicated phases of battle, which requires large skill in organization and provision of combat activity of the troops/forces, high morale of personnel, their resoluteness and persistence with the execution of assigned mission.

In the last war Soviet army showed the models unprecedented in the history of the successful assault crossing of rivers. With the large skill were forced Deene, Dnepr, Dniester, Vistula, Oder, Tissa, Morava, Danube, Elba, Amur. In this case the majority of them was forced on the move, under the conditions of the successful development of offensive or pursuit of the waste/exiting enemy. Our troops/forces without prolonged preparation/training, in proportion to output/yield to the river, captured existing and equipped new crossings, fast overcame water obstacles and is continued decisive attack.

Assault crossing rivers can be realized on the move with the successful development of offensive and the pursuit or with deliberate preparation/training in short periods under the conditions of direct contact with the enemy on the river line, and also after the unsuccessful assault crossing of river on the move. Assault crossing rivers on the move is considered as the basic method of overcoming the water obstacles.

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In the contemporary conditions during the careful organization of assault crossing and sufficient reinforcing by crossing means the troops/forces have all possibilities for overcoming the water obstacles at the high rate/tempo. Important role in this case plays comprehensive engineering provision.

The engineering provision of assault crossing water obstacles is a very complex problem. This complexity depends on the fact that together with the accomplishment of ordinary missions by the provision of offensive appears the need for the crossing of units and subunits through the water obstacles in those combat formations which are required for combat on the opposite shore and advance into the depth of the defenses of enemy without a considerable descent in the general/common/total rate of advance. The retention/preservation/maintaining rate of advance in many respects will depend on the possibility of the simultaneous crossing of motorized rifle subunits with the artillery and the tanks, with a sufficient density, necessary under the normal conditions of offensive.

The appearance of nuclear weaponry introduced basic changes in the character of the combat operations of the troops/forces with assault crossing of rivers. In connection with this arose new engineer support missions.

As a result of nuclear attacks on the routes of approach to the river can arise large/coarse destruction, obstructions, fires and zones with high radiation levels. Furthermore, during the burst of nuclear mines/fougasses in the water and on the coasts as a result of the formation of earth shaft around the craters can sharply change the mode/conditions of river, the configuration of river bed and the character of coastal terrain, which will create supplementary difficulties for the attacking troops/forces. All this will require the introduction of substantial changes into the organization and the methods of execution of the engineer support missions of assault crossing. In connection with this the value/significance of engineers and engineering provision of assault crossing rivers considerably rises.

Theoretical positions/situations and practical recommendations are set forth on the basis of the requirements of contemporary all-arms combat, presented to the engineering provision of assault crossing water obstacles under the conditions of applying new combat materiel.

The author expresses sincere gratitude to the lieutenant general of engineers A. N. Tarasov, to colonels A. F. Gontarev, M. S. Bublikov, V. A. Shchedrov and I. N. Nikolayev for the valuable advice/councils for content and formulation of the book.

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Chapter One.

RIVER OBSTACLES AND CONDITIONS FOR THEIR OVERCOMING.

Rivers in combination with the obstacles and the destruction exert a substantial influence on the character of the combat operations of the attacking troops/forces. They can lower the rate of advance of attacker, deprive the possibility of introducing into activity simultaneously all available forces, squeeze freedom of maneuvering and at the same time create favorable conditions for the effective use/application of nuclear weaponry by that defending.

With providing of the troops/forces with modern combat equipment, especially by tanks, the value/significance of rivers as obstacles, at the present time is not decreased.

For successful overcoming of rivers is required not only the detailed provision of combat operations of the troops/forces, but also a precise knowledge of the character of water obstacles and their possible change in the process of assault crossing. The degree of the effect of river obstacles on the rate of the crossing of the troops/forces and offensive on the opposite shore is determined by the properties of river itself (by width, by depth, with rate of flow, by the character of the soil of the bottom, coasts and valley, by the presence of fords and hydraulic engineering constructions), by season and by weather conditions, and also by character of the adjacent terrain and defense of enemy on the water obstacle.

The width of river is one of the most important factors, which characterize it as obstacle. According to the width the rivers are divided conditionally into the narrow ones (to 60 m), the averages (to 300 m) and the wide ones (it is more than 300 m).

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The width of water obstacles is variable. It depends on the season and character of the terrain over which the river flows/occurs/lasts. The greatest width of river they usually achieve in spring flood and the seasonal floods. In the individual sections the width of river can be strongly increased as a result of tolerances, created with the aid of the water-engineering constructions.

The width of river barrier/obstacle depends, furthermore, from building/structure of river bed. The river beds of rivers are usually winding and consist of the straight/direct and curvilinear sectors

(Fig. 1). In the curvilinear sectors (reaches) the rivers become narrow, while on the rectilinear ones (sand bars) they are expanded.

The width of river exerts considerable effect on the selection of the methods of crossing and organization of assault crossing. Thus, on the narrow rivers, in view of the fact that is difficult to realize turns, to disadvantageously create ferry crossings. Under these conditions, as soon as will be seized opposite shore, it is necessary to lay foating bridges and to construct low-level bridges. And vice versa, on the average/mean and wide rivers are advisable ferry crossings.

From the width of river in many respects depends the requirement for different crossing means. In the presence of modern self-propelled assault amphibious vehicles, which have the velocity of movement on the water 8-10 km/h, the effect of the width of river to the duration of trip and the requirement for the landing means/facilities is manifested insignificantly. However, the requirement for the pontoon-bridge means/facilities, necessary for bridge laying, depends on the width of river.

The time of the determination of the troops/forces under the fire/light of enemy, and hence also possible losses also depend on the width of water obstacles. Vulnerability of on the water considerably more than in the terrain where for the purpose of defense it is possible to utilize natural covers and ground features. Furthermore, on the wide rivers hinders suppression and annihilation weapons of enemy by guns and by the tanks, drawn for the delivery of fire by direct laying. Therefore for the provision of assault crossing wide river barriers/obstacles will be required a larger quantity of forces and weapons.

Depth of river. In the depth the rivers conditionally are subdivided into the fine/small ones (to 1.5 m), deep ones (to 5 m) and very deep (it is more than 5 m).

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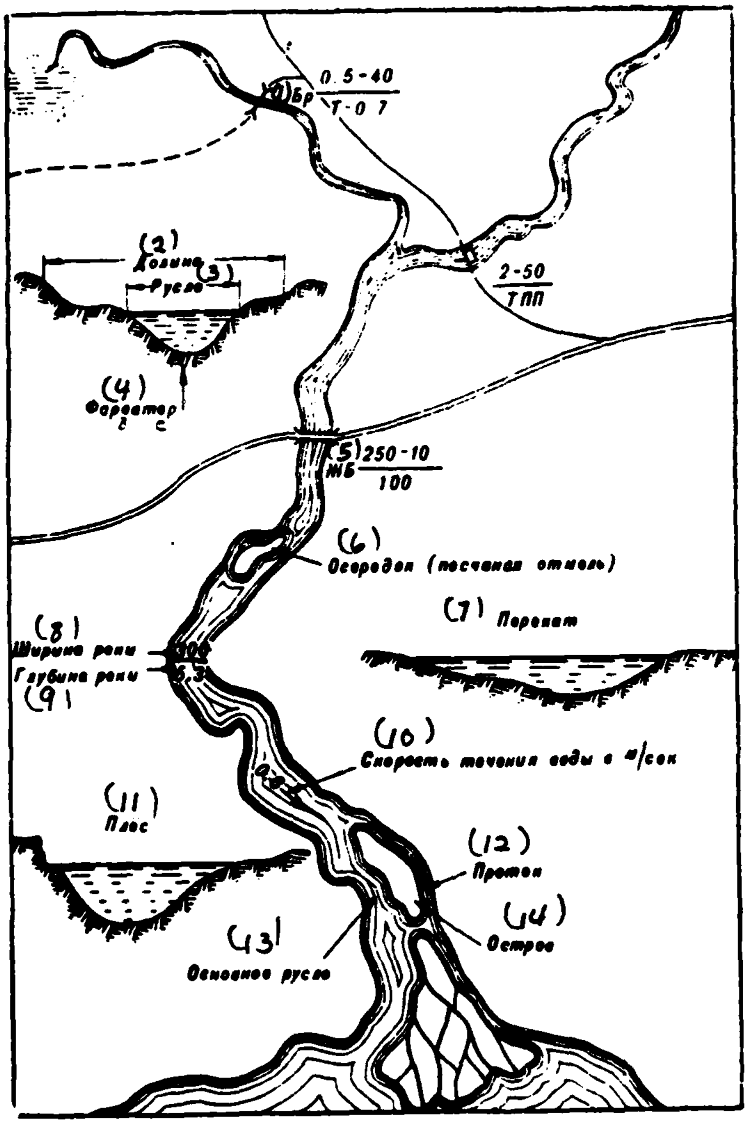

Fig. 1. River barrier/obstacle.

Key: (1). Ford. (2). Valley. (3). River bed. (4). Fairway. (5).

Reinforced concrete. (6). Alluvial islet (sand bar). (7). Pereneate. (8). Width of river. (9). Depth of river. (10). Rate of flow of water in m/s. (11). Reach. (12). Duct. (13). Basic river bed. (14). Island.

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The depth of river is variable, it closely related to the character of the soil of the bottom and coasts. In the curves the river bed of river undergoes the more intensive eroding/scouring and depth grows/rises, and in the straight portions flow decelerates, are created conditions for depositing the river alluviums (silt, sand). As a result are formed the sand-bars (sand bar).

The greatest depth of river (fairway) does not always coincide with its middle: on the reaches the fairway approaches the eroded shore, but on the sand bars - to the middle of river.

Furthermore, the depth of river is found in definite dependence on the trace of its river bed and width. Depth is usually greater at the steep/abrupt bendings of the river: the narrower the sector of river, the deeper it is. The fairway of river on the curves usually is passed near the concave shores, and sand bar - in convex ones. When river is divided by islands, basic river bed is always deeper duct.

The depth of water obstacles during the year is also variable. It usually changes in connection with the thawing of snows and abundant precipitation. For the different areas the time of seasonal floods is dissimilar. For some areas are characteristic spring and autumnal seasonal floods, while for others - winter and summer. A change of the depth of water obstacle in many respects depends also on the character of the terrain over which flows/occurs/lasts the river. On the rivers, which flow along the flat terrain, the depth changes gradually and, with rare exception, it is insignificant. Mountain rivers are characterized by sharp inclines and decrease in the water level.

Across the rivers, which have small depth and sufficiently solid ground of the bottom, the troops/forces can be crossed wade. For the armament of landing and ferry crossings, just as for the launching of a floating bridge, the minimally acceptable depth of river is determined by value of the residues/settlings of transport facilities. In this case it is necessary to avoid place with the soft ground and a depth of less than one meter, since on these sections assault amphibious vehicles will skid, floating bridges with the crossing of heavy combat technology due to the large draft will malfunction, but ferries cannot be moved.

An increase in the depth of river is not reflected in the work of landing and ferry crossings, or in the launching of a floating bridge.

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At the same time an increase in the depth of water obstacle exerts a substantial influence on the success of works with the construction of fixed support bridges. With the small depth and the dense soil it is possible to establish/install in the place the frame supports already fabricated. In the considerable depth of water obstacle or the high shores are raised, as a rule, pile or pile-frame supports, which requires the supplementary works (growth of piles and others). In this case is spent more than time and becomes complicated the organization of works on the construction of bridge.

During the incline of water as a result of natural seasonal floods and artificial tolerances can be immersed floodplains of rivers. If one considers that floodplains are usually folded by the river alluviums, subjected to rapid soaking, then in such places with small depth of water the use of crossing means without the construction of piers will be hindered/hampered. In connection with this the time of the armament of crossings can sharply be increased.

The rate of flow of river also has an effect on the organization of the crossing of the troops/forces. Rivers can have a weak current (to 0.5 m/s), average (to 1 m/s), rapid (to 2 m/s) and very rapid (more than 2 m/s).

The rate of flow of river as its other properties, is variable. In each section of river the maximum velocity is observed on the fairway, and smallest - on the coasts and the bottom.

The rate of flow of entire river flow is affected by the crookedness of river bed, the alternation of reaches and sand bars and the front rakes of the bottom of river. The maximum rate of flow of river most frequently is observed in the straight portions (sand bars). In the curvilinear sectors (reaches) they usually decrease. Hence it follows that in the selected crossing area there can be different rates of flow.

The rate of flow of river affects the drift of assault-crossing means/facilities, the duration of trip, focusing/induction of fused ones and building of low-level bridges, and also had an effect on overcoming of river wade. On the rivers with weak current this effect is not of practical use.

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On the rivers with the average/mean and rapid current occurs the considerable drift of landing crossing means and ferries, increases the duration of trip and is lengthened the time of focusing/induction and construction of bridges. During the rapid current for an increase in lateral stability of floating bridges it is necessary to produce attachment by the installation of supplementary anchors and delays to the coast. During the building of low-level bridges are applied crib supports.

With an increase in the rate of flow of water decreases the passability of fords, while at the rate of flow of more than 4 m/s fording is generally eliminated.

During the considerable incline of water and with a sharp increase in the rate of flow can arise the need for march/passage from the bridge ones and to ferry crossings. In this case for retaining/preserving/maintaining of continuity and rate/tempo of crossing will be required more means/facilities, in order to tow transporting ferries. With the crossing of the troops/forces on self-propelled engineer-amphibian equipment influence machines the rate of flow of river will be manifested less.

As a result of the continuous motion of water in the river appears different river-bed formations: shoals, sand bars, alluvial islets, islands and thresholds. The value/significance of river terms is given in appendix 1.

The soil of the bottom of river and river-bed formation exert great effect on the organization and armament of crossings.

Thus, sand bars frequently form the fords, suitable for the crossing of combat materiel, and islands and alluvial islets impede armament and content of ferry crossings.

The quality of the soil of the bottom of river affects the duration of the crossing of combat materiel wade, the selection of the type of supports with the construction of low-level bridges, and also the periods of readiness of piers during the armament of ferry crossings. For example, solid ground (stony, gravel) impedes the tamping of piles and attachment of the neglected/deserted anchors, but it at the same time provides a good capacity of fords, does not require reinforcing of congresses/descents for the self-propelled assault amphibious vehicles and decreases the washing of the supports of low-level bridges.

The soil of the bottom of the river of average density (sand, clay) permits implemention of a crossing of combat materiel wade. However, with the fording of a large quantity of equipment can arise the need for strengthening the bottom of river.

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←Soft ground (loess, peaty, silted) extremely complicates the armament of congresses/descents and outputs/yields from the water, the construction of piers and the construction of bridges, and also the crossing of tanks wade.

As a rule, from rate of flow it is possible to tentatively judge quality and composition of the soil of the bottom of river, since they between themselves are found in the definite dependence: 0.1-0.2 m/s - silt or silted sand; 0.2-0.6 m/s - sand of different size; 0.6-1.2 m/s - gravel; 1.2-2.4 m/s - pebbles of different size; 2.4-4.0 m/s - cobblestones and boulders.

The character of the coasts and terrain, adjacent to the river, is important condition with the estimate of river as obstacles.

With the estimate of the coasts and adjacent to them terrain are considered: the protective and camouflaging properties; the presence of the concealed/latent routes of approach to the river and of forests; the passability of valley and floodplain out of the roads (oxbow, drying/drainage channels, the swampy sectors, etc.); the condition of road construction; the accessibility of the coasts (abrupt, boggy, that was overgrown with bushes or reed).

High and abrupt shores impede the descent/release of crossing means to the water and output/yield of it. In such cases is required supplementary work on the armament for the congresses/descents into the water and of outputs/yields to the opposite shore. It is known that the wheel vehicles and armored personnel carriers are capable of overcoming descents/releases into the water and outputs/yields from it on opposite shore by slope/transconductance of 6-12°, and tanks - descents/releases to 25° and outputs/yields not more than 15°.

During the selection of the sectors of forcing are considered the crookedness and the branching of the river bed of river. The convex sectors, turned to the side of attackers, are convenient for the armament of crossings and give the greatest freedom for the maneuver by crossing means. However, excessive tortuosity, loop bends of river bed and oxbow create the supplementary difficulties for the attacking troops/forces. The straight portions of river bed are examined/scanned well and are shot through by small arms fire. Furthermore, in these sectors hinders maneuver by crossing means.

The wide and swampy floodplains or of floodplains, cut by oxbows, drying/drainage channels and floodland lakes, are impenetrable into the low-water level, i.e., on the most stable summer level they are water in the river.

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In the period of overflows the floodplains of such rivers are flooded and they become virtually impregnable for combat materiel.

The swampy floodplains even of small rivers hold up the advance of the attacking troops/forces. During the last war, for example, the advancing units could not overcome the swampy floodplains on r. Nittse-Fliz during two, and on r. Ine during a day and a half, although the width of these rivers was not more than 10 m. On the same reason almost on half-day was detained the offensive of the troops/forces with the assault crossing of Pronya (width of river in the area of pellets 50 m, and the width of the swampy floodplain 500 m). The crossing tanks jammed in floodplain and could not support the attack of the infantry, which lowered rate of advance and led to the excess losses.

Forest other natural covers on the near bank make it possible for the troops/forces secretly to move out to the river and for the enemy to unexpectedly force it. Furthermore, forest can be used for obtaining the building material for the armament of crossings.

Water-engineering constructions and reservoirs created by them have a considerable effect on the character of the combat operations of the troops/forces. In this case the engineering provision of assault crossing rivers can be strongly complicated.

Utilizing water-engineering constructions (dam, sluices, hydroelectric power plant, etc.) and created by them reservoirs, it is possible to suddenly change the level of water, to eliminate the available fords, to destroy crossings and to immerse the adjacent terrain.

The Great Patriotic War gave many examples of the skillful use of water-engineering constructions for the delay of advance of hostile troops. Thus, in the course of battle for Moscow during December 1941 from the reservoirs through the water-engineering constructions way of life is realized jettisoning water, as a result of which ice in the Moscow sea was broken up and on the route/path of the Fascist-German troops/forces arose enormous water obstacle.

Reinforcing of the river as an obstacle can be realized by means of the active tolerances of water from the reservoirs (by opening of breechblocks, by the destruction of dam itself) or by an overhead cover of the river beds of rivers. With tolerances appears the wave of active flooding, which can considerably change the character of river.

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Upon the destruction of the dams of large/coarse reservoirs is formed the high wave, which moves at a high speed. It can destroy water-engineering constructions, cities, populated areas and flood/ignite the large area of the underlying floodplain, and sometimes also the river valley. It suffices to recall the destruction of the dam during May of 1943 on r. Eder (the left tributary of r. Ful'd). As a result of air strikes/shocks in the body of dam was formed the large breach through which water gushed downstream. It destroyed bridges, flooded/ignited the coastal populated areas. Was stripped the work of river transport.

Another similar example can be destruction of dam on r. Mene (inflow of r. Ruhr). As a result of air raid during May 1943 the dam of reservoir was destroyed. The freed water was fixed on the valley of r. Mene, and then on r. Ruhr at a high speed, producing on its route/path enormous destruction. There was flooded a considerable number of populated areas, and at the removal/distance 50 km from the dam were destroyed all bridges and was flooded the hydroelectric power plant. Because of this the river was intensified as natural obstacle, in the work of large/coarse industrial center it was paralyzed.

Thus, the destruction of the dams of large/coarse reservoirs can lead to considerable increase in the width of river, rate of flow and annihilation of crossings. And, as a result, it will hinder/hamper in these directions/axes offensive operations.

In the places of the contraction of valleys is possible the overhead cover of the river beds of rivers by the blasting/detriment of coastal scales. As a result can be formed the cross connection and occur the passive flooding of terrain over the considerable area.

Terrain can be flooded also by destroying the dams, which enclose the river bed of rivers, at the moment of seasonal floods or jettisoning the water of higher than the arranged/located reservoirs. Furthermore, is possible the decomposition of the coasts of channels, which pass in the mounds, the overhead cover of drain systems.

Season is the important factor, determining the conditions for assault crossing rivers. The most essential effect on the conditions of overcoming of rivers and channels have water and ice modes/conditions. In this case it is necessary to consider meteorological conditions.

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Cloudy weather and fogs/mists facilitate camouflage, but considerably complicate the cooperation of the troops/forces. Direction/axis and wind force affect the character of the attachment of combat materiel on the landing and ferrying means/facilities and the velocity of their movement by the water.

Seasonal-climatic phenomena determine time ice formation, spring and autumnal floatings of ice and seasonal floods.

In the period of showers and prolonged rains appear the seasonal floods. In this case increase the width of river, depth and velocity of its flow. Fords, accessible in the ordinary time, in the period of seasonal floods are immersed. In connection with this the fording is impossible not only on deep ones, but also on the fine/small rivers.

The wide overflow of rivers, especially in the unbanked sectors, complicates armament and content of crossings and presents large threat, first of all, for the low water bridges, constructed in the period of the standing of low water. For example, during April 1944 on r. Prut in the area Santa Maria as a result of the large number of fallen residues/settlings sharply rose the water, which tore away the low-level bridge with construction of which was not considered the possibility of the rapid incline of water.

With the assault crossing r. Oder, which coincided with the violent spring seasonal flood, was brought down several ten low-level bridges, which placed the troops/forces in the difficult position/situation.

In order to avoid similar cases, the advancing/attacking units must have the necessary data about a possible change of the condition of river in the course of assault crossing and about water mode/conditions of this river obstacle. Large role in this case is assigned to hydrometeorological and hydrogeological predictions/forecasts.

Approaches to the crossing areas out of the roads in the period of showers and prolonged rains as a result of moistening of soils will require performing special work, especially in the marshy terrain.

In autumn-winter time, just as by early spring, large jamming/interference for the crossing of the troops/forces creates the floatings of ice: floating ice impedes the use of the assault-crossing and pontoon-bridge means/facilities, sometimes destroy constant bridges. During this period is especially difficult the maintenance of fused and low-level bridges.

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Assault crossing rivers in winter with the durable ice cover is facilitated, since basic combat technology can be crossed on ice. When ice does not possess the necessary load capacity, it they reinforce.

In the west assault crossing rivers in winter in view of the insufficient thickness and the durability of ice strongly hinders. For laying of bridges and armament of crossings under these conditions is required the construction of lanes, on what are spent considerable forces, means/facilities and time.

Approaches and to rivers during this period of year considerably are improved, since freezes the upper layer of soil. The swampy floodplains and even swamps/marshes become passable for the light combat technology. At the same time it should be noted that the heavy combat technology can be moved on the swampy terrain only in the severe winters.

Thus, if necessary for assault crossing river obstacles should be in advance and thoroughly studied the properties of river, considered changes of its mode/conditions in the dependence on the season and weather conditions, and also possible of reinforcing by the enemy of river as natural obstacle. As a result of comprehensive estimate it is necessary to establish, in what measure the river and the terrain adjacent to it create difficulty for the attackers. Simultaneously with this it is necessary to come to light/detect/expose the sectors of river, most convenient for the assault crossing, and the concrete/specific/actual places of armament and content of crossings.

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Chapter Two.

ENGINEERING PROVISION OF DEFENSE OF RIVER LINES ACCORDING TO VIEWS OF THE COMMAND ELEMENT OF THE ARMY OF THE USA.

Are basic the defenses of river lines. American command element attaches the important value/significance of the organization of defense on the river lines. It considers that the attacking hostile troops with the approach to the river will advance, first of all, to the surviving bridges and other crossings, and also to the sectors, convenient for the assault crossing. In this case unavoidably will occur the accumulation of the troops/forces, which will create favorable conditions for the nuclear attack.

Defense in the army of the USA on the river lines is constructed on the basis of the general principles of mobile defense and defense of area. The selection of one or the other method of defense depends on assigned mission, forces and means/facilities, character of water obstacle and adjacent terrain, and also on the season and meteorological conditions.

Upon the retention of considerable river lines, as a rule, is created the mobile defense, which to the larger degree satisfies the requirements of the conduct of combat operations with the contemporary weapons of destruction. It makes it possible to maximally utilize striking power of the troops/forces, and by nature it is the most active form of defensive operations.

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In the mobile defense the large part of the forces and means/facilities is emitted in the reserve (the second echelon) for conducting of counterattacks and counteroffensives of the crossing enemy at that moment/torque when is crossed only the unit of the subunits, and its main forces are concentrated on the opposite shore. In connection with this in the forward defensive area it is arranged/located to one third of forces and means/facilities with the problem of delaying the crossing of the enemy across the river and creation thereby of conditions for the maneuver by reserves and realization of counterattack. By the basic problem of the counterattacking troops/forces is not only the retention of the river line, but also complete annihilation the nuclear attacks of the crossing hostile troops.

The defense of area is applied when it is necessary to deprive the enemy of the possibility to force river in this sector. In the defense of area to the maximum degree is utilized river line as the natural obstacle, on which or in immediate proximity of it is arranged/located not less than $^{2}/_{3}$ of all forces and means/facilities. The second echelon is intended for increase in the depth of the defenses and conducting of counterattacks following the nuclear attacks for the purpose of the restoration/reduction of defense on the river or detention of the enemy wedged in into the defense.

Large units/formations and strategic formations on the river lines most frequently organize mobile defense, and units and subunits their order/formation can construct conformably both to the defense of area and for the mobile defense.

Assumed the defense of area on the river it should be in such a case, when the sector of its shore dominates above the opposite and is suitable for organizing the fire system, observation, camouflage, cover of personnel and combat materiel, and in the nearest depth from the river terrain limits freedom of maneuvering by reserves.

However, to the mobile defense on the river line they resort usually when by the available forces it is not possible to solidly hold down/retain the river line and its shore it is inconvenient for observation and fire of opposite shore, but at the same time it is possible to use large-scale maneuver by reserves.

The forward edge of defense zone depending on the character of the terrain, adjacent to the river, can pass on the shoreline or be in full or in part referred to the slopes of the valley of river line.

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In all cases strong points are arranged/located so that to ensure the cover of its shore by small arms fire.

The command element of American army high value/significance gives to the engineering provision of defense of river lines for the purpose of an increase in the effectiveness of the fire/light of all forms of weaponry, cover of its troops/forces from the nuclear attacks and the fire/light of the ordinary weapons of destruction, conducting of counterattacks and counteroffensives, and also for the purpose of the maximum difficulty of overcoming river by the attacking troops/forces.

Engineering terrain organization in the defense zone of division on the river line includes: the armament of the security zone and bridgeheads, foremost defense area and area of the disposition of reserves; the preparation of the firing positions of rocket forces and artillery; the construction of obstacles and the carrying out of decomposition in the water, on the coasts and in the depth of the defenses; preparation/training and the maintenance of routes/paths for the maneuver, the delivery and evacuation; construction and the armament for structures/installations on the command posts; camouflage and other engineer operations (Fig. 2).

Engineering armament of zones, positions and areas of the occupied by the troops/forces in the defense water obstacles. As the basic element/cell of the defense of river lines is considered the forward area, the character of engineering armament of which depends on the chosen form of defense. During the conduct of mobile defense on the river line previously cannot be created the so-called killing grounds, since it is in advance difficult to determine the direction/axis of the activities of the main forces of enemy. At the same time turns considerable attention to the timely preparation of the restrictive and blocking positions, and also to the preparation of deployment lines for conducting of counterattacks and counteroffensives.

It is direct on the river, in the places of possible crossings and in the most important directions/axes in the nearest depth of the defenses, the troops/forces create strong points. They can be occupied by subunits from the platoon to the reinforced company. Besides real strong points and observation posts, between them can be equipped dummy and spare strong points.

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However, the limited forces, isolated for the exercise of foremost defense area, and the absence of conditions for the wide application of means of mechanization do not make it possible to equip all outlined elements/cells of defense (Fig. 3).

When in the defense the basic efforts/forces of the troops/forces are concentrated directly on the river line, it is organized according to the principle of the defense of area. Main forces and weapons are arranged/located in the forward area in limits of which are equipped the defense areas of battalions, position of rocket forces and artillery, command posts are arranged engineering obstacles.

Battalion in the defense occupies area along the front to 3 km and into the depth to 2.5 km.

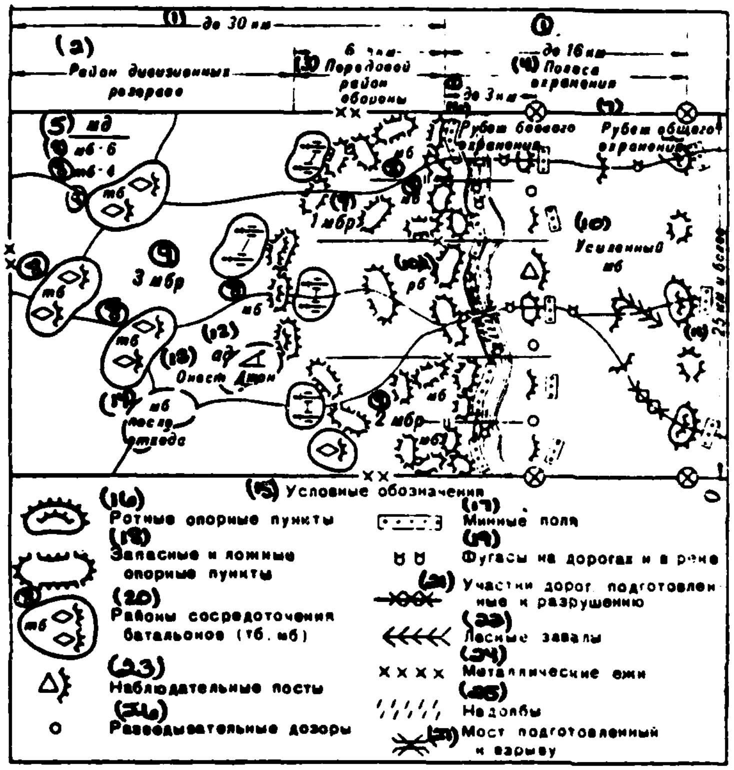

Fig. 2. Engineering armament of the areas, occupied by mechanized division (md) during the conduct of mobile defense on the river line.

Key: (1). up to. (2). Region of division reserves. (3). Foremost region of defense. (4). Outpost area. (5). md. (6). Line of combat security unit. (7). Line of general/common/total protection. (8). bridge battalion (mb). (9). bridge brigade (mbr). (10). Reinforced mb. (10a). labor battalion (rb). (11). 25 km and more. (12). artillery division (ad). (13). Honest John (14). mb after withdrawal/departure. (15). Conventional designations. (16). Company strong points. (17). Minefields. (18). Spare and dummy strong points. (19). Mines/fougasses on roads and in river. (20). Concentration areas of battalions (tank battalion (tb), mb.). (21). Sectors of roads, prepared and to decomposition. (22). Forest obstructions. (23). Observation posts. (24). Metallic hedgehogs. (25). Blocks. (26). Reconnaissance patrols. (27). Bridge, prepared and to burst.

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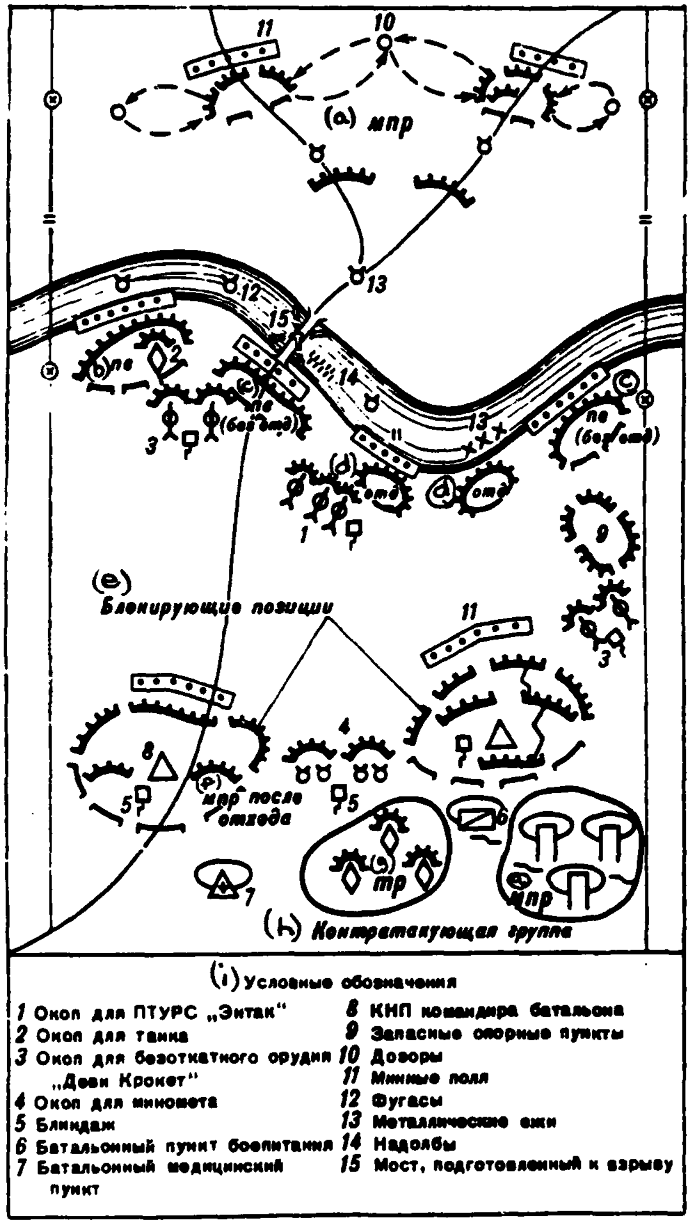

Fig. 3. Engineering armament of area, occupied by motorized infantry battalion (mpb) during conduct of mobile defense on river line.

Key: (a). mine disposal company (mpr). (b). machine-gun platoon (pv). (c). pv (without detachment (otd)). (d). otd. (e). Blocking positions. (f). mpr after withdrawal/departure. (g). tank company (tr). (h). Counterattacking group. (i). Conventional designations. (1). Trench for PTURS "ENTAC". (2). Trench for tank. (3). Trench for recoilless rifle of "Davy Crockett". (4). Trench for mortar. (5). Dugout. (6). Battalion point/post of ammunition supply. (7). Battalion medical aid station. (8). Command and observation post (knp) of battalion commander. (9). Spare strong points. (10). Patrols. (11). Minefields. (12). Mines/fougasses. (13). Metallic hedgehogs. (14). Blocks. (15). Bridge, prepared to burst.

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It includes company and platoon strong points and positions for the fire supporting means. In the strong points of companies and platoons are equipped single and two-man foxholes, sectors of trenches and communications trenches, trenches for the fire means/facilities and the structure/installation on the command posts. Covers for the personnel are equipped in the form of subparapet bays, slots, overhead shelters of trenches and dugouts. For the combat and cargo vehicles is provided for the erection of trenched type covers (Fig.

4).

Character and degree of the engineering armament of strong points, defense areas and positions depend on the presence of forces, means/facilities and time. Under the conditions of the rapidly changing situation main attention is paid to the erection of single and two-man foxholes. The official leadership/manual of the army of the USA require so that the infantry subunits would break away the infantry entrenchments independent of retention time of their on the positions.

If there is a time, are equipped trenches to each infantry squad. Cells for the riflemen, the submachine gunners and the grenade launch operators are arranged at a distance from 5 to 9 m one from another. On the flanks of trench for the personnel are equipped the covers for 4-5 people.

In the locations of division reserves tank, motor-infantry and infantry battalions equip concentration areas and, furthermore, train/prepare defense areas. In the defense area of battalions are equipped basic and spare company strong points, while in the gaps/intervals between them can be equipped dummy.

In the concentration areas of battalions, first of all, is conducted careful camouflage of the disposition of subunits. In this case extensively are used the masking properties of terrain, and also authorized camouflage covers/roofs/pavements. It is considered that for the personnel of armored personnel carriers and tanks of supplementary covers to raise it is not necessary, since combat materiel, which is located in the trenches, provides to it the necessary defense.

The engineering armament of position areas for the battalions of rocket projectiles includes the preparation of the firing positions of batteries, command post of fire/light and location of transport means. Besides position area, can be equipped expectant.

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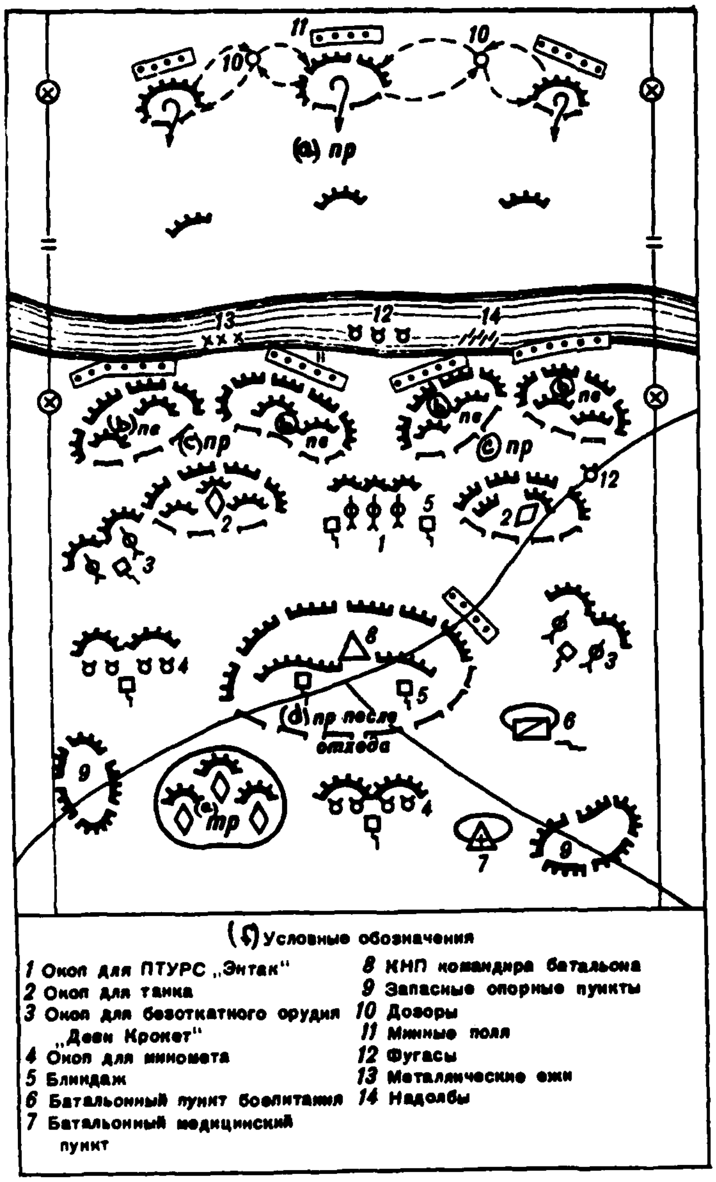

Fig. 4. Engineering armament of defense area, occupied by mpb on river line.

Key: (a). infantry company (pr). (b). pv. (c). pr. (d). pr after withdrawal/departure. (e). tr. (f). Conventional designations. (1). Trench for PTURS "ENTAC". (2). Trench for tank. (3). Trench for recoilless rifle of "Davy Crockett". (4). Trench for mortar. (5). Dugout. (6). Battalion point/post of ammunition supply. (7). Battalion medical aid station. (8). knp of battalion commander. (9). Spare strong points. (10). Patrols. (11). Minefields (12). Mines/fougasses. (13). Metallic hedgehogs. (14). Blocks.

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During the preparation of firing positions for the launchers "Honest John" entire area is inspected/checked against the presence of mines, is cleared, if necessary are equalized the areas/sites, are prepared siding tracks and is organized careful camouflage. In the presence of time can be raised the simplest covers for the detachments, the instruments, which measure the velocity and the wind direction, and the panel/console for the starting/launching of shells. For the launcher, installed on the chassis/landing gear of special automobile, the fragment of trench on the firing position, as a rule, is not conducted. Camouflage of launchers is realized by the skillful use of ground and of installation/setting up of the authorized camouflage nets which, as a rule, are installed in advance, to the exercise by the combat vehicles of positions, and before the starting/launching of shells are dropped to the ground.

On the firing positions of artillery are equipped the trenches for materiel and cover for the personnel and the transport means. For each battalion one should have basic and alternate positions.

On the firing positions of the antitank guided missiles (PTURS) are equipped the areas/sites and covers for the detachments.

During the armament of position and defense areas extensively are used the means of mechanization. In the large units/formations for this purpose is utilized authorized attached bulldozer armament. For example, in the armored division are 30 mechanisms: in field-engineer battalion 12 bulldozers and on one attached bulldozer armament in each tank company (in the mechanized division - 23 bulldozers, and in the infantry division - 20). Furthermore, in the combat engineer battalions of division is other excavating and highway engineering, in particular field-engineer tanks, excavators and motorized road graders. These means/facilities make it possible to mechanize earthwork and to conceal entire combat technique of division during two - three days.

In order to shorten the periods of the erection of defensive installations and covers for the military personnel, one should apply the unit constructions, prepared centralizedly in the rear of its troops/forces. For this purpose are developed standard units.

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Furthermore, are provided for in-house production and use/application of elements of corrugated plate, plastics and light alloys, and also covers/roofs/pavements from the multilayer fiber glass with polyether/polyester resin, nylon canopies with the plastic spokes and other covers/roofs/pavements. However, it is noted that during the first stage of assumption of the defense the troops/forces cannot obtain the necessary number of finished constructions/designs, and therefore one should utilize the building materials (at hand soil, turf, lumber, sand bags, tarpaulin, wire and camouflage nets).

The character of fortification terrain organization in the zone of division on the river line depends on the conditions of the translation/conversion of the troops/forces to the defense and the presence of time for the engineering works. If the troops/forces are arranged/located the limited time (1-2 days), then, first of all, are raised single and two-man foxholes with the standard overhead covers, trenches for weapons with the simplest covers for the personnel.

Construction of obstacles and the carrying out of decomposition in the defense of river lines. Under the conditions of applying new combat materiel the role of obstacles and decomposition considerably grows/rises. This, in the opinion of Americans, it escape/ensues from the fact that, in the first place, in the missile and nuclear weapons warfare sharply they increased frontage and the depth of troop dispositions in the defense and, in the second place, grew considerably the mobility of subunits and units.

For reinforcing the river lines in the defense are installed an obstacle and is conducted decomposition in the security zone, in the river, on the coasts, and also in the depth of the defenses. In the latter case usually are conducted only preparatory works, and minefields are installed in the course of defensive action. For the construction of obstacles and carrying out of decomposition in essence are applied mine-explosive means/facilities and nuclear mines/fougasses.

Mine-explosive means/facilities. In recent years for the armament of the army of the USA it is accepted the series/row of the new models of antitank and antipersonnel mines, and also all possible river mines.

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The improvement of the accepted and newly developed/processed models of mines follows the path of using of more powerful/thicker explosives, creation of mines with the nonmetallic corps also of bodiless mines, increase in explosive-stability and increase in the antisweeping ability of mines. The characteristic of the basic means of mine laying is given in Appendix 4.

For reinforcing the rivers as obstacles are provided for engineering obstacles in the water and on the coasts. They are installed in the places of probable crossings. For this purpose are arranged the submerged obstacles. Are reinforced the coasts of rivers, are applied floating obstacles for their descent/release along the flow of river, are trained/prepared for the annihilation all water-engineering constructions, bridges, local crossing means and fords.

For the submerged obstacles are utilized river mines (anchor, bottom, floating) and mines/fougasses in combination with the nonexplosive obstacles - blocks, the hedgehogs and the barriers.

Anchored mines are intended for the decomposition of crossing means and floating combat technology. They are installed on the small depth with the aid of the special cable, called mine mooring cable, and anchor. The weight of mine can be from 10 to 40 kg. For the buoyancy the mine in the upper unit has air area. According to the operating principle the anchored mines are subdivided into the contact ones and the noncontact ones. The first explode from the contact with the floating objects/subjects, and the second have the explosive mechanism, which operates/wears under the effect of the metal corps or sound of the motor of crossing means, amphibious tanks and armored personnel carriers.

Bottom mines are applied for mine laying of the fords and coasts. They are designed for the annihilation of crossing means at the moment of their mooring to the coast or for the annihilation of combat materiel, which is crossed on the fords. Besides special bottom mines, for mine laying of fords and coastal zone can be used the guided mines/fougasses and antitank mines.

Floating (alloyed) mines are intended for the decomposition of crossings and crossing means. They are discharged with the flow of river or are dropped from the aircraft and the helicopters. Alloyed mines can swim on the surface of water or at certain depth. They operate/wear from the contact with the obstacle or in the specified time as a result of the effect of timing device.

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For mine laying in the outpost area, directly the coasts and in the depth of the defenses are applied antitank, antipersonnel and special mines. They yield well to camouflage; therefore their bursts for the enemy are always not expected. As a result the advance of the troops/forces to the water obstacle decelerates, and they become the profitable targets for the nuclear attack.

Nuclear mines/fougasses. In the defense of river lines nuclear mines/fougasses it is proposed to apply for the purpose of the delay of the output/yield of hostile troops to the river and its conversion into the unsurmountable obstacle. Bursts of nuclear mines/fougasses, in their opinion, it is expedient to utilize for the decomposition by defile, the defiles, the sectors of the most important highways, bridges and water-engineering constructions, and also for changing the mode/conditions of river. In combination with the mine fields and by natural obstacles they create single barrier system.

For the first time nuclear mines/fougasses were tested by Americans in 1955-1956 in wasteland of the state of Nevada. In recent years were created nuclear mines/fougasses with the low (up to 200 kg of ordinary explosive (VV)) and large TNT equivalents.

At present engineers of the USA are arranged/located the nuclear mines/fougasses of different power. In particular, the nuclear mine/fougasse, which has the destructive force, which corresponds to the activity 1000 t of conventional explosive, has insignificant weight, it they can transfer four people.

Nuclear mines/fougasses can be accommodated underground in the in advance prepared bore pits, on the earth's surface or are installed into the body of water-engineering and other constructions. They consist of the nuclear fuel, placed into the sealed/pressurized packing, and the mechanism of the fuse which permits implemention of a burst at a distance with the aid of the wires/cables or a radio. Can be used also automatic contact maker with different periods of delay.

During the burst of nuclear mine/fougasse heaves into air the large mass of soil. The diminished earth/ground in this case creates radioactive cloud and it resounds by wind, and the pieces of soil and stones are brought down, forming mound around a deep crater with the high level of radioactive contamination.

The sizes/dimensions of craters depend on the power of nuclear mines/fougasses and quality of soil.

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For example, the burst of nuclear charge with the power of 1 kt on the earth's surface in the average/mean soils forms crater with the diameter of 40 m and with the depth of 8 m [1].

FOOTNOTE [1]. All data on the nuclear weapons, given in the book, are undertaken from the foreign press. ENDFOOTNOTE.

The volume of the rejected/thrown out soil achieves 5 thousand m^3. During the burst of nuclear charge with the power of 100 kt the diameter of crater can be 185 m, depth - 20 m, the volume of the rejected/thrown out soil - about 300 thousand m^3.

The sizes/dimensions of craters also depend on the depth of the laying of nuclear mines/fougasses. Thus, during the burst of nuclear charge with the power of 1.2 kt above the earth's surface to 1 m is formed crater by the diameter of 27 m and by the depth of 6.4 m; during the burst of the same charge at the depth of 5 m the diameter of crater achieves 79 m, and the depth of 16 m; during the burst of nuclear mine/fougasse at the depth of 20.4 m the diameter of crater is equal to 89 m, and the depth of 27.4 m; with the optimum sinking of nuclear charge (41 m) can be formed the crater by the diameter of 116 m and by the depth of 30 m.

As a result of the burst of nuclear mines/fougasses appear extremely high radiation levels. For example, the hour after surface/ground nuclear charge 100 kt in the zone of burst the radiation level is approximately 3000 r/h. On this radiation level the work on breaching of passages in the zone of burst virtually is eliminated. In the course of time the radiation level will be lowered, but for breaching of passage it is necessary to move 1500-2500 m³ of soil, for which it will be required from 20 to 40 hours of the work of bulldozer. Therefore most frequently in the areas of surface/ground and underground nuclear explosions it is necessary to make alternate routes from the windward side from the place of nuclear explosion. Alternate routes can be laid, also, from the lee side, but at the more considerable removal/distance from the point of impact of nuclear mine/fougasse.

Forest obstructions and decomposition of built-up area, which arose as a result nuclear explosions, considerably impede the cleanup of the march routes of movement. Thus, according to the data of the foreign authors, for the cleanup of passage in the forest obstruction with the width of 6 m and with the length of 1 km the combat engineer platoon with the tracked bulldozer and by helicopter will be required 10-15 hours. [Page 28.]

In the destroyed populated area with the single-stage stone buildings/structures for the cleanup of the march route of the same extent for the passage of tracked vehicles platoon will be required 2 hours, and for the wheel vehicles to 20 hours.

If the burst of nuclear weapons occurs in the water or in immediate proximity of the water, then as a result of the formation of the mound of crater can sharply change the mode/conditions of river. When the diameter of the formed crater is more than the width of river, will arise its kind the cross connection, which in the upper flow will create backwater of water, which will lead to the flooding of floodplain. Can be formed islands, change the river bed of river and considerably increase its width. As a result of erosion of the fallen into the river soil entire water will be infected by radioactive materials. In the lower flow can sharply be lowered its level.

Depending on the power of nuclear mines/fougasses the dam during the burst can be partially or completely destroyed. The freed water at a high speed will be spread downstream. On its route/path it can flood/ignite floodplain, destroy constant bridges, water-engineering constructions.

The basis of obstacles in the defense of river lines compose the mine-explosive means/facilities and the individual nuclear mines/fougasses, established/installed in combination with the natural obstacles and the barriers/obstacles. For mine laying of the sectors of river, convenient for the assault crossing, and in the depth of the defenses are applied the antitank mines, which are usually reinforced by antipersonnel and signal mines. Furthermore, in the places of the accumulation of landing means/facilities, and also in the places of the possible armament of crossings can extensively be used the mines of fragmentation-directed activity.

Obstacles in the water are set in several zones. It is direct on the shore and in the very shoreline of mine, at the depth to 1.5 m - nonexplosive obstacles, bottom mines and mines/fougasses, and at the depth to 2.5 m - anchored mines (Fig. 5).

The character of obstacles in the water in many respects depends on the profile/airfoil of the bottom of river. Thus, on the rivers with the abrupt shores and the steep/abrupt profile/airfoil of the bottom one should establish/install anchor and bottom influence mines, and in the rivers with the flat profile/airfoil of the bottom - antitank and antilanding.

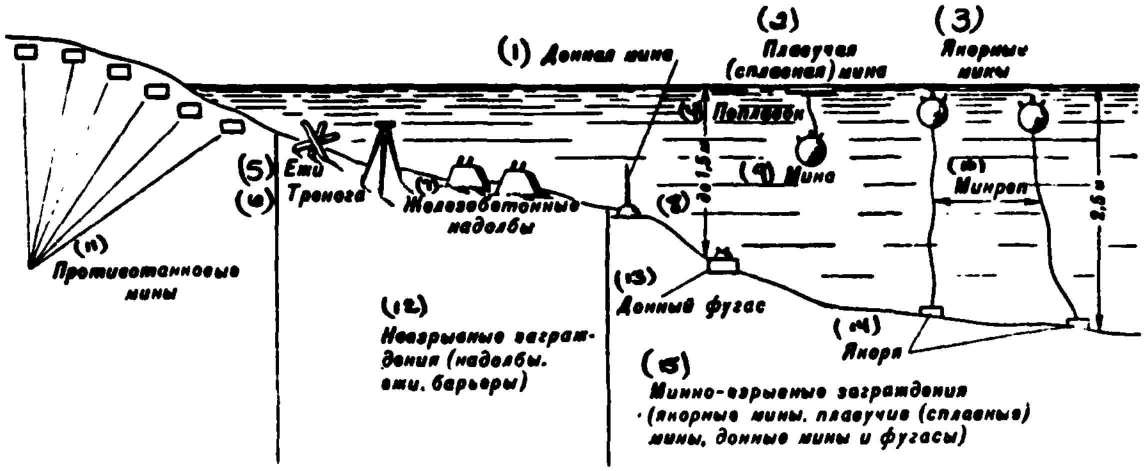

Fig. 5. Installation/setting up of engineering obstacles in the river and on the coasts.

Key: (1). Bottom mine. (2). Floating (alloyed) mine. (3). Anchored mines. (4). Float. (5). Hedgehogs. (6). Tripod. (7). Reinforced concrete blocks. (8). up to. (9). Mine. (10). Mine mooring cabale. (11). Antitank mines. (12). Nonexplosive obstacles (block, hedgehogs, barriers). (13). Bottom mine/fougasse. (14). Anchors. (15). Mine fields (Anchored mines, floating (alloyed) mines, bottom mines and mines/fougasses).

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Antitank mines in the river are established/installed with larger intervals, than on dry land. The distance between the mines can achieve 8 m. During the installation/setting up of antitank mines in the water are provided for hard backings/blocks. Furthermore, antitank mines can be fastened to the blocks and other underwater nonexplosive obstacles. On the fords are established/installed the antitank mines of the type M-15, the guided mines/fougasses or previously are arranged crater.

Simultaneously with the installation/setting up of minefields are conducted preparatory works for the decomposition of objectives in the defense zone of division. The objectives of decomposition can be the impenetrable sectors of roads, defile, road centers, bridges and water-engineering constructions. Depending on the importance of objective can be utilized both the conventional explosives and nuclear mines/fougasses. Considerable attention is paid to the use of reservoirs for the flooding of terrain and decomposition of bridges.

For the creation of the barrier system and decomposition is provided for the enlistment from one third to half of all available sappers/combat engineers. In the division for this purpose it can be drawn to one combat engineer battalion which for 10 hours can establish in the defense zone of 8-10 thousand antitank mines or create other forms of obstacles.

Engineering provision in the course of defensive action on the river line. Defensive action for the retention of the river line is subdivided into three stages: in the security zone, it is direct across the river and in the depth of the defenses. With the direct contact with the enemy on the river line occur only two latter/last stages.

In the course of combat operations in the security zone of a subunit and unit the aim is to detain enemy, to force him for the premature deployment main forces and thereby to create conditions for the organized exercise of defense on the river.

At this time the troops/forces of cover and protection apply the harassing minefields, especially along the basic roads, destroy the sectors of roads with the difficult detour, road centers and road construction. For the accomplishment of these objectives are drawn all of the arm of service, the operating in the security zone. Furthermore, for the construction of obstacles and carrying out of decomposition on the withdrawal routes of protection are emitted the subunits of engineers.

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All bridges, dams and other water-engineering constructions with the threat of capture by enemy are annihilated. Fords are given into such condition which eliminates the crossing of combat materiel. The subunits of protection and cover for the withdrawal/departure to their shore after the execution of combat mission are provided by the floating means/facilities even if there are bridges. Furthermore, one should on the opposite shore have boats with the ropes, lengthened to their shore. This, in the opinion of Americans, it will ensure the crossing of the subunits of protection in the case of the premature decomposition of the bridges and other crossings.

Combat directly for the river line begins with the output/yield of enemy to the river and in the course of its overcoming. During this period will be inflicted the damage/defeat to enemy by nuclear weaponry, by the fire/light of artillery and by air strikes. All engineering obstacles, established/installed on their shore, are given into full combat readiness and are destroyed the outlined targets in the forward defense area of defense. Furthermore, considerable attention is paid to the growth of the mine fields on the outlined lines in accordance with the folding combat situation. For this purpose one should apply mine layers and helicopters.

Simultaneously with this for an abrupt change in the mode/conditions of river those defending extensively use the arranged/located above with the flow water-engineering constructions and the reservoirs created by them.

The crossing hostile troops are annihilated by fire/light and counterattacks, in this case are drawn the greatest possible forces and weapons. Counterattack will be deposited at that moment/torque when crossed only the unit of the troops/forces, and the main forces of enemy was concentrated in crossings on the opposite shore and presents the profitable target for the nuclear attacks, artilleries and aviation.

Thus, in modern missile and nuclear weapons warfare the medium and wide rivers, reinforced by mine fields and decomposition of water-engineering and other constructions, especially by means of the nuclear mines/fougasses, can be, on the views the command elements of the army of the USA, serious obstacles for the attacking troops/forces and therefore must be used extensively in defense and during conduct of delaying operations.

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Chapter Three.

CROSSING MEANS OF SOVIET ARMY.

In the last war with assault crossing of rivers advance detachments and subunits of the first echelons utilized, as a rule, light authorized and local crossing means, and also available materials. Their load capacity provided the crossing only of rifle/infantry subunits. For the crossing of tanks and artillery, even light, it was necessary to accumulate ferries and to build a bridge, on what was spent much time. The limited possibilities of the existed crossing means and their insufficient quantity not only decreased the rate/tempo of the crossing of units and subunits, but also led to the slow accumulation of forces and means/facilities on the seized bridgeheads/beachheads, the prolonged struggle for their expansion and, consequently, also to the delay of the march/passage of the troops/forces into the offensive.

Under the contemporary conditions the rates/tempos of assault crossing of rivers must be maximally approximating the rates/tempos of ordinary offensive. This is achieved by the simultaneous crossing of all branches of services, including tanks and artillery, so that they by the combined efforts/forces would capture opposite shore and would press home the attack into the depth of the defenses of enemy.

At present this mission successfully is accomplished. Are created new self-propelled assault amphibious vehicles, pontoon trains, automobile and bridge-laying tanks. Furthermore, are such engineer-amphibian equipment means/facilities, as landing collapsible and inflatable rubber boats, and means/facilities of the motorization of crossings.

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1. Self-propelled assault amphibious vehicles.

For the crossing of motorized rifle and artillery subunits and their combat technology are applied the self-propelled assault amphibious vehicles, which retain the basic properties of land vehicles and therefore easily they are moved on the terrain. At the same time they possess the supplementary qualities which make it possible for them freely to be moved on the water. Such vehicles include: the small floating automobile MAV, the large floating automobile BAV, the tracked amphibious personnel carrier K-61, the tracked amphibious personnel carrier average/mean PTS. Furthermore, for the assault troop crossing of motorized rifle subunits are utilized the tracked and wheel floating armored personnel carriers.

Contemporary self-propelled assault amphibious vehicles provide the simultaneous crossing of units and subunits and their combat technology. These vehicles in comparison with the previous landing means/facilities possess completely new possibilities for the assault troop crossing and therefore they make it possible to in a new way organize overcoming rivers. If in the past landing force could sit down itself on the not self-propelled crossing means only in very shoreline, then now landing the subunits of the first trip can be realized in the natural covers at the considerable removal/distance from the coast of river. Consequently, subunits with combat materiel can simultaneously advance to the river in the self-propelled assault amphibious vehicles and force water obstacle without the considerable expenditure of time for preparatory measures. Finally, is now considerably facilitated maneuver by engineer-amphibian equipment means/facilities in the course of assault crossing rivers.

The small floating automobile MAV (Fig. 6) is intended for the provision of combat operations of engineering-reconnaissance subunits. Furthermore, it can be utilized for the execution of auxiliary activities during focusing/induction of fused ones and building of low-level bridges, and also with the content of crossings. Basic performance data of the floating automobile MAV are given in Table 1.

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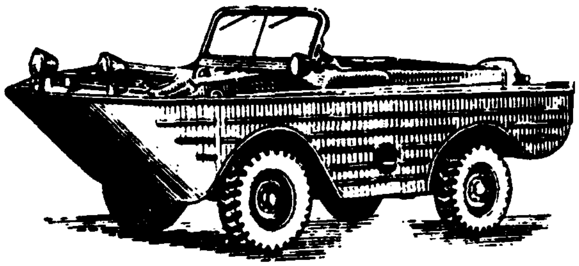

Fig. 6. Small amphibious automobile MAV.

Table 1. Performance data of the floating automobiles MAV and BAV.

(1) Наименование характеристик	МАВ	БАВ
(2) Вес машины без груза, т	2,0	7,15
(3) Грузоподъемность машины, т:		
(4) по суше	0,5	2,5
(5) по воде	0,5	3,5
(6) Вместимость, человек	5	(7) 28 или одна пушка до 85 мм, или одна гаубица до 122 мм, или один автомобиль (ГАЗ-69)
(8) Экипаж, человек	1	2
(9) Скорость движения, км/час:		
(10) по шоссе	90	До 60
(11) по грунтовым дорогам	35—50	20—35
(12) по воде (с грузом)	8—9	8—9
(13) Дорожный просвет (клиренс), м		0,28
(14) Наибольшие преодолеваемые углы, град:		
(15) подъема	25	32
(16) входа в воду	25	25
(17) выхода из воды	22	18
(18) Запас хода по топливу:		
(19) по суше, км	500	500
(20) по воде, час	5—6	6
(21) Движитель ходовой части	(22) Колесный	(22) Колесный
(23) Число гребных винтов, шт.	1	1
(24) Марка двигателя	ГАЗ-67	ЗИЛ-485
(25) Мощность двигателя, л. с.	55	110

Key: (1). Designation of characteristics. (2). Weight of vehicle without cargo, t. (3). Load capacity of vehicle, t. (4). on land. (5). on water. (6). Capacity, man. (7). 28 either one gun to 85 mm, or one howitzer to 122 mm, or one automobile. (8). Crew, man. (9). Velocity of movement, km/h. (10). on highway. (11). on dirt roads. (12). on water (with cargo). (13). Road clearance (clearance), m. (14). Greatest overcome bearings/angles, deg. (15). incline. (16). entrance into water. (17). output/yield from water. (18). Endurance on fuel/propellant. (19). on land, km. (20). on water, hour. (21). Propeller/motor of running gear. (22). Wheel. (23). Number of screw propellers, pieces. (24). Mark of engine. (25). Power of engine, hp.

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The small floating automobile has the metal watertight welded body which provides its buoyancy. Movement along the water is realized by rotation of the engine of three-bladed screw propeller, and on drier - drive wheels. In the body in the point of emergence of propellor shaft, is established/installed sealing construction. For the pumpage, which caught in the body through the leakages/loosenesses and the damages, is a pump with a productivity of 150 l/min.

On the water the floating vehicle is controlled/guided with the aid of the water rudder which is arranged/located after the screw propeller. In front of the vehicle is established/installed the breakwater, which can be set in the working or march position.

For pulling itself out when overcoming impenetrable sectors and on leaving from the water the floating vehicle is equipped with the special winch which is set in motion from the engine of vehicle.

In bad weather and during the movement along the water with the high wave the body of the floating automobile can be closed by quick-detachable tarpaulin awning.

The large floating automobile BAV (Fig. 7) is intended for the assault troop crossing of motorized rifle and artillery subunits with combat materiel with a total weight of up to 2.5 t. Basic performance data of the floating automobile BAV are given in Table 1.

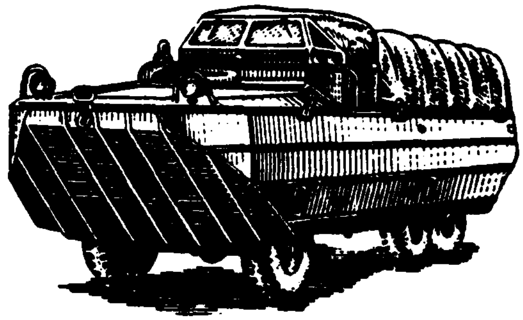

Fig. 7. Large floating automobile BAV.

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The floating automobile BAV has the watertight body, welded made of sheet steel. The top of the body is equipped under the special cargo platform which serves for positioning/arranging of combat materiel and personnel of the crossed subunits. Platform is closed by tarpaulin awning. The rear board of the automobile of hinged/reversible, which is convenient for on-loading and unloading combat materiel. On-loading and unloading vehicles and other technology are realized with the aid of the winch on the cargo detachable beams/gullies. Winch, furthermore, it is applied for self-pulling of automobile, and also for rendering aid to the jammed vehicles.

All wheels of the floating automobile leading. For increasing the passability under the severe road conditions, and especially on leaving from the water, the floating automobile BAV has the central system of pumping and pressure adjustment in the busbars/tires. Driver can change pressure in the busbars/tires and, therefore, the area of its support in the process of movement in accordance with a change in the road conditions.

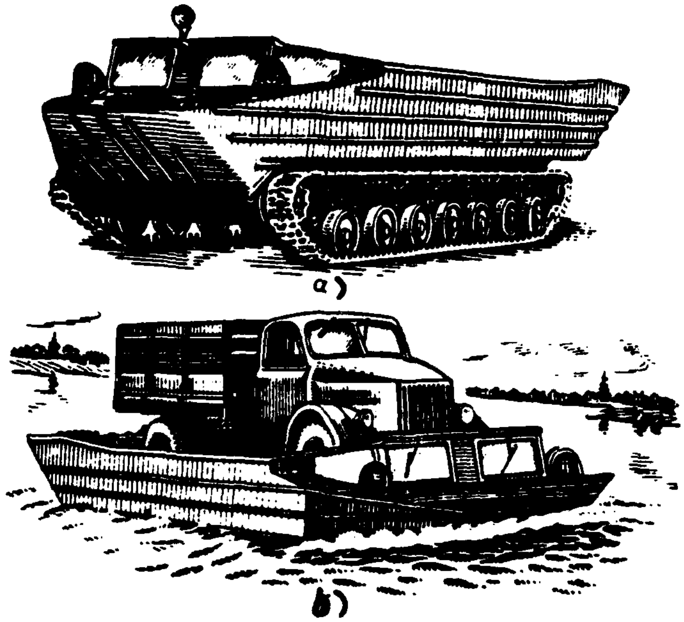

Fig. 8. Tracked amphibious personnel carrier K-61: a) on dry land; b) on the water.

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The movement of automobile along the water is realized by rotation of screw propeller, and its control on the baud is conducted with the aid of the water rudder. For the pumpage, which caught inside the body of automobile, is established/installed the special water-evacuating system.

The tracked amphibious personnel carrier K-61 (Fig. 8) is intended for the assault troop crossing of artillery, tractors and other combat technology with a total weight of up to 5 t. Basic performance data of the tracked amphibious personnel carrier K-61 are given in Table 2.

Table 2. Performance data of the tracked amphibious personnel carriers K-61.

(1) Наименование характеристик	К-61
(2) Грузоподъемность машины, т	
(3) на суше	[illegible]
(4) на воде	[illegible]
(5) Экипаж, человек	2
(6) Вместимость, человек	(7) 50 или одна пушка до 122 мм, или одна гаубица до 152 мм, или один автомобиль (ЗИЛ 151 без груза)
(8) Скорость движения, км/час:	
(9) по шоссе	(9a) До 35
(10) по грунтовым дорогам	10—25
(11) по воде (с грузом)	8—9
(12) Дорожный просвет (клиренс), м	0,36
(13) Наибольшие преодолеваемые углы, град:	
(14) подъема	42
(15) входа в воду	15
(16) выхода из воды	15
(17) Запас хода по топливу:	
(18) по суше, км	170
(19) по воде, час	8
(20) Движитель ходовой части	(21) Гусеничный
(22) Число гребных винтов, шт.	2

Key: (1). Designation of characteristics. (2). Load capacity of vehicle, t. (3). on dry land. (4). on water. (5). Crew, man. (6). Capacity, man. (7). 50 either one guns to 122 mm, or one howitzer to 152 mm, or one automobile (ZIL-151 without cargo). (8). Velocity of movement, km/h. (9). on highway. (9a). To 35. (10). along dirt roads. (11). on water (with cargo). (12). Road clearance (clearance), m. (13). Greatest overcome bearings/angles, deg. (14). incline. (15). entrance into water. (16). emergence from water. (17). Endurance on fuel/propellant. (18). on land, km. (19). on water, hour. (20).

Propeller/motor of running gear. (21). Tracked. (22). Number of screw propellers, pieces.

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The tracked amphibious personnel carrier K-61 consists of the body, engine, power transmission, running gear, screw propeller, mechanisms of the control and special armament.

The body of amphibious personnel carrier the watertight, is metallic, the carrying type. Cargo platform from behind has the flap which in the open position/situation serves as a ramp for on-loading and unloading combat materiel. The propeller/motor of the running gear of amphibious personnel carrier tracked, consists of two caterpillar chains, road wheels, two guide wheels with the tighteners and two holding racks. Caterpillar chain fine-link, the width of component/link is 300 mm.

The movement of personnel carrier along the water is realized with the aid of the screw propeller which is placed in two tunnels of the rear portion. Screw propellers are three-bladed. For the turn of personnel carrier on the spot serve the screw propellers, which in this case rotate in the different sides. The direction of the motion of personnel carrier on the water changes with the aid of the water rudders, arranged/located in the tunnels behind each screw propeller.

On the water the personnel carrier is controlled/guided with the aid of steering wheel construction, connected with the water rudders.

Bilge/hold water is driven out by the water-evacuating system, which is of two pumps the general/common/total productivity of 800 l/min. If does not work engine, water is evacuated with the aid of the hand pump.

Amphibious personnel carrier is equipped with the winch which is utilized for on-loading and unloading of combat materiel and incline of anchor. Winch in certain cases can be used for self-extrication of personnel carrier.

The tracked amphibious personnel carrier PTS (Fig. 9) is intended for the assault troop crossing of artillery subunits with combat and transport materiel, the motor vehicles and the armored personnel carriers.

Amphibious personnel carrier has the durable watertight welded body. In its rear unit there is a flap for on-loading of combat materiel to the cargo platform and unloading.

The propeller/motor of vehicle on the water are screw propellers, and the control of it is realized with the aid of the water rudders.

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Amphibious personnel carrier is equipped with the water-evacuating system, winch and instrument for towing of technology both on land and on the water.

The tracked amphibious personnel carrier possesses high passability during the movement along bottom land, it can perform under the severe road conditions, it is capable to overcome in the process of assault crossing sand bars, shallows and shoals.

Tracked self-propelled pair of GSP is intended for the crossing of tanks and other combat technology crawler-mounted. It consists of two half-ferries (Fig. 10) - right and left, which have different disposition of units and assemblies and which therefore are noninterchangeable.

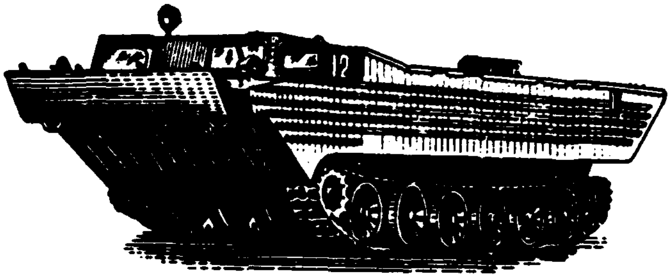

Fig. 9. Tracked amphibious personnel carrier PTS.

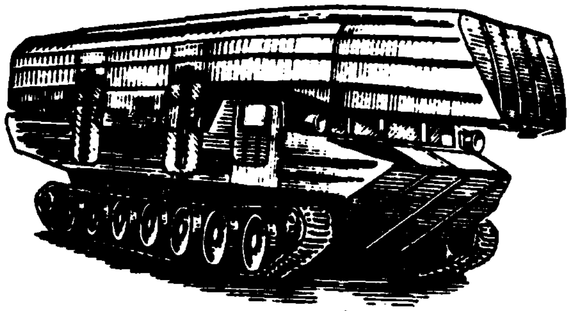

Fig. 10. Half-ferry of tracked amphibious ferry GSP.

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Half-ferry it is the tracked vehicle, above which in the transport position/situation is placed the boat. The deployment of ferry is conducted on the water. In this case at first will be joined together the leading vehicles, and then are opened boats and access ramps of half-ferries.

In the places of support of the access ramps of the tracked amphibious ferry during the on-loading and off-loading of tanks are driven out/selected the coasts by height/altitude to 0.5 m. Depth on the coast in these places must be not less than 1.2 m, is otherwise possible the damage of ferry.

2. Engineer-amphibian equipment means/facilities.

For the crossing of reconnaissance and motorized rifle subunits can be utilized light engineer-amphibian equipment means/facilities. They include: the landing boat DL-10, inflatable boat NL-5 and inflatable landing boats NDL-10 and NDL-20 (Table 3). These boats on the water can be moved with the aid of motor-oars, outboard motors or on the oars.

The landing boat DL-10 consists of two half-boats, connected between themselves by draw bars, by lugs and by tightening bolts. The body of half-boat is manufactured from the bakelitized plywood.

Load capacity of landing boat 3 t. Simultaneously on the boat they can be crossed landing force by strength to twenty people and five rowers on the oars. With the crossing with the outboard motor the landing force can be increased to twenty three people.

For the crossing of artillery and motor vehicles by total weight to 4 t can be used the paired boats, while for the cargoes to 6 t are collected ferries of three boats.

Are transported boats in the folded configuration on the trucks. On the 3-ton automobile of the type ZLI-150 can be transported eight sets of boats DL-10, while on 1.5-ton automobile of the type GAZ-63 - five.

Inflatable boats NDL-10 and NDL-20 are prepared from the rubberized fabric. For increasing the unsinkability of boat inflatable chamber/camera is divided by the isolated/insulated compartments. Boat NDL-10 has eight compartments, while boat NDL-20 fifteen.

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On boat NDL-10 can be crossed twelve people, while on boat NDL-20 - up to twenty five. In this case the velocity of the movement of boats on the oars can be to 3.5 km/h, and with the outboard motor - to 10 km/h.

For the crossing of artillery pieces and automobiles from the inflatable landing boats can be accumulated two- and three-boat ferries which are moved on the water with the aid of the outboard motors. On the twin-hull ferry can be crossed the technology with a total weight of up to 3 t, while on the three-boat ferry - technology to 5 t.

For replacing the inflatable boats NL-5, NDL-10 and NDL-20 respectively are discharged inflatable boats NL-8, NL-15 and NL-30, which are prepared from the rubberized fabric on the kapron basis.

Inflatable boat NL-8 for increasing the unsinkability has five compartments which are closed over with valves. Weight of the equipped boat 55 kg, load capacity 650 kg. On the boat can be crossed eight people. Velocity of the movement of boat with the aid of outboard engine to 8 km/h, and on the oars on the average to 3 km/h.

Inflatable boat NL-15 has seven isolated/insulated compartments. Weight of the equipped boat 95 kg, load capacity 1.5 t. On the boat can be crossed twelve people and, furthermore, three people of the operating detachment.

Table 3. Basic performance data of landing boats.

(1) Характеристика лодок	ДЛ-10	НЛ-5	НДЛ-10	[illegible]
(2) Вес, кг	120	50	80	150
(3) Грузоподъемность, т	3	0,7	1,5	2,5
(4) Десант, человек	23	5	12	25
(5) Скорость передвижения, км/час:				
(6) с забортным двигателем	12	—	10	10
(7) на веслах	7	2—3	3—3,5	3,5
(8) Габариты м:				
(9) длина	8,6	3,3	5,0	6
(10) ширина	1,4	1,2	1,7	2,2

Key: (1). Characteristic of boats. (2). Weight, kg. (3). Load capacity, t. (4). Landing force, man. (5). Velocity of movement, km/h. (6). with outboard motor. (7). on oars. (8). Overall sizes m. (9). length. (10). width.

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Velocity of the movement of boat on the oars 3.5-4 km/h, with the aid of the outboard motor on the average to 8 km/h.

Inflatable boat NL-30 consists of external (onboard) and internal chambers/cameras. The inflatable chambers/cameras of boat are divided by partitions/baffles in fifteen compartments.

Weight of the equipped boat 200 kg, load capacity 3.4 t. On the boat they are crossed to 30 people. Velocity of the movement of boat on the oars 3.5-4 km/h, with the aid of the outboard motor to 8 km/h.

For the crossing of light cargoes from boats NL-15 and NL-30 can be accumulated transporting ferries. Construction/design of superstructure and the order/formation of the assembly of transporting ferries the same as for boats NDL-10 and NDL-20.

3. The pontoon trains.

For the crossing of the troops/forces across the average/mean and narrow rivers are utilized in essence the bridges. This is explained by the fact that they possess the greatest capacity. At present for the launching of a floating bridge and armament of the ferry crossings of different load capacity are following pontoon-bridge motor pools: heavy pontoon equipage TPP, pontoon-bridge motor pool PMP and transport motor pool PVD-20.

The existing pontoon trains make it possible to mechanize labor-consuming fitters work, to the minimum to bring preparatory and fitters work directly on water during adjustment of floating bridges, during the assembly of transporting ferries and the installation/setting up of piers (construction of berths). The survivability of pontoons is achieved by the filling with their unsinkable material. These pontoon trains possess the increased maneuverability with the advancement to the water obstacles and in the course of their assault crossing.

Heavy pontoon pool TPP consists of metallic unsinkable pontoon units by load capacity to 8 t, span building/structure, frame and roller bearings, coast units, ferry-boat identities/accessory equipment and engine means/facilities.

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The characteristic feature of motor pool is the pontoon unit, which includes pontoon, girders/drives, deck panels and the necessary rigging for the sector bridge or ferry. Such transport-assembling units/blocks are adapted for the mechanized on-loading to the specially equipped automobile and the unloading it directly to the water.

The pontoons of motor pool are filled with the light porous unsinkable material - foam plastic. By this is achieved its unsinkability by the damage of skin/sheathing.

The use/application of roller bearings considerably accelerates the construction of piers, especially on the opposite shore of river. Truck piers to the opposite shore usually are transported since the beginning of the assembly of ferries.

Automobiles ZIL-157, utilized as the pontoon vehicles, increase the maneuverability of the pontoon train TPP, since they possess high passability, have three driving axles and system of a change of the pressure in the busbars/tires of wheels.

From materiel of the motor pool TPP usually are collected the floating bridges (Fig. 11) and are equipped ferry crossings by load capacity 50 t. Furthermore, can be laid floating bridges by load capacity 16 and 70 t and be equipped ferry crossings by load capacity 16, 35 and 70 t.

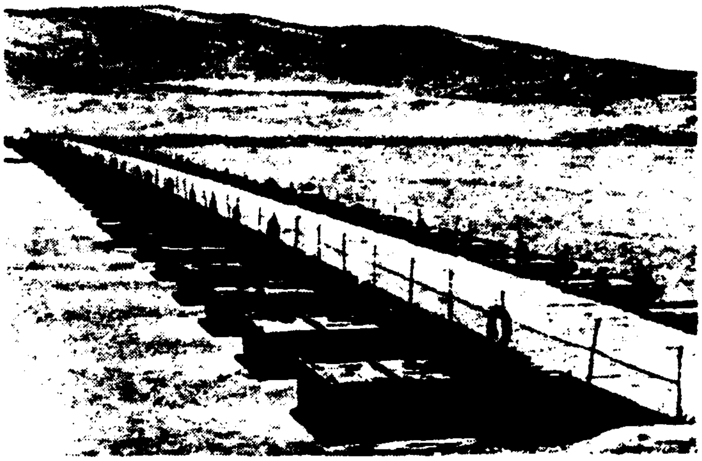

Fig. 11. Floating bridge from the pontoon train TPP.

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Performance data of heavy pontoon pool TPP.

1. Composition of motor pool:

quantity of pontoon blocks, pieces 96

quantity of supports, pieces 8, of them 4 roller

quantity of motor boats BMK-150, pieces 12 transport means, pieces 116 ZIL-157

2. Characteristic of the bridges, laid from the set of the motor pool:

the maximum length of bridge, m:

16-ton 335/311 [1]

FOOTNOTE [1]. In the numerator is given the overall length of bridge, in the denominator - length of fused unit. During the addition to authorized materiel of the deck panels and stringers the overall length of bridge can be 506 m. ENDFOOTNOTE.

50- ton/grand 265/241

70-ton/grand 205/181

the width of transient unit, m:

16-ton/grand 3.2

50 and 70-ton/grand 4.0

the time of laying bridge, min:

50-ton/grand	120
16 and 70-ton/grand	150

3. Characteristic of the transporting ferries, accumulated from the set of the motor pool:

a quantity of ferries, pieces.

16-ton/grand	24
35-ton/grand	16
50-ton/grand	12
50-ton/grand of large area	10
70-ton/grand	8

the time of assembly, min:

16-ton/grand	20

35-ton/grand	25
50-ton/grand	30
50-ton/grand of large area	35
70-ton/grand	35

the sizes/dimensions of ferry, m:

16-ton/grand	11/4 [2]

FOOTNOTE [2]. In the numerator is given the length of ferry, in denominator - width of transient unit. ENDFOOTNOTE.

35-ton/grand	16/4
50-ton/grand	17/4
50-ton/grand of large area	16/8
70-ton/grand	24.5/4

Note. The assembly time and the load capacity of ferry are given for the rate of flow to 2 m/s.

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Pontoon-bridge park PMP - this is new space in comparison with the motor pool TPP. The basis of motor pool PMP are the four-pontoon collapsible components/links, which are the finished sectors of bridge or transporting ferries. In this case decks of collapsible components/links in the bridge and ferry-boat constructions/designs are utilized as the transient unit.

During the mating of individual components/links is formed bridge strip (Fig. 12). Since the process of forming the components/links is simplified, on bridge laying is spent insignificant time.

During the armament of ferry crossings from the motor pool PMP it is not required piers. Transporting ferries moor/berth to the coast, and for on-loading of combat materiel on ferry and its unloading are utilized the access ramps of river components/links.

The transport motor pool PVD-20 is intended for the armament of crossings under the effect of the units airborne troops in the rear of enemy. The characteristic feature of motor pool PVD-20 are low weight and overall sizes of the individual elements/cells of materiel of the motor pool. This makes it possible to transport motor pool on the aircraft and the helicopters, and also on the unequipped automobiles. For the transportation of motor pool on more drily are required ten automobiles GAZ-63 or six automobiles ZIL-151.

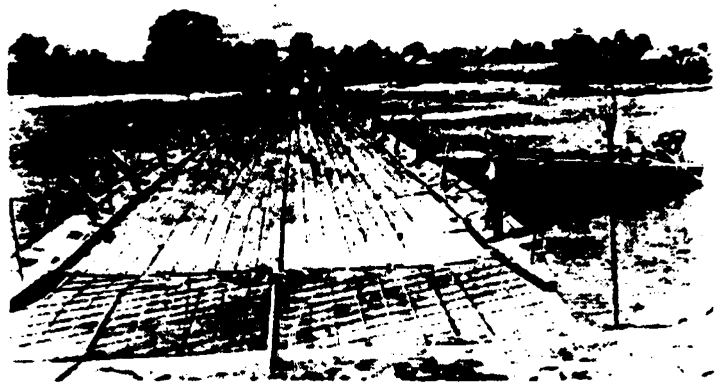

Fig. 12. Floating bridge from the pontoon train PMP.

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In motor pool are included floating supports, span building/structure and booster agents. As the floating support is utilized boat MDL-20, prepared from the rubberized fabric. Such boats in motor pool 20. Is transported boat in the convoluted position/situation. It has small sizes/dimensions and weight of approximately 115 kg. During the damage to the rubberized fabric of fifteen compartments, isolated/insulated from each other by the airproof partitions/baffles, they provide the unsinkability of boat.

Span building/structure is assembled of two duralumin tracks. Track is the box-shaped unit, which fulfills the functions of travelling unit and framework. Depending on tread of the crossed technology the tracks in the bridges and the ferries can be set up to different distance from each other. In all into the set of motor pool enter 60 duralumin tracks.

The ferries, assembled from the equipment of motor pool PVD-20, can be supplied to the water with helicopters. In this case they are fastened to the helicopters on the external suspension. The movement of ferry on the water is realized with the aid of the outboard motors or by towing by the floating automobiles.

Motor pool weighs 13 t. Entire/all materiel of the motor pool is divided into ten sets (ferries). One set of a 4-ton/grand transporting ferry weighs about 1.3 t and is transported on automobile GAZ-63. Together with the set on the automobile it can be transported to one squad of sappers/combat engineers.

From motor pool PVD-20 can be bridged by load capacity from 4 to 8 t, by length of 88 and 64 m. Time of laying bridge 50 min. Equipment of motor pool makes it possible to accumulate the ferries: four-ton/four-grand - 10, six-ton/six-grand - 6 and 8-ton - 4. On the assembly of ferries are spent with respect 15, 20 and 25 min.

4. Tow-engine motor boats.

With the composition of pontoon-bridge motor pools are connected tow-engine motor boats BMK-90, BMK-150 and BMK-T. They are utilized for reconnaissance/intelligence of river, movement of ferries with focusing/induction and separation of bridge crossings, towing of transporting ferries, and also for throwing and extraction of anchors, haul of the cables across the river and execution of different works with armament and content of bridge and ferry crossings.

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A tow-engine motor boat BMK-90 (Fig. 13) is light river ship. The forward section of the hull is closed with deck. The movement of motor boat along the water is realized with the aid of the screw propellers.

The direction of the motion of motor boat on the water changes with the steering which consists of control wheel and two rudders. For towing of ferries on the water is a special tow construction. Basic performance data of a tow-engine motor boat BMK-90 are given in Table 4.

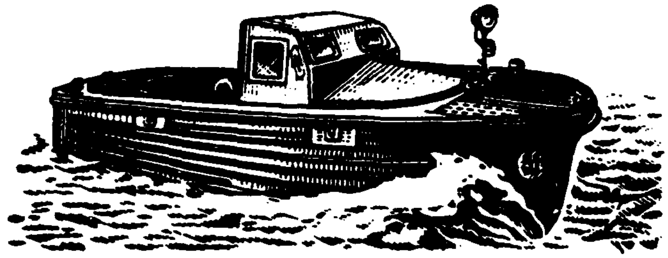

Fig. 13. A tow-engine motor boat BMK-90.

Table 4. Performance data of tow-engine motor boats BMK-90, BMK-150 and BMK-T.

(1) Наименование характеристик	БМК-90	БМК-150	БМК-Т
(2) Длина, *м*	7,80	8,20	8,60
(3) Ширина, *м*	2,10	2,55	2,70
(4) Высота, *м*	1,50	2,00	2,20
(5) Вес без заправки, *т*	2,45	2,27	—
(6) Осадка при полном водоизмещении, *м*	0,51	0,65	0,75
(7) Тяговое усилие на швартовах, *кг*:			
(8) на переднем ходу	900—1100	1500	2000
(9) на заднем ходу	До 400	700	750
(10) Максимальная скорость хода, *км/час*:			
(11) порожний	20,5	22	17
(12) с 50-тонным груженым паромом	8	9	10
(13) Число двигателей, шт.	1	2	1
(14) Эксплуатационная мощность, *л. с.*	75	2×65	130
(15) Обслуживающий расчет, человек	2	2	2

Key: (1). Designation of characteristics. (2). Length, m. (3). Width, m. (4). Height/altitude, m. (5). Weight without servicing, t. (6). draft with full load displacement, m. (7). Thrust on mooring lines, kg. (8). at forward running. (9). at backward motion. (10). Maximum speed of course, km/h. (11). empty. (12). with 50-ton/grand loaded ferry. (13). Number of engines, pieces. (14). Service power, horsepower. (15). Operating detachment, man.

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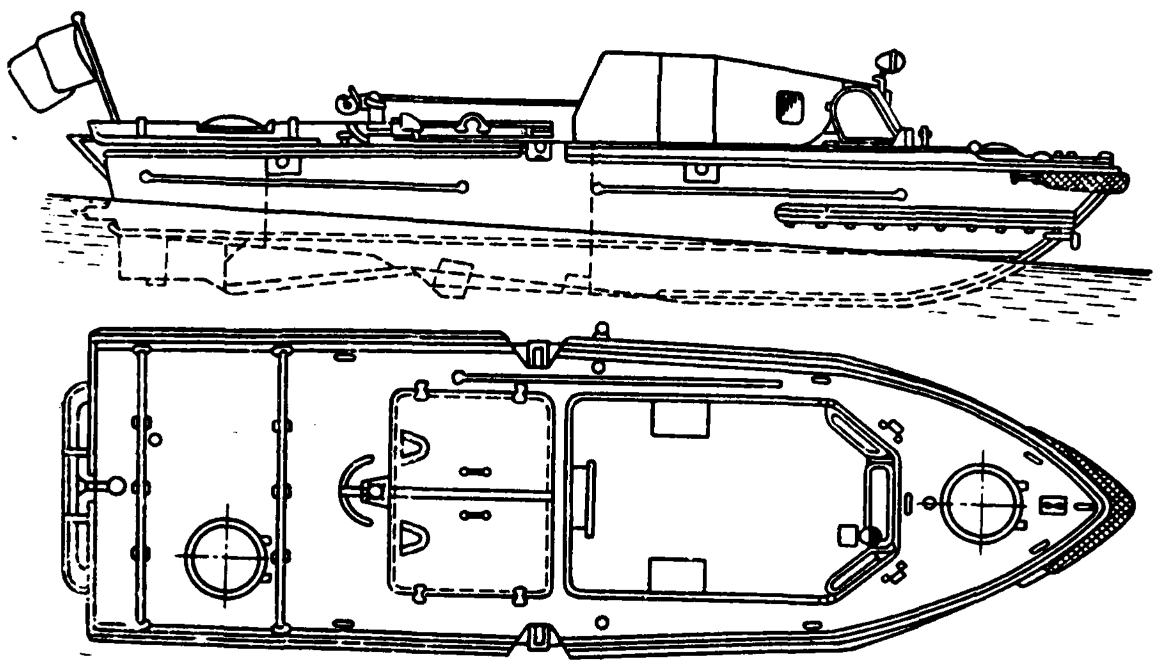

Fig. 14. Towing launch BMK-150.

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On dry land motor boat BMK-90 it is transported on the special trailer PBMK-90, which is towed by automobile. With the aid of this trailer is conducted the mechanized descent/release of motor boat to the water and its incline from the water. The load capacity of the automobile, which tows trailer PBMK-90 with the motor boat, must be not less than 3 t.

Towing launch BMK-150 (Fig. 14) possesses the good ones, than motor boat BMK-90, by seaworthiness and by large thrusts on the mooring lines.

Motor boat BMK-150 has two motors and two screw propellers. This increases its maneuverability and survivability on the water. Screw propellers can work in the different directions/axes, which provides small radius of turn.

The housing of motor boat has the duralumin covering. It is divided in four compartments, which increases the unsinkability of motor boat. Above the compartment of the control is a hinged/reversible tarpaulin awning, which can be raised with the heavy sea or in the rainy weather.

Motor boat BMK-150 has a tow construction and a device/appliance for the pushing of the ferries, accumulated from the motor pool of tanks in support of infantry (TPP). Device/appliance consists of pole, mooring strut and hinged construction.

For the transportation of motor boat on more drily is conveying

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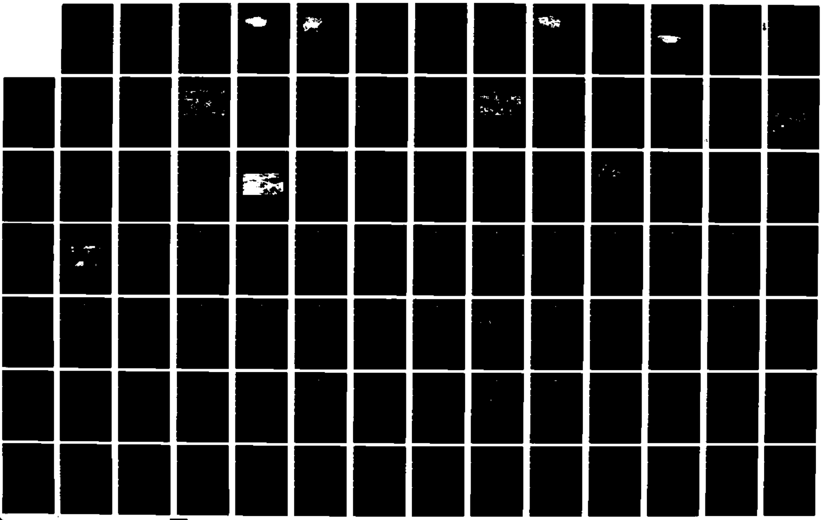

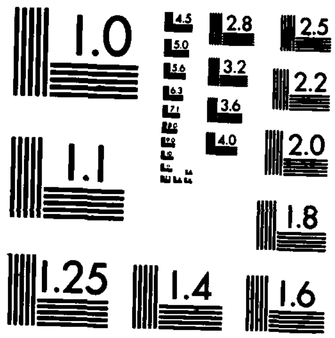
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appliance, which includes two suspensions and pole. Suspension is the ceiling jack with the automobile wheel, which is set to the boards of motor boat. Pole with one end is secured to the rear board of motor boat, and others - to three-ton truck.

To the water the motor boat must be lowered from the sloping shore, having solid ground. Before the descent/release the motor boat is set by stern to the water and slowly is supplied until it floats. After this is removed/taken the suspension and are included engines.

Basic performance data of towing launch BMK-150 are given in Table 4.

Towing-pushing launch BMK-T (Fig. 15) differs from the motor boats examined in terms of the fact that it in essence is intended and adapted for the pushing of transporting ferries.

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For the movement by the water it is equipped with the shipboard propeller/motor, which consists of two steering rotary columns with the screws/propellers of the nozzles. This provides the high maneuverability of motor boat on the water. On drier the motor boat it is transported on automobile KrAZ-214, equipped by special platform.

Basic performance data of towing-pushing launch BMK-T are given in Table 4.

5. Bridge layers.

For overcoming of narrow rivers, channels, ditches, gullies and other similar obstacles are applied the bridge layers, prepared on the base of tanks or automobiles. The base vehicles of bridge layers are the means/facility of transportation and installation/setting up of bridge to the obstacle. For the automobile bridge layers are utilized the automobiles of the increased passability and large load capacity. The bridge-laying tanks usually are created on the base of the tanks of series production. Using the mounting method of bridge to the obstacle the bridge layers can be dumping, extensible and folding systems.

Basic bridge layers are: the track mechanized bridge KMM, the heavy mechanized bridge TMM and the bridge-laying tank MTU. The bridge farms/trusses of bridge layers provide the passage of combat materiel of units and subunits of the attacking troops/forces.

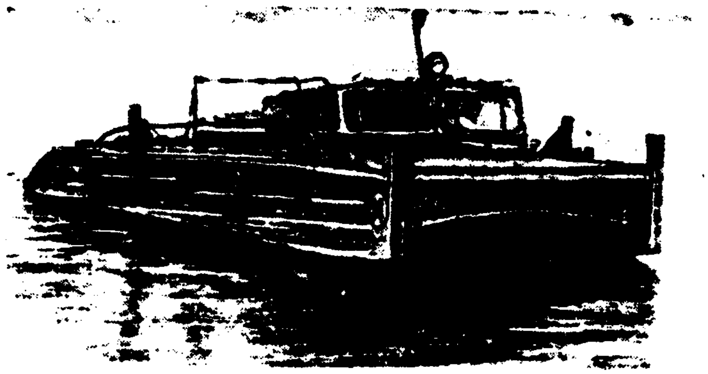

Fig. 15. Towing-pushing launch BMK-T.

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The track mechanized bridge KMM consists of five same-type bridge layers with the bridge unit (Fig. 16). The base vehicle of bridge layer is automobile ZIL-157. It has three driving axles and, furthermore, the construction, which makes it possible to change air pressure in the busbars/tires, which considerably increases the passability of bridge layer.

Bridge unit includes span building/structure, inner bearing and infrared equipment. Span building/structure track, has two identical tracks. The track of box section is prepared from I-beams, connected by cross-beams and communications/connections.

Inner bearing is intended for supporting two adjacent span buildings/structures. Support is frame, with the telescopic cross bars. It consists of two struts, two half-cleats and two spurs. The latter are intended for distributing the vertical load on the soil of the bottom of obstacle.

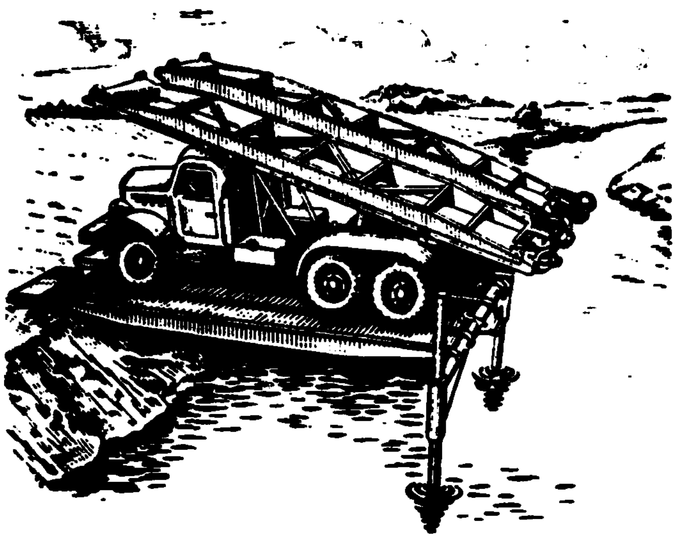

Fig. 16. Bridge layer KMM at moment of its installation/setting up to obstacle.

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The set of the track mechanized bridge KMM can be used in full strength or by individual vehicles. When is assembled bridge from the set KMM, working process includes: the preparation of bridge layers; their feed for the obstacle; the installation/setting up of bridge units and their disconnection from the bridge layers; the consecutive conclusion/derivation of bridge layers; the attachment of bridge and his control/regulation on the height/altitude.

Performance data of track mechanized bridge KMM.

Set of the bridge ... of 5 vehicles with the bridge units.

Load capacity, t ... 15.

Width of overcome obstacle, m ... 35.

Base of bridge layer ... automobile ZIL-157.

Detachment, man ... 3.

Weight with the bridge unit, t ... 8.8.

Velocity of movement the km/h: along the highway ... 35-40, along the unimproved road ... 20-25.

Time of the installation/setting up of bridge for obstacle, min: in the daytime ... 45-60, at night ... 60-80.

Time of the removal/taking bridge, min ... 45-60.

Span building/structure ... track.

Overall sizes of span building/structure, m: length ... 7.0, width in the line of bridge ... 2.95, track gauge ... 1.075, the width between-track space ... 0.8.

Weight of unit (bridge), t ... 1.42.

Inner bearing ... frame with the telescopic cross bar.

Weight of support, t ... 0.45.

Width of support in the line of bridge, m ... 3.95.

Height/altitude of the installation/setting up of support, m ... from 1 to 3.

The heavy mechanized bridge TMM consists of four bridge layers, intended for the transportation of bridge units, installation/setting up for the obstacle and their removals/takings from the obstacle. The base vehicle of bridge layer is truck KrAZ-214, which has three driving axles, which increase its passability (Fig. 17).

Bridge unit includes span building/structure, inner bearings and auxiliary armament.

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Span building/structure collapsible, consists of two metallic tracks.

Before the assembly of the heavy mechanized bridge engineer reconnaissance drives out/selects place with the convenient entrances and the area/site for the turn of bridge layers. The outlined range/alignment for the assembly of bridge is designated by posts/stakes. The sequence of the installation/setting up of bridge units to the obstacle is shown in Fig. 18.

The bridge-laying tank MTU, developed on the base of tank tractor, is intended for the passage of the tank subunits through the narrow obstacles in the course of combat operations (Fig. 19).

The characteristic feature of this bridge layer is the fact that it without the preparatory works in obstacle in short periods is capable to set the farm/truss of bridge under the fire effect of enemy. Crew in this case from vehicle does not emerge. Furthermore, having armor protection, tank crew can set bridge in the radioactively contaminated area.

Bridge layers of MTU usually perform in the combat formations of the advancing/attacking subunits, having by problem a provision of rapid overcoming of the encountered obstacles. In the cover nearest from the obstacle the crew of bridge layer conducts preparatory works, and then advances to it and on the move is set the bridge.

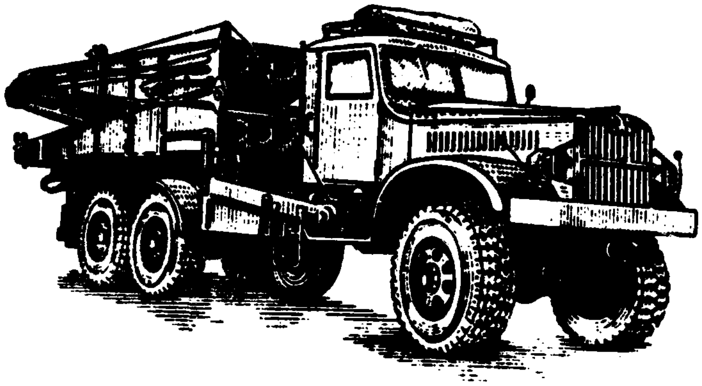

Fig. 17. Bridge layer TMM in transport position/situation.

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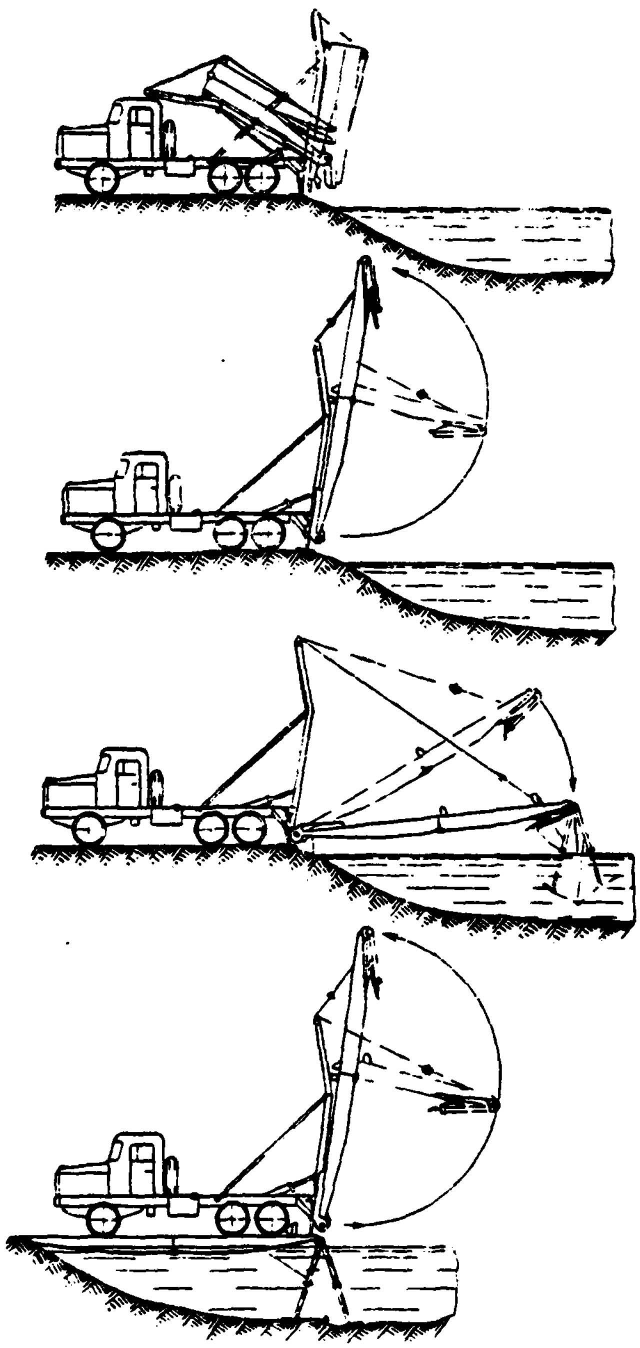

Fig. 18. Assembly diagram of bridge from set TMM.

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From all that has been previously stated, it follows that transport means are capable of fast advancing of the water obstacle together with the attacking troops/forces, and their skillful use and sufficient quantity provide the crossing of the advancing/attacking units and subunits without a descent in the general/common/total rate of advance.

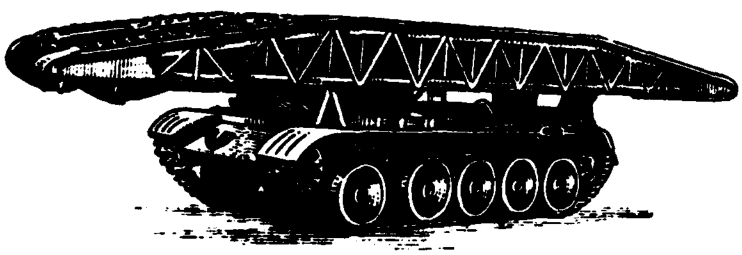

Fig. 19. Bridge-laying tank MTU.

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Chapter Four.

METHODS OF THE CROSSING OF TROOPS AND FORMS OF CROSSINGS.

Modern offensive combat is combined-arms combat. The success in it is achieved by the combined efforts/forces of all branches of services and special troops. In this case all of the arm of service perform in the interests of all-arms combat, carrying out missions inherent in them.

Hence it follows that for the successful assault crossing of rivers at the rates/tempos to contemporary cross motorized rifle, tank subunits and artillery. Otherwise combat on the opposite shore will be developed slowly, which, naturally, will lead to a descent in the rate of advance or will generally place in doubt its success.

Contemporary crossing means, amphibious tanks and armored personnel carriers, and also possibility of the crossing of tanks on deep fords and under water considerably increase the possibilities of the troops/forces on overcoming of river barriers/obstacles in the course of offensive. At the same time increase in the troops/forces of combat materiel, especially tanks, causes the need for further improvement of crossing means, and also improvement in those existing and investigation of the new, most advisable methods of crossing.

Depending on the situation conditions, presence of crossing means and character of water obstacle the units and the subunit can be crossed by different methods, namely: landing on the amphibious tanks, the armored personnel carriers, the engineer-amphibian equipment means/facilities and on the ferries; in the shallow sectors - wade: on the bridges; in the winter time - but to ice; tanks, furthermore, under the favorable conditions - by its course on deep fords and under water.

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With the offensive with overcoming of water obstacles to units and to subunits are assigned the crossing areas. By crossing area is understood the unit of the river barrier/obstacle and terrain adjacent to it in which the subunit (unit) realizes its overcoming with combat. With the accessibility of the coasts and terrain adjacent to them the crossing areas usually are driven out/selected in the entire zone of attack. With the limited and squeezed approaches to the river the crossing area occupies only most convenient and advantageous unit of water obstacle in the limits of this zone.

Depending on the method of crossing in the crossing areas of units and subunits are equipped landing, ferry-boat and bridge crossings, crossings of tanks under water, wade, and in winter - crossings on ices. Furthermore, the attacking troops/forces utilize the crossings, seized in enemy.

Crossing accepted to call the sector of water obstacle with the adjacent to it terrain, provided with necessary facilities and equipped for the crossing of troops/forces by one of the possible methods. They are arranged/located at the wide front in accordance with the combat formation, accepted for conducting combat by the opposite shore. This organization provides the crossing of the troops/forces without their essential redisposition on the near bank.

Crossings are equipped and are provided by crossing means depending on the character of the crossed subunits and their armament. In this case one should approach that so that the subunits (detachments, crews) would be crossed in full strength from the owls by authorized combat technology. By this are determined the form of crossing, its load capacity and necessary engineering equipment.

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1. The assault troop crossings.

The assault troop crossings are intended for the crossing of the motorized rifle and artillery subunits, which operate in the first echelon, and also in advance guard and advance detachments. This is explained by the fact that the contemporary self-propelled assault amphibious vehicles possess the necessary maneuverability, they are capable of being moved on drier with the march speed of the troops/forces and they can be used for the crossing immediately after output/yield to the river. On the assault troop crossings can be crossed and following the echelons.

On these crossings are utilized the self-propelled assault amphibious vehicles (floating automobiles and personnel carriers), which ensure simultaneous crossing with the landing force of personnel with their combat technology (Fig. 20). Furthermore, can be drawn local crossing means (boat, motor boat, river ships, etc.), and also improvised materials.

Even more advantageous for the assault crossing conditions are created when motorized rifle subunits are equipped with the floating armored personnel carriers. In these cases by them are not required special crossing means, since river they overcome in their authorized vehicles. Thus, the use/application of the floating armored personnel carriers considerably enlarged the content of the landing method of the crossing of the troops/forces. Because of these new means/facilities the assault troop crossing underwent its further development.

The crossing of subunits on the floating armored personnel carriers although relates to the assault troop crossing, it differs significantly from crossing in the self-propelled assault amphibious vehicles. Combat floating materiel to the near bank in this case does not return, since crossing on them is realized not by trips, but in the form of the consecutive flow of the authorized floating combat vehicles.

The assault troop crossings are characterized by capacity, i.e., by the capability to cross for one trip the specific quantity of subunits with their combat technology. The capacity of assault crossing usually is accepted of the detachment of crossing by one trip of the intensive motorized rifle company. On the wide rivers with the accessibility of the coasts the assault troop crossing can be created to two intensive motorized rifle companies, and sometimes also to the reinforced battalion.

The crossing of the troops/forces on the landing means/facilities is realized by the consecutive completion of trips.

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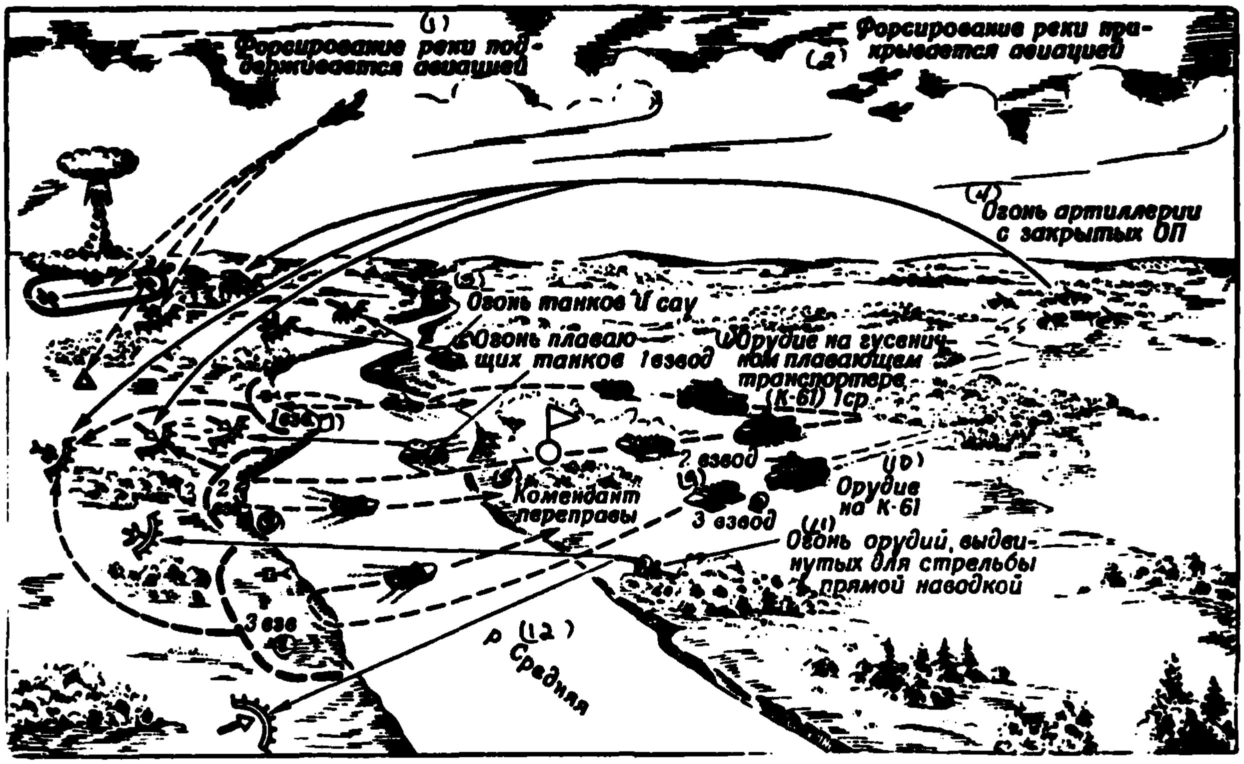

Fig. 20. Assault troop crossing.

Key: (1). Assault crossing river is supported by aviation. (2). Assault crossing river is covered by aviation. (3). Fire/light of tanks and SAU. (4). Fire/light of artillery from closed OP. (5). Fire/light of floating tanks 1 platoon. (6). Gun on tracked amphibious personnel carrier (K-61) of 1 rifle company (sr). (7). 1 platoon (vzv). (8). Crossing area commandant. (9). platoon. (10). Gun on K-61. (11). Fire/light of guns of those advanced for direct fire. (12). R middle.

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Into the complete trip of self-propelled assault amphibious vehicles enter: on-loading combat materiel on the near bank, its congress/descent into water, movement from the near bank to the opposite, departure to the coast, unloading of combat materiel, congress/descent of the empty floating vehicles into the water, the movement to the near bank, the output/yield from the water and feed under the on-loading. Sometimes, especially during the first stage of assault crossing, self-propelled assault amphibious vehicles to the coast can and cannot emerge.

During the determination of the composition of the first trip into the basis are accepted the order/formation, accepted for the crossing, and the presence of landing crossing means. In this case it is necessary to approach that so that simultaneously would be crossed entire subunit, will be otherwise hindered/hampered the control of it with the execution of combat mission. Defining the classification of the subsequent trips, they approach the best use of landing crossing means and the maximum crossing of the troops/forces.

To the advantages of the assault troop crossings should be related the possibility of the crossing of troops dispersed at the wide front without the redisposition of combat formation. This creates the best conditions for the defense of the crossings and crossed troops/forces from the weapons of mass destruction and from conventional means of struggle. The assault troop crossings independent of the width of river are equipped in short periods. Furthermore, they are less than other forms of crossings, they are attached to the equipped shores, which facilitates maneuver by crossing means in the course of assault crossing.

Crossing on the landing means/facilities is one of the basic methods of the crossing of motorized rifle and artillery subunits, especially during the first stage of assault crossing. In this case the specific gravity/weight of the assault troop crossings in comparison with other crossings is found in direct dependence on the width of river. The wider the water obstacle, there the larger number of troops/forces is forced to be crossed on the landing means/facilities, especially in the beginning of assault crossing, and, on the contrary, the narrower the river, the more rapid the center of gravity can be postponed by other forms of crossings. On the wide rivers when for laying of the bridges of pontoon-bridge motor pools it will insufficiently or bridge inexpediently, engineer-amphibian equipment means/facilities can show/render decisive importance.

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2. Ferry crossings.

During the armament of ferry crossings are utilized the tracked amphibious ferries GSP and the transporting ferries, accumulated from the pontoon trains. They are intended for the crossing of tanks, artillery, armored personnel carriers, automobiles and other combat technology (Fig. 21).

The crossing of tanks on the tracked amphibious ferries GSP in comparison with the assault troop crossings is realized with the insignificant step on the time, since the joining of half-ferries can begin immediately after landing to the opposite shore of the subunits of the first trip, and to joining itself and preparation of ferries for the crossing of tanks are spent a total of several minutes. The access ramps of ferries will make it possible to realize a crossing of tanks without the piers with the insignificant armament of the places of berth.

The pontoon-bridge subunits and the subunits of the tracked amphibious ferries, isolated for the armament of ferry crossings, advance to the river following the subunits of the first echelon. Ferry crossings are created by capacity each of the detachment of the provision of a simultaneous crossing of entire tank platoon or artillery battery (the firing platoon).

On the ferry crossing with the transporting ferries depending on several pairs of piers (berths). On one pair of piers (berths) are based one or several ferries. A quantity of ferries which can be based on one pair of piers (berths), depends on the width of river, rate of flow and time, necessary for on-loading (unloading) of combat materiel, and is determined by the division of the duration of the trip of ferry into the period of on-loading combat materiel on pair.

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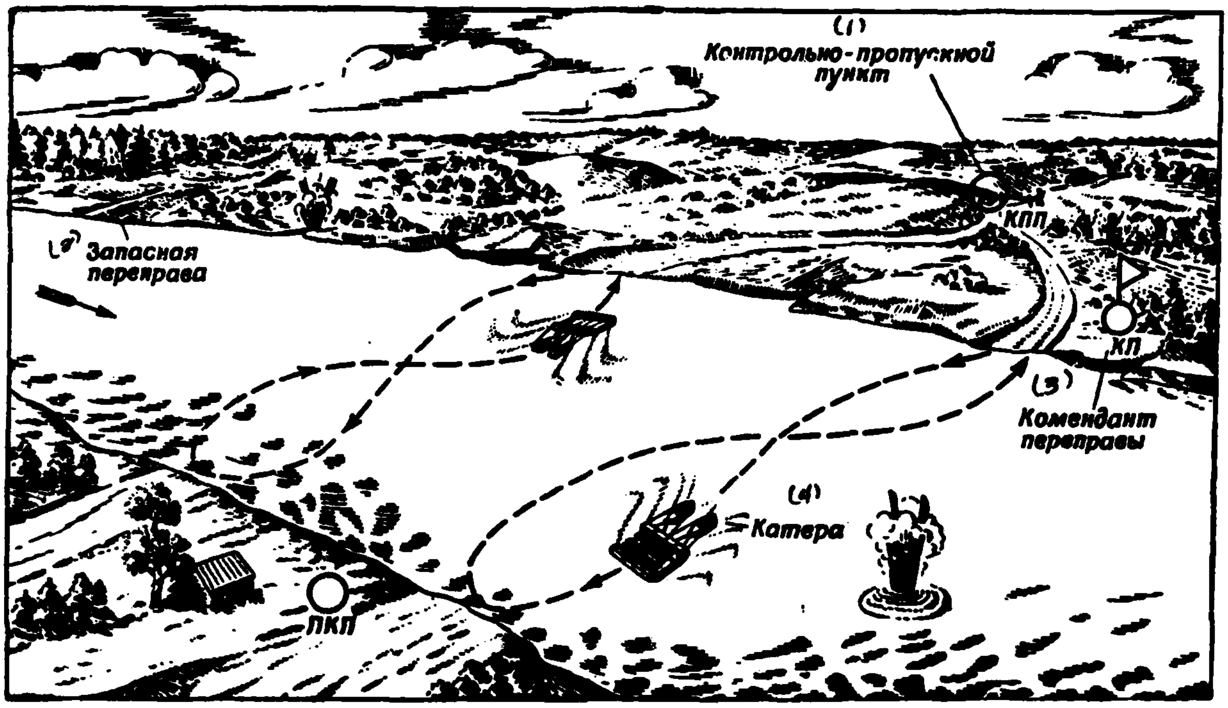

Fig. 21. Ferry crossing (version).

Key: (1). Check point. (2). Spare crossing. (3). Crossing area commandant. (4). Motor boats.

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A maximum number of ferries, which are based on one pair of piers (berths), is determined from the formula

$$K=\frac{2R}{T},$$

where K - maximum quantity of ferries which can be based on one pair of the piers: R - duration of the trip of ferry, min; T - time, required for the on-loading, unloading, berth and refuse/bank, i.e., the time of the execution of all loading-unloading operations/processes in one trip, min.

A quantity of transporting ferries which can be based on one pair of piers (berths), depending on width and rate of flow of river can be determined, also, on Table 5.

From the Table it is evident that on the rivers with a width of up to 300 m upon one pair of piers (berths) usually are based two ferries, and on the rivers of more than 300 m - 3-4 ferries.

With assault crossing of the rivers with a width of up to 1100 m ferry crossings from the pontoon trains to equip inexpediently. In these cases after the capture of opposite shore more advantageous immediately to begin focusing/induction or assembly of bridges, which will considerably accelerate the crossing of the troops/forces.

The crossing of tanks and other combat technology on the ferry crossings is realized consecutively/serially, by trips. Tanks, making up the next trip-detachment, advance to the coast, and those following are arranged/located sheltered, at certain removal/distance from crabs/cancers, utilizing for this the protective and camouflaging properties terrains (ravines, bushes, forest, etc.). In this case the unit of the tanks is drawn for the delivery of fire on the surviving weapon emplacements of enemy. In order to avoid the accumulation of combat materiel in crossings, in advance is set the sequence of its output/yield to the river.

Table 5.

(1) Скорость течения реки, м/сек	(2) Ширина реки, м			
	100-150	200-250	300-400	450-500
(3) Предельное количество паромов				
(4) До 0,5	2	2	2	3
0,5—1,0	2	2	2-3	3
1,5—2,0	2	2	3—4	4
2—2,5	2	3	4	5

Key: (1). Rate of flow of river, m/s. (2). Width of river, m. (3). Maximum quantity of ferries. (4). To.

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Ferry crossings are equipped dispersed at the wide front. By this is achieved the smaller vulnerability of ferry crossings and crossed technology to the fire/light of artillery, aviation and nuclear attacks of enemy and are created favorable conditions for accomplishing maneuver along the water obstacle. Ferries, possessing large load capacity, make it possible to cross entire combat technology, available in the troops/forces.

Thus, ferry crossings are the reliable means/facility of overcoming rivers, and with assault crossing of wide rivers can be basic means the crossings of the troops/forces.

3. Crossing of tanks on deep fords and under water.

For increasing in rate/tempo and reaching/achievement of the surprise of assault crossing under the favorable conditions and with the solid ground of the river bed of river are equipped the crossings of tanks on deep fords and under water (Fig. 22). This method of crossing relatively new, it was used during the Great Patriotic War. Thus, during March 1944 one of the tank regiments, which operate as advance detachment, overcame r. the Southern Bug on the bottom of river by its course. The depth of river in this sector achieved 3 m, and the width of 250 m.

Hermetic sealing/pressurization of tanks in the last war was realized with the aid of the improvised means. The exhaust gases were devoted along the tin pipes/tubes which were secured to the exhaust openings, and were ejected upward higher than the level water.

At present the method of crossing of tanks on deep fords and under water was widely applied in many armies of peace/world. It suffices to note that during the exercises of the troops/forces of NATO, which are located in the FRG, the crossing of tanks M-60 under water was realized on many rivers, including on r. Rhine in the area of Cologne.

This method of the crossing of tanks in tactical sense has a series/row of advantages. In particular, during the careful organization of assault crossing can be achieved the surprise of the crossing of a large quantity of tanks at the wide front in short periods. Should be considered that the fact that in this case decreases the requirement for the pontoon-bridge means/facilities and the tracked amphibious ferries.

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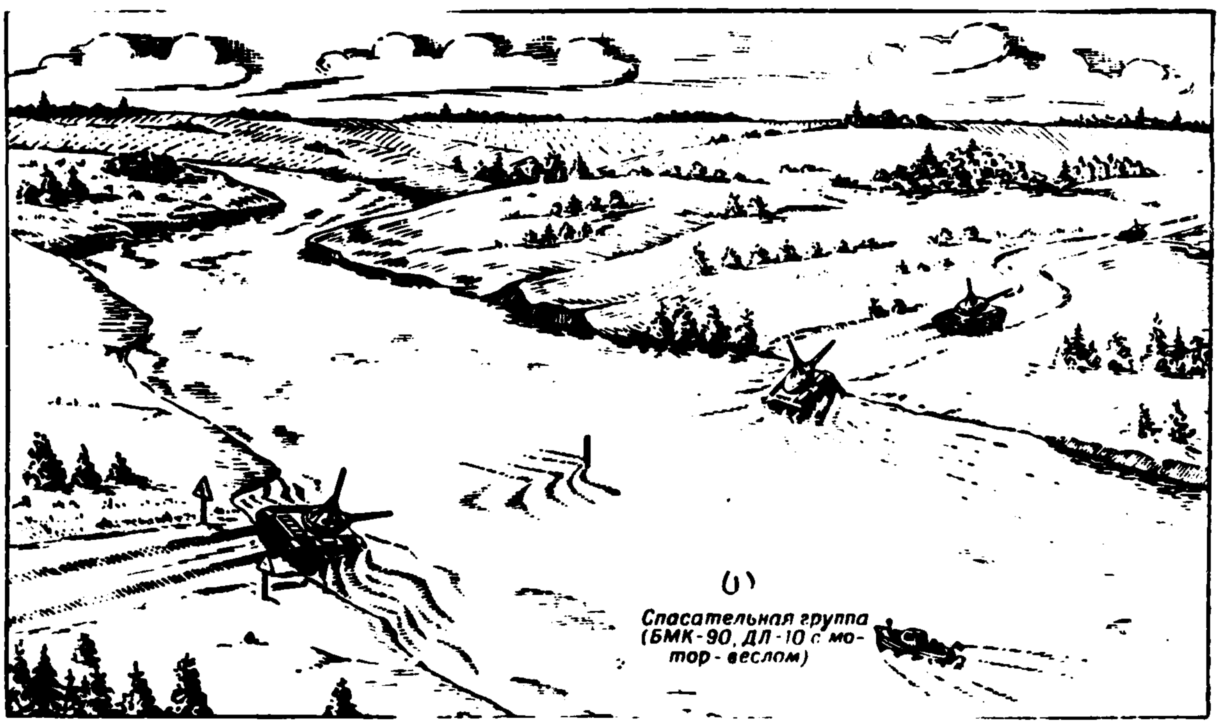

Fig. 22. Crossing of tanks under water.

Key: (1). Rescue group (BMK-90, DL-10 with motor-paddle).

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At the same time this method of crossing has a series/row of substantial limitations. First of all it is applicable only in the sectors of river, which have convenient approaches to the river and outputs/yields of the water, even with the solid ground bottom (gravel, sand, etc.). On the paths of motion of tanks along the bottom of the river must not be of steep/abrupt ones and abrupt it is lowering, pits, ravens, boulders, the sunken objects/subjects (logs, barges, etc.).

It is necessary to consider that the fact that for the special preparation of tanks for the crossing on deep fords and under water will be required their cessation before the river, and crossing can be conducted only after careful reconnaissance/intelligence and removal/distance from the bottom of the river of natural obstacles and obstacles, for which will be required considerable time.

To the armament of deep fords and crossings of tanks under water they begin after our troops/forces seize opposite shore. Therefore the crossing of tanks during the first stage of assault crossing is realized on the tracked self-propelled and transporting ferries. Simultaneously with this are reconnoitered and are equipped the crossings of tanks under water.

To tank battle for successful overcoming of river it is necessary to prepare one - two such crossings.

The placenta of preparation/training and designation of fords (tracers)- begin crossing of tanks at the low speeds without gearshift, cessations and change in the direction of motion. Movement is realized in the wake column with the observance of the established/installed sequence. Distance between the tanks on the wide and average/mean rivers must be not less than 50 m, but on the narrow rivers tank begins crossing after in front going will move out to the opposite shore.

The possibility of the crossing of tanks on deep fords and under water is located in direct dependence on the natural conditions, which characterize river and adjacent terrain.

With the favorable conditions, correctly organized reconnaissance/intelligence, armament and designation of tracers (fords) the crossing of tanks in this manner can find wide acceptance.

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4. Bridge crossings.

On the bridge crossings depending on specific conditions are laid fused, are constructed low-water and submersible bridges from the previously prepared/prefabricated elements/cells or are collected the combined bridges.

Bridge transitions in comparison with other crossings possess the larger capacity of all types of combat materiel and are the means/facility of the mass crossing of the troops/forces (Fig. 23). Therefore with assault crossing of rivers the troops/forces attempt to take the existing bridges or to equip new bridge crossings.

For the launching of a floating bridge are applied pontoon trains, and also are utilized captured pontoon-bridge means/facilities. In the contemporary pontoon-bridge motor pools all preparatory and fitters work directly on water and during launching of a floating bridge as a result of high mechanization are led to the minimum. Therefore floating bridges are laid in short periods and with the insignificant expenditure of forces.

Floating bridges usually attempt to lay in the not wide places of river, where there are concealed/latent routes of approach and solid flat descents/releases to the water and where is sufficiently developed road net, i.e., near the existing bridge and ferry crossings. However, it is necessary to consider that precisely in such sectors the enemy can establish obstacles and prepare fire/light. With a deficiency/lack in the time, especially with assault crossing of rivers on the move, it is frequently necessary to utilize the existing road net, which leads to the constant crossings.

Bridge laying they take up after will be seized the zone of the coast, which ensures the assembly of ferries, i.e., when enemy is deprived of the possibility to conduct small arms fire according to the place of bridge laying.

For the crossing of tanks and heavy combat technology are usually laid bridges with load-carrying capacity 50-60 t. With a deficiency/lack in the pontoon trains for the crossing of artillery, armored personnel carriers and other tractor technology can be laid 16-20-ton bridges. The use of the bridges of different load capacity will require with the crossing of the troops/forces of the regrouping of tanks for the movement only along the heavy bridge, and other combat technology - on the light bridges.

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Fig. 23. Bridge crossing.

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This will strongly complicate the control of the advancing/attacking units and of subunits and their cooperation.

On the narrow rivers for the construction of marches/passages, besides the floating bridges, must extensively be used the track mechanized bridges or the combined marches/passages from the earth embankments and elements/cells of wooden bridges.

The track mechanized bridges allow in the course of combat operations in the limited time to equip the bridge transitions through the obstacle with width to 35-40 m.

The fused and mechanized bridges are replaced by the low-water wooden bridges which are constructed usually from the previously prepared/prefabricated elements/cells, which contributes to their rapid assembly.

However, under combat conditions will not always occur the possibility to organize the centralized procurement of the elements/cells of bridges. Furthermore, their delivery/procurement to the place of building up to the large distances will present great difficulties, since will be required a large quantity of motor vehicles which to the certain degree will brake the advance of the attacking troops/forces.

Therefore in a number of cases it is necessary to build a bridge from the local materials. In this case the rate/tempo of building will be considerably below. But even under these conditions low-water wooden bridges to construct necessarily, since are freed the pontoon-bridge motor pools, which can be utilized for the provision of assault crossing the attacking troops/forces on the subsequent rivers. Furthermore, bridges on the rigid supports possess larger working life and are less vulnerable to the strikes/shocks of enemy than the bridges, laid from the pontoon-bridge motor pools.

With the contemporary means/facilities of detection the content of the bridge crossings presents great difficulties even with the well organized antiaircraft cover. This is explained by the fact that the bridge crossings are the unit of the intense effect both by the ordinary weapons of destruction and nuclear weaponry.

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With the advent of nuclear weaponry extremely they were complicated the content and the provision of survivability of bridge crossings. With assault crossing of wide rivers under the conditions of a good visibility the bridge crossings to equip is generally inexpedient, since they can be the independent objective of the nuclear attack of enemy. The bridge crossings are easily vulnerable also to the ordinary weapons of destruction - artillery and aviation. For the breakdown of bridge is sufficient to destroy one bridge pair. Therefore on the wide rivers during the day pontoon-bridge means to more advantageous employ as the ferry crossings. However, with the onset of dark, just as under other conditions of the restricted visibility, for the short period is possible bridge laying. With the dawn or with an improvement in the visibility the bridges must be separated and again converted/transferred to the ferry crossings.

With a sufficient quantity pontoon of means/facilities the bridge crossings can be equipped under the conditions of the restricted visibility and on the wide rivers, but while the reliable air defense, good camouflage and taking of other protective measures.

The rate/tempo of overcoming narrow rivers and rivers of average/mean width in many respects will depend on a quantity of bridge transitions and time of their readiness.

The steadiness of crossing on the bridges is provided by maneuver by them in the crossing area, transition from the bridge to ferry-boat crossings, and also by construction of dummy bridges. The most important measure for an increase in the survivability of the bridge crossings is as before the air defense which is intended to reliably ensure the protection of the crossed troops/forces from the strikes/shocks of enemy from air.

The bridge crossings, providing the continuity of movement and possessing the greatest capacity, remain one of the most effective methods of crossing of troops/forces and all types of combat materiel through the water obstacles.

5. Fording.

On the rivers, which have small depth and solid ground of the coasts and bottom, are equipped the fordings (Fig. 24). Their use is profitable in all cases, since for the armament is not required large forces and much time.

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According to the capacity of ford approach the bridge crossings. However, of greatest interest fords are in that sense, that they give the possibility to organize the crossing of tank subunits almost simultaneously since the beginning of the general/common/total assault crossing.

Fords are revealed/detected via the interrogation of local residents, radiation/emission of large-scale maps, aerial photographs and then they are more precisely formulated by reconnaissance/intelligence on the spot on characteristic features. Such signs/criteria can be the roads and the paths, which go to the river and which are continued on the opposite shore, drops/jumps in the water, expansion of the mirror of water, especially in the straight/direct sectors of river and, etc.

The passability of fords for combat materiel depends on the depth of river, soil of bottom and rate of flow. This dependence is shown in Table 6.

If higher than the ford with the flow of river are water-engineering constructions (dams, sluices, etc.), it is necessary to attempt to take them. Otherwise the enemy can blow them up and thereby tear away the crossing of the troops/forces wade.

The crossing of combat materiel wade precedes careful reconnaissance/intelligence of the bottom of river. All discovered obstacles (boulders, snag, pit, crater, etc.) in advance are driven out, are filled up or are fenced in.

Fig. 24. Fording.

Key: (1). Enclosure/protection against floating mines. (2). Enclosure/protection of damage.

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With the soft ground of the bottom of river and approaches to it a crossing of the troops/forces to wade realize is nevertheless possible. For this it is necessary approaches and the bottom of river in the place of the armament of ford to strengthen by stone, crushed stone, gravel, gravel or other materials. Otherwise ford rapidly is destroyed and it becomes impervious/impassable.

With crossing of a large quantity of combat materiel are equipped separately the fords for the wheel and tracked vehicles. In this case the bottom of ford for the crossing of trucks must be not only solid, but also it is sufficient to even ones.

Descents/releases to the water must be flat, especially outputs/yields on the opposite shore, since the water flowing from the vehicles, being mixed with the soil, forms contamination. As a result on the steep climbs on leaving from the water wheel and even tracked vehicles skid.

The crossing of combat materiel wade is realized at the low speeds without gearshift and without a change in the direction of motion. Automobiles and armored personnel carriers move over the ford at certain angle to the flow of river to the lower side, in order to avoid flooding by water of radiators.

Table 6. Maximum depth of fords, which allows/assumes the crossing of combat materiel.

(1) Боевая техника	(2) Скорость течения, м/сек		
	(3) до 1	(3) до 2	(4) более 2
(5) Допустимая глубина брода, м			
(6) Автомобили (бронетранспортеры колесные)	0,6—1,0	0,5—0,9	0,4—0,8
(7) Артиллерия с гусеничными тягачами (АТЛ, АТС)	0,8—1,2	0,7—1,1	0,6—1,0
(8) Артиллерия с тягачами АТТ	1,5	1,4	1,3
(9) Тракторные бульдозеры (тракторы)	0,8	0,7	0,6
(10) Средние танки	1,2	1,1	1
(11) Тяжелые танки	1,5	1,4	1,3

Note. Tanks, applying special attachments, are capable of overcoming rivers on deep fords and under water.

Key: (1). Combat materiel. (2). Rate of flow, m/s. (3). to. (4). it is more. (5). Permissible depth of ford, m. (6). Automobiles (armored personnel carriers wheel). (7). Art llery with caterpillar tractors (ATL, ATS). (8). Artillery with tractors ATT. (9). Tractor bulldozers (tractors). (10). Medium tanks. (11). Heavy tanks.

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It is especially dangerous crossing at the rate of flow of more than 2 m/s, since in front of the radiator is formed the breaker, which pours motor. Furthermore, strong flow can shoot down from the ford to a deep place the crossed technology. The width of ford must be not less than 8-10 m. In this case is feasible the detour of the stopped vehicle.

For maintenance/servicing and repairing the ford, especially with the soft ground, are assigned special subunits. For the extraction of the jammed combat technology to them in by aid are emitted the tractors.

Fording on the shallow rivers, and sometimes also on the deep ones, which have sand-bars, can be the basic method of the crossing of the attacking troops/forces and their combat technology.

6. Crossings on ice.

In the winter time, if the thickness of ice can maintain/withstand combat materiel, equip crossings on ice (Fig. 25). With a sufficient load capacity of ice cover overcoming river by the troops/forces does not present great difficulty. However, in this case it will be necessary to equip descents/releases and coupling of ice with the coast. Crossings are equipped after careful reconnaissance/intelligence and determination of the bearing capacity of ice and its large unit/formation with the coast.

The load capacity of ice is called the capability to maintain/withstand the crossed cargoes of the specific weight. It depends on the structure of ice, its thickness and temperature of air. The thickness of ice of river barrier/obstacle is dissimilar and variable. Ice cover has large thickness in the sectors of river with the weak current (reaches), at deep places and, where is less snow cover. Consequently, in these places ice possesses the larger bearing capacity.

Thinner ice can be on the sand bars, i.e., in the sectors with the rapid current, on the fairway, in the places with the peat bottom, on the swampy shores and, where very thick snow cover.

The durability of ice depends on the season and days. It is more durable at night and by the early morning. In spring, with the prolonged thaws, ice changes its structure and becomes loose.

The load capacity of ice depends also on the chemical composition of water and different admixtures/impurities.

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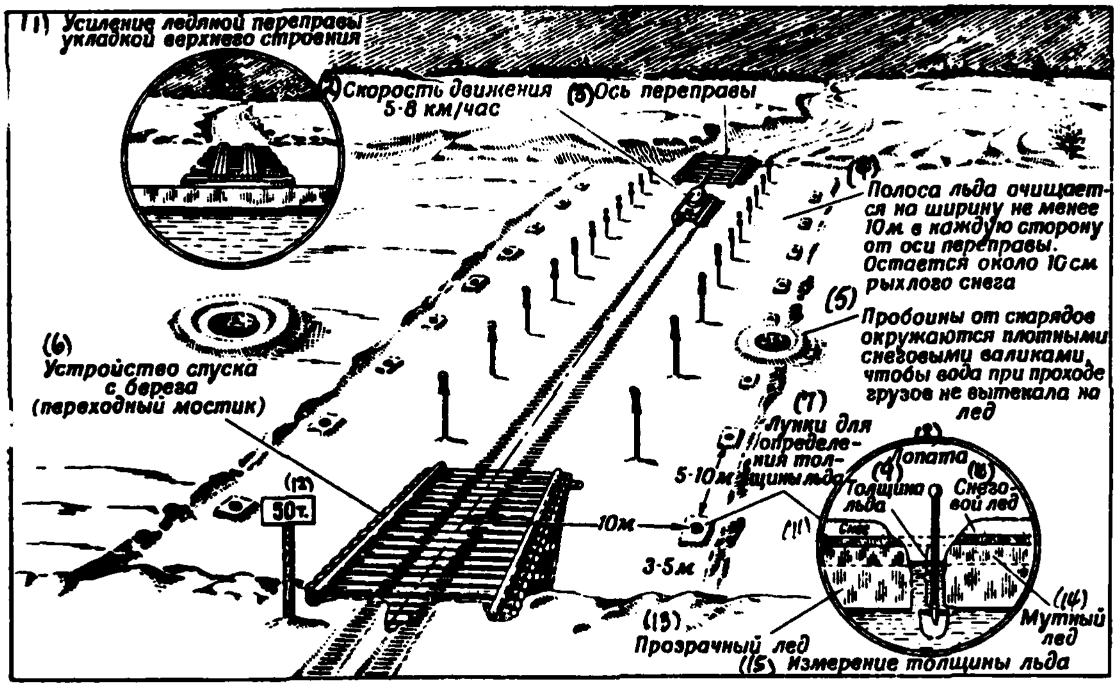

Fig. 25. Crossing on ice.

Key: (1). Reinforcing of ice crossing by placing superstructure. (2). Speed of motion 5-8 km/h. (3). Axis of crossing. (4). Zone of ice is cleaned to width not less than 10 m to each side of axis of crossing. Remain about 10 cm of loose snow. (5). Holes from shells are encircled by dense snow cylinders so that water with passage of cargoes would not ensue/escape/flow out to ice. (6). Construction of descent/release from coast (transfer navigation bridge). (7). Holes for determining thickness of ice. (8). Shovel. (9). Thickness of ice. (10). Snow ice. (11). Snow. (12). 50 t. (13). Transparent ice. (14). Turbid ice. (15). Measurement of thickness of ice.

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Ice, formed from the fresh water, is two times more durable than ice from the sea water. The upper layer of ice (turbid), formed from the contaminated water, is weaker than the transparent. Therefore during the determination of load capacity the upper layer of ice into the detachment does not enter.

The thickness of ice, which allows/assumes the passage of vehicles, can be determined according to the following formulas:

for tracked vehicles $H=9\sqrt{p}$;

for the wheel vehicles $H=11\sqrt{p}$,

where H - thickness of the transparent layer of ice, cm; p - weight of vehicles, t.

For example, it is necessary to determine the thickness of ice, with which is possible the crossing of the tanks with a weight of 49 t. Using this formula, let us determine the minimally permissible thickness of ice cover. The crossing of the tanks of the weight indicated is possible with the thickness of ice 63 cm ($H=9\sqrt{49}=9\times 7=63$ *см*).

When the crossing of the troops/forces is realized at a temperature of air of 0° and above, the thickness of ice cover obtained according to the formula increases 1.3-1.5 times.

The load capacity of ice can be determined also according to the special tables, in which are considered the temperature of surrounding air and the permissible intervehicle distance (Appendix 2, Table 5).

The minimum thickness of ice, with which is allowed/assumed the crossing, depending on weight must be: for the automobiles and the armored personnel carriers 16-35 cm, for the artillery 20-51 cm, for tanks 50-75 cm. With smaller to thickness it is necessary to take measures for reinforcing of ice cover via the construction of superstructure and conducting of the measures, which warn its wear.

Summing up the sum, it is possible to say that to the existing methods the crossings of the troops/forces and in the forms of crossings are inherent both the positive and negative properties, which are determining the advisability of their use/application in one or the other cases. Therefore with assault crossing of rivers depending on specific situation conditions it is necessary to skillfully combine all methods of crossing, in order within the limited periods to ensure crossing without a considerable descent in the general/common/total rate of advance of the troops/forces.

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Chapter Five.

ARMAMENT OF CROSSINGS.

The reliable and trouble-free operation of the crossings, created in the crossing areas, is achieved by timely engineering armament, skillful use of the chosen crossing means and by maintenance of routine.

The engineering armament of crossings independent of the method of assault crossing includes: the inspection/check of terrain to the presence of obstructions and the removal of obstacles of routes/paths, coasts and quite water obstacle within the limits of the equipped crossings; preparation of paths, that go from the basic roads to the crossings; the construction of the congresses/descents into the water and of departures for the self-propelled assault amphibious vehicles; the assembly of transporting ferries and the preparation of means/facilities for their towing, and if necessary and the construction of piers; focusing/induction of fused, the construction low-water and other bridges; armament and the designation of the crossings of tanks under water and the fords; the armament of river pickets and the construction of anti-mine enclosures/protections; the construction of covers for the personnel of traffic-control service and detachments, which operate crossings; camouflage measures.

1. Removal of obstacles in the places of the armament of crossings.

For reinforcing the rivers as obstacles the enemy can extensively use different engineering obstacles and, first of all, mine-explosive. Overcoming of mine obstacles, established/installed in the water, is complex problem.

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Therefore during the selection of the places of crossings one should avoid the mined areas of river. When cannot be gone around obstacles, are made and are designated passages, is organized their content.

The removal of obstacles of near bank depends on the method of assault crossing. With assault crossing of rivers on the move in the obstacles are made the passages by the tanks, equipped with the mine sweepers, or explosive method. The investigated minefields are designated and are fenced in. These methods provide reliable breaching of passages at entire depth of minefield within the shortest possible periods.

With assault crossing of rivers with deliberate preparation/training is conducted the continuous mine clearing of near bank in the limits of the equipped crossings. The mine clearing of near bank is realized secretly, by hand in some-one day before the beginning of assault crossing. It is expedient for this to draw those subunits which set the mine fields.

Passages in obstructions, established/installed in the water, are made by elongated charges which are supplied with the aid of the cable-throwers. They can be made by mechanical method with the use of special river sweeps, towed by self-propelled assault amphibious vehicles. However, elongated charges have an advantage over the river sweeps: with their aid it is possible to make passages both in the submerged obstacles and in the obstacles, established/installed on the opposite shore.

For the mine clearing of fords and breaching of passages in the mine fields, established/installed in the water at the depth to 1.2 m, can be drawn the tanks, equipped with the mine sweepers.

A quantity of passages is defined not by a number of operating in the first line platoons as in the offensive, but with a quantity of routes/paths, prepared for all equipped crossings.

The width of passages in the submerged obstacles depends on the width of river, rate of flow, character of obstacles, type of the utilized crossing means, ides of the equipped crossings, presence of forces, means/facilities and time.

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But in all cases passages for the self-propelled assault amphibious vehicles and the ferries must provide security with the turns, departures of contrary vehicles and ferries, and also with the deflection from the running course with the high wind, the high rate of flow of water and restricted visibility (night, fog/mist, etc.). Furthermore, is calculated the method of the movement of ferries on the basis of water. During towing of ferry the width of passage must be more than with the pushing.

During the determination of the width of passages on the bridge crossings they proceed from the method of focusing/induction. With bridge laying by rotation it is necessary to clear mines the sector, equal to the width of river; during the focusing/induction components/links the width of passage in the submerged obstacles can be somewhat less.

The width of passages on deep fords and on the crossings under water must provide the continuous movement of tanks even with cessation of one of them. The width of passage for the tracked amphibious personnel carriers (floating automobiles) must be 15-20 m, and for the crossing of tanks under water and on the fords depending on the width of river - 20-50 m.

The boundaries of passages in the submerged obstacles and the cleared mines sectors of river are designated by floating posts/stakes or buoys, painted into different ones of color; for example, from the upper side in the red color, with the lower - into the white.

On the opposite shore the passages in the obstacles are arranged by the subunits of engineers, connected with the composition of the first trip-detachment. In the beginning of assault crossing the passages are arranged in the obstacles, established/installed directly on the opposite shore and in the form in order to ensure the landing of the subunits, crossed by the first trip.

After crossing to the opposite shore, the subunits, assigned for armament and content of crossings, expand the made passages and if necessary equip new ones, they fence in them and advance in the passages mooring signs. Basic work on the removal of obstacles of opposite shore in the limits of the assault troop crossings must be completed to the time of the arrival of the subsequent trip-detachment.

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On the ferry-boat and bridge crossings are cleared mines the sites of installation of piers, coast sectors of bridges are made passages in the obstacles on the routes/paths, which lead to the coastal belt road.

Removal of obstacles on the opposite shore is conducted with the aid of the tanks, equipped with the mine sweepers, or explosive method just as in the ordinary offensive.

2. Armament of the assault troop crossings.

Most advantageous for the armament of the assault troop crossings are the sectors of river and the terrain adjacent to them, that ensure: the concealed/latent approach to the river; a good observation of the opposite shore and convenience in the conduct of artillery direct fire; the preparation of the routes/paths of approach from the existing road net to the crossings, armament it is lowering into the water also of outputs/yields on the opposite shore in short periods without the considerable expenditure of forces and resources; convenience in landing (on-loading) subunits on the self-propelled assault amphibious vehicles and the landings (unloading) from them, output/yield by the shortest and concealed/latent paths to the assault objectives on the opposite shore of river. In this case in the crossing areas must not be of obstacles and obstacles, river must have the moderate flow and a sufficient depth, which allows/assumes the movement of all engineer-amphibian equipment resources.

The armament of the assault troop crossing includes: the removal of obstacles of the coasts and the elimination of the submerged obstacles, the armament of trails and construction it is lowering on the near bank also of outputs/yields on the opposite shore, the preparation of places for on-loading of combat materiel, the timely feed of engineer-amphibian equipment resources and the provision of their work, the preparation of signal communication net (radio, by mobile resources and by signals), the erection of the simplest covers for the subunits, which contain crossing.

For the armament of the assault troop crossings are utilized the authorized self-propelled assault amphibious vehicles which advance to the river together with the subunits of the first echelon. At the same time can be utilized the local crossing means, seized in enemy (motor boat, engine boats, etc.).

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Quantity of passages in the mine-explosive obstacles (if it is impossible to go around them) depends on the character of the banks and self-propelled assault amphibious vehicles isolatable to the crossing. Under the average/mean conditions with the accessibility of the banks on each assault troop crossing are made one - two passages to the squad of the floating vehicles (personnel carriers).

For the provision of fast output/yield of the subunits of the crossed troops/forces and transport subunits to the river is trained/prepared the net/system of routes/paths. Trails for the self-propelled assault amphibious vehicles are equipped and are plumbed of the detachment one route/path from the area of on-loading to the check point; from it according to one - two routes/paths to the squad of the floating vehicles to the latter/last natural cover; further to the river each trail branches according to a number of self-propelled assault amphibious vehicles. Under the difficult conditions of terrain a quantity of trails can be abbreviated/reduced.

During the armament of trails maximally are utilized the existing routes/paths and the concealed/latent routes of approach. All routes/paths are thoroughly designated, especially in the night time, for which are applied the lighted one-way signs or metallic antispray lamps/canopies.

Check point (KPP) usually is equipped on the crossing of coastal belt road and frontal route/path, which goes from the area of on-loading the first trip to the self-propelled assault amphibious vehicles. Simultaneously are closed over all unusable existing roads, which lead to the crossing. On the trails, which go from the check point to the river, for the organized output/yield of the subsequent subunits are established/installed traffic-control posts and traffic regulation posts.

In the sectors of river, which have soft ground or steep/abrupt and abrupt shores, are equipped the departures. Slope/transconductance it is lowering and especially outputs/yields from the water on the opposite shore it depends on the possibilities of the self-propelled floating vehicles. These possibilities are very great. Thus, the greatest gradient of the incline of the large floating automobile is equal to 32°, and tracked amphibious personnel carrier of 40°.

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At the same time on leaving of them from the water unavoidably is moistened ground and deteriorates passability of the slopes. Therefore it is expedient to drive out/select descents/releases by slope/transconductance of 6-12°.

During the armament it is lowering into the water for the self-propelled assault amphibious vehicles, furthermore, it is necessary to consider the gradient of the underwater unit of the congress/descent (departure), on which they from floating position/situation emerge to the coast, since cohesion/coupling with the wet soil considerably is reduced. The slope/transconductance of the underwater unit of the departure for the self-propelled assault amphibious vehicles must be not more than 6-8°. Sectors of river with the steep/abrupt shores, on which the break departs under the water, for the armament of the assault troop crossings to utilize is generally inexpedient.

The enumerated limitations considerably impede the selection of places for the assault troop crossings, and softening it is lowering, especially during the first stage of assault crossing river on the move, it requires sometimes the expenditure of large forces and time. With the considerable steepness and abrupt shores the congresses/descents are trained/prepared with the aid of the excavating and road vehicles or the explosives. For the savings of time it is possible to utilize the prefabricated concentrated explosive charges. For the subsequent erasure it is lowering they are utilized tanks or vehicles with attached bulldozer armament. For strengthening of coasts with the soft ground in the places of entrance and exit of self-propelled assault amphibious vehicles are applied the elements of road surfaces or local building materials (brushwood, poles, etc.). It must be noted that the efforts, spent on the preparation of approaches, congresses/descents and departures, for the unfavorable sectors of river can be paid due to reaching/achievement of the surprise of assault crossing.

Descents/releases to the shoreline are equipped after breaching of passages in the obstacles, and outputs/yields on the opposite shore - after the crossing of the first trip-detachment. The points of emergence of self-propelled assault amphibious vehicles are designated by one-way reference points. On the wide rivers they are established/installed in the water and on the near bank. The boundaries of crossings on the river are designated by buoys and posts/stakes.

For on-loading of combat materiel to the floating vehicles in immediate proximity of the shoreline are equipped loading areas/sites.

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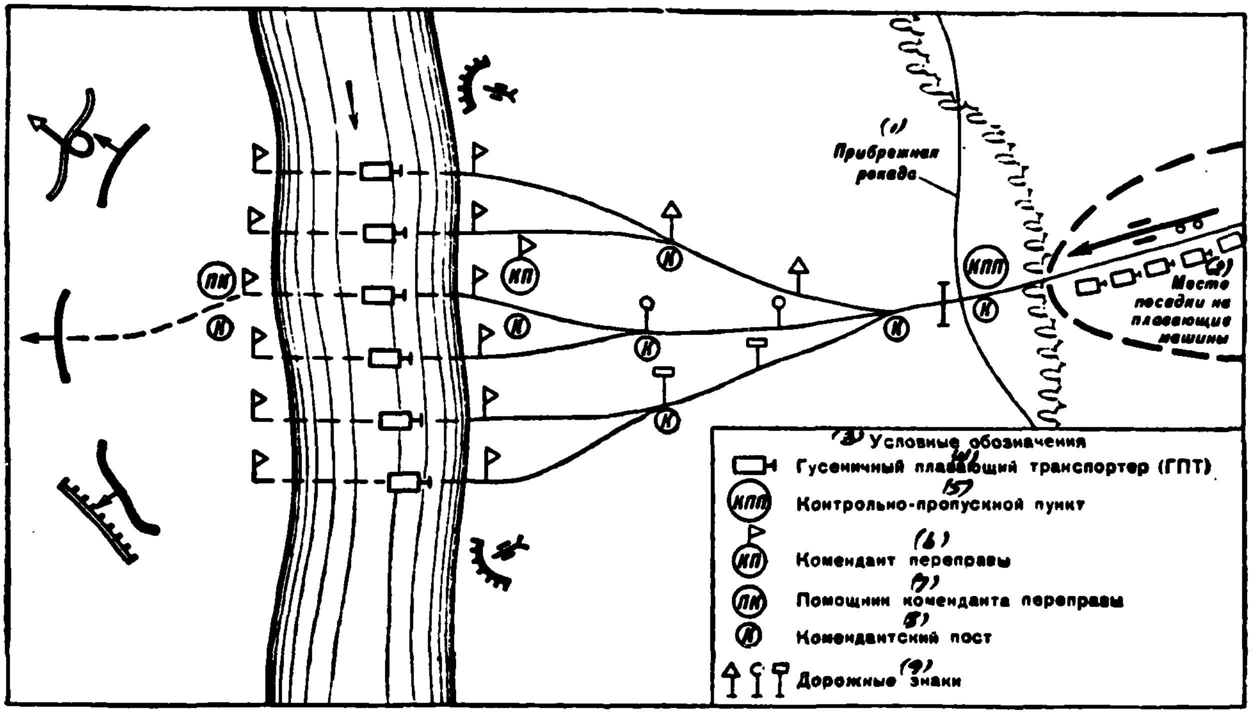

Fig. 26. Engineering armament of assault troop crossing (version).

Key: (1). Coastal belt road. (2). Landing place on floating vehicles. (3). Conventional designations. (4). Tracked amphibious personnel carrier (GPT). (5). Check point. (6). Crossing area commandant. (7). Assistant of crossing area commandant. (8). Traffic-control post. (9). Road signs.

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For this, first of all, are utilized the riverbed (sand bar, beaches) and even areas/sites on the shore, closed from the observation of enemy.

For the personnel of traffic-control service and crews of the floating vehicles, after will be fixed a trouble-free operation of the assault troop crossing both on the initial and on the opposite coasts, can be equipped single and paired trenches, open and overlapped slots.

Assault amphibious vehicles and floating armored personnel carriers most frequently are crossed on the equipped ranges/alignments. However, if in the area of the assault troop crossing flat shores, solid ground there are no obstacles, then it is expedient to realize it in the expanded/scanned combat formation/order of subunits. The version of the engineering armament of the assault troop crossing is shown in Fig. 26.

The engineering subunits, isolated for the armament of the assault troop crossings, provide the uninterrupted work of engineer-amphibian equipment means/facilities, the organized output/yield of the subunits crossed to the river and their rapid crossing to the opposite shore, maintain order on the crossing.

3. Armament of ferry crossings.

For the ferry crossings are driven out/selected the sectors of river with the flat shores, which make it possible to train/prepare siding tracks, to establish/install piers (to equip the places of berth) and to unload pontoon-bridge means/facilities without the considerable expenditure of forces and time. In the places of the armament of ferry crossings must be a sufficient depth of water. In these sectors must not be of islands, sand bars, boulders, sunken objects/subjects and other obstacles, which impede the movement of ferries.

The armament of ferry crossing include: removal of obstacles, armament and ranging of trails, armament of unloading area/site, congresses/descents and departures, the preparation of means/facilities (motor boats) for towing of ferries, the erection of the simplest fortifications for the cover of personnel, traffic-control service and subunits, which operate crossing, and if necessary breaching of passages in the submerged obstacles.

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Trails are equipped and are plumbed of the detachment one route/path from the check point to the nearest to the river natural cover where is set the traffic regulation post, and further along one route/path to each pair of piers (berths). The check points of ferry-boat and assault troop crossing in the crossing area of battalion usually are combined.

For the armament of ferry crossings are utilized the tracked amphibious ferries and pontoon-bridge motor pools. Simultaneously with the assembly of transporting ferries are trained/prepared berths or are set piers (latter during the assembly of transporting ferries from the heavy pontoon pool TPP).

The load capacity of transporting ferries depends on the character of water obstacle and crossed combat technology. If crossings are equipped under the squeezed river-bed conditions, then are collected the transporting ferries of small load capacity. On the wide water obstacles they are accumulated, as a rule, the ferries of large load capacity. Furthermore, from the motor pool TPP are collected the ferries of large area.

During the armament of ferry crossings together with the authorized pontoon trains it is necessary to utilize local crossing means (river barges, different boats, seized in enemy pontoon trains, local ferries, etc.).

Simultaneously with the assembly of ferries and the installation of piers are equipped approaches, descents/releases to the water and outputs/yields on the opposite shore. For the construction it is lowering they are applied bulldozers, tracklayers and explosives. Descents/releases must have a width not less than 5 m, and gradients not are more than 8-10°. Before the pier or with berth it is desirable to equip the horizontal area/site of lengths 8-10 m.

Pier - this is adapter between the coast and the ferry. It serves for on-loading of combat materiel on ferry and unloading from it. With the work with the pontoon-bridge motor pool (PMP) this role perform the access ramps, and on the heavy duty ferries, furthermore, and coast components/links.

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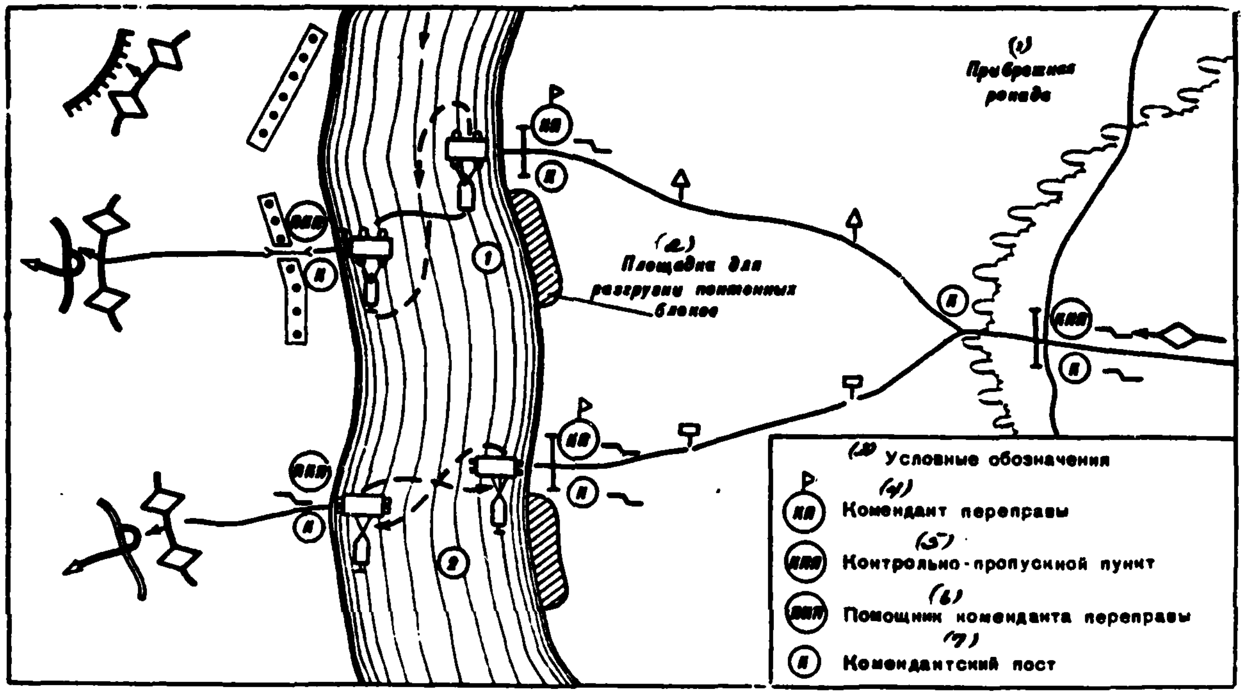

Fig. 27. Engineering armament of ferry crossings (versions): 1 - from motor pool TPP; 2 - from motor pool PMP.

Key: (1). Coastal belt road. (2). Area/site for unloading pontoon units. (3). Conventional designations. (4). Crossing area commandant. (5). Check point. (6). Assistant of crossing area commandant. (7). Traffic-control post.

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Pier must be durable, stable and correspond to the load capacity of ferries. For the construction of piers are driven out/selected the places with the flat shores, the solid ground. The depth of water on the coast in this case must be such that ferry with the peak load it could without difficulty moor to the pier. Piers are arranged from the organic equipment, and with its deficiency/lack - from the local materials.

The sector of the coast of river, assigned for the armament of ferry crossing, must make it possible to perform unloading motor boats, pontoons (components/links) and assembly of transporting ferries which is realized simultaneously with the installation of piers both on its and on the opposite shore. With the work with the motor pool PMP and the tracked amphibious ferries GSP instead of the piers are equipped the berths for the mooring of ferries to the coast.

In proportion to readiness of ferries and piers (berths) the freed subunits take up the armament of the simplest covers for the personnel, which operates ferry crossing, and train/prepare spare places for the piers (berths). The versions of the engineering armament of ferry crossing are shown in Fig. 27.

After armament is organized content of ferry crossing, which has as a goal to ensure the uninterrupted crossing of combat materiel at the high rates/tempos and the maintenance of routine.

4. Armament of the crossings of tanks on deep fords and under water.

For the crossing of tanks on deep ones and under water are reconnoitered the tracers, after which are equipped the crossings. Their width can be different. It depends on width and rate of flow of river. On the average/mean rivers are equipped the crossings by the width of 20-30 m, while on the wide ones - 40-50 m.

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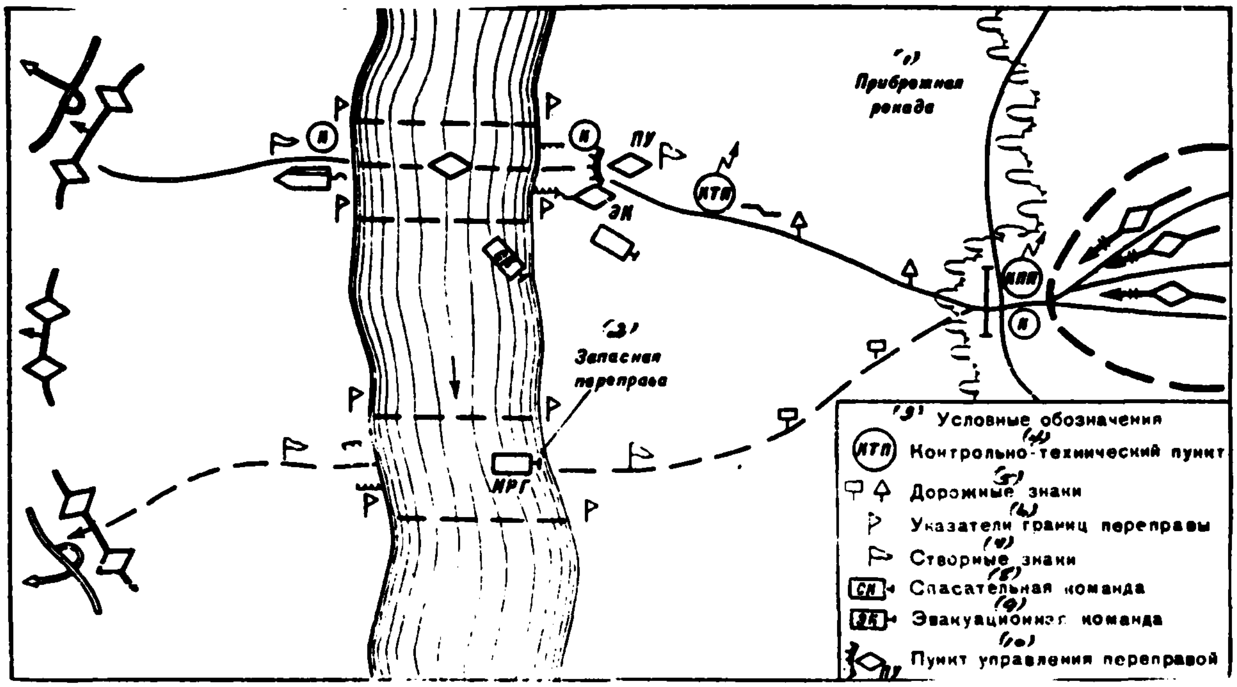

Fig. 28. Engineering armament of crossing of tanks on deep fords and under water (version).

Key: (1). Coastal belt road. (2). reserve crossing. (3). Conventional designations. (4). controlling-technical point/post. (5). Road signs. (6). Indicators of boundaries of crossing. (7). Double signs. (8). Rescue unit. (9). Evacuation group. (10). Command post of crossing.

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The engineering armament of the crossings of tanks on deep fords and under water includes: reconnaissance/intelligence of tracers and elimination in the selected directions/axes of obstacles, boulders and sunken objects/subjects, the removal of obstacles of the approaches to the river and of routes/paths on the opposite shore, the armament for the congresses/descents in the river and of departures from it, the designation of the boundaries of crossing on the water, armament and the ranging of trails and the construction of covers for the personnel, which operates crossing.

On the basis of data, extracted by reconnaissance/intelligence, the subunits of engineers remove the mine fields and natural obstacles in the water.

The obstacles, which cannot be removed, are fenced in. The boundaries of ford and crossing under water are designated by the well visible signs, and on the coasts are set indicators. Simultaneously with this are trained/prepared and are designated the methods of approach, descents/releases and outputs/yields on the opposite shore. Descents/releases on the near bank must be not more than 25°, and outputs/yields on the opposite shore not are more than 15°.

For the armament for approaches and congresses/descents to the river are drawn the tracklayers BAT, tanks with the attached bulldozer armament or other highway engineering. The ranging of trails, the preparation of the check of the column ones of point/post, traffic-control posts are conducted just as during the armament of other crossings.

Into the maintenance of the crossing of tanks on deep fords and under water enter the provision of advancement of tank subunits to the river, the repair of approaches, it is lowering and outputs/yields on the opposite shore, observation of the river and bearing of evacuation-rescue service on the crossing.

For the reliable provision of a crossing of tanks on deep fords and under water, especially with the insufficiently solid ground, are equipped spare crossings. The version of the engineering armament of the crossing of tanks on deep fords and under water is shown in Fig. 28.

5. Armament of the bridge crossings.

The bridge crossings usually attempt to equip in the sectors of river with the sufficiently developed road net, i.e., near the constant bridges and the existing ferry crossings. However, it is necessary to consider that in such sectors the enemy can establish/install mine-explosive obstacles, prepare artillery fire and strikes/shocks by weaponry.

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Nevertheless with a deficiency/lack in the time under the conditions for assault crossing rivers on the move it is frequently necessary first of all to utilize precisely this road net, which leads to the constant crossings.

Floodplains and coasts of river must be free from the obstacles and the radioactive contamination. As far as possible the approaches to the bridge crossings are equipped in the places with the solid ground, which ensures the passage of heavy combat technology. Near bank is driven out/selected with the flat and convenient entrances to the shoreline, which make it possible to simultaneously unload all pontoon units (components/links) near from the axis of bridge. Furthermore, on the near bank must be the areas, which make it possible to secretly arrange/locate the reserve of crossing means and vehicle after unloading of pontoon units (components/links).

In the river bed of the river must not be of islands, sand bars and sunken objects/subjects which could hinder/hamper focusing/induction and content of the bridge crossing. In all cases it is necessary to approach the selection of the sectors of river, which have the smallest width, rate of flow and a sufficient depth.

The armament of the bridge crossing includes: launching of a floating bridge (building of fixed support bridge or combined), the preparation of areas/sites for unloading of components/links (pontoon units), motor boats or deployment of construction site, the preparation of spare place for the bridge crossing, the armament of the locations of river pickets and the installation of anti-mine enclosure/protection. Are equipped also the elements/cells, inherent in all crossings (trail and road, check point, passages in the obstacles and cover for the personnel, which contains crossing).

In order to in proper time direct bridges and at the same time to not allow the losses of personnel and pontoon-bridge equipment as a result of the effect of the weapons of destruction of enemy, is very important to correctly determine the time of the beginning of launching of a floating bridge and, consequently, also the place of pontoon subunits in the combat formations on leaving to the river. This is confirmed by experiment of the Great Patriotic War. Thus, on 23 July, 1944, the 15th engineer pontoon bridge battalion obtained order to begin bridge laying through river San in Nelepkovits area.

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In view of the fact that the place of the assembly of ferries were shot through by small arms fire, battalion suffered large losses, and the constructed bridge was soon destroyed. Even more badly was matter concerning the launching of a floating bridge 23rd pontoon-bridge battle with the assault crossing r. of the vistula. The battalion on 29 July, 1944, moved out to the river in Аннополь area together with advance detachment and was obtained order immediately to begin bridge laying. As a result pontoon battalion lost to 50% of pontoon-bridge means/facilities.

As an example of correct decision/solution can serve bridge laying on r. Morava in Brodsk area. To the river together with advance detachment moved out the 44th engineer pontoon bridge battalion. However, bridge laying it began only after capture by the leading detachment of the first topographic crest on the opposite shore. Thus, enemy could not fire by small arms fire the place of the assembly of ferries. A 45-ton/grand bridge, induced from motor pool N2P, he ensured the successful crossing of all troops/forces.

Consequently, the time of the beginning of launching of a floating bridge with assault crossing of rivers in each specific case is determined depending on the established situation. However, on no account should be artificially held up bridge laying. To bridge laying one should begin immediately, as soon as the subunit of the first echelon they will take the line, which eliminates conduct by the enemy of small arms fire on the place of the assembly of ferries.

Unloading components/links (pontoon units) usually is realized at the wide front. In this case to the pontoon company is assigned such sector of coast, which would allow for the vehicles, which transport the pontoon units (components/links), freely to be deployed and to begin as far as possible with simultaneous the descent/release of pontoons to the water. For unloading each vehicle is required the sector of the coast during the day 10 m, and at night to 15 m. In the steep/abrupt shores are equipped the descents/releases. Their quantity depends on the character of coast, presence of forces and time. Minimally to each platoon (squad) it is necessary to equip with one descent/release.

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Special attention turns to the preparation of siding tracks. Usually for this purpose are utilized the existing roads or the routes/paths, laid by advance detachments and advance guards. With bridge laying far from the roads, under the unfavorable conditions to the preparation of siding tracks sometimes it can be required time more than to laying of bridge itself. It is desirable to the bridge to equip two routes/paths: one for wheeled vehicles, with another for tracked vehicles; under the difficult conditions is trained/prepared one basic route/path. For the output/yield of pontoon subunits to the river is utilized the route/path prepared by the advancing/attacking units which is continued along the coast and they branch it in a quantity of places, convenient for unloading of pontoon units and motor boats. In order to avoid counter movement during the output of automobiles after unloading of components/links (pontoons) into the concentration area, are equipped and are plumbed supplementary trails.

On basis of intelligence information before bridge laying are determined: the sectors of unloading pontoon units (components/links), place of the descent/release of the motor boats: the place of laying bridge, and also route/path of approach to the crossing. On the near bank is conducted the laying-out/sitting the axis of bridge and anchor lines, for which in advance is sent the detachment headed by the officer of reconnaissance unit. The axis of bridge is designated by two white flags. One is set at a distance of 15-20 m from shoreline, and another at a distance of 15-20 m from the first. Anchor lines are driven out/selected at the removal/distance from the axis of bridge not nearer than 30 m. In this case upper anchor line is designated by two red flags, and lower - by two green flags. With the poor visibility the flags are duplicated/backed up/reinforced by the light signs of the corresponding color which must be well visible from the opposite shore.

Pontoon subunits in proportion to output/yield to the river and unloadings pontoon units (components/links) from the vehicles begin the assembly of the floating spans and coast units.

Bridge laying can be realized by three methods: by the rotation of entire bridge, on the sectors or by input/introduction into the line of the bridge of components/links (ferries). If coast makes it possible to unload the pontoon units (components/links) at the wide front, then launching of a floating bridge is realized by rotation. In this case the ferries (components/links) are clamped between themselves along the near bank higher than axis of bridge, and then rotation with the aid of the motor boats are introduced into the line of bridge.

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Bridge laying on the sectors is accepted when the sectors of coast convenient for unloading the pontoon units are separated at the considerable removals/distances, and also when on the near bank are jet-directing dams, jetty and different structures/installations.

Furthermore, bridge laying on the sectors is realized with the squeezed river bed of river (island, sand bar, the sunken ships and other large/coarse objects/subjects). With this method introduce into the line of bridge whole sectors. It is necessary to approach that so that there would be least possible number of sectors.

Bridge laying by ferries (by components/links) is advisable with the limited quantity it is lowering to the shoreline (swampy and soft ground, steep/abrupt and abrupt shores) also, under the special conditions.

After will be induced the bridge and is organized crossing, they take up the armament of the spare place of the bridge crossing, which must provide maneuver with pontoon-bridge means/facilities with the nuclear attack of enemy or the fire/light of artillery and the air strikes. To spare place are plumbed the routes/paths and are equipped descents/releases. Simultaneously with this on the basic crossing are raised slots for the traffic-control service and subunits, which operate the bridge crossing, and for the crossing area commandant and his assistants can it is raised dugouts. The version of the engineering armament of the bridge crossing is shown in Fig. 29.

On the averages and especially on the narrow rivers since the beginning of the assault crossing one should begin the building of low-water and submersible bridges. They usually are raised to the brief period for the passage of the attacking troops/forces.

During the building of low-level bridges most frequently are applied pile supports. On the dry valleys and the narrow rivers with the low speeds of flow (to 1.5 m/s) can be used trestle bents. At the high altitude of coasts and under the special conditions raise pile-frame supports.

Underwater bridges are characterized by the fact that their passing part is under water at the depth of 30-40 cm. This contributes to certain concealment of the location of the bridge crossing and increases its survivability.

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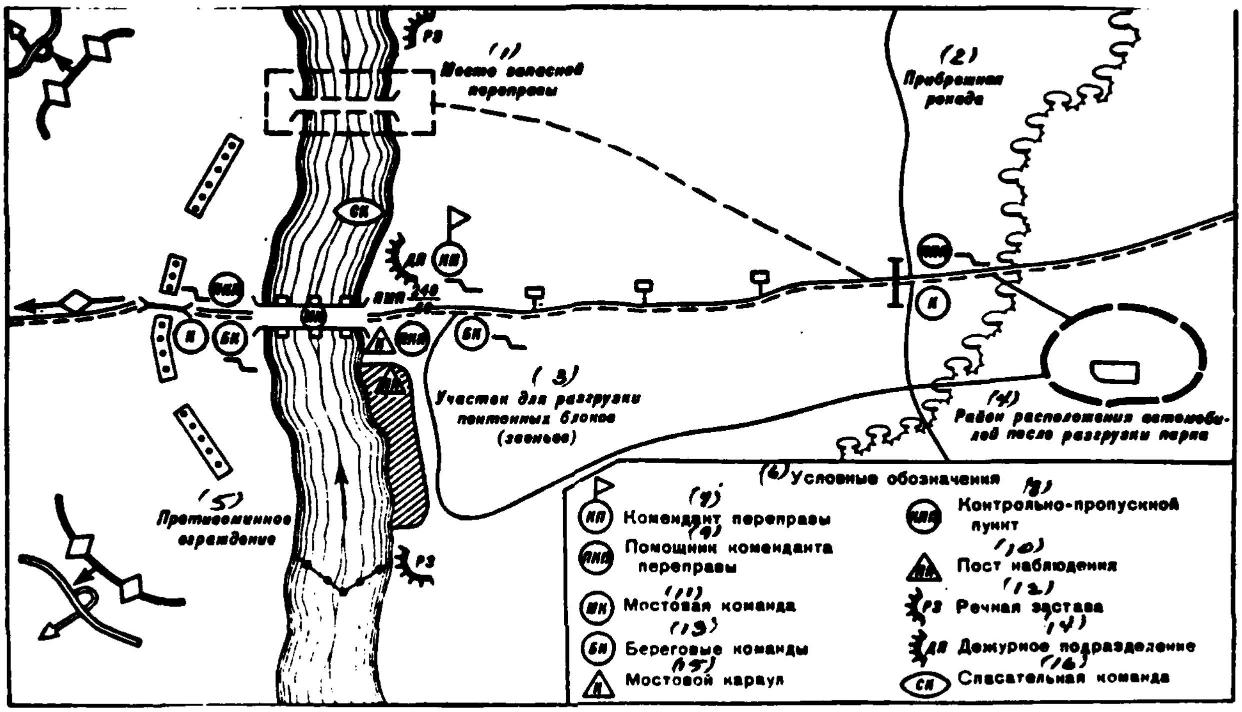

Fig. 29. Engineering armament of bridge crossing (version).

Key: (1). Place of spare crossing. (2). Coastal belt road. (3). section for unloading pontoon units (components/links). (4). Area of disposition of automobiles after unloading of motor pool. (5). anti-mine barrier. (6). Conventional designations. (7). Crossing area commandant. (8). Check. (9). Assistant of crossing area commandant. (10). Observation post. (11). Bridge group. (12). river picket. (13). Beach crews. (14). Duty unit. (15). Bridge guard. (16). Rescue unit.

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When it is missing pontoon-bridge means/facilities or there are shallow sectors and the poured floodplains of river, can be raised the combined bridges. In this case deepest sectors of river are closed over with the fused unit of the bridge, and on the coasts are constructed piers.

After laying (construction) of bridge is organized its content which is realized since the beginning of the crossing of the troops/forces and continues to the close-down of the bridge crossing.

Character and volume of the engineering armament of crossings depend on the methods of assault crossing and conditions of combat situation. With assault crossing of rivers on the move, especially during the first stage, are fulfilled only the most necessary works, which ensure the crossing of the advancing/attacking subunits. With assault crossing of rivers with deliberate preparation/training when there is more than time to organization and preparation of crossings, is fulfilled entire complex of measures for the armament of crossings.

The engineering armament of crossings in winter and in the shallow sectors is examined in Chapter Ten.

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CHAPTER SIX.

Organization of the engineering support of crossing river.

The organization of the engineering guarantee of crossing water obstacle can be realized by varied conditions of combat situation. During crossing of rivers on the move it is implemented simultaneously with the development of onset or with the pursuit of the waste/exiting enemy. In this case the problem for crossing of part and subdivision usually is obtained at the considerable removal/distance from the water obstacle. In proportion to their approach to the river the problem can be changed and be made more precise. Under these conditions the organization of the engineering guarantee of crossing river on the move is realized in the very complicated situation. Together with the engineering guarantee of onset of troops it is necessary to ensure the timely advancement of transport subdivisions for the river and simultaneously to be prepared for overcoming of water obstacle on the move.

For organizing the engineering support of crossing river on the move are characteristic the following special features/peculiarities: taking basic engineer operations in those extremely limited terms; movement of transport subdivisions to the river after combat orders of the advancing/attacking parts, equipment of crossings only with the approach of troops to the river and in short periods, in the course of the already begun crossing. In this case in connection with the nonsimultaneous output/yield of troops to the river and an abrupt change in the situation, the especially nonuniform development of combat on leaving to the river and on the opposite shore, grows the role of maneuver by engineering subdivisions and by crossing means.

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During crossing of rivers with systematic preparation/training when it is realized from the position of direct contact with the enemy on the river border, conditions for organizing engineering support will be more favorable, since there is somewhat more than time.

Organization of the engineering support of crossing rivers with systematic preparation/training, conducted in short periods, are inherent some characteristic features which distinguish it from the organization of engineering support of crossing rivers on the move. Such special features/peculiarities include: the possibility of the more careful radiation/emission of the crossing areas and places of the equipment of crossings, the guarantee of the concealed/latent advancement of crossing means and their concentration in the assigned areas prior to the beginning of crossing, early performing of preparatory work on the equipment of crossings and their termination in the period of fire training.

1. The bases of the organization of the engineering support of crossing water obstacles.

Organization of the engineering support of crossing rivers and control of engineering subdivisions are realized in connection with offensive combat; however, main attention in this case is concentrated on the questions, connected with the organization of the engineering equipment of crossings and the guarantee of a direct crossing of the troops through the river barrier/obstacle.

Initial moment/torque for organizing the engineering guarantee of boosting river are the decision of general military commander and the order of old engineering chief. Work the chief of engineering service begins, as usual, from understanding of task and engineer estimate.

Explaining the obtained task, the chief of the engineer service must comprehend the project of the forthcoming combat operations of subdivisions during boosting of river and, in particular, explain: the special features/peculiarities of the section of river, planned for the boosting; the order of the advancement of subdivisions for the river; combat order, accepted for the boosting, and combat missions with the onset on the opposite shore; what engineering forces and transport means are given, place and the time of their arrival where what crossings are equipped by the higher chief and for what period they are allotted to part (subdivision).

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Then the chief of the engineer service must consider situation in order to come to light/detect/expose the conditions under which one must realize an engineering guarantee of boosting river. It is obligated to consider: composition and equipment of the engineering subdivisions of enemy, character of his actions, conducted by it engineer operations and their effect on the organization of the engineering support of river crossing; composition, equipment and the state of its engineering subdivisions and their possibility by the execution of the engineer support missions of crossing river; the radiological situation on the ways of output/yield to the river barrier/obstacle and in the areas of the planned crossings; the property of river and adjacent to it terrain and weather conditions, the effect of the season and days on organization of the engineering support of river crossing.

During the evaluation of situation the chief of engineering service studies the enemy before the crossing area and on the flanks. He reveals/detects: defense areas least prepared in the engineering relation; character and the location of the barriers, established/installed on the shore and in the river; preparation of water-engineering constructions and bridges for destruction the possible sites of installation of nuclear contact mines; the possibility of use/application by the enemy of floating mines and saboteur parties for the destruction of the equipped crossings.

During the evaluation of enemy individual attention is converted on the possibility of its engineering subdivisions on the decomposition of water-engineering constructions and the use of reservoirs for an abrupt change of the mode/conditions of river in the course of boosting. Furthermore, are evaluated the possibilities of the engineering subdivisions of enemy according to the use application of nuclear contact mines for the decomposition of ...rs dearly in the gorges, bridges, dams are determined the possible volumes of decomposition, avalanches and fires in the crossing areas.

As a result of this study are determined the strong and weak sides of the engineering support of the defense of enemy, are pinpointed locations of crossings and are planned engineer operations for the decontamination of nuclear contact mines, overcoming of barriers, avalanches, decomposition and for the protection of crossings.

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It should be noted that is more frequent the defense weaker in the sections with the natural conditions, which impede overcoming the river (have in mind the swampy floodplains, oxbows and floodland lakes, steep/abrupt abrupt shores of rivers, soft ground of the bottom of river and shores, etc.). However, for overcoming river barriers/obstacles in these sections will be required taking considerable engineer o[illegible]ions.

The evaluation of [illegible] s[illegible]ns of engineers is produced for the purpose of the determ[illegible] [illegible] their composition, state and equipment with engineering [illegible] from the point of view of the possibilities of accomplishing the forthcoming engineer support missions during boosting of river. First of all it is necessary to consider composition and position of amphibious and pontoon-bridge subdivisions, especially during boosting of rivers ss to course, and to determine their place in of the combat or in pre-battle orders: advancing troops, and to also ensure their advancement to the river barrier/obstacle. Under these conditions it is necessary to consider that the advancing/attacking parts fast move to the river, and combat formation is created in the course of advancement to the river barrier/obstacle.

Further are considered the presence and the states of amphibious and pontoon-bridge resources and are determined their possibilities with respect to the guarantee of a crossing of troops in that combat formation which is planned for boosting the river. Simultaneously, on the basis of the construction of the accepted combat formation of the advancing/attacking parts and of subunits, is determined the necessary quantity of crossings and their capacity/capacitance.

Considering the possibilities of the subdivisions of engineers, the chief of engineering service considers also the degree of the radioactive irradiation of personnel and its influence on the organization of the content of crossings.

The evaluation of locality is produced as in the offensive combat. However, especially important attention is paid to the evaluation of river as obstructions, and also to the evaluation of the sections of decomposition and radioactive contamination of locality. In this case are planned the bypass routes of such sections, are pinpointed the places of crossings, order of their equipment and content in the process of the crossing of subdivisions.

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During the evaluation of river barrier/obstacle are determined the width, depth and rate of flow, the character of the soil of the bottom and coasts, the presence of fords, sand bars, islands, water-engineering constructions, especially arranged/located upstream, and convenient approaches to the river. In accordance with the characteristic of river barrier/obstacle are determined cart the possible methods of the crossing of troops, convenient places for the equipment of crossings, duration of the voyages of landing resources and ferry boats and periods of the readiness of the planned crossings.

Terrain adjacent to the river, is considered from the point of view of use for the protection of troops from the nuclear weapons, and from determination of masking capacity/capacitance for the concealment of the actions of the attacking troops, accessibility and passability/trafficability of valley out of the roads, presence of the concealed/latent approaches and roads, possibility of the laying out of trails and equipment of approaches to the river. Are revealed/detected local crossing means, building materials, production enterprises, and also the possibility of their use during the equipment of crossings and the guarantee of a crossing of troops.

Are considered also accessibility and masking properties of locality on the opposite shore, are revealed/detected advantageous borders for developing/scanning the mobile orders of barrier and are determined the borders whose capture/grip by advancing parts will make it possible to start equipping of ferry-boat and bridge crossings.

As a result of this evaluation of river and locality are determined the places, convenient for the device/equipment of crossings, and the character of the necessary works on their equipment, and also are revealed/detected engineer operations for arming of approaches to the river and engineer support missions on the opposite shore.

During the boosting on the move for the evaluation of river and adjacent locality even to the output/yield to the river are used large-scale topographic maps, military geographic descriptions, materials of road organizations, planned and oblique aerial photographs and data of all forms of prospecting. But also in this case the chief of the engineer service will not have comprehensive data for the engineer estimate.

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During the boosting with systematic preparation/training when our parts are found in the direct contact with the enemy on the river barrier/obstacle, the evaluation of river and locality does not present special difficulties, since has the capability for its early and detailed study.

Season and meteorological conditions exert a substantial influence on the mode/conditions of river and, first of all, to the emergence of seasonal floods and floatings of ice. Therefore during the evaluation of situation it is necessary to establish the possibility of changing the level of water or appearance of ice flows and in connection with this to provide further engineer operations for equipment and content of crossings.

As a result of the evaluation of the situation the chief of the engineer service is obligated to determine: the basic engineer support missions of boosting river; the possible methods of the crossing of troops; place, a quantity and the forms of crossings and character of their engineering equipment; the duration of the crossing of troops and possibility of parts and subdivisions on accomplishing of the separate engineer support missions of boosting river barrier/obstacle.

On the basis of understanding task, evaluation of situation and order of senior engineering chief the chief of the engineer service prepares the data, necessary for commander for making of the substantiated decision, and are given up the warning orders to engineering subdivisions.

During the consumption/production/generation by the general military commander of the solution with boosting of river the chief of the engineer service must be it is ready to report his propositions on the organization of engineering support and the combat employment of subdivisions of engineers. In particular, he proposes the distribution of engineer forces and crossing resources and the order of their advancement to the river, the place, a quantity and the forms of the equipped crossings, possible rates and the periods of the crossing of parts and subdivisions, the planned maneuver by crossing resources in the course of crossing and engineering measures with respect to the guarantee of onset on the opposite shore of river.

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Basic for organization of the engireering support of crossing river are the command decision and his indications in which it determines: the tasks of the subdivisions of engineering troops and the order of their performance; the distribution of crossing means and possible maneuver by them; place, forms and the time of the equipment of crossings, and also engineer support mission of combat operations of troops on the opposite shore of river. Volume and elaboration of these indications can be different and depend on situation.

After the acceptance of command decision and his indications the chief of the engineer service plans/glides accomplishing task with respect to the engineering support of crossing river and simultaneously prepares orders with respect to the engineering guarantee of combat operations of troops and gives up the operation instructions to the subdivisions of engineers.

In the operation instruction by the subdivisions of engineers, isolated for equipment and content of crossings, they are indicated; the enemy information, combat of task the order of its accomplishing (place and the form of the equipped crossing, load capacity, capacity/capacitance or capacity and the period of the readiness of crossing), the place in the combat (march) formations with the advancement to the river, the measure of the combat security unit, sequence and the periods of crossing of troops, the order of interaction with the crossed and ensuring subdivisions, measure for the protection against mass destruction weapons, order and the methods of the representation of reports and organization of connection/communication.

Gliding/planning the engineering support of crossing river it is most expedient to map graphically on the large-scale map. In this case most in detail is planned/glided the use of amphibious and pontoon-bridge subdivisions.

On the base map they must be reflected: routes of exit to the crossings and the maneuver of troops; the assigned departure line for the boosting; the landing regions on the amphibious resources, the departure areas and the conducted in them engineer operations (checking locality to the presence of mines, the restoration/reduction of road net, the device/equipment of shelters for personnel and combat materiel); crossing in the crossing area, the isolatable forces and crossing means for their equipment and content; commandant service on the crossings; the engineering guarantee of combat operations on the opposite shore (constructed road net, the deployment lines of the mobile order of barriers and the borders of attachment).

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Simultaneously the chief of the engineer service develops/processes orders to parts with respect to the engineering guarantee, he performs the calculation of crossing, takes direct part in scheduling of crossing, is monitored accomplishing engineer support missions and it leads engineer reconnaissance. Furthermore, it previously organizes the preparation of materiel of crossing means and ensures their timely advancement to the river.

In the course of boosting the chief of the engineer service follows the work of all crossings, is accomplished the necessary maneuver by crossing means for the purpose of reaching/achievement of the planned rate of the crossing of troops and organizes the engineering support of a combat on the opposite shore.

Above in the compressed form were examined sequence and the basic content of the work of the chief of the engineer service on the organization of the engineering guarantee of boosting river. It is obligated to know and to be able to organize the accomplishment of all objectives of engineering support of crossing river. However, this does not mean that in all cases of situation, even with the limited time, it implements entire volume of work indicated. Thus, during boosting of rivers on the move when entire organization of engineering guarantee will be realized in the course of the fast advancement of troops to the river barrier/obstacle and periods will be very limited, it will be able to solve only the most important problems of the engineering suppport of a crossing of troops.

However, during crossing of river with systematic preparation/training for the organization of engineering support there will be more than time and the chief of the engineer service will be able to lead it especially thoroughly. At the same time in all cases he is obligated to in proper time issue the operation instructions to the subdivisions of engineers, to ensure the advancement of crossing means to the river and to organize equipment and content of crossings so that the crossing of troops would be realized at the assigned rate.

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2. Calculation of the crossing of subdivisions.

During the organization of the engineering guarantee of boosting river of one of the most important and complex problems is the determination of the possibilities of combined units and subdivisions for overcoming of water obstacle. In this case must be considered the following factors, which are determining the duration of the crossing of the subdivisions: the character of river; composition and the equipment of the crossed subdivisions, order and sequence of their crossing; the presence of engineering forces and crossing means and their possibility by the crossing of personnel and combat materiel.

These factors between themselves are closely related and mutually caused. Change in one of them will unavoidably entail a change in others. For example, the greater the crossing means, the less the time will be required for the crossing of subdivisions; for overcoming the wide rivers (with one and the same amount of crossing resources) it will be required more time in comparison with the rivers of average/mean width, etc.

The noted factors permit for the chief of the engineer service to produce the substantiated calculation and together with staff to plan the crossing of subdivisions taking into account of combat formation and specific conditions of boosting the river barrier/obstacle.

Necessary data for the calculation the chief of the engineer service obtains from the staff, and some are determined independently. Composition and the sequence of the crossing of subdivisions, the necessary periods of crossing, and also a quantity, place and the capacity/capacitance of crossings he determines together with staff. Data of calculation are used for substantiated distribution of subdivisions for the voyages, the crossings, and also for scheduling of crossing.

Before boosting of river the calculation of crossing is performed or for determining the necessity for the crossing means, proceeding from the established/installed period to the crossing of subdivisions, or for determining the duration of the crossing of subdivisions, on the basis of the presence of crossing means.

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The first version will, first of all, find use when on the assigned period of crossing it is necessary to determine the intensification of troops by crossing means. In this case they proceed of two basic requirements of the all-arms of offensive combat: first, subdivisions must be crossed at the high rate and in this grouping and sequence which are required for conducting the combat on the opposite shore; second, beginning from the first voyage, powered rifle subdivisions must be crossed together with the regular armament, artillery and by tanks.

The second version is commonly used when known intensification by crossing means is required to determine the time during which the subdivisions with their combat technology can be crossed to the opposite shore of river.

Calculation of crossing on the landing resources and the ferry boats. The time of the crossing of subdivisions depends on their composition, character of water obstacle, amount of crossing means. It can be determined according to the form ula

$$T = \frac{M \cdot R}{K},$$

where T - time of crossing, min;

M - quantity of voyages of amphibious resources (ferry boats), necessary for the crossing combat machines and diff·rent resources;

R - duration of complete voyage, min;

K - quantity of landing crossing means (ferry boats), pieces.

A quantity of the vehicle trips of each form of assault amphibious vehicles and ferry boats depends on the composition of crossed subunits and possibilities of the available crossing means. For determining the quantity of voyages the chief of the engineer service in a timely manner prepares auxiliary calculated materials in

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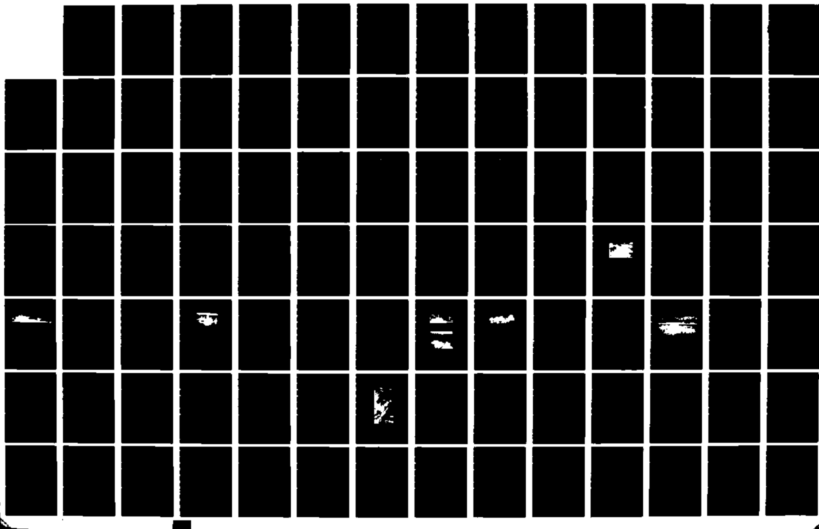

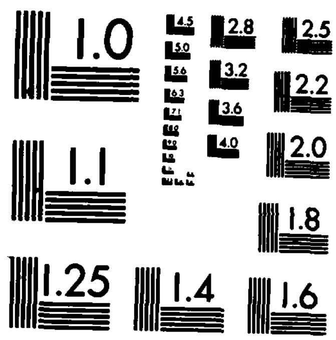

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

the form of the tables, in which is summarized a required quantity of voyages of one or the other assault amphibious vehicles ($M_{К-61}$, $M_{ПТС}$, $M_{ГСП}$) and ferry boats ($M_{паромов}$), of the necessary for the crossing subdivisions with their combat technology. If was changed the composition of the crossed subdivisions in the course of their advancement to the river, then into the tables before the calculation are introduced the necessary refinements.

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The duration of the complete voyage R depends on the width of river and rate of flow of water, time of loading and discharging of combat materiel, speed of the movement of the self-propelled and motorized transport ones, resources. It is determined from the formula

$$R = \frac{2b}{V}(1 + 0,3V_p) + t,$$

where b - width of river, m;

V - speed of the motion of crossing means by water, m/min;

t - total time of loading, unloading and motion along drier, min (latter only for the self-propelled assault amphibious vehicles);

V_p - rate of flow of water in river, m/s.

At the rate of flow to 1.5-2 m/s by expression $(1+0{,}3V_p)$, that considering the removal/drift of crossing means, can be disregarded/neglected. And then formula will take the following form:

$$R=\frac{2b}{V}+t.$$

Applying this formula and considering that the speed of the motion of self-propelled crossing resources along the water 130-140 m/min (8 km/h), and to the loading, the unloading, the descent into the water and the output/yield from it will be required to 6 min, we obtain the duration of complete voyage for different width of river. Thus, at the rate of flow of water to 1 m/s the duration of complete voyage with the crossing across the river with a width of 100 m is approximately 7 min, 150 m - 8 min, 200 m - 9 min, and across the river with a width of 250 m - 10 min.

Hence follows the conclusion that with the contemporary self-propelled amphibious resources the width of river does not exert a substantial influence on the duration of complete voyage, since the basic portion of time is spent on on loading and unloading of combat materiel whose duration in many respects depends on the training of teams and crews of the crossed subdivisions and the correct organization of the content of crossings.

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For determining the duration of the complete voyage of self-propelled assault amphibious vehicles and motorized ferry boats it is possible to use the tables comprised earlier (Tables 7 and 8).

Knowing the duration of the voyage of self-propelled assault amphibious vehicles and ferry boats, composition and the sequence of the crossing of subdivisions, it is possible to determine the periods of the crossing of subunits or the necessity for the crossing means.

Table 7. Duration of the voyage of self-propelled assault amphibious vehicles depending on width and rate of flow of river.

(1) Скорость течения реки, м/сек	(2) Ширина реки, м						
	100	150	200	250	300	400	500
	(3) Продолжительность рейса, мин						
(4) До 0,5	7	7	8	9	10	11	12
0,5—1,0	7	8	9	10	12	13	15
1,5—2,0	8	10	11	13	15	18	20
2,0—2,5	9	12	14	16	18	22	26
2,5--3,0	11	14	17	20	22	28	34

Note. Complete voyage switches on the time, necessary for preparation, loading (landing), descent to the water, the crossing with the load, the output/yield to the opposite shore, the unloading and the return of self-propelled assault amphibious vehicles to the initial position.

Key: (1). Rate of flow of river, m/s. (2). Width of river, m. (3). Duration of voyage, min. (4). To.

Table 8. Duration of the voyage of ferry boat, moved on the water by launches by the method of pushing, depending on width and rate of flow of river.

(1) Скорость течения реки, м/сек	(2) Ширина реки, м						
	100	150	200	250	300	400	500
(3) Продолжительность рейса, мин							
(4) До 0,5	10	11	12	13	14	15	16
1,0—1,5	11	12	13	15	16	18	20
1,5—2,0	12	13	15	16	18	22	25
2,0—2,5	13	15	17	20	22	26	36
2,5—3,0	15	18	22	25	28	35	44

Key: (1). Rate of flow of river, m/s. (2). Width of river, m. (3). Duration of voyage, min. (4). To.

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If is known intensification by crossing means, then is determined the duration of the crossing of subdivisions and vice versa.

For the calculation according to the first version it is necessary to know a composition of the crossed subdivisions and a required quantity of voyages of crossing means M, the duration of the complete voyage R the presence of crossing means K.

Let us assume that for the crossing of the intensive motorized rifle battalion it is necessary to complete 16 voyages PTS, 15 voyages K-61 and 9 voyages GSP[1].

FOOTNOTE [1]. Number of the voyages of crossing means is taken conditionally. ENDFOOTNOTE.

A battalion must cross river whose width 200 m, rate of flow to 1 m/s. To it are allotted four PTS, three K-61, three tracked amphibious ferries (latter enter in the action 9-10 min after the beginning of boosting). It is necessary to determine the duration of the crossing of battalion.

For simplification in the calculations let us take the duration of the complete voyage R for all self-propelled crossing means of the equal to 9 min. In this case for the crossing of the separate types of combat technology on different crossing means it will be required:

$$T_{\text{К-61}} = \frac{M \cdot R}{K} = \frac{15_{\text{К-61}} \cdot 9 \text{ мин}^{(1)}}{3_{\text{К-61}}^{(1)}} = 45 \text{ мин}^{(1)};$$

$$T_{\text{ПТС}} = \frac{M \cdot R}{K} = \frac{16_{\text{ПТС}} \cdot 9 \text{ мин}}{4_{\text{ПТС}}^{(1)}} = 36 \text{ мин}^{(1)};$$

$$T_{\text{ГСП}} = \frac{M \cdot R}{K} = \frac{9_{\text{ГСП}} \cdot 9}{3_{\text{ГСП}}} = 27 \text{ мин}^{(1)}.$$

Key: (1). min.

Hence it is possible to draw the conclusion that the conditional motorized infantry battalion on the chosen to it crossing means will be able to surmount the river with a width of 200 m (taking into account the time, necessary for the development/scanning of ferry boats) in 45 min.

When are selected crossing means of another load capacity, then preliminarily is required to produce recomputation in the necessity of the vehicle trips (ferry trips) taking into account their tactical and technical data.

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However, the method of calculation regarding duration of the crossing of subdivisions on the amphibious resources and the ferry boats and in these cases is retained.

The second version of calculation is conducted when is assigned the time of the crossing of subdivisions T, are known the composition of the crossed subdivisions, expressed in the machine or ferry boat-voyages M, and the duration of the voyage through the river barrier/obstacle R, and it is necessary to determine a required quantity of crossing means K. In this case the calculation is conducted according to the modified formula

$$K=\frac{M\cdot R}{T}.$$

Let us consider this based on specific example. Thus, conditional motorized rifle battalion must cross the river with a width of 150 m at the speed of flow of 1.5 m/s. For the crossing of personnel and combat materiel it is necessary to complete 20 voyages K-61, 16 voyages PTS and 9 voyages GSP. The latter entering in the action 10 min after the beginning of boosting. The duration of the complete voyage R is equal to 10 min. It is necessary to determine the intensification of battalion by crossing means which would ensure its crossing in 40 min.

Substituting in the formula initial values, we obtain the necessary intensification of battalion by different crossing means

$$K_{\text{К-61}} = \frac{M \cdot R}{T} = \frac{20_{\text{К-61}} \cdot 10\ \text{мин}}{40\ \text{мин}} = 5_{\text{К-61}};$$

$$K_{\text{ПТС}} = \frac{M \cdot R}{T} = \frac{16_{\text{ПТС}} \cdot 10\ \text{мин}}{40\ \text{мин}} = 4_{\text{ПТС}};$$

$$K_{\text{ГСП}} = \frac{M \cdot R}{T} = \frac{9_{\text{ГСП}} \cdot 10\ \text{мин}}{40\ \text{мин} - 10\ \text{мин}} = 3_{\text{ГСП}}.$$

Key: (1). min.

Hence it follows that for guaranteeing boosting river with the width of 150 m in 40 min battalion it will be necessary to isolate three tracked amphibious ferries GSP, four catepillar amphibious personnel carriers PTS and five catepillar amphibious personnel carriers K-61.

Calculation of crossing according to the bridges.

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The duration of the crossing of subdivisions on the bridges depends on the length of column, allowable speed of motion and time of days. It is determined from the formula

$$T = \frac{L}{n \cdot V},$$

where T - transit time of subdivision on the spendthrift, hour;

L - length of column with motion along the spendthrift, km;

V - speed of motion along the bridge, km/h;

n - quantity of bridges, pieces.

With the crossing of subdivisions on the floating bridges the distance between the motor cars is received as 30 m, and between the tanks - 50 m. The speed of the motion of combat materiel along the floating bridges depends on the load capacity of the induced bridge and on tactical and technical data pontoon-bridge parks/fleets. Thus, with the crossing of subdivisions on a 50-ton/grand bridge, induced from the pontoon train TPP, in the daytime is allowed/assumed the motion of tanks at a rate of 10 km/h, and motor cars and artillery - 15 km/h. With the crossing at night the speed descends to 25-50%.

The crossing of combat materiel on the bridges is realized at the maximum speeds, permitted for the given construction/design of bridge. In this case statutory distances between the subdivisions by the minimum are decreased. However, on the opposite shore of subdivision they increase the speed of motion and are restored the established/installed tactical distances. This organization of motion will permit for one and the same time to cross a larger quantity of combat materiel and thereby to avoid the congestions before the bridges.

During the determination of the length of the column of the subdivisions, which are crossed on the spendthrifts, are considered a quantity of machines, intervehicle distance and the length of machines. In this case the length of column can be determined according to the formula

$$L=(K-1)\,l+(K\cdot b),$$

where L - length of the column, m;

K - quantity of machines, pieces:

l - intervehicle distance, m;

b - length of machine, m.

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For simplification in the calculation during the determination of the length of column expression (K•b), which considers the total length of machines, can be disregarded/neglected.

Let us consider an example regarding the duration of the crossing of subdivisions on the floating bridges. Let us assume that on a 50-ton/grand bridge, constructed from heavy pontoon pool TPP, it is necessary to in the daytime pass the column, which consists of 20 tanks and 100 motor cars. It is necessary to determine the transit time of column on the bridge.

The general/common/total length of the column will be equal to 4 km, of them tanks 1 km (20x50 m=1 km) and motor cars 3 km (100x30 m=3 km). If we this technology we pass on the floating bridge of the mixed column with the general/common/total speed, equal to the speed of the motion of tanks, then the time of crossing will be 24 min:

$$T=\frac{L}{V}=\frac{4\ км}{10\ км/час}=24\ мин.$$

Key: (1). km/h. (2). min.

However, it is most expedient in the head of the column to have tanks, and then motor cars. This organization of crossing will make it possible to have first of all tanks on the opposite shore and to decrease the general/common/total duration of the crossing of subdivision with 24 min to 18 min:

$$T_{\text{танков}} = \frac{L}{V} = \frac{1\ \text{км}}{10\ \text{км/час}} = 6\ \text{мин};$$
$$T_{\text{машин}} = \frac{L}{V} = \frac{3\ \text{км}}{15\ \text{км/час}} = 12\ \text{мин}.$$

Key: (1). km/h. (2). min.

The method of calculation of the crossing of combat materiel according to the bridges can be applied also during the determination of the duration of its crossing from the fords. However, during the determination of the length of the column and speed of motion are some differences. In particular, during the determination of the speed of the motion of machines along the fords it is necessary to consider the character of the soil of coasts and bottom of river and the rate of flow of water. It is known that with an increase in the rate of flow of river is reduced the passability/trafficability of fords, and at the rate of flow 3-4 m/s and more they become impervious/impassable.

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Under the average/mean conditions tanks, the artillery and motor cars can move over the ford with a speed of up to 10 km/h, i.e., with the same speed, that also on the the fused bridges constructed from the park/fleet TPP. Hence it follows that on the equipped fords, which have the solid bottom and the rate of flow to 1 m/s, can be crossed for the time unit the same quantity of tanks, as on the floating bridge, constructed from the park/fleet TPP.

When tanks are crossed across the river on deep fords and under water or on fords with the high rates of flow of water, distance between them increase, and overcoming is realized in the low gear. The rate of crossing in this case considerably is reduced.

During the calculation of subdivisions the chief of the engineer service is obligated to consider the specific conditions under which will be realized boosting river. This will permit it to more accurately determine the possibilities of subdivisions on overcoming of river barriers/obstacles.

3. Gliding/planning the crossing of subdivisions.

The results of calculating the crossing of subdivisions are used for scheduling of crossing. In the graph are reflected: the crossing areas, vengeances and forms of crossings, force and crossing means, isolated for equipment and content of crossings, the readiness time of crossings, sequence and the periods of the crossing of subdivisions.

With development of the crossing schedule they usually adhere to the specific sequence. At first is determined the order of the output/yield of subdivisions to the river, which is shown in the diagram. After this in accordance with the order of the output/yield of subdivisions accepted in the crossing area will plot the crossings, isolated for equipment and content of the crossings of force and the crossing means, and also is determined the readiness of each crossing. Subsequently make more precise the places and the sequence of the crossing of subdivisions and on the basis of the calculations conducted are determined the periods of their crossing. Usually the crossing of subdivision is planned/glided according to voyage- calculations.

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During scheduling are considered all possibilities of the available crossing means, in order to ensure the crossing of subdivisions in that grouping and within those periods which are determined in the decision of general military commander. The crossing schedule develops/processes staff. The chief of the engineer service in his development takes direct part. Large by aid in this they can show/render such auxiliary calculated materials as the necessity of subdivisions for the vehicle trips (ferry boat-voyages) and duration of the crossing of subdivisions on the floating bridges and the fords. Such calculations comprise in advance, and before scheduling crossings are made more precise in accordance with the specific situation conditions.

The degree of the elaboration of graph depends on the time, available for its development, the completeness of the data about the river and the actions of enemy. In this case, if the crossing schedule is developed/processed in the process of the pursuit of enemy within the limited periods and in many conditions they cannot be in advance taken into consideration, it is comprised tentatively; are set only beginning and end of the crossing of subdivisions. In proportion to the approach to the river and of the refinement of the solution of graphs/curves it is supplemented, and if necessary and is detailed.

In the course of boosting the river the chief of the engineer service all efforts of engineers and crossing means directs to reaching/achievement of the high rates of the crossing of subdivisions in that sequence, which is provided by the crossing schedule. For this is organized the content of crossings and is realized large-scale maneuver by crossing means.

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Chapter Seven.

ENGINEERING PROVISION OF ASSAULT HASTY RIVER CROSSING.

Assault crossing river on the move can be realized under varied conditions of the combat situation: when units and subunits advance and force water obstacle on the arms of the waste/exiting enemy when they emerge to the river simultaneously with the approach from the depth of the reserve of enemy and his march/passage to the defense, and also when enemy in advance organized defense on river line and prepared for repulsing of assault crossing.

In all cases the success of assault crossing river on the move will depend on the surprise and fast activities of advance detachments (advance guards), which with the output/yield to the river unexpectedly capture opposite shore and immediately develop opposite shore and immediately develop offensive into the depth of the defenses of enemy. In this case the comprehensive engineering provision of combat operations of advance detachments (advance guards) in the final analysis will contribute to successful assault crossing.

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With assault crossing of rivers on the move on the engineering provision they are laid:

- taking the engineer operations, which facilitate the fast output/yield of subunits to the water obstacle and its surprise assault crossing on the move;

- provision of the advancing/attacking subunits with a sufficient quantity of contemporary crossing means;

- timely advancement of crossing means to the river directly in the combat ones or the approach march formation which is necessary for conducting combat on the opposite shore;

- provision of simultaneous crossing of small units and their comb... equipment (tanks, artillery, armored personnel carriers) in the order which is necessary for conducting battle on the opposite bank;

- assistance to stability of subunits on the opposite shore of river via skillful maneuver by engineering forces and by the mine fields with repulsing of the counterattacks of enemy and the cover of flanks;

- execution of engineer operations for the defense from the nuclear weaponry of subunits and equipped crossings.

Fulfilling these tactical requirements composes the essence of the maintenance of the engineering provision of assault crossing rivers on the move. Specifically, from these requirements escape/ensue concrete/specific/actual engineer support missions, basic of which are: engineer reconnaissance of the ways of the advancement of subunits, river barriers/obstacles and defenses of enemy; preparation of routes/paths and provision of advance of the attacking troops/forces, pontoon-bridge and engineer-amphibian equipment subunits for the water obstacle; armament and the content of crossings; organization and the bearing of commandant and rescue-evacuation services on the crossings; the protection of crossings from floating mines and sabotage of enemy; the armament of the firing positions of the AA units, which cover crossings; the provision of further offensive of subunits on the opposite shore of river.

The most important of the enumerated engineer support missions of assault crossing river is the armament of crossings and the realization of the direct crossing of the troops/forces and combat materiel to the opposite shore.

1. Engineer reconnaissance of water obstacle.

The success of assault crossing river on the move to a considerable degree depends on correct and in proper time organized reconnaissance/intelligence of enemy, river and adjacent and by it terrain.

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Data of reconnaissance/intelligence make it possible for combined-arms commander to make the substantiated decision to assault crossing of river, and with the approach to it - to in proper time him refine. In this case the especially important value/significance acquire the engineer intelligence data which are necessary first of all to the commander/chief of engineering service. Having available the necessary information about the river and the terrain, it can give the most substantiated propositions to commander on the advisable use of engineering, engineer-amphibian equipment and pontoon-bridge subunits and is purposeful organize the execution of the engineer support missions of assault crossing river on the move.

Engineer reconnaissance, conducted for the purpose of the provision of assault crossing river, must establish/install: the concealed/latent routes/paths of approach to the river, the character of the engineering armament of the position of enemy on the river line, the presence of obstacles in the water and on the coasts, and also the possible areas of destruction and flooding; width, depth and the rate of flow of river; the character of the soil of the bottom and coasts, convenient descents/releases to the water and outputs/yields on the opposite shore; the sectors, convenient for the armament of crossings; presence and the condition of fords and water-engineering constructions, the load capacity of the existing bridges and measure of enemy for protection and their preparation for the destruction; the presence of local crossing means (boats, barges, motor boats, ferries and the like) and building materials (lumber, hardware, sand, gravel); character and the passability of valley and floodplain of river; the presence of natural terrain masks and concealed/latent routes of approach to the river, and also natural covers (ravines, forests) and possibility of their use, especially in the interests of the defense of the troops/forces from the nuclear weaponry.

With assault crossing of rivers in winter engineer reconnaissance must determine also thickness and building/structure of ice, the reliability of its joining with the coast, the presence of nonfrozen places (ice-holes) and the thickness of snow cover on ice.

The basic data about the river and the terrain adjacent to it, and also about the character of the engineering armament of zones and positions of enemy on the river line must be obtained in advance. In this case the most important sources of obtaining the necessary data can be topographic base maps, military geographic descriptions, aerial photographs and results of aerial observation.

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Large-scale topographic maps can give the greatest quantity of necessary data about the river. Moreover the accuracy of mapping onto the maps/charts/cards of the characteristic of river and terrain is found in direct dependence on the map scale. Thus, the width of river on the map/chart/card scale 1:50000 can be depicted with an accuracy to 5 m, and on map/chart/card 1:100000 - with an accuracy to 10 m.

The most important means/facility of the timely study of the condition of river and defense on it is aerial photography. Planned and oblique aerial photographs give the sufficiently detailed and comparatively precise characteristic of the river: the presence of crossings, sand bars, sand bars, fords, dams and other water-engineering constructions, the character of its shores and valley, and also the common picture of the defense of enemy up to the moment/torque of organizing the assault crossing. Aerial photographs make it possible with a sufficient accuracy to determine the fundamental characteristics of river. For example, the width of river is determined with accuracy 2-3%, the height/altitude of coasts to 0.5 m, and gradients to 2°. On the aerial photographs it is possible to tentatively also determine depth and rate of flow of river.

Aerial photography is conducted in advance so that the revealed changes and refinements would be in proper time led to the advancing/attacking subunits.

The data about the defense of enemy on the river line in advance can be obtained also from the groups of deep reconnaissance/intelligence, sent into the rear of enemy, and from the information of senior commander. Generalized intelligence information about the river and the engineering armament of the river line the unit commanders and subunits can obtain from the higher headquarters simultaneously with the task to the assault crossing.

With the withdrawal/departure the enemy will attempt to destroy roads, bridges fords, water-engineering constructions, increase the mine fields and set nuclear mines/fougasses. Therefore previously obtained intelligence information in proportion to the output/yield of the advancing/attacking subunits to the river are continuously more precisely formulated and supplemented.

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Engineer reconnaissance with the approach to river and before the assault crossing is directly led by the subunits of engineers, connected with the composition of army reconnaissance parties and combat reconnaissance patrols, and also by individual engineering reconnaissance patrols. Very useful and fresh information can give the engineering reconnaissance units, connected with the composition of tactical airborne troops.

The quantity and composition of engineering reconnaissance subunits, necessary for conducting engineer reconnaissance, are determined by the width of crossing area and by a quantity of crossings outlined on it.

In the last war engineer reconnaissance of the assault troop crossings was carried out by the forces of the individual reconnaissance parties, isolated from advance detachments (advance guards) and subunits of the first echelon in composition of which, as a rule, were included engineering reconnaissance units. For reconnaissance/intelligence of the places, convenient for the armament of ferry-boat and bridge crossings and fords, were sent out individual engineering reconnaissance patrols (as a rule, one to each crossing).

The reconnaissance party, intended for reconnaissance/intelligence of the sector of river, can consist of the platoon of amphibious tanks, two - three BRDM, squad of sappers/combat engineers and squad of radiation and chemical reconnaissance. Upon the formulation of the problem to this group are indicated the direction/axis of conducting of reconnaissance and the sector of river, which is necessary to reconnoiter.

Reconnaissance/intelligence of river is conducted at the wide front. When there is no enemy on the opposite shore, are defined sectors, convenient for overcoming the river on the floating means/facilities. For this the sappers/combat engineers connected with the composition of reconnaissance party, reveal/detect convenient approaches to the river, character of coasts and convenient descents/releases to the river, width and the rate of flow of water, the presence of obstructions both on the coasts and in the water and their possible turning movements. The remaining forces of group are arranged/located on the shore in readiness to cover by the fire/light of the activity of sappers/combat engineers. If we go around obstacles impossibly, sappers/combat engineers make passages and designate their boundaries. After reconnaissance/intelligence and removal of obstacles of the sectors, convenient for the crossing, the unit of reconnaissance party is crossed to the opposite shore and organizes observation for the adequate/approaching the river enemy, and rest they reconnoiter and designate places for the crossings on the floating armored personnel carriers and self-propelled floating vehicles.

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If opposite shore is in advance occupied with enemy, then reconnaissance party is thrown to another direction/axis or it continues to conduct reconnaissance/intelligence from its shore.

Under the favorable conditions the reconnaissance parties and combat reconnaissance patrols are capable of taking the existing crossings and of holding them to the approach of the advancing/attacking subunits. After the capture of crossings the sappers/combat engineers immediately begin their reconnaissance/intelligence and mine clearing. Experiment of the last war gives many successful examples on capture and retention of crossings to the approach of main forces.

There are unsuccessful examples on the capture of crossings. Thus, on 23 January, 1945, the separate reconnaissance patrol of the

62nd guards tank brigade unexpectedly for the enemy took bridge on r. Oder and area of city Shtenau. But the commander of the reconnaissance patrol did not organize reconnaissance/intelligence of bridge and did not take measures to his mine clearing and protection. After using this, fascists exploded bridge and detained advance of our troops/forces, and group, after proving to be that cut off from main forces, in unequal combat perished.

The absence of solid front in the defense of enemy, the daring and decisive activities of combined-arms reconnaissance/intelligence, advance detachments and advance guards - all this makes it possible to successfully conduct engineer reconnaissance/intelligence of river and terrain and defense of enemy not only in the composition of army reconnaissance patrols and groups, but also independently via the dispatch of individual engineering reconnaissance patrols.

Engineering reconnaissance patrols are sent out by the commander/chief of the engineer service or by the commanders of assault-crossing and pontoon-bridge subunits, intended for the provision of a crossing, for the purpose of the refinement of places, of convenient for the armament of ferry-boat and bridge crossings, crossings of tanks under water and the fords.

The composition of engineer reconnaissance patrols can be different. It depends on the available enemy data and river barrier/obstacle, its removal/distance from the advancing/attacking subunits and from the presence of forces, means/facilities and time.

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For reconnaissance/intelligence of ferry crossing engineering reconnaissance patrol can be in the composition of one squad, bridge crossing - from two squads to the platoon, while for reconnaissance/intelligence of a deep ford or crossing of tanks under water to each direction/axis usually is sent out the combat engineer squad.

To the engineer reconnaissance patrols, intended for reconnaissance/intelligence of places, convenient for the armament of crossings, are allotted BRDM or the small floating automobiles MAV. For the same purpose can be emitted large floating trucks and personnel carriers. Entire personnel of patrols is provided by floating suits or life jackets. Patrols are supplied also with special means of reconnaissance/intelligence (by mine detectors, by hydro-revolving doors, by hydro-speedometers, by bottom probes, by binoculars, by range finders, by cables, by the night vision devices, etc.).

For reconnaissance/intelligence of deep fords and places, suitable for the crossings of tanks under water, engineering reconnaissance patrols are equipped with 2-3 sets of diving gear, by mine detectors, instruments for determination of the profile/airfoil of the bottom (by accoustic sounders and by the apparatuses for reconnaissance/intelligence of river) and, furthermore by the concentrated and extended explosive charges and means for the designation of the investigated crossing (by flags of red, white and green color).

With the advancement to the river and in the course of assault crossing for engineering reconnaissance patrols frequently it is necessary to perform in the complicated radiation and chemical situation. They must be ready to envelop and to cross the zones of obstructions and destruction and to perform in the contaminated area. Therefore it is expedient in the composition of engineering reconnaissance patrols to include chemist-spys. This will make it possible to in proper time have data about the radiation and chemical situation on the ways of advancement and in the places of the outlined crossings. In the course of advancement to the river in the columns of pontoon-bridge and engineer-amphibian equipment subunits, furthermore, must be conducted reconaissance by the observers/spotters who are provided by the necessary instruments.

Chemists-scouts, connected with the composition of engineering reconnaissance patrol, are provided by the indicators of radioactivity and by the instruments of chemical reconnaissance. After being moved on BRDM, scouts periodically include these instruments.

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During the detection of radioactive contamination or toxic substances they supply warning signal about the gas danger, and the commander of patrol reports about this to the commander of pontoon-bridge subunit or to the commander/chief of the engineer service and reveals/detects the most advisable routes/paths of output/yield and to river barrier/obstacle.

Engineering reconnaissance patrols advance to the river barrier/obstacle under the cover of reconnaissance parties, combat reconnaissance patrols, advance detachments and advance guards. In the course of advancement they designate the discovered obstacles, the zones of destruction, reveal/detect possible bypass routes, they rapidly advance the river and begin its reconnaissance/intelligence.

It is possible that the engineering reconnaissance patrols will perform on one direction with the airborne troops, landed on the opposite shore. In this case after large unit/formation on the water obstacle of advance detachment (advance guard) with the airborne troops engineering reconnaissance/intelligence is conducted under the cover of its subunits.

Reconnaissance/intelligence is conducted at the wide front and first of all in the places of the outlined crossings. It is conducted by observation of the defense of enemy, direct measurement of river barrier/obstacle, by examination/inspection of its shores and adjacent terrain.

In the course of reconnaissance/intelligence of the places of crossings engineering reconnaissance patrols determine: the characteristic of water obstacle, way of the advancement of the crossed troops/forces, pontoon-bridge and engineer-amphibian equipment subunits to the places of crossings, the presence of obstructions and contaminated sectors within the limits of crossing, place of descent/release in the water of motor boats and of pontoon units (components/links), the possible ranges/alignments for the bridge crossing, the places of piers or berths for ferry crossings. In the places of the armament of deep fords and crossings of tanks under water are determined the profile/airfoil of the bottom of river, presence and possibility of eliminating of obstacles and natural obstacles (pits, craters, boulders, the sunken objects/subjects, etc.), the condition of congresses/descents and outputs/yields and the volume of works on their armament, the presence of natural terrain masks and shelters on the near bank of river.

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For determining the properties of river (width, depth, rate of flow and the character of the bottom) are applied different receptions/methods and methods whose selection depends on the conditions of combat situation and need for having information of different accuracy. For example, the width of river for the bridge crossing is determined with the deflection not more than ±1.5 m, for the ferry crossing with an accuracy to 10%, but for the assault troop crossings the accuracy of the determination of width can be still less. The depth of river on fords and crossings of tanks under water is determined by the entire width of river in the zone to 30-40 m, in this case thoroughly is inspected the bottom of river in the entire width of crossing. The depth of river on the bridge crossing must be less than 1 m and is determined along the axis of bridge, while depth on the ferry crossing is determined on entire crossing point. In the limits of the ferry crossing there must not be sand bars, sand bars and large/coarse stones the depth above which must be not less than 0.8-1 m.

The width of river can be determined with the aid of the binoculars, the range finder, and also by direct measurement and by geometric method, utilizing tracing tape or a tape-measure. Under the favorable conditions for wide measurement of river it is possible to utilize a theodolite or a leveling instrument with the rack.

The depth of river is measured with the aid of the hook, the post or the engineering reconnaissance accoustic sounder, established/installed on the floating automobile, the tracked amphibious personnel carrier or the motor boat. By accoustic sounder it is possible to determine the profile/airfoil of water obstacle and to measure the depth of river with an accuracy to 5 cm.

The rate of flow of river can be measured with the aid of the hydro-speedometer, the hydro-revolving door and buoys. The quality of the soil of the bottom of fords and crossings of tanks under water is determined with the aid of detectors and directly by divers.

The most difficult task is reconnaissance/intelligence of the mined obstacles, established/installed in the water. For this purpose sapper-scouts utilize mine detectors and light diving gear. During the detection of mines or other obstructions in the water and on the coasts they designate their boundaries and places of turning movement.

All data about the river and the adjacent terrain it is necessary as far as possible to obtain simultaneously.

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For example, the engineering reconnaissance patrol in the composition of platoon, isolated for reconnaissance/intelligence of the place of bridge laying, is capable to conduct simultaneous reconnaissance/intelligence of all basic elements/cells of the bridge crossing. The accomplishment of the confronting it objective can be organized as follows: one squad sets up the route/path of output/yield to the crossing and the area of the disposition of automobiles after unloading; the second squad sets up near bank and are revealed/detected the sectors, convenient for unloading the pontoon-bridge means/facilities; the third squad conducts reconnaissance/intelligence of quite river barrier/obstacle and opposite shore.

Reconnaissance/intelligence of places for the armament of other forms of crossings is organized according to the same principle, i.e., one should attempt to organize simultaneous data collection about the river, the initial and opposite shores.

All findings are immediately reported to commander, who sent out a reconnaissance party, or commander/chief of the engineer service. In order most to fully and in proper time utilize intelligence information about the river, the defense of enemy and terrain, their assembly and processing are conducted in close cooperation with the staff/headquarters and other services.

2. Preparation of routes/paths and the provision of advancement of the advancing/attacking subunits and the crossing means for the water obstacle.

With assault crossing of rivers on the move the troops/forces, performing rapidly and decisively, strive to forestall the waste/exiting enemy in the output/yield for river. For this advance detachments usually use the roads, to the alternate paths of the withdrawal/departure of enemy, and can not be knited in protracted combat with his individual groups. However, enemy, retreating, will attempt to engage the basic roads, which go into the rear, and after withdrawal/departure create obstructions, destroy the sectors of roads and road construction and establish/install different obstacles. Hence it follows that for the successful advance of advance detachments and advance guards to the river it is necessary, in the first place, to in proper time come to light/detect/expose all obstacles and destruction on the routes/paths and, in the second place, rapidly to find and to equip turning movements.

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The first task is fulfilled by the subunits of engineer reconnaissance, the second - by engineer road-building or specially chosen engineer-sapper subunits, which operate in the combat (prewar) formations of the advancing/attacking subunits. These tasks are fulfilled just as in the offensive combat or with the pursuit of enemy, with exception of some special features/peculiarities.

Assault crossing rivers on the move can be realized in those sectors where the enemy less anything expects our offensive. Most frequently these will be the sectors of river, less available for its overcoming (abrupt shores, swampy floodplains, cut by oxbows and drying/drainage channels, dams, etc.). Under these conditions will be required considerable engineering forces and means/facilities for the armament of the routes/paths, which connect the existing roads with the crossing areas.

The battalions of the first echelon (advance guards, advance detachments) usually advance to the water obstacle on one - two routes/paths which subsequently branch to each crossing, equipped in their crossing areas. If are trained/prepared places for the spare crossings, then in the presence of forces and time are plumbed routes/paths, also, to these crossings.

Besides frontal routes/paths, at the removal/distance 3-5 km from the water obstacle is equipped the coastal belt road, which passes, as a rule, along the line of check points. It is intended for the provision of a maneuver of approaching subunits and crossing means from one crossing to another.

The subunits of engineers (*movement* support detachments), assigned for reconnaissance/intelligence and armament of routes/paths to the crossing area, utilize engineer intelligence data and within the shortest periods clear routes/paths, are arranged turning movements and they designate by their well visible road signs. Therefore they must be equipped greater than usually, with a quantity of elements of road surfaces, bridge constructions/designs for the overhead cover of oxbows, ducts and ditches, means of the mechanization of road work and explosives. All tanks and other combat technology, and also cargo vehicles must be provided with the means/facilities of an increase in the passability.

For feed and installation of road-bridge constructions/designs, especially in the swampy floodplains, can extensively be used the helicopters.

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Depending on situation and character of the impregnated obstacles for the armament for marches/passages are utilized the bridge layers or are arranged the filtering earth marches/passages. Therefore in the movement support detachments and the engineer-sapper subunits, isolated for the provision of advancement of subunits to the river, it is necessary to include tanks with the attached bulldozer armament BTU, bridge-laying tanks MTU and mechanized bridges KMM and TMM.

The construction of the filtering earth marches/passages on the obstacles with the low expenditure/consumption of water has a series/row of positive sides. First, they are reliable and more stable from the nuclear attacks, than bridge constructions/designs, in the second place, they make it possible to shorten the requirement for the transportation of the finished elements/cells of bridges and, thirdly, with the enlistment of tanks with the attached bulldozer armament they can be arranged in the terrain with higher radiation levels.

Important value/significance for the successful assault crossing of water obstacles has the reliable and timely advancement of transport subunits to the river. The place of assault-transport and pontoon-bridge subunits and combat (prewar) formations is determined so that not to trouble the output/yield of the attacking troops/forces to the river and to at the same time ensure their timely crossing. The crossing means, attached advance detachment (advance guard), usually follow together with it main forces. In the head of the column of crossing means usually follow the floating automobiles, the tracked amphibious personnel carriers, and then pontoon-bridge motor pools.

The advancement of pontoon-bridge subunits after advance detachments (advance guards) contributes to the timely armament of crossings and to the rapid crossing of the attacking troops/forces. This is confirmed by experiment of the Great Patriotic War. Thus, during August 1944 advance detachment, pursuing the waste/exiting enemy, moved out on Putna River . it forced it on the move and took bridgehead/beachhead. Simultaneously with advance detachment to the river moved out the 8th engineer pontoon bridge battalion, which in proper time directed floating bridge.

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As an example of the successful advancement of pontoon-bridge subunits to the rivers after advance detachments can serve assault crossing on the move by our units of r. Neisse during March 1944, Pilica rivers and Oder during January 1945.

The advancement of engineer-amphibian equipment and pontoon-bridge subunits to the river under the contemporary conditions is connected with considerable difficulties. In the course of the advancement of motor pools to the river is possible the attack of air and surface/ground enemy. At the same time they have to overcome the considerable contamination zones, destruction and roadblock. Furthermore, with the advancement of crossing means to the river in the course of pursuit in the separate directions it is necessary to consider the possibility of an abrupt change in the combat situation, in connection with which it will be necessary to accomplish a rapid maneuver by transport subunits from the sectors where assault crossing river was detained, in those sectors where were identified the greatest success. Therefore the advancement of crossing means to the river must be covered from the air strikes and from the ground forces of enemy.

For the provision of maneuver and rapid advancement of transport subunits to the river, especially under the conditions of lack of roads and during the autumnal and spring slush, can be drawn engineer road-building subunits, and sometimes it is expedient to utilize helicopters.

Together with the provision of timely advancement of transport subunits for the water obstacle it is necessary to approach the capture of the existing crossings, since finished bridges, ferries, barges and the like can significantly increase possibility in the crossing of the troops/forces. The attacking troops/forces always cannot rely on these crossings, but they must consider them as possible reserve for increasing the rates/tempos of crossing.

In the last war for capturing the existing bridges were emitted special groups with the subunits of engineers, intended for the provision of their surprise output/yield to the river, capturing of crossings, and then inspection/check and mine clearing.

Groups were created in the composition of one - two tank platoons, one rifle platoon, also, to the squad of sappers/combat engineers. With the output/yield to the bridge the leading tanks, without retarding velocity, jumped bridge and annihilated protection. Immediately after this bridge it was cleared mines.

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For the purpose placed onto the tanks was a landing force in the makeup of several riflemen and combat engineers. The remaining tanks, after overcoming bridge, occupied advantageous positions and covered the work of sappers/combat engineers.

During January 1945 this capturing team, isolated from the composition of advance detachment, secretly moved out to r. Varta, for the enemy unexpectedly took bridge and tied combat for Burzenin. Meanwhile sappers/combat engineers, connected with the composition of this group, cleared mines bridge, after removing/taking 118 charges.

Sometimes bridges captured engineering subunits and held them to the approach main forces. As this example it is possible to give the activities of the combat engineer platoon of the 131st combat engineer battalion on the capture of bridge in the area Stary Mlyn on r. Pilitsa (Pilica) on 17 January, 1945. The combat engineer platoon, after moving out unexpectedly for the enemy to the river, took the bridge, prepared to the burst, and held it to arrival of the main forces of advance detachment. With the mine clearing of bridge the sappers/combat engineers removed/took about 200 charges.

It is necessary to indicate also the fact that there were the cases, when in the capturing team of crossings they did not include sappers/combat engineers. During capture the crossings in proper time were not reconnoitered and were not cleared mines. As a result for enemy it was possible to destroy the seized bridges when our units already conducted combat on the opposite shore. This created severe conditions and retarded rate of advance.

The given examples show that in the period of the Great Patriotic War the capture of crossings was most frequently realized not by all forces of advance detachments, but by specially chosen subunits. Yes this is completely natural, since to advance detachment in full strength to secretly from the enemy escape to the river more difficultly than to small group.

In the presence of the wide and swampy floodplains the capture of ·he equipped approaches and to bridges acquires fundamental importance. If overcoming the swampy floodplains presents great difficulties, the capture of corduroy roads, mounds, dams and other approaches to the river is organized and is realized simultaneously with the capture of bridge, dams and other water-engineering constructions.

When enemy managed to destroy fords, bridges and other crossings, the subunits of engineers produced reducing works and equipped the available fords.

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The capture of bridges under the contemporary conditions acquires special importance. On leaving to the river subunits of capture secretly they advance to the bridge, they suddenly attack enemy, they capture crossing and organize defense on the opposite shore. Sappers/combat engineers, who operate together with these subunits, provide noiseless overcoming of those encountering on the routes of approach to the bridge of obstacles, conduct reconnaissance/intelligence and clear mines the seized bridge, if necessary they overhaul it and organize its operation. In this case the success on the capture of crossings in many respects will depend on the skillful and matched activities of sappers/combat engineers with the remaining subunits.

If enemy even to the output/yield of the troops/forces to the river had time to destroy crossing or in this direction/axis there was not constant crossings, advance detachment fast forces river on the move on the authorized floating armored personnel carriers and the attached to it crossing means.

3. Organization, armament and the content of crossings in the crossing areas of subunits.

For motorized rifle (tank) battalion it is necessary to force rivers on the move under varied conditions of combat situation, which depends, first of all, on its place in the combat formation. The most difficult and complicated conditions are created when battalion performs as advance detachment or advance guard, since for battalion it is necessary to organize and to realize assault crossing river on the move independently separately from main forces.

Organization of crossings in the crossing area of subunits. The crossing area of battalion is called the sector of river barrier/obstacle with the terrain adjacent to it, in which the battalion with combat is crossed to the opposite shore. It is driven out/selected taking into account the character of river and established situation. Selection must precede the timely radiation/emission of river and terrain adjacent to it. Crossing area must have concealed routes of approach, as far as possible available shores and valley, i.e., the places, convenient for armament and content of crossings.

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At the same time in the places, convenient for the assault crossing, enemy can establish nuclear-mine obstacles and prepare decomposition. Therefore during the selection of crossing area it is necessary to give preference to the places where the defense of enemy weaker and assault crossing for it will not be expected.

A quantity and a character of the equipped crossings and their mutual disposition in the crossing area depend on the formation of the combat formation which is determined not only by combat missions, but also to the certain degree it depends on the presence of crossing means and properties of water obstacle (width, depth and rate of flow, the quality of the soil of the coasts and the bottom of river).

Advance detachment in the composition of the intensive motorized rifle (tank) battalion usually forces river by two echelons, having in the first echelon two reinforced motorized rifle (tank) companies and the secondly one. There can be other versions of formation. For the crossing of the subunits of the first and subsequent echelons in the crossing area of the motorized rifle battalion they can be equipped one - two assault troop crossings even one ferry crossing (Fig. 30). For the tank battalion they are equipped one - two ferry crossings. At the solid ground of the bottom the rivers, the permissible depths and the rates of flow to the tank battalion are equipped one - two crossings under water. Furthermore, subsequently in the crossing area of advance detachment (advance guards) can be equipped the bridge crossing. Under the deficiency/lack in the crossing means or other unfavorable conditions (swampy shores, floodplains, cut by oxbows, the soft ground of the bottom of river and coasts, etc.) a quantity of crossings can be reduced.

The quantity of crossing resources, isolated to intensive motorized rifle battalion, can be different. It depends on the composition of battalion, its reinforcing, character of water obstacle and presence of crossing means.

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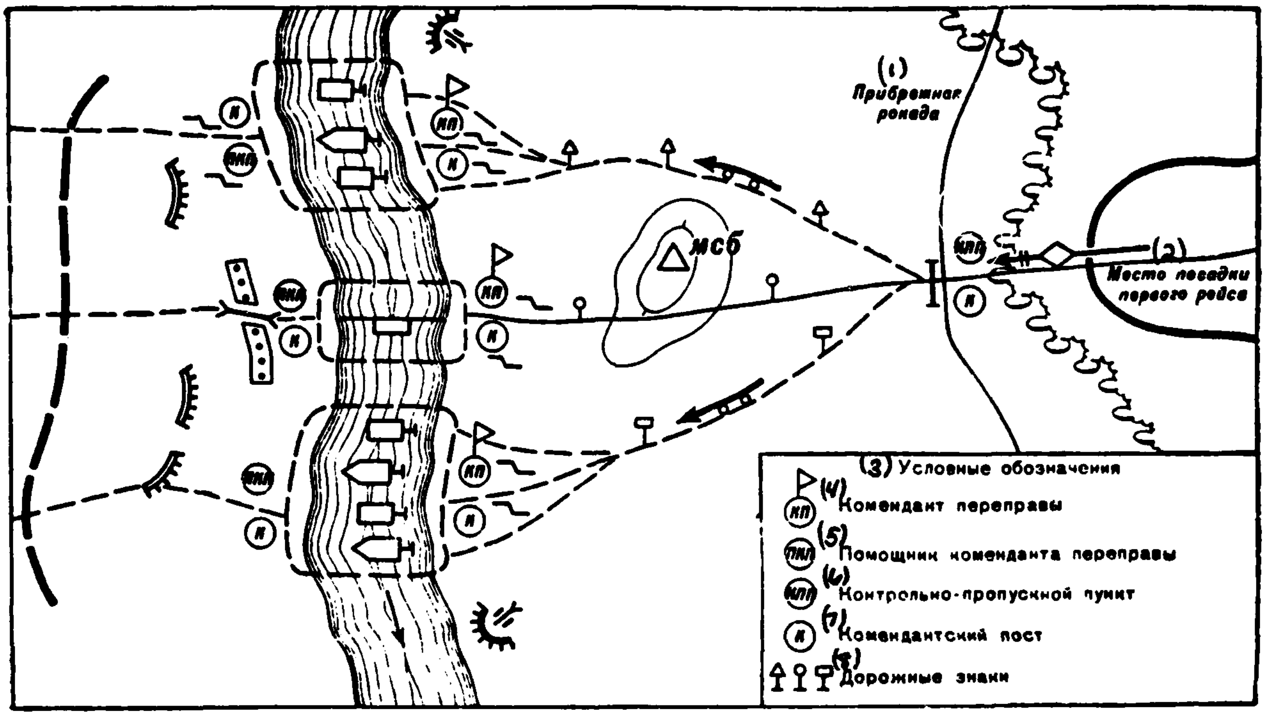

Fig. 30. Engineering armament of crossings in crossing area of motorized rifle battalion (version).

Key: (1). Coastal line. (2). Landing place of first trip. (3). Conventional designations. (4). Crossing area commandant. (5). Deputy of commandant of crossing. (6). Check point. (7). Traffic-control post. (8). Road signs.

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In accordance with the requirements of contemporary all-arms combat to the motorized rifle battalions is usually allotted such quantity of crossing means which would give the possibility to cross by the first trip two reinforced companies, second and third trip - second echelon (reserve), artillery and the subunit of reinforcing of battalion. This sequence and rate/tempo of crossing contribute to the successful execution of combat missions on the opposite shore.

The motorized rifle battalions, which have the authorized floating armored personnel carriers, need smaller reinforcing by crossing means. Thus, the intensive motorized rifle battalion, which operates as advance detachment (advance guard), depending on the width of water obstacle, the presences of crossing means and composition of the crossed subunits can obtain to reinforcing from 1 to 2 squads of the self-propelled amphibious personnel carriers (automobiles), one - two squads of the self-propelled ferries and to one combat engineer platoon. These forces and resources will allow it to overcome river at the high rates/tempos.

Assault crossing water obstacles on the move usually begin the motorized rifle subunits, intensified by the subunits of engineers. They overcome river on the authorized floating armored personnel carriers dispersed at the wide front in the direction/axis of assault objectives, in order to exclude the supplementary redisposition of combat formations for conducting combat on the opposite shore of river. Their crossing is covered by the fire/light of tanks and artillery. After the landing of the subunit of the first echelon fast attack the enemy, annihilate his weapons and advance into the depth of his defense (Fig. 31). Simultaneously or with certain step on the time are crossed reinforcing means (artillery, tanks) and immediately they enter in combat. Artillery and tanks from the near bank suppress the weapon emplacements of enemy and cover the flanks of the crossing subunits. Amphibious tanks, conducting fire/light on to float, supplement the fire/light of artillery.

With the crossing on the authorized floating armored personnel carriers by the commandant of the assault troop crossing they usually assign the officer of the crossed troops/forces. At its disposal from of subunits of engineers, intended for reinforcing the motorized rifle battalion, single out one - two combat engineer squads. Into their task enters reconnaissance/intelligence of the mine fields, ranging of trails, armament and designation of the entrances into water and of outputs/yields on the opposite shore.

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But also measures, as the bearing of commandant and rescue services and armament of covers for the personnel, are fulfilled by the forces of the crossed subunits. With the limited quantity of subunits of engineers all work on the armament of the assault troop crossing on floating BTR under the favorable river-bed conditions can be carried out by personnel of motorized rifle subunits.

Activities of the platoon of amphibious personnel carriers (automobiles) in armament and content of the assault troop crossing. Depending on the available crossing means and the situation conditions for equipment and the content of the assault troop crossing is emitted from the squad to the platoon of the floating vehicles with the squad of traffic-control service and, the fodder of that, are drawn engineer-sapper and engineer road-building subunit.

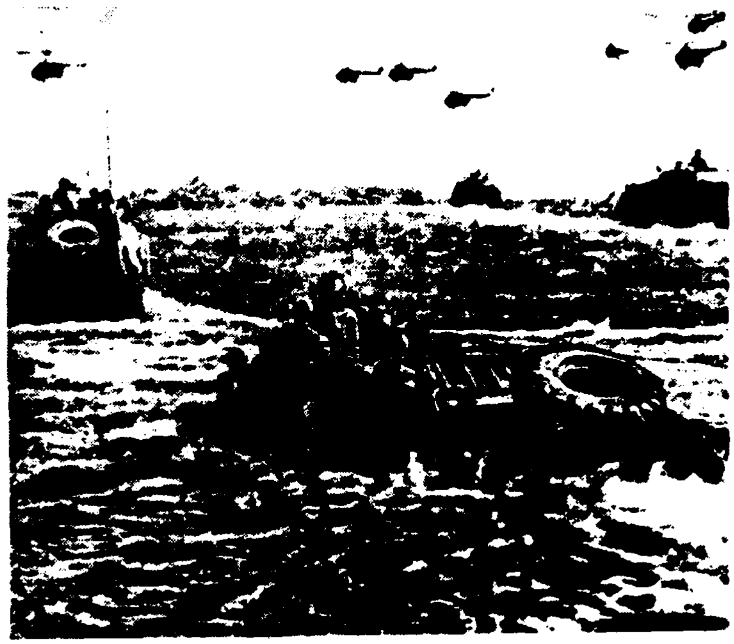

Fig. 31. Crossing of motorized rifle subunits on the floating armored personnel carriers with simultaneous landing of tactical airborne troops.

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The platoon of amphibious personnel carriers (automobiles) to the water obstacle advances together with the battalion, which operates in the first echelon or as the advance guard (advance detachment). In the absence of enemy on the near bank directly to the river the amphibious tracked carrier platoon (GPT) pushes forward and it follows the foremost subunit. If on the near bank enemy offers resistance, then platoon GPT advances to the landing places (on-loading) of combat materiel on the self-propelled assault amphibious vehicles. They are driven out/selected on approaches to the river in the places (forests/scaffolding, natural terrain, after the ground features, etc.) sheltered from the observation of enemy.

The commander of the motorized rifle battalion sets the order/formation of landing (on-loading) the first trip and use of assault amphibious vehicles in the course of assault crossing. Simultaneously with the motorized rifle subunits load antitank guns and PTURS.

The commander of platoon *GPT* is usually assigned by the commandant of the assault troop crossing. He with the squad of traffic-control service emerges to the river for engineering reconnaisance patrol and organizes the deployment of crossing. On the basis of data of engineering reconnaissance patrol the platoon commander more precisely formulates the routes/paths of approach to the coast, he determines the places of congresses/descents and outputs/yields of the floating vehicles and advances of commandant posts. In this stage it is important to organize the close cooperation of the output/yield of amphibious personnel carriers with the engineering reconnaisance patrol, which leads engineer reconnaissance of the place of crossing, and with the engineer-sapper subunits, isolated for the armament of crossing.

The advancement of assault amphibious vehicles with the subunits of the first trip from the areas of on-loading is realized on 1-2 routes/paths which branch to all equipped descents/releases. The floating vehicles on the water move with the interval of 50-100 m (Fig. 32). In the presence of obstacles they move on the previously made passages.

On the wide rivers with the limited number of congresses/descents the floating vehicles on the water can move with "waves".

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The explosion/burst between the "waves" must allow the in front going floating vehicles to moor, to unload combat materiel and to begin movement to the near bank to the approach of the vehicles of the subsequent "wave".

With the first trip usually is crossed the unit of the forces of the engineer-sapper subunits, isolated for the armament of the assault troop crossing, and the squad leader of traffic-control service. The latter, being the assistant of crossing area commandant, organizes traffic-control service on the opposite shore. Engineering - field-engineer subunits immediately begin the mine clearing of river and terrain on the opposite shore, equip outputs/yields from the water for the floating vehicles. The unit of the sappers/combat engineers, which remained on its shore, plumbs and designates trails to the crossings and, once in the course of assault crossing, it additionally equips and contains crossing.

After unloading of the subunits of the first trip the floating vehicles immediately return to the near bank for the crossing of the subsequent trips.

Fig. 32. Crossing in the self-propelled assault amphibious vehicles.

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Their trouble-free operation in the course of assault crossing is provided by the authorized crews of the floating vehicles. For on-loading (unloading) of combat materiel to the self-propelled assault amphibious vehicles are drawn the detachments (crews) of the crossed resources. On-loading (unloading) combat materiel to the floating vehicles usually is conducted on the shore of river, for which near from the shoreline in the sheltered places are equipped loading areas/sites.

Motor vehicles and tractors are loaded by their course. In this case are utilized loading access ramps, and for on-loading of artillery weapons, furthermore, winch. Guns on the cargo pad of personnel carrier are arranged/located with barrels forward. During the on-loading the gun crew supports gun for the trails and guides wheels to the special access ram s. After on-loading is closed rear board, and gun is secured to the cargo platform.

The commandant of crossing the control of the activities of the detachments of the floating vehicles during on-loading of combat materiel and by movement along the water realizes by the groups, supplied with the aid of the flags, megaphone, light signals, also, on the radio. For achievement of the stable control the crossing area commandant must have a radio communication with the floating vehicles in the radio net of the assault troop crossing.

To the loading sites to the floating vehicles traffic-control posts pass the vehicles only of next trip. Combat materiel of the subsequent trip is held up in the sheltered places until floating cargo carriers (trucks) begin movement to the opposite shore.

After the termination of crossing the platoon GPT is concentrated on the opposite shore and takes up maintenance of the floating vehicles. If in the area of crossing is discovered radioactive contamination, then is performed the special working of personnel and assault amphibious vehicles.

Activities of the subunit of the tracked amphibious ferries in armament and content of ferry crossing. To the water obstacle the platoon GSP usually advances after the tank subunits for crossing of which they are intended. With the approach to the river the tanks, crossed by the first trip, occupy firing positions directly on the shore in the places of the armament of ferry crossing.

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The commander of platoon GSP with the squad of traffic-control service and the engineer-sapper subunit, isolated for the armament of ferry crossing, drives out/selects and designates lowering into the water for half-ferries and places of their joining. Simultaneously are trained/prepared and are designated the sites of loading and unloading the tanks on both shores.

Tracked self-propelled ferry services authorized strength. By on-loading tanks and their installation/setting up leads squad leader GSP which after feed of tracked self-propelled ferry under load inspects/checks the reliability of the attachment of ropes, the depth of water on the coast, the condition of entrances on ferry and after this begins on-loading of combat materiel. In the places of mooring for the consolidation of the tracked amphibious ferry is assigned the detachment of two people. The crossing of tank on the tracked amphibious ferry is shown in Fig. 33.

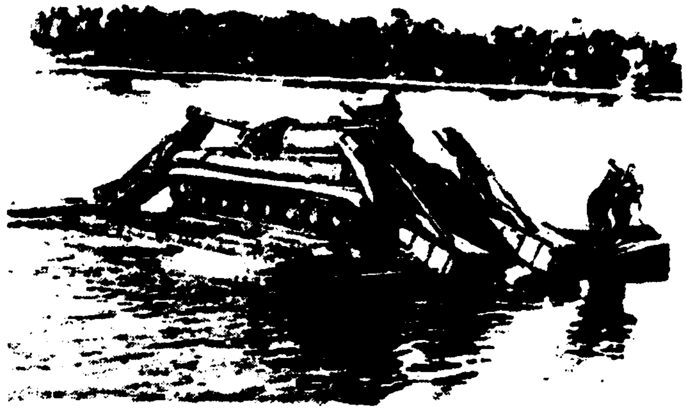

Fig. 33. Crossing of tank on the tracked amphibious ferry GSP.

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Activities of engineering subunits with the provision of a crossing of tanks on deep fords and under water. For reconnaissance/intelligence, armament and maintenance of the crossing of tanks under water usually are emitted the reconnaissance and combat engineer squads, which compose one engineering reconnaissance patrol. For the preparation of routes/paths for the crossings can be drawn the engineering subunits, which ensure the advance of tanks.

Engineering reconnaissance patrol to the river advances independently or together with the subunits of combat reconnaissance. Reconnaissance/intelligence and armament of the crossing of tanks under water begin after the advancing/attacking subunits will engage opposite shore. In this case attempt first of all to use the places of the assault troop crossings, especially on the floating armored personnel carriers, since they are freed/released considerably earlier than others.

For the rapid determination of the quality of soil frequently they resort to the estimate according to the external signs/criteria. Thus, if on the coast fine sand, then on the stream of river it is possible to expect sand of different size and even fine/small pebbles. When, on the coast, silt is present, on the stream is feasible silted or fine sand.

During reconnaissance/intelligence and armament of crossing engineering reconnaissance patrol performs by two groups. On the near bank the unit of the patrol (two divers and one sapper) inspect/check the presence of the mine fields and the passability of the soil of the bottom and coastal unit. The remaining composition of patrol on the amphibious personnel carrier (armored personnel carrier) with apparatus AR-2, moving to the opposite shore, removes/takes the profile/airfoil of the bottom of river, and by detectors is determined the quality of soil. On reaching/achievement of the coast land two divers and sappers/combat engineers for reconnaissance/intelligence and designation of output/yield on the opposite shore. The commander of patrol with the remaining personnel continues reconnaissance/intelligence of river in the entire zone of crossing, sets double signs and designates the boundaries of crossing.

Simultaneously with this tank subunits equip trenches and slots for the personnel of traffic-control service, and also cover for the command post of crossing, rigging squad and tractors. In this case extensively is used bulldozer armament on the tanks and the tractors. After armament they begin the crossing of tanks under water (Fig. 34).

Since the beginning of the crossing of combat materiel the combat engineer squad supports in working order the entrances into the water and outputs/yields, and frogmen bear rescue-evacuation of service.

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Traffic-control service, evacuation jammed and the sunken technology are realized by forces and resources of the crossed subunits.

With insufficiency of assault amphibious vehicles simultaneously with the crossing of tanks on deep fords and under water is organized the crossing of artillery. In this case the artillery prime movers are crossed on the tracked amphibious personnel carriers, and artillery guns in the trailer after the tanks, which go on the bottom (Fig. 35). The crossing of artillery guns on the bottom of river occurred as early as the years of the Great Patriotic War, but at that time gun was outbalanced on the bottom of river by the rope which to the opposite shore was secured to the motor vehicle or the tractor.

Activities of the pontoon platoon (company) with armament and content of ferry and bridge crossings. With the approach in the water obstacle the company commander (platoon) pushes forward and on the basis of data of IRD is produced personal reconnaissance for the purpose of the refinement of the place of the armament of crossing.

The column of the vehicles of the pontoon company (platoon) to the coast of river advances in the specific sequence. During the armament of ferry crossing the column of subunit is constructed by ferry, which will make it possible to accumulate simultaneously all ferries. During the armament of the bridge crossing the company, equipped with motor pool PMP, constructs column on the squads and the platoons, and with the motor pool TPP - by ferry.

Fig. 34. Crossing of tanks under water.

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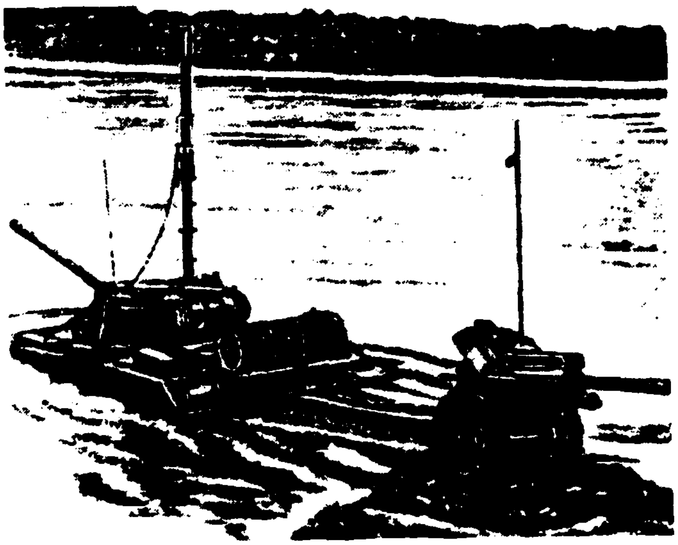

Fig. 35. Crossing of tank under water with artillery gun.

Fig. 36. Advancement of pontoon-bridge motor pool (PMP) to the water obstacle.

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In this case in front usually advance the vehicles with the motor boats, then pontoon vehicles and finally the vehicle of maintenance/servicing. The advancement of motor pool PMP to the river is shown in Fig. 36.

The automobiles of pontoon subunits are unloaded on the prepared pads which preliminarily are inspected/checked against the presence of mines, are produced the filling of pits, craters and the removal/distance of stumps, stones, etc.

The routes/paths of the output/yield of the column of the pontoon company (platoon) and discharging areas/sites equip coast platoons, and with the work with the motor pool TPP - pontoon platoons.

The output/yield of vehicles to the river and their unloading lead the commanders of subunits. At first are discharged into the water motor boats, following them are unloaded the components/links (pontoon units). In this case the column of pontoon vehicles in the sector of unloading moves in parallel to shoreline, then vehicles are turned/run up and with backward motion they are supplied to the water. Unloading components/links can be realized simultaneously. However, it it is possible to produce and consecutively/serially, beginning from the lower side. In this case is provided the security of unloading, and are also created conditions for the retention by the pontoniers of components/links on the coast of river in the course of unloading. The freed vehicles immediately are headed for the concentration area.

During the armament of ferry crossings since the beginning of the assault crossing to the near bank advance the pontoniers and by part forces are crossed to the opposite shore. By this is achieved simultaneousness of the preparation not only of transporting ferries, but also berths (piers) on both shores of river. With readiness of all elements/cells of ferry crossing begins the crossing of combat materiel (Fig. 37).

For the content of ferry crossing are assigned: the commanders/chiefs of ferries with the operating detachments, detachments for the content of berths (piers), coast subunits, observation post of the water obstacle and rescue-evacuation service. The composition of the detachment, which operates ferry, depends on its load capacity and type of the pontoon trains. On the average it can consist of four - eight pontoniers and one - two launch operators.

To each pier is emitted independent detachment in the composition to the pontoon squad.

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Fig. 37. Crossing of tanks on transporting ferries, assembled from motor pool PMP.

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If for ferries are not required pier and they moor/berth to the coast, then to the initial and opposite shore they are assigned on two mooring ones. When ferries are forced frequently to maneuver, transpose of mooring, mooring usually are not assigned.

In the course of the crossing crews provide the entrance of combat materiel to the ferries and its attachment, the refuse/bank and movement from the initial to the opposite shore, the mooring of ferries to the berth (pier), unloading combat materiel, and also dumping, the return of ferries and mooring to their and near bank (pier).

By entrance and the arrangement/position of combat materiel on the ferry leads the commander/chief of ferry. His instructions are necessary for all commanders, drivers of vehicles and personnel of the crossed subunits. By the movement of ferry along the water, and also by mooring to the pier (place of berth), by entrance and by the congress/descent of vehicles the commander/chief of ferry controls/guides by means of the flags or voice, and under the conditions of poor visibility - by signal lamps.

Entrance to the ferries and the congress/descent from them they are conducted only after is completed mooring and ferries are reliably fastened to the piers or the berths. Combat materiel to the ferries enters in the low gear and with the low engine revolutions. On the ferry it is set to entire area evenly. In this case is not allowed/assumed the overload of ferry and the arrangement/position of vehicles on it with considerable listing and the trimming.

The movement of ferries by the water is realized by different methods, namely: towing by motor boats, "shuttle", by towing by motor boats, also, on the rope. Most frequently the movement of ferries by the water is realized by a method of the pushing of ferries by motor boats, since it provides the highest productivity of ferry crossings. In this case is driven out/selected shortest distance to the place of the mooring of ferry on the opposite shore of river. The ferries of large capacity can be moved by "shuttle", for which a motor boat they moor/berth to the boards of ferries.

With the limited quantity of motor boats they are forced to resort to towing of ferries. Towing ferries is realized by motor boats with the aid of time handling lines. In order to ensure the congress/descent of vehicles forward, the ferries on the water are moved not by the shortest route/path, but they move over the locked "eight".

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In this case increases the route/path of ferries and, naturally, decreases their transmission capability.

On the rivers with the rates of flow of water 2 m/s and above can be used the method of the movement of ferries by the rope with the aid of the motor boats, and sometimes by "aircraft". In the latter case is utilized the force of flow of water.

The selection of the method of the movement of ferries by the water depends on the presence of motor boats in the pontoon subunit and the character of river barrier/obstacle. It is necessary to have in mind that most advisable is the method of the pushing of ferries motor boats.

The rate/tempo of the crossing of the troops/forces on the ferry crossing depends on quantity and load capacity of transporting ferries, speed of on-loading and unloading combat materiel, and also on the speed of mooring and refuse/bank of ferries.

For servicing the ferry crossing is emitted the unit of personnel, and the remaining composition of pontoon subunit, after is fixed the crossing of combat materiel, it is drawn for the bearing of commandant service, armament of the spare places of ferry crossings and covers in the concentration area.

The pontoon company, equipped with motor pool PMP, during the armament of bridge crossing adapters does not assemble, but to the extreme river components/links of bridge it hangs up coast components/links (access ramps). For supporting coast components/links are prepared areas, and if necessary is laid metallic pavement.

After alignment/levelling and attachment of bridge the personnel of company begins its content in course of which is provided the organized output/yield of the troops/forces, are supervised of the surface of water for the purpose of the timely detection of the swimming objects/subjects, protection, repair and restoration/reduction of the damaged sectors of bridge, siding tracks and the bearing of rescue-evacuation service.

For the content of the bridge crossing the commander of pontoon subunit (crossing area commandant) assigns bridge group, bridge guard, coast subunits, duty unit, observation post of the river and chemical observation post.

The composition of bridge group depends on the length of bridge and form of the pontoon train.

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Usually in the bridge group, which operates the bridge, induced from the motor pool TPP, they include on one pontoon squad to coast unit and on one pontonier to each floating support; to the bridge, induced from the motor pool PMP, it is emitted on the basis of one pontonier to 2-3 river components/links and on the basis of 3 pontoniers to each coast component/link.

In the course of the crossing of the troops/forces the pontoniers, connected with the composition of bridge group, inspect/check all connections of the elements/cells of pontoon-bridge resources and they follow approaches to the bridge. Furthermore, they inspect/check the attachment of bridge and if necessary pull anchor cables for loading of bridge.

During the damage of pontoons (components/links) the pontoniers of bridge group install holes in the skins/sheathings of pontoons. Simultaneously with this they evacuate water from the pontoons. The damaged floating spans (components/links) are replaced by standby ones. Bridge group provides passage under the bridge of ice, sludge, logs and other swimming objects/subjects, and also are fulfilled other works.

Bridge guard is intended for the defense, the protection of bridge and maintenance of order/formation on it. Guard from its composition advances paired posts in entrance on the bridge and departure with it and single posts on the bridge through 75-100 m. They are obligated to follow the observance of the uniform velocity of movement and the intervehicle distances, to control river, to annihilate floating mines and saboteurs of enemy, and also not to allow/assume to the bridge the floating resources.

Siding tracks both on the initial and at the opposite shore continously are supported in a good transient condition. On the bridge crossing for this purpose are utilized coast subunits with the tracklayers BAT.

Duty unit is assigned for the execution of the unexpected large/coarse works in the content of the bridge crossing (separation of bridge, defense from the swimming ice floes and other objects/subjects, the transfer of crossing to the new place, etc.). With the surprise attack of enemy it can be drawn for the direct protection of bridge. For this the duty unit digs for itself trenches near from the bridge.

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Observation post the consisting of 2-3 people is arranged/located near from the command post of the commandant of the bridge crossing. It observes of the enemy, the river barrier/obstacle, the course of the crossing of subunits, of the appearance floating min and other swimming objects/subjects. Furthermore, post controls the signals of personnel of traffic-control service and river pickets.

Chemical observation post is advanced with the task of the timely detection of radioactive and chemical infection/contamination in the area of bridge crossing and warning of personnel, which operates crossing, and the crossed subunits.

Chemical observation post in the course of conducting radiation and chemical reconnaissance can change positions. In this case it is arranged/located near from the crossing area commandant, the assistants of crossing area commandant, check point and traffic-control posts, in order to have the capability rapidly to report radioactive and chemical infection/contamination. Personnel of traffic-control service and the commanders of the crossed subunits must know the location of chemical observation post and follow the warning signals.

After the armament of the bridge crossing without delay they begin the crossing of the troops/forces. Combat technology must move along the axis of bridge smoothly, without the jerks. Tank, artillery and motorized rifle subunits over the bridge move in the march columns at a velocity, permitted for the type of bridge. Thus, on 60 t to the floating bridge, induced from the motor pool PMP, heavy and average/mean combat technology can move at a rate of 20-30 km/h (Fig.

38). Light vehicles move with the march speed.

On the content of crossings a great effect will have the radiological situation on crossing area. In the case of the radiation infection/contamination of water, soil of the coasts and terrain in the areas of crossings it is necessary to approach their transfer into another place, since the crossed troops/forces and the subunits, which contain crossings, with the prolonged stay in these areas can receive considerable radiation doses. For example, if the hour after burst radiation level was equal to 200 r/h, then personnel of engineer-amphibian equipment and pontoon-bridge subunits only in one hour in this area can obtain about 130 roentgens.

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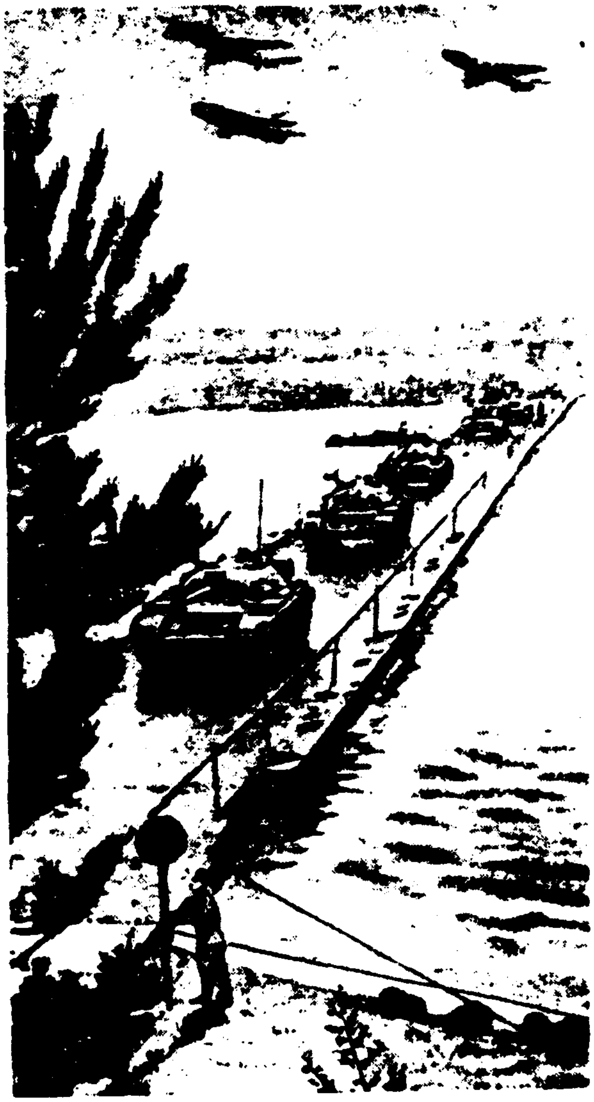

Fig. 38. Crossing of tanks on bridge, induced from motor pool PMP.

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Crossed subunits, moving with the maximum permissible velocity on the tanks and the armored personnel carriers, receive considerably smaller irradiation.

If situation nevertheless forces to equip and to contain crossings in the radioactively contaminated area, it is necessary to take measures for the radioactive decontamination of both crossings and siding tracks leading to them. Radioactive decontamination is realized by washing by water of radioactive deposits from the crossing means.

As far as radioactive contamination of the bottom of river and coastal zones in the area of crossings is concerned, it will be reduced naturally. In this case great effect on a decrease in the radioactive contamination will have a rate of flow of water. On the sand bars where the rate of flow of water is reinforced, radioactive contamination will be less stable. And vice versa, on pools flow becomes weaker, are created conditions for settling the particles of the soil, and together with them and radioactive decay products. Therefore in these sectors the depositing particles of river alluviums contribute to the stronger and more prolonged infection/contamination of the soil of bottom and coasts of river.

For the purpose of the decrease of the irradiation of personnel for content of crossings are emitted the skeleton crews, and remaining personnel is situated in the covers. The replacement of detachments must be conducted through the short time intervals. The duration of the stay of detachments on the crossings depends on radiation levels and obtained it is earlier radiation doses. In this case the radiation doses of personnel must not exceed the permissible limits. Under these conditions it is necessary to provide for the reserve of personnel for replacing the detachments, which contain crossings.

In the course of assault crossing river for providing survivability and increase in the intensity of the crossing of the troops/forces is realized large-scale maneuver by transport means. It can be carried out by timely putting into operation of the reserve for crossing means, transition from the less productive to more productive crossings, and also via removal/taking and transportation of transport subunits from the secondary direction/axis to the direction/axis where is solved the success of assault crossing river barrier/obstacle.

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Reserve self-propelled of assault amphibious vehicles with assault crossing of rivers on the move usually is not created. All available resources are utilized for the crossing of the troops/forces. This makes it possible to have the more powerful/thicker composition of the subunits, which are crossed by the first trip. At the same time for restoring the destroyed or partially damaged bridge crossings is created the reserve of pontoon-bridge resources, which can be utilized, also, for the armament of new crossings.

In the course of assault crossing rivers the situation can sharply change. When appears the danger of the decomposition of the bridge crossings, one should convert/transfer to the ferry crossings as by less vulnerable to the strikes/shocks of enemy. Sometimes situation forces to realize a transfer of crossings into other areas.

Maneuver by pontoon-bridge subunits into the new area can be realized on the water, it is drier and to air. During the transfer of the bridge crossing on the water the bridge dilutes also with the aid of the motor boats is towed upstream on the river or it is discharged downstream.

Under the conditions when on the way of the movement of the pontoon trains by the water are obstacles, thresholds, water-engineering constructions, sand bars, etc., bridge crossing is cut back, pontoon-bridge resources are loaded in the motor vehicles and the pontoon subunits into the new area they are moved on drier. The maneuver of the pontoon trains must be covered by AA units.

4. Traffic-control and rescue- evacuation service on the crossings.

The important value/significance with assault crossing of rivers on the move has timely correctly organized traffic-control service with the advancement of subunits to the river and on the crossings. It is created for the purpose of the organized and timely output/yield of the output/yield of the troops/forces to the crossings, the provisions of a trouble-free operation of crossings, and in the case of breakdown of individual crossings - for the elimination of the accumulation of the troops/forces and combat materiel both on the initial and on the opposite shore of river.

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This is achieved by clear traffic control of subunits with the advancement to the crossings, by maintenance of routine on the crossings and by control of the observance of discipline in the movement. Traffic-control service is organized by the combined arms headquarters. On the routes/paths, which lead to the crossings, it bear the subunits of traffic control of the crossed troops/forces, while on the crossings - subunits of engineers assigned for their content. Since the traffic-control service is deployed in the process of the advancement of the troops/forces to the river, important value/significance have its timely organization and continuous leadership/manual of its activity.

For the leadership/manual of crossing of subunits and maintenance of order/formation on each crossing is assigned the crossing area commandant. Commandant for carrying out traffic-control service assigns two assistants and traffic-control posts (regulators). They are provided with means of communication and traffic control.

Crossing area commandants are assigned from a number of commanders of those subunits of engineers which equipped crossing. On the crossings of tanks under water and on the assault troop crossings where are utilized the authorized floating armored personnel carriers, by crossing area commandants they assign the officers of the crossed subunits.

Crossing area commandant answers for the timely armament of crossing and its correct content. He is obligated: to organize communications/connection, service of regulation of movement and protection of crossing; to contain in working order siding tracks; not to allow/assume the accumulation of the troops/forces and combat materiel on the crossing; to take measures for the rapid restoration/reduction of the destroyed or damaged crossing; to maneuver by crossing means and to lead a rescue-evacuation service.

The crossing area commandant of tanks under water directly leads the crossing of each tank and of subunit as a whole. He inspects/checks the correctness of hermetic sealing/pressurization of tanks, it follows the movement of tanks along the bottom of river and along the radio controls/guides their crossing. In the case of cessation of one of the tanks in the water the crossing of the subsequent tanks continues. The from behind going tanks on the group of the commandant of crossing envelop the stopped tank to the right or to the left.

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A rescue-evacuation group immediately renders aid the crew of the stopped tank.

Crossing area commandant is subordinated to combined-arms commander whose subunits are crossed on this crossing, and to the corresponding commander/chief of the engineer service. It usually is arranged/located on the near bank in the area, whence is observed the crossing trusted to it, and it personally leads the crossing of subunits. In his work the crossing area commandant is guided by the crossing schedule, by the order of commander (staff/headquarters) and by the directives of the commander/chief of the engineer service.

Commandant assigns two assistants. The first of them is located on the near bank of river. It is obligated to in proper time cause to the crossing next subunits or to hold up them during the malfunction of crossing, not to allow/assume the accumulation of subunits on the shore and to in proper time guide to the loading sites to the landing resources and to the ferries, to provide continuous movement along the bridges and to support in the transient condition of route/path at the near bank. To it are subordinated traffic-control posts from the crossing to the check point, and on the bridge crossing, furthermore, coast subunit and bridge guard.

The second assistant of commandant is located on the opposite shore of river. He follows the timely unloading of combat materiel from the self-propelled assault amphibious vehicles and the ferries, provides the continuous movement of subunits along the bridges and the fords, does not allow/assume the delay of the crossing subunits on the opposite shore, organizes the return of crossing means to the near bank and the evacuation of casualties.

Commandant posts follow the observance of concealment and velocity of the movement of subunits to the crossings, they do not allow/assume cessation and accumulation of vehicles, they answer for proper working order of routes/paths and enclosures/protections, established/installed on the passages in the mine fields. They are advanced on the check point, the forks of the roads, which lead to the crossings, in the sites of loading (landing) combat materiel to the floating vehicles, in shoreline ramps (descents/releases) to the crossings and on the opposite shore of river.

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For rendering aid to personnel, caught into the water, and evacuation of the sunken (jammed) combat technology on the crossings is organized a rescue-evacuation service.

The rescue service on the landing and ferry crossings is created in the form of small groups (2-3 people) from the engineering subunits or from the composition of the subunits of the crossed troops/forces. On the bridge crossing in the rescue service is included the rescue unit and the point/post of medical aid. Rescue unit includes the well trained floaters, diving station and medical personnel. The point/post of medical aid is arranged/located on the near bank near the bridge crossing.

Rescue groups and groups are provided by fast navigating resources and identities/accessory equipment for rendering aid by victim (by life buoys, by floats, by hooks, by cords, etc.).

A rescue-evacuation service on the crossings of tanks on deep fords and under water is created of two groups - rescue and evacuation. Rescue group is intended for the rescue of the crews of the tanks stopped in the water, and evacuation group - for the evacuation of the sunken and jammed vehicles. In the composition of rescue group are included engineering subunits, while into the composition of evacuation - tank-repair. The general/common/total leadership of rescue-evacuation service exercises the officer of repair-tank service of the crossed subunits.

Rescue group is provided by the floating resources (motor boats, the floating automobiles, landing boats), by diving gears and, furthermore, by the necessary resources for the rescue of tank crews. It is arranged/located on the water below along the flow from the place of crossing of tanks in readiness for rendering aid.

Evacuation group usually is arranged/located in the covers on the initial and opposite shores of river in readiness for the evacuation of the jammed and sunken vehicles. By it are allotted tank tractors with the rigging armament and tracked amphibious personnel carrier (floating armored personnel carrier).

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Rescue-evacuation service is directly subordinated to the appropriate commandants of the crossing. It must be deployed since the beginning of the crossing of subunits and be removed/taken after overcoming of river and close-down of crossings in the crossing area.

For the provision of a trouble-free operation of crossings and accomplishment of maneuver by crossing means in the course of assault crossing besides usually operating communications/connection it is necessary to create the supplementary net/system with the aid of which the commandants could lead the crossing of subunits. By basic communications in the course of advancement to the river and on the crossings with assault crossing of rivers on the move is radio, since only this form of communication can ensure the reliable control of the crossed subunits and the crossings, equipped in the crossing area. For this purpose they are utilized both the portable and onboard radio sets, established/installed in combat materiel and transport vehicles. At the same time together with the radio communication are applied signal and message-carrying agencies. For the transmission of groups and signals up to the small distances wide application they can obtain electrical megaphons. Communications are applied on the crossings in the complex and they mutually supplement each other.

With assault crossing of rivers on the move engineer-amphibian equipment and pontoon-bridge subunits, and also subunits of traffic-control service on the crossings are deployed without any prolonged cessation before the river, and therefore communications/connection for the control by them should be organized in the course of the advancement of the troops/forces to the water obstacle.

To each crossing area commandant it is necessary to have communications/connection with its assistants, check point, traffic-control posts and with rescue-evacuation service. Furthermore, on the bridge crossing it is necessary to have communications/connection with the reserve of pontoon-bridge resources and the river pickets; on assault troop crossing is created communications/connection with the self-propelled assault amphibious vehicles, and on the crossing of tanks under water - radio communication line of tracer.

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With the approach to the river barrier/obstacle the tank commanders independently reform/redispose onboard radio sets for the frequency of their radio communication line and remain on it during the movement under water to the exit to the opposite shore.

All these communications/connections, as a rule, are supported by VHF portable and onboard radio sets. On the bridge crossings in view of the fact that they perform prolonged time, communications/connection can be supported, also, along the wire circuits. The role of wire resources especially grows/rises during the use/application by the enemy of active radio interference.

For the warning of the crossed troops/forces and subunits, which operate crossings, about the air enemy, about the threat of nuclear or chemical attack are utilized all operating radio nets. Within the subunits for the duplication of warning signal are utilized light and sonic signal resources (illuminating and signal flares, electrical megaphons, etc.).

Stable communications with assault crossing of rivers in many respects will contribute to the timely and organized output/yield of subunits to the river barrier/obstacle, and in the cases of damaging the crossings it will make it possible without the delay to direct subunits toward other crossings. Reliable and continuous communications/connection will make it possible to also most productively utilize all available crossings. In this case the maneuver by crossing means can be realized into the shorter periods, is accelerated the input/introduction of the reserve of transport reducing agents of those damaged or armament of new crossings, and is also realized more rapid transition from one form of crossing to another.

5. Protection of crossings from the floating mines and the sabotage of enemy.

'n the course of assault crossing rivers for the decomposition of the equipped crossings the defended hostile troops can extensively use floating mines, fire ships and torpedoes. Furthermore, for the decomposition of bridges and important water-engineering constructions they can utilize the saboteur parties which infiltrate on drier, they break through on the high-speed/high-velocity motor boats on the water or swim up under water in the diving gear.

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During the Great Patriotic War the Fascist-German troops/forces extensively used these resources and methods. Thus, with the assault crossing by the Soviet troops/forces of rivers Oder and Elba they on the exposed flanks discharged with the flow floating mines and fire ships in the form of rafts, barges and boats, loaded with explosives or incendiary mixtures. Where the situation did not make it possible to fuse/alloy mine, they with hundred dropped them from the aircraft. For the decomposition of important water-engineering constructions and bridges sometimes were applied the torpedoes and small one- and two-place/dyadic submarines (living torpedoes). Simultaneously were sent out saboteurs in the diving gears which attempted to penetrate to the bridges and to destroy them.

However, because of the correctly organized defense of crossings, vigilance and skilful activities of our sappers/combat engineers and pontoniers saboteurs were rendered harmless, and fire ships and mines were recovered or were annihilated by fire/light.

The possibility of the decomposition of the equipped crossings requires from the attacking troops/forces of taking measures for their defense. In particular, in the open crossing areas and on the bridge crossings for the protection from the floating mines and the sabotage of enemy, and also for detention and catching of the swimming objects/subjects it is necessary to advance river pickets.

The composition of river pickets depends on the width of water obstacle and importance of the protected crossing. In them usually are included the subunits of engineers (from the squad to the platoon). On the wide and navigable rivers for dealing with the floating armored personnel carriers, the tanks and the ships of enemy can be emitted artillery and tank subunits.

River pickets are provided by fast motor boats, floating automobiles and armored personnel carriers, and also by communications and signalling. At night or under the conditions of poor visibility by them are allotted searchlights and night vision devices. These resources at any time of days are allowed for personnel of river pickets to in proper time detect and to intercept motor boats, rafts, barges and other swimming objects/subjects, to render safe and to annihilate alloyed mines.

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For the detention of fire ships, min and other swimming objects/subjects river pickets they arrange and contain anti-mine enclosures/protections. Such enclosures/protections must be simple on the construction, easily and rapidly installed on the obstacle, possess a sufficient buoyancy and durability. Furthermore, they must hold up floating mines over entire clear opening of river, be stable during the repeated detention of mines, barely noticeable from air and allow rapid replacement in the case of their damage. Most frequently anti-mine enclosures/protections are arranged in the form of checks and nets/systems or their combinations.

Boom enclosures/protections are arranged from the logs or the poles which are mutually connected by cables or ropes. For the detention of the alloyed mines, which swim at certain depth, are arranged the network or combined enclosures/protections. In the latter case to the checks are fastened the nets/systems with the cargoes suspended/hung to them.

Floating mines and fire ships during the collision/encounter with the anti-mine enclosure/protection (checks and nets/systems) are held up or explode. In this case are destroyed anti-mine enclosures/protections. Therefore they are arranged by individual sections and, as a rule, into several series/rows. In these cases during the burst of alloyed mine is destroyed altogether only one sector of anti-mine enclosure/protection.

On the bridge crossings upper river pickets are arranged/located higher than the bridge at a distance from it not more than 1.5-2 km. This it will allow in the case of the decomposition of anti-mine enclosure/protection the bridge group to breed bridge before the appearance of mines and swimming objects/subjects. Lower river picket is arranged/located below bridge by 500-700 m.

River pickets advance observation posts, they equip firing positions and raise for the personnel the overlapped slots. Firing positions, as a rule, are arranged taking into account the conduct of perimeter defense. Observation posts realize continuous observation of the enemy, of the appearance of the swimming objects/subjects and the signals of traffic-control service.

River pickets (upper and lower) take up the accomplishment of their objectives from the beginning of bridge laying and finish after the close-down of the bridge crossing.

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6. Engineering provision of combat operations of subunits on the opposite shore.

Units and subunits of the first echelon, after overcoming river, capture opposite shore and develop continuous offensive into the depth of the defenses of enemy. After them, utilizing all equipped crossings, overcome river the subsequent echelons (reserves). Under these conditions it is necessary to fulfill the greatest quantity of different engineer operations. When are contained and are equipped new crossings, it is necessary to continue the provision of advancement of the subsequent echelons to the river and to organize the rapid offensive of the crossing troops/forces on the opposite shore of river.

The engineering provision of combat operations of the troops/forces on the opposite shore includes all the measures, conducted with the offensive in the normal conditions. However, most essential of them are: the participation of engineering subunits for repulsing of the counterattacks of the tanks of enemy by the installation/setting up of the mine fields, the provision of advance of the troops/forces in the radioactively contaminated area and overcoming obstructions, decomposition and fires, and also the continuous growth of the rate/tempo of the crossing of the troops/forces and combat materiel to the opposite shore of river.

During overcoming rivers and combat on the opposite shore of subunit must be in constant alert for repulsing of the counterattacks of the enemy whom can precede the nuclear attacks. It suffices to recall that in the last war, for example, of the subunit of the 457th rifle regiment with combat for the retention of bridgehead/beachhead on r. Narev in the area of Surazh on 6 August, 1944, repelled three counterattacks of enemy, the 17th motorized rifle brigade in the cooperation with other units on the bridgehead/beachhead after Oder in Кебен area during 26 January of 1945 repelled seven counterattacks of enemy, and the 838th rifle regiment with combat for the retention of bridgehead/beachhead in r. Dnepr south of Kiev on 24 September, 1943, reflected nine furious counterattacks of tanks and infantry of enemy.

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In the beginning of assault crossing river, especially to readiness of bridges, for the opposite shore will be able to be crossed a comparatively small quantity of tanks. Therefore for dealing with the tanks of enemy it is necessary to as rapidly as possible cross the tank destroyer artillery, PTURS and engineering subunits with the mine-explosive resources. The mobile detachment of obstacles must be crossed together with the antitank reserve following the subunits of the first echelon.

The lines of mine laying the mobile detachment of obstacles are connected with the deployment lines of antitank reserve. Antitank mine fields are set up so that to force the tanks of enemy to move in the direction/axis of the prepared fire/light of anti-tank means. Depending on specific situation conditions the antitank mine fields can be set before the deployment lines of antitank reserve or on the flanks within reach of its fire/light. The mine fields it is provided for to set in several lines and directions/axes, since the enemy can undertake counterattacks from different directions/axes.

After the development/detection of the direction/axis of the counterattack of the tanks of enemy the mobile detachment of obstacle together with the antitank reserve advances to the deployment line. Before the advancement are more precisely formulated the places both the order/formation of the installation/setting up of minefields and signals of interaction. The setting up of minefields and the preparation of objectives for the decomposition are conducted under the cover of antitank reserve. When for repulsing of the counterattack of enemy participate and other subunits, the mobile detachment of obstacles is obligated to cooperate also with them.

With combat on the opposite shore the mobile detachment of obstacles can be drawn, also, for the consolidation of the lines achieved. Besides the mobile detachments of obstacles, for this purpose can be utilized the subunits of engineers, which operate in the combat formations, and engineering reserve. Therefore even to the crossing they are provided by antitank mines and explosives.

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The road subunits, which train/prepare routes/paths on the opposite shore, are equipped by road induction mine detectors DIM, tracklayers BAT, bridge-laying tanks MTU or mechanized bridges KMM and TMM and explosives. The crossing of these subunits is realized following the advancing/attacking subunits. Furthermore, the attacking troops/forces must be in advance provided with the resources of an increase in the passability of roads, reconnaissance/intelligence and rendering safe of the mine fields. This will make it possible within the limited periods to envelop the areas slashings and decomposition, to lay trails on the swampy terrain and to overcome natural obstacles, arranging temporary/time transitions.

For the construction of transitions are utilized the bridge-laying tanks MTU and the mechanized bridges TMM and KMM.

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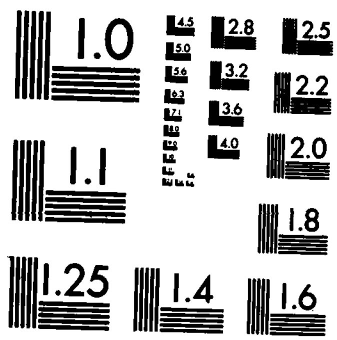

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Through the narrow natural obstacles (ravines, ditches, drying/drainage channels, passes/grooves, etc.) with the aid of the tracklayers BAT or tanks with the attached bulldozer armament are arranged the filtering earth transitions. They rapidly are raised and are reliable.

For the provision of successful offensive on the opposite shore of river important value/significance has the continuous growth of the rate/tempo of the crossing of the troops/forces, which is achieved by the skillful use of crossing means, by timely putting into operation of new crossings, large-scale maneuver of crossing means from the secondary to the main directions, and also by taking measures for the restoration/reduction of the damaged and destroyed crossings. The order/formation of replacement or restoration/reduction of landing and ferry crossings depends on the specific conditions of combat situation and presence of the corresponding crossing means. For the partial restoration/reduction of the bridges, damaged by enemy, is utilized the reserve of pontoon-bridge resources, and also pontoon-bridge equipment of ferry crossings. A question about the complete replacement of the destroyed floating bridge is solved by senior commander. Work on the restoration/reduction of this bridge is fulfilled due to their reserve of pontoon-bridge resources.

All these measures, conducted in proper time, will contribute to the realization of the crossing of the troops/forces in the high rate/tempo and to rapid offensive on the opposite shore of river.

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Chapter Eight.

ENGINEERING PROVISION OF ASSAULT CROSSING OF RIVER OBSTACLE WITH DELIBERATE PREPARATION.

Assault crossing river with deliberate preparation/training is realized, when the troops/forces in the beginning of offensive are situated in the direct contact with the enemy on the river line, or in the course of offensive after the unsuccessful assault crossing of river on the move. In that and in other case the preparation for the assault crossing is decreased by the minimum, especially short it must be with the unsuccessful assault crossing of river on the move, so that the enemy could not considerably increase his defense.

Assault crossing rivers with deliberate preparation/training is conducted with the exercise of initial position on the river line and it can be realized with the advancement of the troops/forces from the assembly areas. In the latter case assault crossing river is conducted with the reliable suppression weapons of enemy and in the terrain, which is favorable to the surprise and fast output/yield of the troops/forces to the river.

In contrast to assault crossing of river on the move the assault crossing with deliberate preparation/training is characterized by the more or less prolonged period of contact with the enemy on the river line. This gives the possibility to enemy to more fully prepare in engineering sense defensive line and to increase river as obstacle by engineering obstacles. At the same time the attacking troops/forces, being found in the direct contact with the enemy, have the capability to organize the timely and careful study of river and terrain adjacent to it, to in proper time and secretly concentrate the necessary quantity of crossing means, to equip initial (assembly) area for the assault crossing and to produce preparatory works on the armament of crossings.

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The engineering provision of assault crossing river with deliberate preparation/training contributes to the concealed/latent and safe exercise by the troops/forces of departure area for the assault crossing, the realization of the crossing of the troops/forces at the high rate/tempo and to rapid offensive on the opposite shore river.

The basic engineer support missions of assault crossing river with deliberate preparation/training are: engineer reconnaissance of river, terrains and character of the engineering armament of the positions of enemy; preparation of departure area for the assault crossing; armament and content of crossings; the organization of traffic-control and evacuation-rescue services on the crossings; the protection of crossings from the floating mines and the sabotage of enemy; the engineering provision of further offensive of the troops/forces on the opposite shore of river.

Some of these tasks, such as the content of crossings, the organization of evacuation-rescue service, the protection of crossings and the engineering provision of combat on the opposite shore, are solved just as with assault crossing of river on the move. The main special feature/peculiarity of the engineering provision of assault crossing in these conditions consists in organization and conduct of engineer reconnaissance of terrain, water obstacle and defense of enemy, in the need for the preparation of departure area for the assault crossing, and also within character and periods of the armament of crossings. Therefore subsequently main attention is paid to examination of the special features/peculiarities of the accomplishment of precisely these objectives.

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1. Special features/peculiarities of engineer reconnaissance of river, adjacent to it terrain and the defense of enemy.

With assault crossing of river with deliberate preparation/training for conducting engineer reconnaissance by water of barrier/obstacle and defense of enemy are in advance advanced engineering-observational posts INP, the surface/ground posts of photography are sent out engineering reconnaissance patrols from the subunits, isolated for the armament of crossings.

Engineering observation posts are created in the composition two - three sapper- scouts, equipped with the necessary instruments of engineer reconnaissance. These posts in the daytime conduct surveillance reconnaissance, and at night also under the conditions of poor visibility, furthermore, by monitoring/listening. Photographing the defense of enemy on the opposite shore of river is conducted by the mobile posts of photography, which make it possible to create the photopanorama of crossing area. For engineer reconnaissance by observation, by monitoring/listening and by photography are drawn the subunits of engineer reconnaissance not only of the attacking troops/forces, but also finding in the direct contact with the enemy on the river line.

For the careful study of the places, outlined for the armament of crossings, are emitted engineering reconnaissance patrols at a rate of one patrol to each crossing. Reconnaissance/intelligence of river, obstacles of enemy and natural obstacles in the water and on the coasts they conduct by direct examination/inspection and by observation. In this case in the daytime the patrols establish observation of the enemy and the water obstacle, and they at night realize measurements of river, examination/inspection of obstacles and more precisely formulate the places of the armament of crossings.

The composition of engineering reconnaissance patrol depends on the form of the crossing for reconnaissance/intelligence of which it is emitted, and it can be from one squad to the platoon. With the prolonged contact with the enemy on the river line for reconnaissance/intelligence can be drawn the scouts. Patrols are provided by the instruments of engineering and radiation reconnaissance.

The tasks of engineering reconnaissance patrols approximately/exemplarily are the same as with assault crossing of river on the move. Besides the refinement of the character of water obstacle, they are obligated to come to light/detect/expose places and character of the obstacles, established/installed by enemy in the river and on the coasts, and also the presence of natural obstacles (oxbows, the swampy sectors of floodplains, dams, etc.), especially on the opposite shore of river. In this case especially careful reconnaissance/intelligence is conducted in the limits of the outlined crossings.

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In the departure area for the provision of concealed/latent concentration and arrangement/position of the troops/forces and the crossing means in advance by the forces of engineer reconnaissance it is necessary to come to light/detect/expose: the protective and camouflaging properties terrains, i.e., forest, the inequality of relief, ravines, mound, the open consumptions/productions/generations and the like; the concealed/latent routes of approach to the outlined crossings; the condition of the existing roads; the possible areas of the procurement of building materials both for the armament of departure area and for the armament of crossings. Furthermore, terrain is inspected/checked against the presence of the mine fields of enemy, especially in the areas, occupied by pontoon-bridge and landing-transport subunits. These data obtain the subunits of engineers, intended for the execution in the departure area of the corresponding engineer operations.

2. Engineering armament of departure area.

With assault crossing of river with deliberate preparation/training the troops/forces occupy departure area for the purpose of the concealed/latent and shielded disposition of subunits. In this case maximally are utilized the fortifications, elevated in the defense. When preparation/training is conducted after the unsuccessful assault crossing on the move, the troops/forces occupy initial position in the unprepared terrain, utilizing forest, natural terrain and other natural covers.

In both cases engineer training of departure area for the assault crossing includes: testing terrain to mine laying and its partial mine clearing; the armament of positions and areas of the disposition of subunits, concentration areas of engineer-amphibian equipment and pontoon-bridge subunits, landing places of personnel and on-loading of combat materiel on the floating vehicles; the preparation of roads and trails for the provision of maneuver and output/yield of the troops/forces for the crossings, and also performing preparatory work on the armament of crossings. All these measures are conducted prior to the beginning of assault crossing river with the observance of the strictest measures of camouflage.

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Testing terrains to the presence of mines and the mine clearing are conducted in essence along the roads and in the locations of personnel and combat materiel. To the continuous mine clearing of entire departure area time will be sufficient neither forces nor; therefore the revealed minefields in the terrain only are designated. Them, as a rule, they envelop. If necessary in the obstacles they make and designate passages.

The characteristic feature of assault crossing river with deliberate preparation/training is the possibility of the complete mine clearing of near bank and the nearest depth in the limits of the outlined crossings. This will ensure the freedom of maneuvering of the crossed subunits, self-propelled landing vehicles both with the approach to the river and in the course of assault crossing itself and, furthermore, it will make it possible to realize unloading pontoon units (components/links) at the wide front. On the pads for boarding the personnel of motorized rifle and artillery subunits and on-loading of combat materiel and motor vehicles on the self-propelled assault amphibious vehicles is realized reconnaissance/intelligence to the presence of the mine fields and is conducted their careful mine clearing. Sometimes in view of the special features/peculiarities of terrain, deficiency/lack in the forces and time instead of the continuous mine clearing of the coast it is necessary to be restricted to breaching of passages in the obstacles.

Under the conditions of prolonged contact with the enemy on water line there can be the high density of obstacles in the water (anchor, bottom mines and mines/fougasses in combination with the nonexplosive obstacles). Therefore reconnaissance/intelligence and removal/taking of individual mines and mines/fougasses must be conducted in advance. However, final breaching of passages in the submerged obstacles by sappers/combat engineers in the diving gear it is necessary to strive to realize on the night before the offensive. If passages could not be prepared in advance, then they do them in the period of fire training by the burst of elongated charges.

The passages, made in the submerged obstacles, and purified from the mines the sectors of river for moving of the self-propelled transport-assault vehicles and ferries are designated by buoys or posts/stakes.

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Character and volume of the fortification armament of departure area depend on the presence of time, situation conditions and volume of the engineering works, made by the defended subunits. If offensive is renewed after the unsuccessful assault crossing of river on tl move and the time of preparation/training is calculated by severa hours, then in the departure area by the forces of personnel of t advancing/attacking subunits are equipped in essence trenches for the small arms, the grenade launchers, mortars, artillery and tanks. On the command posts are raised open type structures/installations and dugouts made of the composite constructions/designs. Cargo vehicles and tractors arrange/locate sheltered, utilizing for this the protective and camouflaging properties terrains.

When assault crossing river with deliberate preparation/training precedes defense on the river line, first of all they attempt to utilize the fortifications, elevated by the defended troops/forces. However, the density of the arrangement/position of motorized rifle subunits in the departure area is approximately/exemplarily two times more than in the defense. Thus, in the limits of one defense area of battalion it can be arranged/located to two advancing/attacking motorized rifle battalions. Therefore trenches and other engineering structures/installations, elevated in the defense area of battalion, for the disposition of the advancing/attacking subunits of two motorized rifle battalions it will be insufficient. Based on this, in the period of preparation for the assault crossing by the forces of the defended subunits under the guise of the improvement of defense are trained/prepared alternate positions, trenches for the fire resources and the cover for personnel and combat materiel.

Simultaneously with this are raised the missing command-observational points/posts for the commanders of subunits. For this purpose must extensively be used assembly-disassembly structures/installations of the corrugated plate, light skeleton structures/installations and elements of fortifications previously prepared/prefabricated from the tree/wood.

With the prolonged contact with the enemy when in the limits of the defense area of battalion are equipped not only basic, but also alternate positions for the subunits, in it they can be arranged to two motorized rifle battalions without the auxiliary equipment.

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In this case the degree of the defense of personnel of subunits from the effect of the nuclear explosion of enemy will depend on the types of fortifications. For example, during the arrangement/position of personnel in open type structures/installations (trench, slot, to trench or communication trench) effective casualty radius from the air nuclear explosion decreases 1.5 times, and the area of damage/defeat - approximately/exemplarily 3 times in comparison with its open disposition in the terrain. But if personnel at the moment of nuclear explosion will be located in the dugouts, then effective casualty radius decreases 2.5 times, and the area of damage/defeat - 6-8 times.

On the firing positions of tanks is explored and is cleared of mines the terrain, are equipped trenches for the tanks and are made camouflage works.

The armament of firing positions for the subunits of surface/ground and antiaircraft artillery includes testing terrain to the presence of obstacles, construction of trenches for the guns, armament for structures/installations on the command posts and covers for the gun crews. In the presence of time are arranged the covers for the artillery prime movers, and vehicles are accommodated in the natural covers and are camouflaged.

One of the special features/peculiarities of the preparation of departure area for assault crossing of river is auxiliary equipment of the concentration areas of pontoon-bridge subunits, self-propelled engineer-amphibian equipment resources, areas/sites for on-loading of personnel and combat materiel to the floating automobiles and the personnel carriers.

Covers for the self-propelled engineer-amphibian equipment resources are equipped, as a rule, along the trails, which lead to the crossings. In this case are utilized the protective properties of terrain, i.e., forest, the inequality of relief, and if them it is insufficient, are raised trenched type covers and is realized their careful camouflage. For the armament of covers are drawn the crews of the floating vehicles and the subunits, isolated for the armament of the assault troop crossings.

For boarding of personnel and on-loading of combat materiel on the self-propelled assault amphibious vehicles, crossed by the first trip, are assigned sheltered areas.

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In these areas by the forces of the crossed subunits for the personnel are broken away the slots, and in the presence of time and cover for the vehicles.

The pontoon-bridge subunits, intended for the armament of ferry-boat and bridge crossings, are arranged/located in the concentration areas at such removal/distance from the river, which makes it possible for them secretly to be arranged in the terrain and at the same time in proper time to move out to the river. By the beginning of the advancement of pontoon-bridge subunits to the water obstacle can be the beginning of assault crossing river the subunits of the first echelon.

In the area of concentration all vehicles of pontoon-bridge motor pool are arranged/located along the roads at the removal/distance 40-50 m one from another. In this case between the subunits must be the distance in the limits to 1 km. In the subunits the vehicles are arranged/located in this sequence, in which they must advance to the water obstacle.

This disposition of pontoon-bridge subunits in the concentration area provides the smaller vulnerability of personnel and combat materiel to the nuclear attacks of enemy. Furthermore, it contributes to their organized and rapid advancement in the crossing area and armament of crossings. In the concentration areas for the defense of personnel are broken away the slots, and for the vehicles with the pontoon units and the auxiliary vehicles - trenched type cover. All work on the armament of this area is done by the forces of pontoon-bridge subunits. After the exercise of the assigned places of vehicle immediately are camouflaged, for which are utilized the natural terrain masks, local materials and authorized camouflage resources. After this are broken away the trenches for the protective agencies and slot for the personnel. If is allowed time, then subsequently are raised dugouts and are broken away covers for the technology.

If in the limits of departure area are oxbows, ducts and sleeves, connected with the basic river bed, then the concentration area of transport subunits can not be equipped. The pontoon-bridge subunits before the offensive can in these ducts in advance gather transporting and floating spans, also, on the signal tow away of them into the basic river bed, into the places of the armament of ferry-boat and bridge crossings.

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The concentration areas of pontoon-bridge subunits are not equipped with the offensive from the assembly areas. However, in both cases are planned the concentration areas of the unloaded pontoon vehicles. During the selection of these areas maximally are utilized the protective properties of terrain. Entire volume of works on the cover of vehicles in these areas is made by driver composition and pontoniers.

The preparation of roads and trails in the departure area for the assault crossing acquires important value/significance. The volume of these works depends on the conditions of terrain, presence of the existing roads, their condition and season. For the accomplishment of large-scale maneuver in the departure area is provided for the supplementary construction of coastal belt road, which must pass along the line of check points to 3-5 km from the shoreline. This removal/distance of coastal belt road from the river will allow in the case of the strikes/shocks of enemy on the crossings to maneuver by crossing means both along the front and from the depth.

The trails and the roads, which go from the depth to the coastal belt road, are laid just as during the preparation of departure area for the offensive. In this case all routes/paths, which go to the crossings, must cross/intersect coastal belt road in the locations of check points. This to ensure the timely advancement of subunits to the crossings.

3. Special features/peculiarities of the armament of crossings.

The engineering armament of crossings with assault crossing of river with deliberate preparation/training includes the same measures, as with assault crossing of rivers on the move. At the same time organization and sequence of the execution of these measures have their distinctive special features/peculiarities.

The armament of crossings with assault crossing of river with deliberate preparation/training begins simultaneously with the armament of departure area.

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At the beginning of assault crossing usually are trained/prepared the trails, covers for the personnel of traffic-control service, is made preparatory work on armament it is lowering to the river for the crossing means, are trained/prepared areas/sites for on-loading of combat materiel to the floating vehicles and place of unloading pontoon-bridge motor pools, and also are realized reconnaissance/intelligence and partial removal/distance of the submerged obstacles of enemy.

The net/system of trails in the limits of crossings, especially on the routes of approach to the river, receives larger development than with assault crossing of rivers on the move. All road work are conducted secretly and thoroughly they are camouflaged. In this case are utilized the masking properties of terrain. All trails are designated by one-way signs, invisible on the part of enemy. On each route/path are set their guide signs.

To the assault troop crossings from the check points it is laid on one route/path which subsequently depending on terrain branch at a rate of one route/path to every two floating vehicles. Under the difficult conditions of terrain (swampy floodplain, steep/abrupt shores, etc.) are laid the trails at a rate of one route/path to the squad of the floating vehicles.

When motorized rifle subunits overcome the river on the authorized floating armored personnel carriers and the coast it favors this, routes/paths they train/prepare so that vehicles could move out to the river in the line formation.

On the ferry crossings and the crossings of tanks under water from the check points it is equipped with one route/path, which branches from the detachment of the provision of an approach to each pair of piers (to berth, to tracer). For the bridge crossing is prepared one road and, furthermore, in the presence of time is trained/prepared route/path to the spare place of bridge laying.

One of the special features/peculiarities of the preparation of crossings and as a whole of departure area for the assault crossing are timely organization of traffic-control service and preparation/training for the personnel of the necessary covers. If with assault crossing of river on the move traffic-control service on the crossings is organized with the approach of the troops/forces to the water obstacle and in the process of crossing, then with assault crossing of river with deliberate preparation/training it is organized previously. This will exclude the premature appearance of combat materiel on the trails and the roads, which lead to the crossings, which will contribute to reaching/achievement of the concealment of the preparation of forced crossing.

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Simultaneously with the deployment of traffic-control service and the preparation of the net/system of trails are equipped check points to the crossings, are closed over all existing roads, which lead to the river, and is forbidden movement along them. For the personnel, which operates check points on the crossings, depending on the presence of time are equipped the slots or dugouts. In the places of the branching off of trails and roads are advanced the posts of control/regulation. Personnel of these posts are equipped with open or overlapped slots.

The preparation of areas/sites for on-loading of combat materiel for the floating vehicles, and also the armament of places for unloading of pontoon units and motor boats they are realized on the night before the assault crossing with the observance of the measures of camouflage. Preparation for the armament for congresses/descents into the water is conducted in advance. For this previously are broken away the bore pits, are embedded charges of VV, near are concentrated tanks with the bulldozer armament or other excavators. The armament it is lowering they take up since the beginning of the fire training.

All noted measures for the timely armament of crossings are conducted through the common plan under the guise of the improvement of defense or consolidation of the seized line. These works, as a rule, are done at night or with the use/application of the smoke screens both in daylight and at night. In order to disperse the attention of enemy and to hinder/hamper the development/detection by it of the conducted measures for the armament of crossings, the smoke screens are placed at the wide front. Since the beginning of assault crossing the subunit of engineers, after landing on the opposite shore, they make and designate passages in the obstacles, are arranged outputs/yields for the self-propelled crossing means, they assemble piers and coast units of floating bridges. Subsequently, in proportion to the advance of subunits on the opposite shore, go into service the ferry-boat and bridge crossings, on which are crossed the second echelons and reserves.

All engineer operations, connected with further provision of crossing and combat of subunits on the opposite shore of river, virtually are made just as with assault crossing of river on the move.

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Chapter Nine.

SPECIAL FEATURES OF THE ENGINEERING PROVISION OF ASSAULT CROSSING OF RIVERS AT NIGHT.

Assault crossing water obstacles under the contemporary conditions can be realized both in the daytime and at night. In this case wide acceptance under the conditions of night can obtain not only advancement of the troops/forces to the water obstacle and its overcoming, but also combat operations in the depth of the defenses of enemy as the result of the incessant daytime offensive.

The night dark contributes to the concealment of the advancement of the troops/forces to the water obstacle, to the surprise of assault crossing. It is at night less than losses from the fire/light of enemy and strikes/shocks of his aviation.

At the same time night impedes organization and direct overcoming of river barrier/obstacle. In particular, becomes complicated the control of subunits, the maintenance of cooperation and the accomplishment of maneuver; it rises the effect of the luminous radiation of nuclear explosions and enervation of personnel; it hinders orientation and the conduct of aimed fire, and also reconnaissance/intelligence of river, armament and the content of crossings. Furthermore, assault crossing river at night can begin without the fire training, and hence sharply grows/rises the role of fire provision in the course of overcoming the river. Therefore all weapons in the course of assault crossing river barrier/obstacle must be they are capable of suppressing the weapon emplacements of enemy, which mix the crossing of the advancing/attacking subunits.

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Assault crossing of rivers will at night affect also the effect of meteorological conditions. Above floodplains, especially in the low and satisfied places, and on the surface of water appear the dense fogs/mists, which sharply decrease the visibility and the effectiveness of the artificial illumination of crossing area. All this can increase the duration of the trip of landing resources and ferries, also, as a whole the period of the crossing of subunits.

In connection with this the engineering provision of assault crossing water obstacles under the nighttime conditions has a series/row of characteristic features. The advancing/attacking subunits in the foresight of overcoming river together with the ordinary engineer support missions realize supplementary measures and works, which facilitate the successful assault crossing of water obstacles. Such measures include: the careful preparation of subunits and technology for the activities under the nighttime conditions; designation by the clearly visible signs and by the luminous markers of the ways of the advancement of the troops/forces for the river, and also the boundaries of crossings and direction of the motion of crossing means along the water; special camouflage measures; the wide application of night vision devices for the self-propelled assault amphibious vehicles with the assembly of ferries and the launching of a floating bridge; armament by the blackout constructions of the self-propelled floating vehicles and vehicles of pontoon-bridge motor pools, and also the provision of combat operations of subunits on the opposite shore of river.

In the foresight of assault crossing water obstacle at night is realized the timely training of the troops/forces for the night activities, which includes: the equipment of units and subunits, including of pontoon-bridge ones and engineer-amphibian equipment, by night vision devices and by the clearly visible in the dark signs; the special training of personnel in armament and in the content of crossings in the conditions of the night dark, and also the preparation of crossing means. Night vision devices to a considerable degree increase possibilities in the conduct of combat operations, including on the conduct of engineer reconnaissance of the places of the armament of crossings.

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The subunits of engineer reconnaissance, besides conventional means of reconnaissance/intelligence of river, are provided by infrared binoculars, instruments of near observation and by night vision devices to the authorized weaponry.

For the successful execution of works in armament and content of crossings pontoon-bridge and engineer-amphibian equipment subunits are supplied with the instruments of near observation and with flashlights with the light filters. All drivers of self-propelled landing vehicles, motor boats, park vehicles, resources of the escort/tracking the troops/forces, armored personnel carriers and transport means are provided by night vision devices. Furthermore, these vehicles are equipped by blackout constructions, size and identification signs.

The subunits of engineers, which ensure output/yield to the river and combat on the opposite shore, are supplied with night vision devices, and combat and cargo vehicles - by auxiliary equipment. Thus, on the rear boards of the armored personnel carriers, which form part of the mobile detachments of obstacles, it is expedient to have the light indicators of distances, and on the trailer mine layers - lighted onboard signs. All this considerably facilitates the orientation of the drivers of armored personnel carriers during the movement in the column and during the installation/setting up of minefields, and also the orientation of sappers/combat engineers during the installation/setting up of mines. On the tanks for the best cooperation with the sappers/combat engineers and by motorized rifle subunits with combat on the opposite shore are set signal resources.

The movement support detachments, the mobile detachments of obstacles and the subunits of engineers, which ensure the advance of the advancing/attacking subunits on the opposite shore, are supplied with the authorized or prepared/prefabricated in the troops/forces light-signal signs.

The successful execution of the engineer support missions of assault crossing rivers at night depends on the ability of all arms of service to make engineering works under the conditions of night.

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Personnel of motorized rifle, tank and artillery subunits must be trained to on-loading (unloading) to the self-propelled assault amphibious vehicles and ferries, to movement along the bridges, the fords and under water, and also to independent overcoming of at night natural obstacles, to trail breaking and to overcoming the mine fields.

The ways of the advancement of subunits to the river are designated with the aid of the authorized and prepared in the troops/forces light and electric signs. At present are applied the electric signs of the signal lights and other signs of the constant brightness of industrial manufacture. The light-signal signs of industrial manufacture are utilized mainly for the designation of the passages, made in the mine fields and on the obstacles. With the deficiency/lack their ways of advancement in the river and coastal belt road are designated by the indicators, prepared with the forces of the troops/forces.

For manufacturing the light signs are applied the luminous compounds of constant and temporary/time brightness, and also usual flashlights with the polychromatic filters and the conventional signs (circle, square, rhomb, etc.). For the designation of routes/paths can be used also the simplest indicators in the form of the shields of various forms, covered with luminous compound or paint/color of white color, and also the painted marking poles and the columns, painted by black-white zones.

By light-signal signs are designated: the routes/paths of the output/yield of subunits to the water obstacle, coastal belt road, passages in the mine fields and transitions on the obstacles, boundaries of crossings and directions of the motion of self-propelled assault amphibious vehicles and ferries, and also route/path on the opposite shore of river.

The methods of the designation of routes/paths, the distance between the signs and requirement of them depend on character and condition of the roads, which go to the river, the conditions of natural illumination, trace of path and area relief.

On the march routes, which pass along good roads, are designated only sharp turns, road forks and road construction. The straight/direct sectors of roads it is possible not to designate, since on them subunits can freely be moved, also, in the night time. The trails, which pass out of the roads (on the virgin soil) or along little-packed roads, are designated for entire elongation/extent, in this case the signs are set within 75-100 m.

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Consequently, for the designation of one kilometer of such routes/paths will be required approximately/exemplarily 10-15 light-signal signs.

The designation of routes/paths can be two-way and one-way. From two sides are designated only the dangerous sectors of route/path (road construction, bridges, defile, obstacle, etc.). With one-way designation the luminous markers are set from the right part on the course of movement.

With the designation of routes/paths it is necessary for each subunit to have its signs, which differ in form, to value and to color. In the course of advancement to the river to entire composition of subunits is communicated the sign, which is set on the way of its movement. This facilitates the orientation of the troops/forces and their movement to the chosen crossings.

The routes/paths of the output/yield of subunits to the river in the limits of crossings are designated by one-way electric signs, and the place of unloading pontoon units (components/links), motor boats and other resources - by special signs with the light number. Furthermore, under the favorable conditions for illuminating the place of unloading pontoon-bridge resources can be utilized local illumination.

Approaches to the crossings are arranged by rectilinear ones and are designated from two sides by electric signs. Descents/releases to the river and outputs/yields on the opposite shore are equipped by flatter than under the daytime conditions.

In order to avoid the blasting/detriment of combat materiel and delay of subunits with the advancement to the river, the minefields, left in floodplains, in the limits of crossing necessary to designate by the signs clearly visible in the dark and as far as possible to set enclosures/protections. The distance between these signs depends on the conditions of terrain and illumination. Tentatively it can be in the limits of 25-30 m.

Passages in the mine fields are designated by one-way signs which are well visible from the side of the subunits outstanding to the river and they are not visible to enemy. For this usually are utilized the authorized signs of in-house production, and with their deficiency/lack - different light signs, prepared in the troops/forces. In this case should be set the signs from two sides along the boundaries of each passage.

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For the bilateral through designation of one passage with the distance between the signs 15-20 m it will be required to 20 light signs. Furthermore, in the beginning of passage it is necessary to set the well visible indentification tag. All this will lighten to subunits overcoming the mine fields.

Traffic-control service on the passages, the trails and the roads, which lead to the crossings, and on the crossings is reinforced by supplementary traffic controllers and guides. Personnel, isolated for the content of crossings, is provided by light-signal lamps/canopies and light signs for the designation of enclosures/protections and installation/setting up of indicators on crossings and paths of motion of subunits on the opposite shore of river.

The contemporary resources of reconnaissance/intelligence to a considerable extent increased possibility in the detection of the operations of the troops/forces at night. Therefore in period of the approach of subunits to the water obstacle and their preparations for the assault crossing is required the hard observance of camouflage discipline. In this case it is necessary to consider that the series/row of the unmasking signs/criteria (noise, light/world, etc.)

at night is detected at the more considerable distance than in the daytime. Thus, the spaces of man and low conversation in calm weather are audible for 200-300 m, the work of the motor of floating and other vehicles - for 1 km. The light/world of the lit up match or burning cigarette is visible on 200-300 m, while the light/world of lamps/headlights or lamp/canopy in the open country is observed from the distance to 5 km.

In view of this with the advancement to the river is inspected/checked proper working order of blackout constructions in the vehicles and it is forbidden to apply the unprotected lamps/canopies, illuminating and signal cartridges. During the preparation for the assault crossing they attempt to also apply the limited quantity of night vision devices, based on the use of infrared rays. Simultaneously with this is organized observation for use/application by the enemy of night vision devices. For this purpose are emitted the observers/spotters, equipped with the special infrared binoculars or other night vision devices.

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These observers/spotters are obligated to in proper time prevent/warn the subunits, which conduct preparatory works on the armament of crossings, and the subunits, which are prepared for the assault crossing, about the fact that they are located in the zone of the infrared rays of enemy. They are obligated to also reveal/detect the locations of the sources of the infrared rays of enemy and to communicate about this to the subunits, isolated for their annihilation.

Special features/peculiarities of armament and content of crossings. The night dark complicates unloading pontoon-bridge units (components/links), it decreases the rate/tempo of the armament of all forms of crossings and considerably complicates their content. Therefore during the assembly of ferries, the installation/setting up of piers and with the execution of other most critical works during focusing/induction of fused ones and building of low-level bridges it is expedient to apply local illumination with appropriate camouflage, and also night vision devices.

The laying-out/sitting the axis of bridge and anchor lines is conducted just as in the day time. However, they are designated not by flags, but by the paired light signs of the same color, as flags (green, red and white).

In order to more safely and more rapidly carry out input/introduction of ferries into the line of bridge, on their ends are set the light signs of red and green color. Before the discovery/opening of movement after passing the unit of the bridge it is designated by the light signal signs, turned to the near bank.

At night considerably becomes complicated the operation of landing and ferry crossings, decelerate on-loading and unloading combat materiel to the landing resources and ferries, hinders the heading hold of movement and rises the danger of the collision/encounter of crossing means on the water. For the designation of the direction of the motion of self-propelled assault amphibious vehicles along the water on the opposite shore are arranged the light beacons of the directional effect, while for the ferries - four-double signs, which are set in range of piers. Ferries at night are moved just as in the daytime, on the closed curve, being found from the double signs at removal/distance 50-70 m. The double line of signs ferries usually cross/intersect on the middle of the river between two signs with the red light. Furthermore, for the designation of the boundaries of landing and ferry crossings and fordings are applied the electric signs, which are set on the floats, the life buoys and the local floating resources.

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On the ferries for the provision of their visibility on the water are set the lamps/canopies of weak white color. For convenience in on-loading combat materiel on the ferries it is expedient to arrange the simplest barriers with the lamps/canopies of red color, which limit the advance of tanks and motor vehicles. On the piers are set red and green signal lights which are shown, is occupied or free pier. Furthermore, the overall sizes of pier are designated by light signs.

It is necessary to keep in mind and that the fact that the productivity during the assembly of ferries, the installation/setting up of piers and as a whole during the armament of other forms of crossings under the conditions of the night dark decreases approximately/exemplarily 1.5-2 times.

In view of the complexity of the armament of crossings in the night time it is necessary during the selection of places to consider not only tactical advantages, but also the possibility to avoid the large volume of works during preparation/training it is lowering for the river, outputs/yields on the opposite shore, or the presence of the swampy floodplains and the character of the coasts of rivers.

The success of assault crossing river in many respects will at night depend on the preparation of detachments for the skillful driving of self-propelled assault amphibious vehicles and motor boats in the conditions of the restricted visibility. During the weak training of drivers are possible the collisions/encounters of crossing means or course deviation and blasting/detriment on the submerged obstacles. In this case increases the duration of trip and descends the general/common/total rate/tempo of the crossing of subunits.

With the beginning and in the course of assault crossing the enemy can use the resources of blinding and illumination. Therefore for the annihilation of searchlights and other sources of light, including sources of infrared rays, previously are emitted snipers, and also artillery and mortar subunits. The drivers of vehicles must have goggles.

Assault crossing river at night can be realized with the artificial illumination and without it. This depends on the defense of enemy, his activities, character of water obstacle and natural illumination of terrain. Illumination support can be realized since the beginning of the assault crossing and with combat on the opposite shore.

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For illuminating of enemy and terrain can be utilized the searchlights, illuminating bombs, illuminating artillery shells, flares and cartridges. Illumination is organized in such a way that would be visible the assault objective on the opposite shore, and the crossed and developable for the attack subunits remained in the shadow.

Special features/peculiarities of the engineering provision of combat operations at night on the opposite shore. The most important engineer support missions with combat on the opposite shore are: the provision of overcoming oxbows, swampy sectors, drying/drainage channels, mine fields, and also participation for repulsing of the counterattacks of enemy.

For overcoming floodplains, which have natural obstacles, are trained/prepared and in proper time are crossed the track mechanized bridges, bridge layers and technology with the attached bulldozer armament. Besides this, it is expedient to extensively use the previously prepared/prefabricated bridge constructions/designs. The points of connection of the individual elements of these constructions/designs should be covered/coated with white paint or designated the well visible signs.

For overcoming the impenetrable sectors of routes/paths are emitted the supplementary subunits of engineers whose composition depends on condition and extent of such places and volume of works on restoration/reduction and repair of the destroyed roads. Besides the execution of works on maintenance in the transient condition of routes/paths engineering subunits must emit guides, restore and contain light indicators, support close connection with the traffic-control service.

Under the conditions of night to with more difficulty reconnoiter gaps/intervals in the obstacles of enemy. Therefore extremely undesirable is a sharp and frequent change of the direction of the motion of tanks in the zone of the minefields of enemy. For the provision of their advance under the nighttime conditions on the opposite shore is required the more careful organization of the cooperation of sappers/combat engineers with the tankmen, especially with the tank crews, equipped with anti-mine sweeps.

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Passages in the minefields of enemy it is most expedient to make by the tanks, equipped with anti-mine sweeps. Sappers/combat engineers, who ensure the advance of the subunits of the first echelon, must widen these passages by the burst of the components/links of elongated charges or by hand and designate by their well visible in the dark pointers. For this purpose each squad of sappers/combat engineers is provided by elongated charges and

30-40 by electric signs. By this quantity of signs it is possible to reliably designate 3-4 passages in the minefields with a depth of 50 m. On the dark/nonluminous night together with the use/application of electric signs on the passages are set the traffic controllers with the signal lamps.

For the purpose of repulsing the night counterattacks of enemy in the directions/axes of the activities of his tanks are arranged the minefields. For this are drawn the mobile detachments of obstacles and the engineering subunits, which operate together with the attacking troops/forces in these directions/axes. For the construction of minefields are drawn the mine layers that move in the assigned direction/axis at the removal/distance 10-15 m from each other. Mine laying in this case is realized by sets, without delivery and camouflage of mines.

In the course of night offensive on the opposite shore of subunit they must possess larger independence, in order to have the capability to more rapidly maneuver and overcoming of the suddenly encountered obstacles and obstacles. For this it is expedient for the subunits, which operate with night in the first echelons, to give a larger number of engineering subunits, than in the daytime.

Thus, under the nighttime conditions increases the volume of engineer operations for the provision of assault crossing river, becomes complicated the execution of ordinary engineer support missions and decrease the possibilities of engineering subunits on the armament of crossings and on the crossing of the troops/forces and combat materiel. But at the same time night contributes to the concealed/latent advancement of the troops/forces to the river and to the surprise of activities, which favors the successful assault crossing of water obstacles both on the move and with deliberate preparation/training.

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Chapter Ten.

ENGINEERING PROVISION OF ASSAULT CROSSING OF RIVERS UNDER SPECIAL CONDITIONS.

With assault crossing of rivers under the special conditions are made all basic engineer support missions. However, their execution has a whole series of the characteristic differences which are caused by the diversity of river-bed and climatic special features/peculiarities, for example, with assault crossing of wide water obstacles, shallow sectors, rivers with the high rates of flow, in the period of autumnal and spring floatings of ice and in the winter time. In view of the fact that river-bed and climatic conditions the greatest effect have on armament and content of crossings, subsequently primary attention will be given to the examination of the special features/peculiarities of the accomplishment of this objective.

1. Special features/peculiarities of the engineering provision of assault crossing wide rivers.

The engineering provision of assault crossing wide rivers is connected with the great difficulties which escape/ensue from the distinctive properties of water obstacle and possibilities of enemy on its reinforcing.

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Besides considerable width, in these rivers are inherent the high rates of flow, oscillation/vibration of water level, high waves with the wind, large quantity of sand bars, islands and duct, and also wide floodplains, cut by oxbows, by sleeves, by drying/drainage channels, by dams and by floodland lakes. These distinctive properties create special conditions for the engineering provision of their overcoming.

Furthermore, the value/significance of wide rivers as obstacles under the contemporary conditions grows/rises in connection with the fact that the enemy on the routes of approach to the river can use nuclear attacks on the attacking troops/forces or set nuclear mines/fougasses. As a result of this on the routes of approach to the river can arise the barrage barriers, which in combination with the water obstacle, on one hand, will hinder/hamper the operations of the attacking troops/forces, and on the other hand - considerably will increase the possibilities of the defended troops/forces.

With assault crossing of wide rivers can be used all forms of crossings, at the same time basic are ferry-boat and assault troop crossings. Under specific conditions can be created the bridge crossings and the crossings of tanks under water. They are equipped just as on the average/mean rivers, but taking into account the properties, inherent in wide rivers.

With assault crossing of wide rivers increases the duration of the trip of crossing means due to the duration of the movement of ferries along the water, and the time of on-loading and unloading remains the same as on the average/mean rivers. Therefore with the large width of river it is expedient to assemble the ferries of the large load capacity and of the large area, which make it possible for one trip to cross several combat vehicles.

As a whole ferry-boat and assault troop crossings on the wide rivers, as a rule, are deployed larger capacity in order to ensure the crossing of strong first echelon, capable of taking opposite shore and of holding down/retaining it to the crossing of the subsequent echelons. Thus, the assault troop crossings can be capacity to the battalion. In this case simultaneously with it must be crossed tanks, the artillery and the subunits of engineers with the mine fields, as a result of which rises the requirement for the crossing means. During ordinary reinforcing by crossing means the rate/tempo of the crossing of the troops/forces due to an increase in the duration of the trip of landing resources and ferries in comparison with the rate/tempo of crossing on the rivers of average/mean width considerably decreases.

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Wide rivers are usually navigable and, therefore, on them there can be local crossing means in the form of the heavy duty motorized ferries, self-propelled and tow barges and steamships. Therefore the local crossing means, seized in enemy in working order, widely are drawn for the growth of the rates/tempos of the crossing of the troops/forces.

For the crossing of the troops/forces and their heavy combat technology it is necessary to simultaneously equip landing and ferry crossings. Contemporary pontoon trains and convenient places on the wide rivers (bays, sleeve and inflows) make it possible to satisfy this requirement.

In the windy weather on the wide water obstacles appear the large waves, which can shake loose attachments and whip by water cargo platforms. Therefore during the preparation for the assault crossing in this weather are provided for the supplementary measures, which ensure the reliability of the attachment of the crossed combat technology to the self-propelled landing vehicles and the ferries.

For the launching of a floating bridge on the wide rivers is required a large quantity of pontoon-bridge resources. Furthermore, for retaining/preserving/maintaining the induced bridges from the air strikes and weapons of mass destruction of enemy it is necessary to carry out a whole series of measures. In this case the antiaircraft protection of the bridge crossings acquires fundamental importance. Simultaneously for the provision of survivability of bridges is provided for the periodic shift/relief of their places and the erection of dummy bridge crossings.

With the armament of the bridge crossings can be laid fused or be constructed the combined bridges. The latter are built with a deficiency/lack in the pontoon-bridge resources or with the small depth of river on the coasts and on the sand bars, which is characteristic for the wide and very wide rivers. The combined bridges can have gantry unit from one or from two shores and fused unit in the sector of river with the greatest depth.

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During the armament of ferry-boat and bridge crossings is considered the possibility of a considerable increase in the water level. In advance according to the data of military geographic descriptions and hydrographic and weather service are determined the possible limits of the oscillation of water, characteristic for the concrete/specific/actual period.

For the provision of a reliable crossing of the troops/forces and combat materiel on the ferries under the conditions for a surprise change in the water level are applied the special piers, which make it possible to regulate the height/altitude of supports, to move them to the coast or to the side of water and to transfer to the new place. When are applied the ferries, to which the on-loading is realized from the unequipped shore, is provided for timely reconnaissance/intelligence and preparation of spare places.

On the bridge crossings coast and gantry units are raised taking into account a possible increase water level. The construction/design of coupling bridge with the coast must allow its rapid dismantling and transfer along the axis of bridge or transfer in another place. Furthermore, are trained/prepared the piers or the spare places, which permit implemention of rapid transition from the bridge ones to the ferry crossings.

During the considerable incline of water can be heated the wide floodplains, cut by oxbows, by sleeves and by inflows. Under these conditions for the provision of output/yield of the troops/forces to the river on the routes/paths, which lead to the crossings, is provided for the construction of pavement and covers/roofs/pavements from different materials. Wide application they must find in this case standard road surfaces.

2. Special features/peculiarities of the engineering provision of assault crossing shallow rivers.

Shallow rivers are characterized by a large quantity of fords. Therefore they are forced on the move, without the redisposition of combat formations. In this case important role will play timely and thoroughly organized reconnaissance/intelligence of fords.

On the shallow rivers basic crossings are: the fords, mechanized track and low-water wooden bridges and the filtering earth transitions. Remaining crossings find limited application or in no way are utilized.

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Fording is realized after the elimination of obstacles and natural obstacles and installation/setting up on the boundaries of ford in the water and on the coasts of the enclosing signs. Fords are numbered, and for each of them is set indicator with its characteristic.

With the crossing of a large quantity of combat materiel are equipped separate fords for the tracked and wheel vehicles. The armament of fords is realized by the attacking troops/forces. Under the difficult conditions are drawn the subunits of engineers, the training/preparing paths of motion.

For overcoming of not wide rivers or rivers with the sharply pronounced deep fairway and the shallow unit of the river on the coasts, which allow/assume fording, are applied the bridge layers, which make it possible in short periods to equip bridges. They are the effective resource, which ensures successful overcoming of water obstacles in the course of the combat operations of the troops/forces.

Subsequently for replacing the bridge layers on the march routes of the movement of the troops/forces are raised the low-water wooden bridges, which possess a sufficient survivability under the conditions for modern combat and provide the safe and repeated passage of combat materiel. The success of works on the building of low-level bridges in many respects depends on timely procurement and timely feed to the obstacle of the constructions/designs of span building/structure and supports, and also overall mechanization of all works. With the small volume of works and under the conditions, which do not make it possible to apply entire complex the mechanizations or the work are made by hand.

In the course of the combat operations when time factor acquires fundamental importance, for the passage of the troops/forces and combat materiel across the shallow rivers with the soft ground of the bottom and the insignificant expenditure/consumption of water can also be arranged the filtering earth transitions (mounds).

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3. Special features/peculiarities of the engineering provision of assault crossing mountain rivers.

Mountain rivers are characterized by high rates of flow and by abrupt changes in the mode/conditions due to the abundant rains or the intense thawing of snow. Because of this even shallow rivers can rapidly become the turbulent flows.

With assault crossing of mountain rivers it is necessary, furthermore, to consider the limitedness of approaches and roads for the advancement of the troops/forces to the river, the presence of high steep/abrupt shores and canyons, the possibility of the emergence of slides, collapse, avalanches, flood flows and rock falls, the general/common/total stoniness of the river bed of river and blocking by its large/coarse stones, the instability of fords, and also the frequent variability of weather. All this impedes the selection of the place of crossings and their mutual disposition in the crossing area of river.

Assault crossing mountain rivers is realized in the available directions/axes. The places of crossings are driven out/selected in the valleys with the flat descents/releases directly to the shoreline. The rate of flow of water in these sectors must be not more than 3 m/s. In the places of the crossings must not be of underwater stones. Is not recommended to arrange crossings in the gorges, since are there possible collapse and slides.

Basic crossings with assault crossing of mountain rivers are bridges. Sometimes can be equipped also the fords, ferry-boat and assault troop crossings.

With the launching of a floating bridge on the mountain rivers special attention turns to its consolidation, since anchors in the stony bottom do not have a sufficient engagement. For the consolidation of bridge are been commonly used the lateral delays, which with the second end are secured to the coasts. In certain cases, especially on the narrow rivers, the floating bridge can be secured to the cable, lengthened across the river and attached to the coasts of higher than water level.

Ferry crossings in view of the complexity of towing ferries on the water due to the boulders, the sand bars and the thresholds on the mountain rivers will have limited application. During the use of motor boats for towing it is necessary to consider that water is saturated by fine sand and strongly drives in cooling system that it leads to overheating of engine, because of this, and also due to the high rate of flow for towing of ferries it is necessary to emit several motor boats.

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In the sectors of river, which have rate of flow it is higher than 3 m/s, launching of a floating bridge and armament of ferry crossings is virtually impossible. Under these conditions are built a bridge on the rigid supports, are arranged suspension bridges, and also can take place cable- suspension roads.

Fixed support bridges usually are constructed with the large spans/flights in order to decrease a quantity of supports and not to trouble the clear opening of river. Supports are driven out/selected so that they could resist the pressure of water. If is possible the tamping of piles, then are arranged tower pile supports with pouring of base/root by stone. When the bottom stone and the tamping of piles is eliminated, are constructed crib supports. Sometimes at the insignificant rates of flow the supports can be made on the frames with the supplementary load stone ballast. The height/altitude of bridge is constructed taking into account the possible sharp incline of water.

With assault crossing of mountain rivers for the armament after dropping it is necessary to make the large volume of works on the construction of siding tracks and it is lowering to the river, to spend is much forces and time on unloading of pontoon-bridge resources and their descent/release to the water, the armament and the content of all forms after dropping.

4. Special features/peculiarities of the engineering provision of assault crossing rivers during the seasonal floods.

In the period of seasonal floods assault crossing water obstacles considerably becomes complicated. This is explained by the fact that the rivers, spilling, immerse floodplains, sharply rises water level, considerably grows/rises rate of flow and even can change the profile/airfoil of the bottom of river. Seasonal floods on the rivers can appear as a result of the intense thawing of snow, abundant fallout of rains, and also tolerance of water from the reservoirs.

The seasonal floods which appear as a result of abundant rains, are characterized by the sharp incline of water in the river and by its relatively rapid decrease. The seasonal floods, which arose in the course of the thawing of snow, are more prolonged more slowly.

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On the rivers, which have reservoirs, active flooding can be conducted by opening and decomposition of the breechblocks of water-outflow apertures or decomposition of the body of dam. Upon opening or decomposition of the breechblocks of water-outflow apertures the duration of active flooding will depend on the time of the emptying of reservoir.

Upon the decomposition of the body of the dam, especially large/coarse reservoirs, are immersed floodplains and river valleys, are destroyed bridges and other crossings. During this period are created exclusively difficult conditions for assault crossing of river. At the same time upon the complete destruction of dam the duration of tolerance will be relative to short-term.

With assault crossing of rivers with rates of flow of 2 m/s and above in the period of seasonal floods and tolerance of water considerably becomes complicated the armament of landing, ferry-boat and bridge crossings, hinder preparation/training and crossing of combat materiel on the fords, and the crossing of tanks under water and on deep fords is generally impossible. Under these conditions assault crossing rivers is realized on the self-propelled assault amphibious vehicles and the ferries. In the sectors of river with the insignificant incline of water and the allowable speeds of flow is possible focusing/induction of fused ones and building of the combined bridges. Furthermore, in some sectors can be equipped the crossings of tanks under water.

With armament and content of crossings in the period of seasonal floods and tolerance of water must be organized careful observation for the fluctuations of water level, rate of flow and swimming objects/subjects. Simultaneously with this is reinforced the composition of river pickets and are arranged the more durable anti-mine enclosures/protections, capable of detaining the swimming fragments of structures/installations, the trees/wood and other objects/subjects, in order to shield those operating below with the flow of crossing.

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During the disposition of landing, ferry-boat and bridge crossings should be avoided the place lower than which with the flow are islands, sand bars, destroyed bridges and other water-engineering constructions, since during the collision/encounter with them can be damaged the brought-down by flow crossing means. Bridges must be arranged/located above along the flow of landing and ferry crossings so that the brought-down assault resources and the ferries would not injure them.

During the armament after dropping in the period of seasonal floods they are driven out/selected convenient and stable berths, are arranged more durable piers and is reinforced coupling bridge with the coast. With the building of the gantry units of the bridge, the assembly of piers and ramp entrances are considered the possible fluctuations of water level. In connection with this are applied such constructions/designs of ramps and piers which make it possible to change the height/altitude of supports or to move them from one place to another.

The sectors of unloading components/links (units) are driven out/selected in the curves, after the sand bars and the jet-directing dams. In the same places it is necessary to arrange pier and to realize mooring of ferries, since the relatively lower speed of flow in these places is convenient for the unloading, and also for the rapid mooring of ferries. At the rate of flow of above 1 m/s the automobile for the unloading is supplied at angle so that component/link would be omitted into the water with the flow. Unloading components/links begins consecutively/serially from the lower side.

Unloading pontoon-bridge resources into the water begins after the organization of the rescue service. For unloading the vehicles are designated the large sectors of the coast and increases the distance between the vehicles in comparison with the normal conditions, in order to avoid the collision/encounter of pontoons (components/links) and motor boats with each other with the drift by their flow.

The transfer of transporting ferries in the period of seasonal floods and tolerance of water is realized by two, and sometimes also by three motor boats. In this case one - two motor boats are utilized for towing and one for the pushing of ferry. On narrow rivers the transfer of transporting ferries by motor boats is hindered/hampered or is virtually impossible. Under these conditions the transfer of transporting ferries can be realized on the cable, tightened from one shore to another. The ends of the cable are tightened on the coasts so that during the movement of ferry cable would be located above the water.

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Launching of a floating bridge from the equipment of pontoon TPP at the high rate of flow is realized only from one shore. Focusing/induction from two shores is eliminated, since floating bridge under the effect of the flow is bent, as a result of which it is difficult to bring the file closer by ferry. Depending on rate of flow consecutive input/introduction into the line of bridge is conducted by ferries or half-ferries. Bridges from the pontoon-bridge motor pool PMP are collected along the coast and are introduced into the line of bridge by rotation, since they possess high horizontal rigidity.

With assault crossing of rivers in the period of seasonal floods and tolerances great difficulty will present the armament of approaches on the gotten soaked and swampy floodplains. Under these conditions it is necessary first of all to utilize hard surface roads and protective dams. Furthermore, for reinforcing the soil in the individual sections it is necessary to have road surfaces.

5. Special features/peculiarities of the engineering provision of assault crossing rivers in the period of floating of ice.

Autumnal and spring floatings of ice exert a substantial influence on the armament, content of crossings and organization of assault crossing rivers. In this case their effect is dissimilar.

Autumnal floating of ice usually precede the formation of coastal ice, appearance on the surface of water of sludge and "grease", which go sometimes by continuous mass. In the stable cold weather at first appear individual ice floes, and then begins floating of ice. It is characterized by insignificant intensity and duration. Therefore with assault crossing of rivers during the autumnal floating of ice the crossing of the troops/forces and combat materiel is possible on all forms of crossings, including on the floating bridges.

Spring floating of ice, as a rule, is escorted/tracked by the strong overflow of the rivers, by a considerable increase in the rate of flow by the appearance not only of fine/small ones, but also of large/coarse ice floes, but sometimes also by the education of congestions. In a number of cases spring floating of ice is twice: at first goes local ice, and then upper from the lakes and the inflows. Therefore during the spring floating of ice the crossing of the troops/forces on the crossing means is considerably hindered/hampered, and in strong ice flow it is virtually impossible.

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Furthermore, in the period of spring and autumnal floating of ice is possible slush, which impedes the output/yield of troops and crossing means to the river, the armament of approaches and is lowering to crossings and outputs/yields to the opposite shore. The troops/forces in the period of slush are forced to overhaul and to reinforce the most difficult sectors of roads, applying standard road surfaces or local materials (crushed stone, gravel, etc.), to equip detours, to lay trails to the crossings with the flooded and become sodden soils, to reinforce entrances to crossings and outputs/yields on the opposite shore by continuous polewood or timbered flooring.

In the period of floating of ice can be arranged landing and ferry crossings, since assault amphibious vehicles and ferries are mobile and more stable with the contact with "grease", sludge and ice. Furthermore, in certain cases can be laid floating bridges. For the defense from the strikes/shocks of ice floes against the board of landing resources, pontoons (components/links) and their motor boats they face/trim with boards, old tire covers and other shock-absorbing materials. The detachments, which operate crossing means, are provided by hooks and posts for the repulsion of the encountered ice floes. The crossing of tanks under water during this period generally is eliminated.

The places of the armament of the assault troop crossings are driven out/selected in the rectilinear and widened sectors of river. Upstream from the places of the crossings must not be of the sharp turns, sand bars and contractions of the river bed of river, i.e., such places where is possible ice accretion. Special attention should be focused on the armament of outputs/yields from the water. Great difficulty for the self-propelled assault amphibious vehicles represent sectors with ~~coast~~ shore ice ~~of ice~~ or ice rejected/thrown out to the ~~coast~~ shore. Such sectors with the possibility must be enveloped.

The places of the construction of piers or mooring of ferries are driven out/selected in the sectors of river, protected from movement and accumulation of ice floes and having the low speeds of flow of water. For the defense of ferries and piers from the strikes/shocks of the swimming ice floes during the on-loading and unloading combat materiel it is expedient to arrange special checks.

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They are set above with the flow so that to overlap river only on the coasts and thereby to direct the flow of ice to the middle of river. The movement of ferries by the water in the period of floating of ice is usually realized by the method of pushing by tow motor boats.

In the period of floating of ice the use/application of floating bridges is sharply limited. They can be laid only if on the river they go sludge, "grease" and fine/small ice floes. In the period of floating of ice to avoid the congestion of ice the floating bridges are laid far from the destroyed bridges, the islands, the sand bars and other natural obstacles, which trouble the flow of water. However, should be considered the difficulty of the armament of approaches and arranged/located bridges as far as possible near the roads, which cross/intersect water obstacle.

With the filling of floodplains with water in the period of floating of ice can be raised the combined bridges. In this case floodplains and shallow sectors of river are closed over with piers on pile supports, and at deep places are laid floating bridges.

For facilitating the assembly of ferries, focusing/induction and maintenance of bridges above with the flow are set timbered checks.

Saved ice is passed by the periodic separation of bridge and checks. The supports of floating bridges are protected by the boards, attached to the pontoons at the level of the course of ice, and anchor ropes - by boxes, biased/beaten from the boards.

With assault crossing of rivers in the period of floating of ice is organized systematic observation for the condition of river, the movement along it of ice, different objects/subjects (rafts, barges, ships, etc.) brought down by water. Large/coarse ice floes are granulated, the sailing objects/subjects are held up, since they can destroy or damage bridges. When does not succeed in intercepting the swimming objects/subjects and detaining them on the coast, they open a draw bridge and warn the drivers of motor boats and landing resources.

For the fragmentation of ice are emitted the groups of the demolition men who are provided with explosives, by the resources of explosion and by fast motor boats. Furthermore, groups are supplied with hooks, entrenching tool and rescue facilities. They are included in the composition of pickets and perform upstream from the bridge. After revealing/detecting large/coarse ice floe, group approaches it, it follows in parallel to it and granulates, throwing charges of VV to its surface.

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On the bridges is set around-the-clock tour of duty of the demolition men who pulverize the floating to the bridge ice floes.

Large danger to the crossings present the congestions of ice. Therefore in the places of the possibsle emergence of blockages are arranged posts with the communications. For the elimination of the congestions of ice are drawn the groups of demolition men, and sometimes were utilized the fire/light of mortars and high-explosive bombs. If we in proper time do not take measures for the elimination of congestions, then the crossing of the troops/forces in this sector ceases.

6. Special features/peculiarities of engineering provision of assault crossing rivers in winter.

Assault crossing the rivers, having ice cover, can be realized on natural and intensive ice, on the fused and low-level bridges, on the ferries, unfordable, and, under water.

Crossings on ice in the areas with the severe and prolonged winter can find wide acceptance. In the areas where the ice covers/roofs/pavements become apparent in the form of the shore ices (ice-free shores), relieved by floating of ice, or where ice is formed only in the severe winters to the brief period, the armament of crossings on ice in the majority of the cases it will be impossible. Large that, at this time of year are created supplementary difficulties for armament and content of ferry-boat ones and bridge and the crossings of tanks on deep fords and under water.

Crossings on ice are equipped after thoroughly carried out engineer reconnaissance. It is obligated to determined the thickness of ice, coupling ice with the coast of ice tracers. In these places ice must have the greatest thickness, be uniform, not have hummocks and cracks.

For conducting engineer reconnaissance of crossing on the basis of ice usually is emitted the combat engineer squad. With the limited time for reconnaissance/intelligence it can be emitted to the combat engineer platoon. The subunits, isolated for conducting engineer reconnaissance, are equipped with ice-bores, gauges, hooks, marking poles, markers, charges of VV and entrenching tool.

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For determining the thickness of ice cover are broken through the holes at a distance of 8-10 m one from another. In the holes the thickness of ice ~~I~~ [them] determine by icemeter or entrenching shovel.

With a sufficient load capacity of ice cover the crossing of the troops/forces is conducted on natural ice. In this case it is necessary to equip descents/releases, transitions from the coast to ice, to clear the zone of snow with width to 20 m, to establish indicators and tables with the characteristic of ice crossing.

During the armament of crossing special attention turns for coupling of ice with the coast. This is connected with the fact that on the coast usually the smaller durability of ice cover, and is also possible its hovering as a result of a change in the water level in the river.

Therefore in the places with weak coastal ice is arranged wooden pier, and in certain cases are placed bridge spans/flights or they utilize elements of road surfaces. With a deficiency/lack in the time for the armament of crossings it is necessary to extensively use organic equipment.

Crossings on ice are equipped separately for the wheel and tracked vehicles. The distance between the individual crossings must be not less than 100-150 m.

The movement of combat and transport materiel along the ice crossing is realized, as a rule, into one belt/ribbon. In this case the velocity of the movement of combat materiel must be different. The greater the cargo weight, the less the velocity of movement. Thus, light cargoes on ice can be moved at a rate of 20-25 km/h, average/mean - 10-15 km/h, and heavy - 6-8 km/h. Combat materiel must move, observing the permissible distances, smoothly, without the jerks and the cessations.

During the prolonged operation becomes apparent the "fatigue" of ice. It loses its durability and gradually it is destroyed. Therefore for replacing of the "tired" crossings or crossings, damaged by the fire/light of enemy, in advance equip spare crossings.

During the crossing of combat materiel on ice is conducted the observation of the condition of ice cover, of its connection with the coast and the fluctuations of the temperature of air. Furthermore, is organized observation for the fluctuation of water level in the river, mobile of ice and by the opening of river.

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In accordance with the changing meteorological conditions take the measures for reinforcing of ice cover or they transfer crossings to another place.

Reinforcing of ice is conducted by piling superstructure (flooring), which consists of cross-beams and timbered shields, fastened by dowels or by clips. Superstructure not only reinforces ice, but also protects it from the wear and damages by the moving heavy combat technology.

When reinforcing does not achieve necessary effect, and the thickness of ice does not make it possible to let pass on it the troops/forces, are laid fused and are constructed underwater bridges and are equipped other crossings.

Floating bridges can be assembled on ice or be laid in the lane, i.e., in the corridor artificially made in ice to entire width of river. The Mayne are usually arranged by explosive method. Ice in the limits of lane is granulated with the aid of VV, after which fine/small pieces they are forced by hooks downstream under the ice cover.

Mines can be arranged also via sawing of ice by power saws or by special rip saws. With the aid of the saws are done longitudinal and transverse gashes/propyls, as a result are formed the ice floes which are forced under ice.

If one considers that the width of lane must achieve several ten meters, then it will become obvious, how this a work is labor-consuming. Therefore with the thickness of ice it is more than 20 cm, as a rule, lanes are not arranged, but the assembly of the fused unit of the bridge is realized on ice.

Depending on the thickness of ice unloading pontoon-bridge resources is conducted on the shore with the subsequent feed of pontoons into the line of bridge or above ice in immediate proximity of the place of the assembly of bridge. The butting of pontoons it is conducted on ice. In this case for the connection of couplings frequently it is necessary to weigh pontoons.

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On the narrow rivers focusing/induction of the fused unit of the bridge from the light motor pools is possible by rotation. For this the unloading and the assembly of the fused unit of the bridge are conducted along the coast, and its rotation into the line of bridge is realized with the aid of the winch of engineer vehicles, for example tracklayer BAT. Preliminarily in entire sector/arc of the rotation of the fused unit of the bridge ice is cleaned of the snow and different inequalities (hummocks).

After installation/setting up to ice of fused unit into the line of bridge independent of the method of its assembly they dive-submerge in the water via the blasting/detriment of ice or sawing from both sides of bridge. Ice is blasted/undermined/blown up with the aid of the under-ice charges or the beams of the detonating fuse. After burst, fragmentation and passage of individual combat vehicles ice under the supports dive-submerges in the water and to the certain degree due to its buoyancy increases the load capacity of bridge.

When the thickness of ice does not exceed 10 cm, bridge laying can be conducted by conveyor method. For this on the near bank is made the lane with a length of 20 m and with a width of up to 15 m. In the lane they at first unload coast component/link, and then 1-2 river components/links and consecutively/serially connect up to each other. After this with the aid of BAT whose cable is passed through the unit, fastened/strengthened to the opposite shore, advances the nose section of the bridge. In proportion to its advance on the near bank is freed/released the lane, into it they unload and connect next components/links. This occurs until is assembled the bridge, which closes over entire obstacle.

In the course of operating the bridge the duty unit systematically cleans pontoons from freezing ice and does not allow/assume their freezing into ice. Furthermore, duty unit cleans lane from ice and forces by the hooks of ice floe downstream. Floating bridges at the first opportunity must be replaced by low-level bridges.

Crossing area commandant (commander of pontoon subunit) is in winter additionally obligated to equip the warming-up points of personnel, to increase evacuation-rescue and to designate the places of safe walking by the ice cover.

On the rivers, covered with ice, can be equipped ferry crossings. However, this is possible only with the construction of lanes. The width of lane must be such that ferries with the motor boats could freely move over the surface of water, in this case for the provision of a turn directly in piers the lanes are widened.

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In the course the crossings of vehicle are cleaned of the ice floes, and ferries and motor boats - from freezing ice.

Furthermore, the movement of ferry in the lane can be realized by a method of "shuttle" on the rope. For movement of ferry are utilized the amphibious personnel carrier and automobile, which are arranged/located on the coasts. In this case the cable of one vehicle is secured directly to the ferry, and another through the unit, fastened/strengthened to something stable. With this method of the movement of ferries the broadening of lane will not be required.

In the places where the river has solid ground of the bottom, but ice cover does not possess a sufficient load capacity, can be equipped the crossings of tanks under water and crossings of unfordable. In this case appear great difficulties for conducting engineer reconnaissance and, in particular, for determining the profile/airfoil of the bottom of river.

For the armament of crossings of such under water and unfordable are developed/processed lane. Methods and the receptions/methods of the removal/distance of ice in the entire width of river are the same as during the armament of bridge and ferry crossings. However, prior to the beginning of the crossing of tanks under water entire/all surface of lane must be purified from the fine/small pieces and the ice floes. In this case crushed ice is forced downstream or is extracted. In the course of the crossing of tanks under water special attention turns for the removal/distance of newly forming ice and the timely extrusion downstream of the appearing ice floes.

Thus, with assault crossing of rivers under the special conditions appears a whole series of supplementary engineering tasks and measures for the provision of advancement of the troops/forces and the crossing means to the river, in equipment and content of the crossings and with combat on contrast to the coast, which must be in advance considered and decided in accordance with the concrete/specific/actual properties of water obstacle, the character of terrain adjacent to it, the season and the conditions of combat situation.

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APPENDICES

Appendix 1.

Value/significance of river terms.

River - open water flow, which flows in the developed by it valley. The longitudinal section of river is curve concave down with the alternation of steep and sloping sections and the gradual decrease of gradient from the source to the mouth. Cross section includes river bed, riverbed sand bars and floodplain. The passes/grooves and creeks, which inflow into the river, are called inflows. The beginning of river is accepted to call source, the place of inflow into sea, lake or another river - by mouth.

Valley of river - lowered/reduced unit of the earth's surface, created by the eroding activities of the flowing along it water.

Shore ice (fast ice) - the sectors of ice cover, which froze to the coast in the absence of ice in the river bed of river.

Creek - river molded edge/gulf, in which the flow is absent or occurs in the opposite direction/axis.

Sastrugi - sand underwater sand bar of small sizes/dimensions, which goes from the coast to the fairway at sharp angle.

Canyon (gorge) - a deep river valley with the steep/abrupt slopes and the narrow bottom, occupied usually completely with the river bed of river.

Karchi [карчи] - trees/wood, which fell into the water as a result of the washing of the coast. Waterlogged wood occur floating and lying/horizontal on the bottom rivers.

Maydanas - place in the river where the flow has rotary character.

Sand bar - sand bar, embeded with narrow long wedge into the river bed of river.

Mayne - artificially made in ice corridor to entire width of river.

Low-water level - prolonged seasonal low-level standing of water in the river when supply of rivers occurs in essence due to the ground water.

Ogrudki [огрудки] - stones, arranged/located along the river bed.

Odinets [одинец] - large-size stone, which lies separately at the river bed of river.

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Alluvial islet - sand bar, arranged/located halfway of the river bed of river.

Seasonal flood - rapid, but relatively short-term elevation water level in the river, which appears as a result of the rapid thawing of snow or jettisoning of water from the reservoirs. Seasonal floods in contrast to the high water are not periodically repeated.

Pass - place of the transition of fairway from one shore to another.

Sand bars - shallow sectors of river with the underwater sand bars (sand bars, sastrugi), the encountered in the places expansions of river bed and before the curves.

Reaches - deep sectors of the river bed of the plains river, arranged/located between the shallow sectors - sand bars.

Underwater ridge - accumulation of stones in the width of river.

Floodplain - unit of the valley, immersed only in the high water. It is folded usually by river alluviums.

High water - seasonal overflow of rivers, caused by the thawing of snows or by the prolonged fallout of abundant rains.

Ice-hole - space of pure water in ice. It is formed usually in the sectors with the rapid current and in the places of the entrance of ground water.

Thresholds - sectors of rivers with the noticeable incidence/drop in the water level and the high rates of flow. They are formed in the points of emergence of difficult-to-erode rocks.

Riverbed sand bars - sectors of the coast, deprived of vegetation and immersed on the average/mean and high levels (sand bar, beaches, foreshores).

Duct (duct) - the secondary river bed of river during its separation into two or several sleeves.

River bed - low ground, which accomodates river flow on the low-water level.

"Grease" - the thin raid of ice on the surface of water. It is formed from the accumulation of the crystals of ice which during the freezing take the form of the thickening grease.

Oxbow - old, in full or in part separated/liberated from the river sector of its previous flow, the sometimes forming inflow or flood plain lake.

Fairway - deep, free from the underwater obstacles path in the river, safe for cruising/sailing the ships.

Sludge - fine/small crystals of ice, which appear in the thickness of river flow at a zero temperature of water and the minus temperature of air, if the surface of water is not covered with ice.

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Appendix 2.

Reference data from the engineering works.

Table 1. Quantity of vehicles and combat materiel, crossed on the transporting ferries for one trip.

(1) Машины и боевая техника	(2) Грузоподъемность паромов (т), собираемых							
	(3) из парка ТПП				(4) из парка ЛПП			
	16	35	50	50 (5) большой площади	70	25	25 (5) большой площади	40
(6) Танки и САУ:								
(7) средние	—	1	1	1	2	—	—	1
(8) тяжелые		–	1	1	1	—	—	—
(9) Артиллерийские тягачи:								
АТЛ (АТ-Л)	2	2	3	6	4	2	4	2
АТС	1	2	2	3	3	2	2	2
АТТ	–	1	2	2	2	1	1	1
(10) Артиллерия с тягачом:								
(11) 85-мм пушка с ГАЗ-63	1	1	2	3	2	1	2	1
(12) 152-мм пушка с АТС	-	1	1	2	2	1	1	1
(13) 57-мм зенитная пушка с АТЛ	1	1	1	2	2	1	2	1
(14) Тракторы:								
С-80	1	2	3	4	5	2	2	2
ДТ-54	2	4	4	8	6	2	4	2
(15) Бронетранспортеры:								
БТР-40	2	3	3	9	4	2	4	2
БТР-152	1	2	2	5	4	1	2	1
(16) Автомобили с грузом:								
ГАЗ-69	3	4	4	12	6	3	9	3
ГАЗ-51	2	2	3	9	4	2	4	2
ЗИЛ-157	1	2	2	5	3	1	2	1
ЯАЗ-214		1	2	3	3	1	1	1
МАЗ-200	—	1	2	3	3	1	1	1
КрАЗ-214	—	1	2	3	3	1	1	1

Key: (1). Vehicles and combat materiel. (2). Load capacity of ferries (t), assembled. (3). from motor pool TPP. (4). from motor pool LPP. (5). large area. (6). Tanks and SAU. (7). medium. (8). heavy. (9). Artillery prime movers. (10). Artillery with tractor. (11). 85-mm gun with GAZ-63. (12). 152-mm gun with ATS. (13). 57-mm anti-aircraft gun with ATL. (14). Tractors. (15). Armored personnel carriers. (16). Automobiles with cargo.

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Table 2. Payload capacity of the logs of different species/rocks in kg (pine tree, asp, linden).

(1) Длина бревна, м	(2) Диаметр бревна в верхнем отрубе, см									
	12	14	16	18	20	22	24	26	28	30
2	5/10	7,5/15,5	9,4/18	12/24	15/30	17/34	22/42	26/50	30/58	34/66
3	7,5/15	11/22	14/28	18/36	22/44	26/52	32/64	38/76	44/88	50/100
4	10,5/21	16/32	20/40	24/48	30/60	36/72	42/84	50/100	58/116	68/136
5	14,5/22	20/40	24/48	32/64	38/76	46/92	54/108	64/128	74/148	85/170
6	19,5/39	26/52	32/64	38/76	48/96	56/112	66/132	78/156	90/180	104/208
7	22/44	30/60	38/76	46/92	56/112	68/136	80/160	94/188	108/216	124/248
8	28/56	38/76	46/92	56/112	68/136	80/160	94/188	110/220	126/252	144/288
9	34/68	44/88	54/108	66/132	78/156	94/188	110/220	126/252	146/292	156/312
10	40/80	50/100	62/124	76/152	92/184	108/216	126/252	144/288	166/332	190/380

Notes: 1. In the numerator - load capacity of the freshly-felled tree/wood; in the denominator - air-dried tree/wood.

2. For birch, larch data of table must be multiplied by 0.7,

while for even if poplar - to 1.2.

Key: (1). Length of log, m. (2). Diameter of log in upper holding, cm.

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Table 3. Load capacity of ice depending on its thickness and temperatures of surrounding air.

(1) Наименование боевой техники	(2) Полный вес, т	(3) Необходимая толщина льда при средней температуре воздуха в течение трех суток, см		(4) Дистанция между машинами, м
		(5) от 0 до −5°	(6) −10° и ниже	
(7) Гусеничные машины (танки, БТР, тракторы)	6	24	22	15
	10	31	28	20
	16	40	36	25
	20	44	40	25
	25	49	45	30
	30	54	49	35
	40	62	57	40
	50	69	64	40
	60	75	70	45
(8) Колесные машины (автомобили, БТР)	2	18	16	15
	4	22	20	15
	6	29	27	20
	8	33	31	32
	10	38	35	35
(9) Артиллерия на гусеничных и колесных тягачах	6	23	20	15
	8	26	23	20
	10	28	25	20
	20	40	36	30
	30	48	44	35
	40	55	51	35

Notes: 1. The necessary thickness of ice for the passage of combat materiel relates to the ice cover, which was being formed from the fresh water.

2. At temperature from 0° and above, that is held during several days, thickness of ice indicated at -10° they increase by 25%.

Key: (1). Designation of combat materiel. (2). Full weight, t. (3). Necessary thickness of ice with mean temperature of air during three days, cm. (4). Intervehicle distance, m. (5). from 0 to -5°. (6). -10° it is below. (7). Tracked vehicles (tanks, BTR, tractors). (8). Wheel vehicles (automobiles, BTR). (9). Artillery on tracked and wheeled tractors.

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Appendix 3.

Characteristic of the resources, used for engineer reconnaissance of water obstacles.

Field-engineer range finder (DSP-30).

Distance of measurement ... from 50 to 2000 m.

Accuracy of the measurement of the distances:

to 50 m ... 0.3%.

to 200 m ... 1.0%.

to 500 m ... 2.0%.

Increase in the optical system ... 12-fold.

Distance between centers of the intake objectives (base) ... 0.30 m.

Weight of the field-engineer range finder:

in the cover ... 3.4 kg.

without the cover ... 2.2 kg.

Field hydrometric revolving door.

Limits of the measured velocities ... from 0.14 to 4 m/s.

Accuracy of the measurement of velocity ... 6%.

the depth of measurement ... To 4.0 m.

Weight of the hydrometric revolving door ... 0.4 kg.

Time of the preparation of revolving door for the measurement ... 1-2 min.

Time of the measurement of the velocity at one point ... To 1 min.

Profilograph (PG-48).

Width of the measured river ... to 500 m.

Depth of the measured river ... to 5 m.

Scale of the width of river ... 1:200.

Scale of the depth of river ... 1:100.

Accuracy of the measurement:

horizontal distances ... from 3 to 6%.

the depth of river ... 6-8%.

It is applied at the rate of flow ... to 1.5 m/s.

Full weight of the instrument ... 24 kg.

Weight of instrument in the water ... 17 kg.

Apparatus for reconnaissance/intelligence of river AR-2.

Maximum depth of the measurement ... 6.0 m.

Minimum depth of the measurement ... 1.0 m.

the accuracy of the measurement:

depth ... ±0.25 m.

the width ... 3 m on 1000 m of route/path.

Velocity of reconnaissance/intelligence ... to 6 km/h.

Floating vehicle for towing AR-2 ... amphibious personnel carrier (armored personnel carrier).

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Bottom probe.

Sizes/dimensions of the bottom probe:

the length ... 380 mm.

the length of the working cylinder ... 240 mm.

the diameter of the working cylinder ... 40 mm.

Depth of measurement ... to 5 m.

Time of the taking of one test/sample ... 1-2 min.

Weight of the instrument ... 1.8 kg.

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Appendix 4.

Performance data of the mine-explosive resources of the armies of capitalist states.

(1) Наименование мин	(2) Общий вес мины, кг	(3) Вес заряда ВВ, кг	(4) Материал корпуса	(5) Габаритные размеры, мм: (6) длина	(7) ширина (диаметр)	(8) высота	(9) Марка взрывателя	(10) Усилие, необходимое для срабатывания мины, кг	(11) Радиус поражения, м
					(12) 1. США				
					(13) Противотанковые мины				
М-15	13,6	10,0	(14) Металл	—	300	130	М603	136–180	(15) Перебивает гусеницу танка
М-19	12,7	9,5	(16) Пластмасса	300	300	90	(17) То же	165–225	(17) То же
М-21	8,0	4,7	(14) Металл	—	230	115	„	1,7	(18) Кумулятивная, пробивает днище танка
М6А2	9,1	5,4	(17) То же	—	330	83	„	135—180	(19) Перебивает гусеницу танка
М7А2	2,3	1,6	„	178	114	63	„	60–110	—
					(19a) Противопехотные мины				
М-14	0,13	0,03	(16) Пластмасса	—	56	40	(20) Специальный	(21) До 9	(22) Поражает одного человека
М-16	3,5	0,45	(14) Металл	—	100	120	(23) М605	(21) До 10	15–20 м
М-18	1,13	0,5	(17) То же	—	70	90	(23) По проводам	—	(24) 30–40 м в секторе 60°
М-25	0,09	0,009	(16) Пластмасса	—	29	92	(20) Специальный	7—10	—
М-3	4,4	0,4	(14) Металл	89	89	140	М7А1	5–10	9 м
					(25) Специальные мины				
М48	2,3	(26) Пиропатрон	(14) Металл	—	—	—	—	(21) До 15	(27) Горит 20 сек
М49	0,6	(28) Осветительный состав	(17) То же					(21) До 2	(27) Горит 60 сек
(29) Напалмовая мина	—	(30) Напалм 20 л	„					(21) До 15	(31) Горит в радиусе до 25 м
					(32) 2. АНГЛИЯ				
					(13) Противотанковые мины				
Мк7	13,6	9,1	(14) Металл	—	330	127	№ 5	180	(19) Перебивает гусеницу танка
Мк5	5,4	3,6	(17) То же	—	203	100	№ 3	150—200	—

				Противопехотные мины					
№ 6 Мк1	0,23	0,14	Пластмасса	—	44	203	№ 2	9	—
№ 7 Мк1	0,11	0,05	Металл	—	57	32	Специальный	11—16	—
Мк2	4,5	0,45	То же	—	76	152	То же	2	—
				3. ФРГ					
				Противотанковые мины					
ДМ11	7,4	7	—	—	300	90	ДМ46	450	Перебивает гусеницу танка
				Противопехотные мины					
ДМ11	0,2	0,1	Пластмасса	—	80	35	Специальный	10	—
ДМ31	0,4	0,55	Металл		100	124	ДМ56	5	60
				4. ФРАНЦИЯ					
				Противотанковые мины					
Обр. 1948 г.	9	5,2	Металл	—	320	90	Механический	300	Перебивает гусеницу танка
Бескорпусная, 1951 г.	7,4	7,0	—	—	300	90	Терочный	450	То же
Кумулятивная, 1948 г.	15	7	Металл	—	280	140	Механический	—	„
Пластмассовая кумулятивная 1951 г.	3,6	1,9	Пластмасса	—	170	390	—	150—300	„
				Противопехотные мины					
Обр. 1951 г.	0,09	0,06	Пластмасса	—	70	52	Механический	10—20	—
Обр. 1951 г. (осколочная)	4,0	0,4	Металл	—	100	160	То же	2—3,5	8—10 м
Обр. 1959 г.	0,135	0,06	Пластмасса	—	60	32	Терочный	18	—
Обр. 1951—1955 гг. (осколочная)	4,0	0,35	Металл	—	100	160	—	10	10 м

Key: (1). Designation of mines. (2). Total weight of mine, kg. (3). Weight of charge of VV, kg. (4). Material of housing. (5). Overall dimensions, mm. (6). length. (7). width (diameter). (8). height/altitude. (9). Mark of fuse. (10). Condition, necessary for operating mine, kg. (11). Effective casualty radius, m. (12). USA. (13). Antitank mines. (14). Metal. (15). It smashes track of tank. (16). Plastic. (17). The same. (18). Cumulative, breaks through bottom of tank. (19). It smashes track of tank. (19a). Antipersonnel mine. (20). Special. (21). To. (22). It destroys one person. (23). On wires/cables. (24). 30-40 ~~20-30~~ m in sector/arc of 60°. (25). Special mines. (26). Squib. (27). Burns __ s. (28). Illuminating composition. (29). Napalm mine. (30). Napalm 20 l. (31). It burns in radius to 25 m. (32). England. (33). FRG. (34). France. (35). Model. (36). Mechanical. (37). Bodiless. (38). Friction. (39). Cumulative. (40). Plastic cumulative.

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Appendix 5.

Characteristic of combat floating materiel and crossing means of the armies of capitalist states.

Table 1. Basic performance data of the floating tracked armored personnel carriers of the USA.

(1) Характеристика бронетранспортеров	М-59	ЛВТП-5	М-113
(2) Год выпуска	1953	1954	1960
(3) Полезная нагрузка, т	1,2	(4) На суше 8,2, на воде 5,4	—
(5) Боевой вес, т	21	31,8	10
(6) Экипаж, человек	1	3	1
(7) Десант, человек	11	30	12
(8) Габаритные размеры, м:			
(9) длина	5,46	9.00	4,81
(10) ширина	3,25	3.56	2,66
(11) высота	2,50	2.70	2,19
(12) Броневая защита, мм	9,5—25,4	38	(13) Противопульная
(14) Мощность двигателя, л. с.	2×146	810	215
(15) Скорость хода, км/час:			
(16) при движении по суше	50	48	64
(17) на плаву	6,9	11,2	5,6
(18) Угол подъема, град	31	35	31
(19) Запас хода, км:			
(16) при движении по суше	190	290	320
(17) на плаву	—	80	—
(20) Удельное давление, кг/см²	0,5	—	0,5

Key: (1). Characteristic of armored personnel carriers. (2). Year of issue. (3). Payload, t. (4). On dry land 8.2 on water 5.4. (5). Fighting weight, t. (6). Crew, man. (7). Landing force, man. (8). Overall dimensions, m. (9). length. (10). width. (11).

height/altitude. (12). Armor protection, mm. (13) Bulletproof. (14). Power of engine, hp. (15). Speed of running, km/h. (16) during movement along dry land. (17). on to float. (18). Bearing/angle of incline, deg. (19). Endurance, km. (20). Specific pressure, kg/cm².

Table 2. Characteristic of the floating tracked personnel carriers.

(1) Основные характеристики	(2) США		
	(3) М-29С „Ласка"	(4) М-76 „Оттер"	(5) „Аллигатор"
(6) Вес, т	2.2	4.0	14.4
(7) Экипаж, человек	2—4	2—3	4
(8) Десант, человек	—	12	24
(9) Габаритные размеры, м:			
(10) длина	4.8	4.9	6.5
(11) ширина	1.7	2.5	4.0
(12) высота	1.8	2.6	2.47
(13) Мощность двигателя, л. с.	75	135	146
(14) Скорость хода, км/час:			
(15) при движении по суше	50	45	20
(16) на плаву	6.5	7	10
(17) Угол подъема, град.	—	—	20
(18) Запас хода, км:			
(15) при движении по суше	280	260	360
(16) на плаву	130	96	—
(19) Удельное давление на грунт, кг/см²	0.135	—	0.8
(20) Дорожный просвет, мм	265	—	—
(21) Тип движителя на воде	(22) Гусеничный	(23) Гребной винт	(22) Гусеничный

Key: (1). Fundamental characteristics. (2). USA. (3). "Weasel". (4). "Otter". (5). "Alligator". (6). Weight, t. (7). Crew, man. (8). Landing force, man. (9). Overall dimensions, m. (10). length. (11). width. (12). height/altitude. (13). Power of engine, hp. (14). Speed of running, km/h. (15). during movement along drier. (16). on to float. (17). Bearing/angle of incline, deg. (18). Endurance, km. (19). Footprint pressure, kg/cm². (20). Road clearance, mm. (21). Type of propeller/motor on water. (22). Tracked. (23). Screw propeller.

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Table 3. Performance data of floating trucks.

(1) Основные характеристики	(2) США				(3) Англия	
	DUKW	(4) Супердак М-147	(5) Ларк-5	(5) Ларк-15	(6) Столвэг	(7) „Террапин-II"
(8) Вес, т	6,7	6,8	7,3	18,0	8,3	16,5
(9) Полезная грузоподъемность, т	3,2	3,6	4,5	13,2	5	5
(10) Габаритные размеры, м:						
(11) длина	9,4	9,7	10,6	13,7	6,25	9,27
(12) ширина	2,5	2,6	2,7	3,6	2,54	2,70
(13) высота	2,4	2,1	3,0	4,2	2,47	2,00
(14) Дорожный просвет, мм	—	—	—	—	457	355
(15) Скорость хода, км/час:						
(16) при движении по суше	80	80	50	35	70	40
(17) на плаву	9,5	12	16	16	9,2	10
(18) Угол входа в воду, град	—	—	20	22	—	—
(19) Угол выхода из воды, град	—	—	31	30	25	—
(20) Мощность двигателя, л. с.	91	155	270	2×270	220	(22) —
(21) Тип движителя на воде	(22) Гребные винты				(23) Водомет	Гребные винты
(24) Запас хода, км:						
(16) при движении по суше	325	400	—	—	640 800	—
(17) на плаву	80	10	—	—		—

Key: (1). Fundamental characteristics. (2). USA. (3). England. (4). Superduck. (5). Lark. (6). Stolvet. (7). "Terrapich-11". (8). Weight, t. (9). Payload capacity, t. (10). Overall dimensions, m. (11). length. (12). width. (13). height/altitude. (14). Road clearance, mm. (15). Speed of running, km/h. (16). during motion over dry land. (17). on float. (18). Angle of entry into water, deg. (19). Angle of

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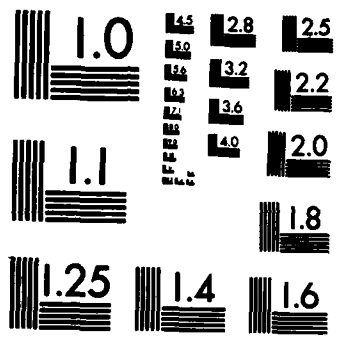

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departure from water, deg. (20). Power of engine, hp. (21). Type of propeller/motor on water. (22). Screw propellers. (23). Jet. (24). Endurance, km.

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Table 4. Basic performance data of landing boats.

(1) Наименование лодок	(2) Вес, кг	(3) Грузоподъемность, т	(4) Десант, человек	(5) Габаритные размеры, м: (7) длина	(8) ширина	(6) Скорость передвижения на воде, км/час: (9) забортный мотор	(10) на веслах
(11) США							
(12) 5-местная надувная лодка	50	0.7	5—7	3.6	1.7	—	3—5
(13) 15-местная надувная лодка	70	1.5	15	5.5	2.0	20	—
(14) Фанерная лодка М-2	190	1.8	15	4.0	1.8	22	3—5
(15) Скоростная деревянная лодка	200	1.4	12	5.0	2.0	30—40	—
(16) Пластмассовая 16-футовая лодка	130	1.5	13	4.0	1.6	35	5—7
(17) ФРГ							
(18) 2—3-местная надувная лодка	45	—	2—3	3.0	1.15	—	4
(19) Надувная лодка	127	—	8—10	5.5	1.9	10—12	5
(20) 8—10-местная надувная лодка	140	—	8—10	6.0	1.85	—	2—3
(21) Штурмовая лодка	200	—	8—10	5.6	1.7	25—35	—
(22) Англия							
(23) 5-местная надувная лодка	28	—	3—5	3.0	1.2	10	3
(24) Десантная алюминиевая лодка	180		13	5.2	1.9	13	—
(25) Десантная складная лодка МК3	160		13	5.[illegible]	1.8	—	5
(26) Скоростная десантная лодка	680		18	6.0	2.0	30—35	—
(27) Десантная надувная лодка из нейлона	—		7	4.5	—	30—40	—

Key: (1). Designation of boats. (2). Weight, kg. (3). Load capacity, t. (4). Landing force, man. (5). Overall dimensions, m. (6). Speed of movement on water, km/h. (7). length. (8). width. (9). outboard motor. (10). on oars. (11). USA. (12). 5-man inflatable boat. (13).

15-man inflatable boat. (14). Plywood boat M-2. (15). High-speed/high-velocity wooden boat. (16). Plastic 16-foot boat. (17). FRG. (18). 2-3-man inflatable boat. (19). Inflatable boat. (20). 8-10-man inflatable boat. (21). Assault boat. (22). England. (23). 3-man inflatable boat. (24). Landing aluminum boat. (25). Landing collapsible boat MKZ. (26). High-speed/high-velocity landing boat. (27). Landing inflatable boat from nylon.

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Table 5. Performance data of nonself-propelled pontoon trains.

(1) Основные характеристики	(2) США			(3) ФРГ			(4) Англия	
	M-4	(5) T5 класса 60	M4T6	(6) „Хольплаттен" 50/80	(7) Парк класса 16/30/50	(5) SE класса 50/80	(8) Парк класса 30	(8) Парк класса 30
(9) Время выпуска	(10) В период второй мировой войны	(11) В середине 50-х годов	1958	*1960	(12) В начале 60-х годов		(13) В конце 50-х годов	(12) В начале 60-х годов
(14) Грузоподъемность моста, т	54	54–60	54–60	50; 80	16; 30; 50	50; 80	27	72
(15) Длина 50-т моста (из одного комплекта), м	180	180	43	88	38	130	120	120
(16) Ширина проезжей части, м	4.2	4.0	4.0	4.25	4.0	4.4	3.5	4.5
(17) Расчет для наводки моста, человек	180	110	30		(18) Рота		130	(19) Эскадрон
(20) Время наводки моста, ч	5	2–3	2–3	2–3	3–4	6–8	6	3–4
(21) Грузоподъемность паромов, т	54; 63	51; 65	45–50	30; 50	16; 30; 50	50; 80	—	—
(22) Количество 50 (60) паромов, собираемых из комплекта, шт.	—	—	2	5	4	8	—	—
(23) Время сборки 50–60-т парома, час	—	1.5	1–1.5	1.5	1	1.5	—	—
(24) Транспортные средства, необходимые для перевозки комплекта, шт.	(25) 40–2.5 т автомобилей с прицепом	(26) 40–5 т автомобилей	12–5 т автомобилей	60–7 т автомобилей с прицепом	10–7 т автомобилей	70–7 т автомобилей	25–3 т автомобилей с прицепом	26–10 т автомобилей с прицепом

Key: (1). Fundamental characteristics. (2). USA. (3). FRG. (4). England. (5). class. (6). "Khol'platten". (7). Motor pool of class. (8). Motor pool of class. (9). Time of issue. (10). In period of Second World War. (11). In middle of 50's. (12). In the beginning __ of years. (13). At the end of 50's. (14). Load capacity of bridge, t. (15). Length of 50-ton bridge (of one set), m. (16). Width of transient unit, m. (17). detachment for laying of bridge, men. (18). Company. (19). Squadron. (20). Time of laying bridge, h. (21). load capacity of ferries, t. (22). Quantity 50 (60) ferries, assembled from set, pieces. (23). Time of assembly of 50-60-t ferry, hours. (24). Transport means, necessary for transportation of set, pieces. (25). t of automobiles with trailer. (26). t of automobiles.

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Table 6. Characteristic of self-propelled pontoon trains.

(1) Основные данные	(2) США (5) Самоходный парк МАВ	(3) Франция (6) Парк „Жиллуа"	(4) ФРГ (5) Самоходный парк М-2
(7) Состав комплекта, шт.:			
(8) мостовых машин	16	16	—
(9) аппарельных машин	8	8	—
(10) Экипаж машин, человек	3	4	4
(11) Вес машины, т	23,0	26,5	20,5
(12) Количество и мощность двигателей, л. с.	1×335	1×220	2×178
(13) Скорость хода, км/час:			
(14) при движении по шоссе	56	60	60
(15) на плаву	11	11	12
(16) Грузоподъемность моста, т	54	60	50
(17) Длина моста из одного комплекта, м	148	144	(18) На 100 *пог. м* требуется 12 машин
(19) Ширина проезжей части, м	4,0	4,0	5,6
(20) Время наводки моста, *час*	1—1,5	1—1,5	
(21) Грузоподъемность паромов, т	(22) Из 4 машин 50; из 5 машин 60; из 6 машин 70	(23) Из 2 машин 45; из 3—4 машин 60	(24) Из 2 машин 30; из 3 машин 50
(25) Количество 50—60-т паромов, собираемых из комплекта, шт.	4	4	—
(26) Время сборки парома, *мин*	25	40—60	20

Key: (1). Basic data. (2). USA. (3). France. (4). FRG. (5). Self-propelled motor pool. (6). Motor pool "Zhillua". (7). Composition of set, pieces. (8). bridge vehicles. (9). ramp. vehicles. (10). Crew of vehicles, men. (11). Weight of vehicle, t. (12). Quantity and power of engines, hp. (13). Speed of running, km/h. (14). during movement along highway. (15). on to float. (16). Load capacity of bridge, t. (17). Length of bridge of one set, m.

(18). On 100 lin. m are required 12 vehicles. (19). width of transient unit, m. (20). Time of bridge laying, hour. (21). Load capacity of ferries, t. (22). Of 4 vehicles 50; of 5 vehicles 60; of 6 vehicles 70. (23). Of 2 vehicles 45; of 3-4 vehicles 60. (24). Of 2 vehicles 30; of 3 vehicles 50. (25). Quantity of 50-60-t ferries, assembled from set, pieces. (26). Time of assembly of ferry, min.

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Table 7. Characteristic of tracked and wheel bridge layers.

(1) Основные данные	(2) США	(3) Англия	(4) Франция	
	(5) Танковый мостоукладчик	(6) Танковый мостоукладчик „Центурион"	(7) Танковый мостоукладчик АМХ	(8) Штурмовой мост „Жиллуа" на колесном шасси
(9) Вес машины с мостовой фермой, *т*	58,2	—	17,0	30
(10) Вес мостовой фермы, *т*	13	—	5	—
(11) Экипаж, человек	2	2	3	4
(12) Габаритные размеры в транспортном положении, *м*:				
(13) длина	11,8	—	8,5	11,65
(14) ширина	4,05	—	3,55	3,4
(15) высота	3,94	—	3,35	3,91
(16) Грузоподъемность, *т*	54	72,0	35	30
(17) Длина моста, *м*	19,2	13,7	14	22—34
(18) Ширина перекрываемого препятствия, *м*	18,3	12,2	12	20—32
(19) Ширина проезжей части моста, *м*	3,81	3,6	3,0	3,4
(20) Время установки моста на препятствие, *мин*	3	5	5	2—40
(21) Время на снятие моста с препятствия, *мин*	10	5—8	5	10—15
(22) Максимальная скорость движения по дорогам, *км/час*	45	35	60	65

Key: (1). Basic data. (2). USA. (3). England. (4). France. (5). Bridge-laying tank. (6). Bridge-laying tank "Centurion". (7). Bridge-laying tank AMX. (8). Assault bridge "Zhillua" on wheel under-carriage. (9). Weight of vehicle with bridge farm/truss, t. (10). Weight of bridge farm/truss, t. (11). Crew, man. (12). Overall dimensions in transport position/situation, m. (13). length. (14).

width. (15). height/altitude. (16). Load capacity, t. (17). Length of bridge, m. (18). Width of closed over obstacle, m. (19). Width of transient unit of bridge, m. (20). Time of installation/setting up of bridge for obstacle, min. (21). Time for removal/taking of bridge from obstacle, min. (22). Maximum speed of movement along roads, km/h.

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