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RAFTING AND BRIDGING

MILITARY TRAINING PAMPHLET No. 74

Part III

ASSAULT CROSSING EQUIPMENT

1944

THE WAR OFFICE,
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Prepared under the direction of
The Chief of the Imperial General Staff

19470

PREFATORY NOTE

Military Training Pamphlet No. 74.—Rafting and Bridging will consist of the following parts :--

Part I. Staff duties—Organization and tactics.
Part II. Provision and movement of equipment.
Part III. Assault crossing equipment.
Part IV. Bridge classification of " B " vehicles.

DISTRIBUTION (PART III)

All arms ... ... Scale C
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CHAPTER 1

INTRODUCTION

SECTION 1.—OBJECT OF PAMPHLET

1. The object of this pamphlet is to describe the means of getting infantry and their immediately supporting weapons across a water obstacle in an assault.

2. Any river that is a tank obstacle is a formidable obstacle to overcome. The infantry have to establish a sufficiently large bridgehead and hold it for the time it takes the engineers to build the bridges necessary for the rest of the formation to cross and deploy. They will have to hold this bridgehead in the face of determined, and probably armoured, counter-attack :—

(*a*) Without the aid of their own armoured forces.

(*b*) With the aid only of those close support weapons that have been ferried over on rafts, and such other support as can be given from the other side of the river.

3. The supporting weapons that the infantry will require over early and that can be ferried are :—

(*a*) Anti-tank guns and carriers.

(*b*) Mortars and 15-cwt ammunition trucks, and later, for consolidation, the 4·2-in mortars and medium machine guns from the brigade support group.

4. No opportunity of crossing a river and establishing a footing on the far bank must be missed by forward troops. If, however, the enemy has denied this by adequate demolition of bridges, weirs, etc., and by the damaging or removal of all other practicable means of crossing, then the assaulting troops will use the equipment provided for this purpose and carried by the assault platoon of the Bridge Coy, RASC. This equipment is described in Chapter 3.

5. The amount of this equipment carried and the manner in which it is allotted will be forecast for each operation and will depend on the tactical situation expected on the river line.

6. Generally, in the pursuit, or against lightly held rivers, the equipment will be decentralized early to leading brigades, or even battalions, to enable them to exploit immediately any and every opportunity.

7. Assault against highly organized resistance or on a river line strongly held, is, however, a different matter. The crossing will be made on a divisional or even a corps plan. It will require considerable reconnaissance. This will precede the decentralization of the assault bridging equipment.

8. In the unforeseen circumstances of the assault platoon equipment not being available, improvised methods such as those described in Chapter 4 will be used.

9. Except for setting down the above principles this pamphlet does NOT deal with tactical considerations. These are fully dealt with in MTP 23, Part VIII (1942), which will be rewritten as Part I, " Staff Duties, Organization, and Tactics," of this MTP.

10. Chapter 2 is a chapter on watermanship with hints for training.

Section 2.—RESPONSIBILITY

1. It is the duty of the CE of an army or corps or the CRE of a division to advise his commander on the best employment of bridging equipment. This is carried in the field by the Bridge Company, RASC. When it is allotted to a division the RE are responsible for looking after it. When decentralization to brigades or battalions is ordered, the RE are responsible for getting assault crossing equipment to the RV ordered, where it will be handed over to the infantry who then assume the responsibility. The movement of bridging equipment will be fully dealt with in Part II of this MTP.

2. The first stage of recovery after an operation, *i.e.* securing the boats or rafts to the bank, must be the responsibility of the troops who operate them. The other stages, *i.e.*, reloading on the transport and returning to a RV, must be covered in the orders issued for the operation by the Assaulting Formation.

3. The infantry are responsible for the operation of all their own assault boat ferries. In high winds, in wide or fast flowing rivers, this task calls for a high standard of watermanship. The difficulties will be increased in the smoke or darkness essential to a successful assault at an opposed crossing, where many boats will be crossing at once. It should be the aim of every battalion commander to have trained, with sufficient reserves to cover casualties,

teams of men capable of building and operating with the standard gear provided those assault rafts described in Secs 10 and 11 of Chapter 3.

4. Assistance from the RE of their own formation should be sought for this purpose. Pioneers and handymen should also be practised in improvisations along the lines laid down in Chapter 4.

5. Even with such trained men available in the battalions it is probable that on difficult crossings some engineer assistance and supervision will have to be provided for these rafts. Such provision will materially deplete the number of RE available for the main bridging commitment.

6. Drills for erection of the two service rafts are given in some detail and should be learnt. This point is important because in the smoke and noise of an assault crossing orders will not easily be heard. The erection of the rafts must proceed silently in the correct order ; otherwise time and valuable equipment will be lost because of stores being forgotten, or connections being left undone. As with battle drill, so it is essential that these drills should be treated as being adaptable to the particular circumstances, and every man must know the complete sequence as well as his own part.

CHAPTER 2

WATERMANSHIP

SECTION 3.—GENERAL

1. The movement of a boat or raft on water is dependent on three main factors :—

(*a*) The speed and direction of the current.
(*b*) The strength and direction of the wind.
(*c*) The actions of the crew.

Of these, the third only is under the control of the commander. To be successful he must exercise judgment in the allowance he makes for the effects of wind and current, which may be very considerable indeed. He must know what orders to give to attain his object in spite of these effects and his crew must know how to carry out these orders promptly and efficiently. This standard of efficiency calls for plenty of practice on the part of commander and crew.

2. Watermanship cannot be learnt from a pamphlet. Practice under varying conditions is essential.

The following notes on boat orders and drill will be of considerable help in this training. They are not exhaustive, and far better results will be obtained if they are supplemented by the assistance of the formation RE.

SECTION 4.—BOAT ORDERS AND DRILL

1. **Parts of a boat.**—The names of these parts of a boat occur frequently in orders and should be understood by all.

Bows.—The " pointed end." In boats pointed both ends (*e.g.* Mk III assault boat), the forward end.

Stern.—The " blunt end " or end away from the bow.

Port side.—The left hand side when looking towards the bow.

Starboard side.—The right hand side when looking towards the bow.

Breastline.—The piece of rope fastened to the bows by which the boat can be moored.

Ferry line.—The long length of rope attached to the bow or stern which can be pulled from the bank to haul the boat backwards and forwards over a river.

Stroke.—The man from whom the others take their time when rowing or paddling. In a boat that is rowed the man nearest stern on port side. In paddled boats the man nearest bow on port side.

Ferrymen.—Each assault boat Mk III will have a crew of three.

Freeboard.—The distance between the water level and the *gunwale* or *top of rim of boat.* It should always be given in connection with a particular loading.

2. **How to paddle.**—On one knee (the gunwale knee), facing the bows.

3. **Orders.**—The following orders are common. Commanders must use these and the crew must know what action each entails, and why.

File in.—Party to be ferried across file into the boat, moving carefully; the boat is held off shore by two ferrymen to make sure it does not ground as the load comes on.

Shove off.—Ferrymen push the boat off and jump in.

Trim the boat.—All numbers adjust position slowly until boat or raft is floating horizontally.

Stand by to give way.—Rowing or paddling numbers prepare to row or paddle. If there is a fast current, men should stand by to give way before the shove off and should give way immediately the boat floats.

Give way—all (or *port or starboard*).—Those named row or paddle at an even rate and all in time together. The time is normally taken from the front man on the port side.

Hold water—all (or *port or starboard*).—Those named hold their paddles or oars in the water to slow or turn the boat.

Back water—all (or *port or starboard*).—Those named row or paddle in the reverse direction to reverse the boat.

Oars all—(or *port or starboard*).—Those named complete their stroke and cease rowing.

Bows.—Ferrymen detailed to land and hold boat to shore for offloading get prepared to land as soon as they are able.

File out.—All but crew leave the boat in turn.

Section 5.—FERRYING

1. For crossing rivers up to about 100 ft in width it is generally quicker to haul a boat or raft backwards and forwards on a ferry cable than to paddle. For this purpose two ropes are necessary, each 20 ft longer than the width of the stream. One is made fast to the bows and the other to the stern of the boat. The other ends are made fast to pickets on shore. By hauling on one and paying out on the other the boat can be moved quickly backwards and forwards, across the gap. Hauling and paying out can usually be done more easily by having a man on each bank who can be in a covered position from enemy fire. A man in the boat can haul the rope into the boat, but extra room is then used in a boat which may already be crowded, and the hauler is more vulnerable to fire. Pull on a rope in any boat must be applied ONLY at the bow or stern. Accidents to assault boat ferries nearly always result from neglect of this rule.

Section 6.—HINTS TO COMMANDERS

1. Make up your mind how you mean to cross before you give the order " Shove off ". You will need to know the direction of the wind and the current, and which is the stronger.

2. If possible tactically, don't battle against the stream or wind—concentrate on getting across. You may have to start upstream of the point opposite where you want to land.

3. If you have to get straight across a swift stream point yourself and paddle upstream of your objective. The stream will carry you down.

4. If you do go too far downstream, paddle back against the current inshore in the shallows, where the current is weakest.

5. Slight turns can be made by one side paddling harder than the other. The man in the bows has the bigger turning effect. Turn so that the current helps you, where possible.

6. Your steering oar should be used to help in a turn. It gives its maximum turning effect at about 45 degrees to the boat; a wider angle slows the boat and reduces the turning effect.

7. Sharper turns can be made by holding water (sharper still by back watering) one side and paddling normally on the other. Remember, however, to check the turn very early, or you will swing round much farther than you meant to and it will be difficult to stop.

8. Make sure that your breastlines are always properly coiled and clear of men's feet. If you don't they'll be tangled up when you need them. When you need them you'll need them in a hurry!

9. See, before you start carrying to the river, that the emergency repair patches are in the boat and that your crew know how to fix them quickly.

10. Watch out for the other boats. Their mistakes may mean disaster to you as well.

11. All men must kneel on one knee in the boat. Don't let them try to change positions when afloat.

12. All keep strict silence except the crew commander. Hand signals may be necessary even for turns on some occasions.

13. Don't charge the bank hard in a collapsible boat. It won't stand it, least of all when filled. Watch out for sharp rocks and snags that may rip the canvas.

14. Keep cool and don't lose your head. Don't mix PORT and STARBOARD.

15. Ensure that all your men can coil and throw a rope correctly. Coiling and throwing can be practised anywhere. Water is not necessary. Get a sapper, a sailor, a bargee, or an amateur yachtsman to show you how to if you don't know!

16. Always coil and lay a rope so that it is ready for immediate use and is out of the way of everybody's feet.

CHAPTER 3

SERVICE EQUIPMENT

SECTION 7.—GENERAL

1. The service assault crossing equipment is carried in the assault platoon of the Bridge Company RASC. These platoons will be allotted to the infantry on the scale necessary for the operations contemplated. The exact composition of the assault platoon is not yet firm.

Each type of the equipment to be contained in the platoon is shown in Secs 8 to 13 with complete descriptions for erection and use. The exact scales to be carried are not yet settled, but will be published as an amendment to this pamphlet as soon as they are firm. Table I gives an indication of what this will be.

Secs 14 and 15 show other types of service equipment, not carried in the assault platoon and not for general use, that may be met in the field.

TABLE I.—Provisional scale for the assault platoon.*

Equipment	Assault platoon scale	Remarks
Assault boats	72 Mk III boats	Each boat equipped with gear as shown in Sec 8, para 3.
Raft superstructure A tk gun, Mk II	15 sets	1 set of superstructure and 2 Mk III boats make 1 raft. If 3 Mk II boats are used 1½ sets of superstructure are required for 1 raft.
Attachments carrier flotation (assault boat method)	18 sets	2 boats Mk III or Mk II required with each set to float carrier.
Kapok equipment	160 floats, decking and materials for 44 bays	Enough decking for use with 40 floats, *i.e.* 4 bridges 11 bays long. Remainder of floats (or all if none used for bridge) for carrier flotation Kapok method with attachments below.
Attachments carrier flotation Kapok method	16 sets	Require 160 Kapok floats for 16 carriers.
FBE Raft Cl 5 Mk III	5 complete rafts	Each raft has a set of ferry gear and 2 outboard motors for propulsion. Will carry Cl 5 loads not exceeding about 132 ins wheelbase. Folding boats will be carried on FBE Mk II trailer.
Recce boats, Mk II	Total of 30	Reserve for Div RE only.

* Will be carried in 3 ton 4×4 GS lorries. It is not yet decided whether composite loadings of certain equipments will be made or whether each lorry will contain only one type of equipment.

Section 8.—ASSAULT BOATS

General

1. The assault boat is a collapsible canvas boat which is used to carry infantry and their weapons across water in the assault. There are two types as follows :—

(*a*) The Mark II boat which is single ended, about 12 ft long and carries 9 men. It is obsolescent and is no longer being produced.

(*b*) For use with special superstructure to make anti-tank gun is wider and deeper, and carries 18–19 men. It will eventually replace the Mk II boat.

2. In the assault the boats are used in three main ways :—

(*a*) As boats for ferrying infantry.

(*b*) For use with special superstructure to make anti-tank gun rafts or bridge.

(*c*) With special attachments for flotation of carriers.

Assault boat Mk III

3. (*a*) *Description.*—The assault boat Mk III was designed to take the new large sized infantry section and a proportion of their supporting arms in one load. It can be propelled by paddling or by hauling on a ferry line from the bank. It has a stiff plyboard bottom with a further layer which may be of rubberoid or slatted wood, canvas sides, and a stiff timber gunwale. When closed, six webbing straps secure the gunwales to the bottom of the boat ; stem pieces are clipped to the underside of the gunwales and six gunwale struts lie lengthwise in the bottom of the boat. They are hinged to the bottom at one end, secured to it at the other by bolts engaging in wooden blocks.

Attached to the boat there are two rowlocks (metal crutch or rope eye) for steering, one at each end, and two 17-ft breastlines with a mooring spike attached similarly one at each end.

The loose stores to be provided with each boat are as follows :—

7 paddles (1 spare).
1 steering oar.
1 set emergency repair outfit.

The following may be provided :—

40 fathoms 1½-in cordage.
1 maul.
2 5-ft pickets.

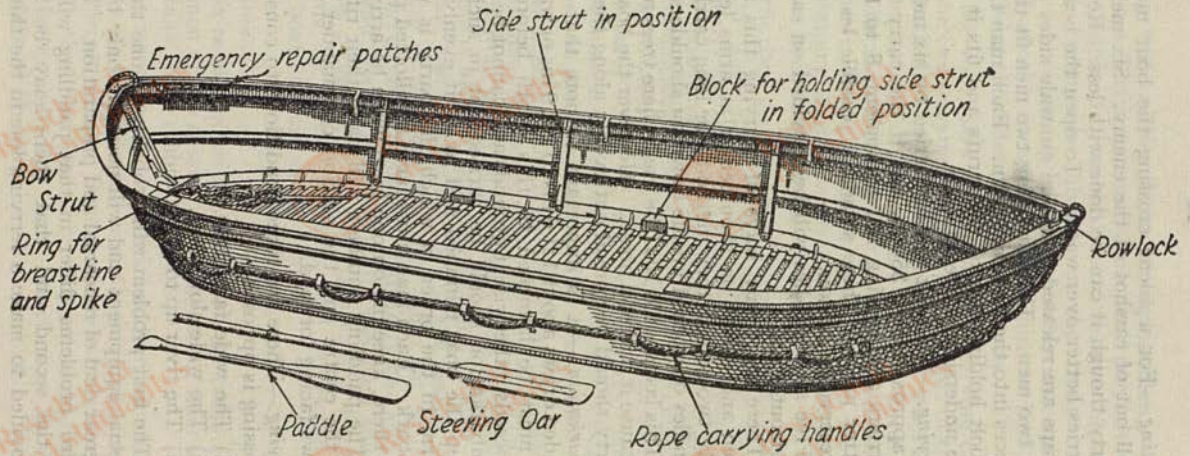


FIG 1.—Assault boat, Mk III

(*b*) *Opening.*—For a silent crossing the boat must be opened well out of earshot of the enemy. Six men is a suitable party though it can be done with less. Remember sound carries better over water. To open the boat the webbing straps are released, and the gunwale sides are lifted each by two men. The remaining two men fit the hinged stem pieces into the bow and stern. Each man then disengages a bolt holding one of the struts and fits it to the hole in the underside of the gunwale.

(*c*) *Carrying.*—The boat can be carried by six men. Its weight is approximately 350 lb, and if the carry is long or the carriers are wearing full equipment, 8 to 10 would be a better party. These should if possible be provided from a reserve formation.

Five rope handles will be provided on each side on the horizontal rib.

There are many ways of carrying this assault boat—open and closed on shoulder or at arms length—but the only two satisfactory methods for long carries are by rope handles or opened upside down on shoulders.

This last should NOT be used where trees may be brushed because it makes a noise. However the boat is carried the party should be spread out evenly along the sides.

(*d*) *Embarkation.*—It is important to note that the boat fully loaded draws about 1 ft 6 ins to 1 ft 9 ins of water ; therefore it must be launched to this depth before embarkation proceeds, otherwise it grounds and cannot be paddled away. Embarkation should be carried out in such a way as to keep the boat trimmed and to fill it evenly from bows to stern, in the order in which the party is wanted to disembark. Each man must have an allotted place and must go there, kneeling on one knee when he arrives.

The paddling numbers will hand their rifles to the men in the centre and the section commander will be in the bows facing forward.

(*e*) *Ferrying.*—There are three conditions to consider where the crossing is opposed :—

(i) The wide fast river.
(ii) The wide slow river.
(iii) The river up to 100 ft wide.

The first problem will probably be one that will call for special equipment and will normally only be tackled after a great deal of rehearsal and preparation. The second and third problems differ in that paddling will be necessary in the second and that there may be sufficient rope provided to make a ferrying line in the third.

They will call for different organization. In each one steersman (ferryman commander) and two ferrymen should be provided, if possible from a reserve formation. The section commander always in the front of the boat facing his objective indicates to the steersman by hand signals or other means where he wants to land, the steersman giving the orders to the paddlemen.

On the wide, slow river where no ferrying cable can be used the two ferrymen (⊙) are in the front of the boat and disembark first to hold the boat in for the remainder to disembark. Six of the assault party (+) will be detailed to paddle and the last two (×) of the assault party will hold the boat to the shore for embarkation and shove off when full, jumping in afterwards. The two ferrymen will take the boat back under the steersman.

On the river up to 100 ft wide, possibly the most common problem where the method described in Sec 5 applies, very nearly the same organization can be used. Six of the assault party must be detailed as paddle numbers for the first crossing and to be ready in case of accidents to do the ferrying in later crossings. One ferryman and one of the assault party shove off, the assault party man jumps in, the ferryman stays on the near bank with a length of cable attached to the boat, a maul, and a 5-ft picket.

When silence is no longer important he drives the picket in and fastening one end of the cable to it, gets in a defiladed position from which he can observe the progress of the boat and haul it back when it has emptied its load. The other ferryman and another member of the assault party are in the front of the boat and they jump out on the far bank and hold the boat to shore. This ferryman stays on the far bank and repeats the action with the maul and picket and ferrying cable. The boat is then hauled backwards and forwards by these ferrymen, the steersman remaining in the boat for purposes of control.

(*f*) *Disembarkation*

(i) On receipt of instructions from the commander, ferrymen of the assault party lay down their paddles and take their rifles.

(ii) On arrival at the far bank two ferrymen hold the boat to shore while the assault party disembark in the correct order. Disembarkation must be controlled so that the boat is not tipped over and the party thrown into the water, which may be deep at the stern of the boat.

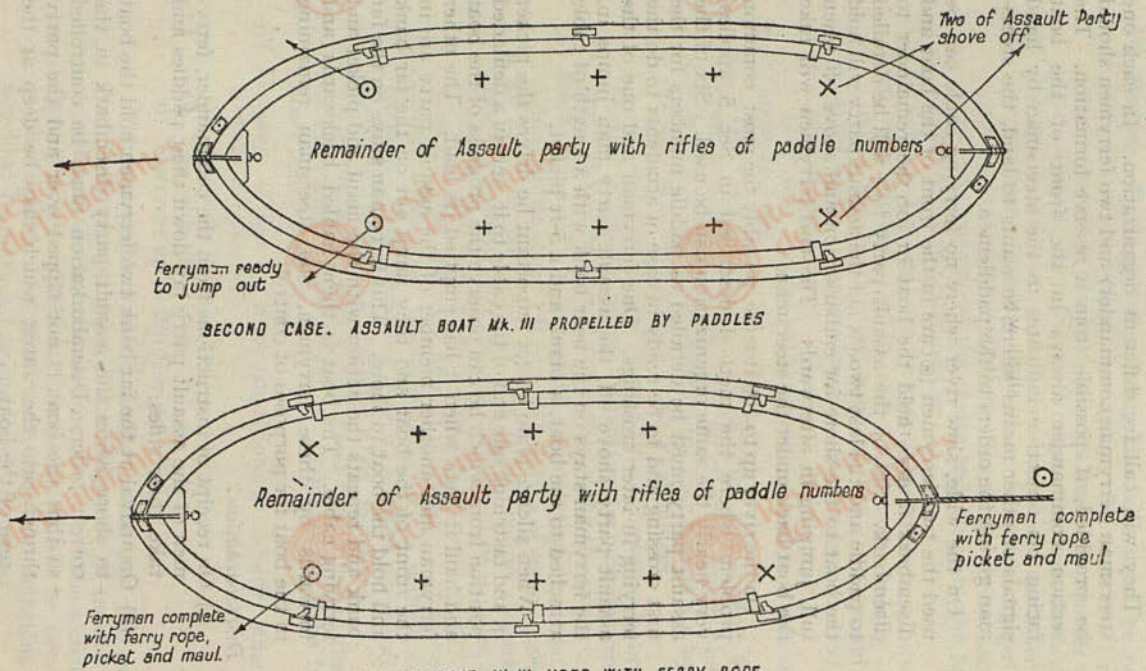


FIG 2.—Loading of assault boat, Mk III

(iii) Troops must be taught to disembark by stepping over the gunwale and NOT standing on it and jumping. The latter practice not only damages the boat but tends to push it away from the bank.

(iv) If the boat is in shallow water, disembarkation will be quicker if troops step over the gunwale into the water rather than filing forward.

(v) Immediately after disembarkation is completed the boat will be returned to the far bank.

4. Assault boat Mk II

(*a*) *Description.*—The assault boat Mk II will carry in calm water seven passengers and a crew of two. Five paddles are provided, four for paddling and one for steering. A mooring line and pin are attached to the bow. Its construction is similar to the Mk III boat save that extra strengthening parts are provided in the larger boat. It weighs 162 lb.

(*b*) *Opening.*—This again must be done well out of earshot of the enemy. To open the Mk II boat four men take up position, two on each side, and undo the eight webbing straps. They then stand astride the gunwale and lift it. Two men each at the bow and stern fix the bow and stern pieces and bolt them in position. Still standing astride the gunwale the four struts are raised from the bottom of of the boat, placed in position, and bolted.

(*c*) *Carrying.*—The boat can be carried at arm's length or on the shoulder by six men.

(*d*) *Embarkation.*—The same rules for embarkation and disembarkation apply to this boat as the Mk III. This boat draws about 1 ft to 1 ft 2 ins water. It is very important that the passengers should be very steady in the boat as this boat is more fully loaded and less stable than the Mk III. The LMG should be in the centre of the boat.

(*e*) *Ferrying.*—The same rules for ferrying apply but the crew can never be more than two men. They are sufficient to paddle back the empty boat.

(*f*) *Disembarkation.*—As for the Mk III boat.

5. Care and maintenance.—When handling assault boats care must be taken not to damage the canvas sides. When closed the canvas should be folded in as much as possible, so as to be protected

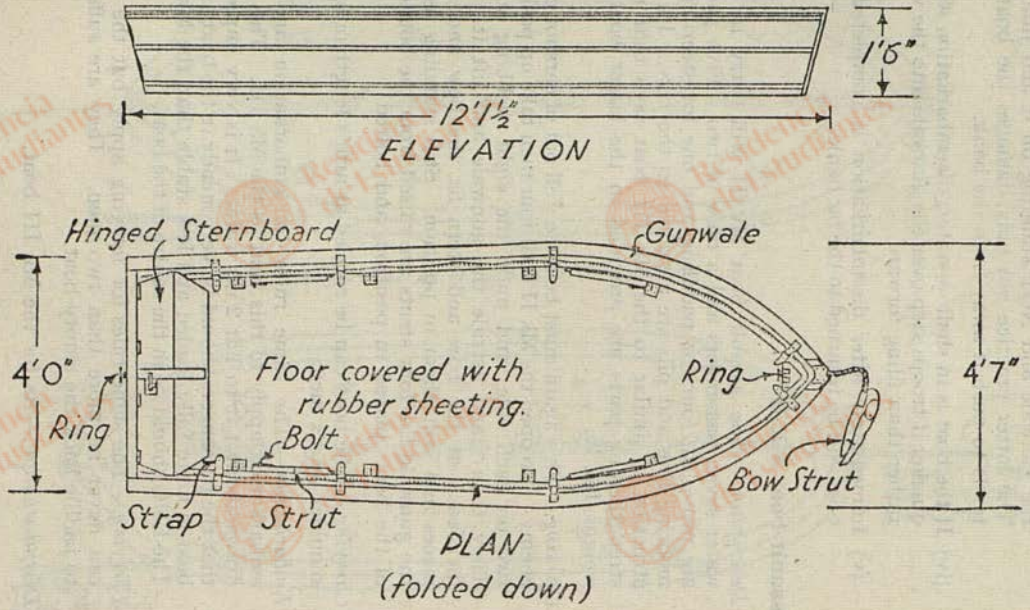


FIG 3.—Assault boat, Mk II

by the gunwale and floor. The canvas should preferably be dry when folded ; if not, the boats should be opened again and dried as soon as possible. Careless handling or bad packing on transport can easily destroy the boats.

6. **Repairs.**—If the boat is holed while in use, the hole can be filled with the patch shown in Fig 4. The method of using this is as follows :—

The spring-loaded rubber washer is applied to the outside of the boat. The cord from the head of the spring which passes through the centre of the rubber washer is taken through the hole in the boat, through the centre of the metal plate with the prongs, and pulled taut. The metal plate is pushed up against the inside of the boat with the flat side to the canvas. The end of the cord is then wound round the prongs and made fast.

A set of these patches is carried with each boat. If this box is missing or all the patches are used up, a temporary repair to get the boat to shore can be made by jamming a shirt or jacket into the hole. Baling the boat may become necessary if it starts to fill with water. It can be done with a steel helmet and must be organized by the boat commander.

The RE Pl of the Bridge Coy has a comprehensive scale of parts for maintenance and are able in the field to do considerable repairs. Even badly damaged boats should be collected and returned to them. Boats holed by SAA fire on return to the assault platoon are automatically patched with canvas and the emergency repair outfits are refilled.

Section 9.—KAPOK EQUIPMENT

The Kapok equipment has two uses as follows :—

(*a*) The Kapok bridge.

(*b*) Carrier flotation (*see* Sec **12**).

2. **Kapok bridge** (Fig 5)

(*a*) General. This is a footbridge which will take fully armed men at 6 ft intervals. It is made of 6 ft 6 in bays of two floats connected by decking. The maximum span is 150 ft, but this is only possible in currents less than 100 ft per minute and no wind. The bridge is kept straight by means

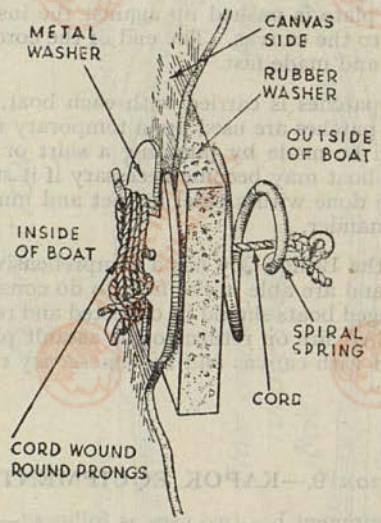
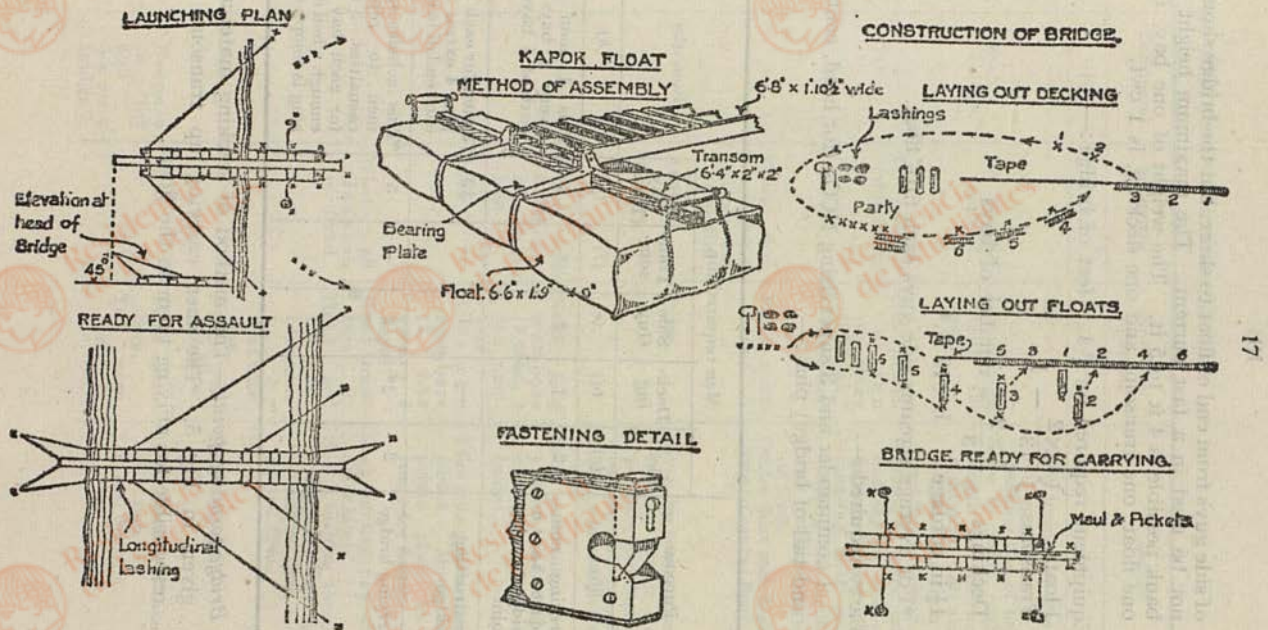


FIG 4.—Emergency repair patch for assault boats



X = Men

FIG 5.—Kapok assault bridge

of side guys from end of float to shore, but the bridge should not be used in a fast current. The maximum height of bank possible is 4 ft to 5 ft. The weight of one bay, *i.e.* one float, one transom, and one decking, is 1 cwt.

(*b*) Equipment required for "L" feet of bridge :—

Floats } $\frac{L \times 2}{13} - 1$
Transoms }

Deckings $\frac{L \times 2}{13}$ = number of bays

1½ in cordage L × 12 ft.*

*For average streams side guys each fifth float.

(*c*) Party required :—

1 commander and 3 supervising NCOs (for head, centre, and tail of bridge) plus :—

	Purpose	Men required for					Remarks
		Float	Decking	Side Guy	Transom	Each Bay (Total)	
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)	(*h*)
1	Carrying components to bridge forming point	2	1	*	*	3	*Plus 1 man for every 4 bays or part of 4 bays.
2	Constructing bridge	2	—	1	—	†3	†3 men for each bay plus 4 extra, 2 at each end of bridge.
3	Carrying bridge	2	2*	1	—	5	*This includes spare men to replace casualties. 3 men for each bay are enough when crossing is unopposed.

(*d*) *Bridge-forming point.*—The method of stacking material is given in Fig 5. The men carrying up transoms are responsible for affixing them to the floats.

(*e*) *Drill for construction of bridges*

	Command	Sequence	Numbers affected	Action
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
1	—	—	All	Party formed up facing dump on opposite side of tape marking line of bridge.
2	"Build bridge."	On completion of 1.	In succession from the right.	Move to dump, each take a length of decking under right arm. Lay along tape, commencing from far end, deckings touching.
3	—	On completion of 2.	Next in succession (becoming "Float" numbers).	Working in pairs, take floats and lay at right-angles to tape at decking joints commencing from centre and working outwards. Each pair remains standing by its float.
4	—	When first three floats are positioned.	Float numbers.	Centre float men fasten decking to centre float.
5	"In."	After 4.	Ditto.	Given by centre men. Float men on either side, then position decking, and procedure is repeated till bridge is completed.
6	—	When all floats are in position.	Next four numbers (2 head, 2 tail numbers).	Each pair take 1 maul, 2 pickets and lashings as ordered. Deposit on bridge.
7	—	After 6.	Side guy numbers (2 for every 5 bays).	Take side guy lashings and 1 picket. Move to appropriate place in bridge, ready for fixing.
8	—	When all decking is fixed.	Head numbers.	Lash landing bay at 45° by draw hitch.
			Head and tail numbers assisted by float numbers.	Run a lashing through float handles. 8 yds spare will be left at each end coiled on end floats.
			Side guy numbers.	Fix side guys.
9	"Prepare to lift and carry bridge."	Zero.	Float numbers.	Bend down and take hold of float handles.
			Tail numbers.	Lift end decking.

	Command	Sequence	Numbers affected	Action
(a)	(b)	(c)	(d)	(e)
10	"Lift."	On completion of 9.	Float and tail men.	Lift bridge.
11	"Advance."	Ditto of 10.	All numbers.	Move forward.
12	"Prepare to lower bridge."	To rest or on reaching bridge site.	All numbers.	Halt.
13	"Lower."	On completion of 12.	Float and tail men.	Place bridge on ground.
14	—	On reaching river.	Front two float numbers.	Launch front float, then act as launching numbers for other floats.
			Side guy numbers.	Move up and down stream, guiding bridge.
15	—	Front two floats launched.	Head numbers.	Get on bridge and signal guiding instructions to side guy numbers.
16	—	On reaching far bank.	Head and tail numbers.	Lower landing bay. Anchor bridge by making fast lashings from landing bays and then through float handles to trees or by lying on the ground with them.
17	—	Bridge launched.	Float and spare numbers.	Double back to rendezvous.
18	—	When attackers have crossed.	Head, tail, side guy numbers.	Picket down and remain as maintenance party.

Section 10.—RAFT, ANTI-TANK GUN, MK II

Description

1. A set of superstructure raft, anti-tank gun, Mk II is designed to be used with two Mk III assault boats (Fig 6).

2. The set consists of a deck of two timber trackways 12 ft long supported above the two boats on welded tubular steel trestle assemblies. The trackways are fixed 4 ft 8 ins centre to centre, and being 1 ft 5 ins between ribands will accommodate vehicles whose overall track does NOT exceed 6 ft 1 in and whose least dimension inside wheels is NOT less than 3 ft 3 ins.

3. The tubular assemblies are each supported on two timber trestle bases placed on the floor of the boat and guyed by tent rope type guys to the bows and sterns.

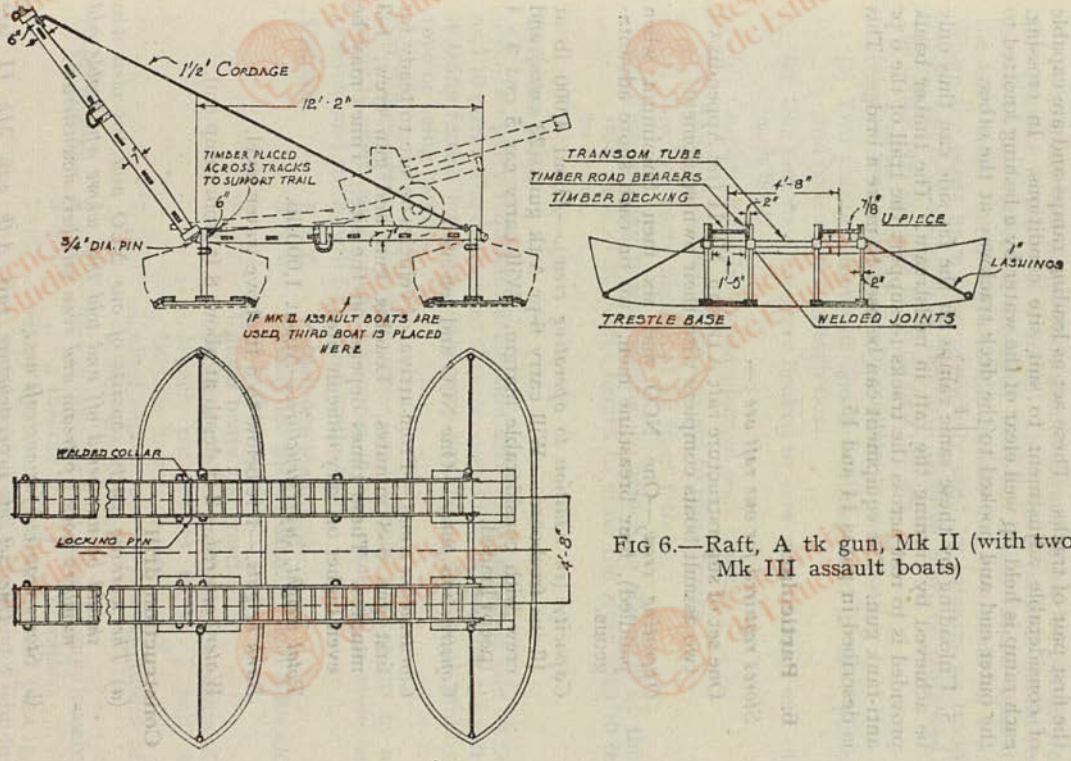


FIG 6.—Raft, A tk gun, Mk II (with two Mk III assault boats)

4. Two exactly similar tracks are fixed with one steel pin each to the first pair of tracks. These act as loading ramps and are capable of considerable adjustment to suit site conditions. In crossing, each ramp is held up well clear of the water by a lashing knotted to the outer end and hooked to the deck trackway at the other.

5. Unloading by these same ramps on the far side can thus only be achieved by turning the raft in midstream. The timber baulk provided is to rest across the tracks to support the trail of the 6 pr anti-tank gun. The equipment can be used to make a bridge. This is described in paras 14 and 15.

6. Particulars

Stores required for one raft are :—

One set of superstructure raft A tk gun, Mk II (*see* Appendix C), two assault boats complete with their own equipment.

Operating crew.—One NCO and six men (minimum when paddled), four breastline men, two on each shore advantageous.

Capacity (*in addition to operating crew*).—About 4,000 lb at 12 ins freeboard. Will carry 6-pr A tk guns (23 cwts) and crew with considerable margin. Will carry car 5 cwt 4 × 4 (peep) loaded.

Construction party.—One NCO and ten men.

Construction times.—From arrival of vehicles on site to ready for first gun 5–8 minutes. Loading gun and gun crew, 1–3 minutes. These times depend on the site. Times may be even higher on very difficult sites.

Total weight, superstructure.—About 1,000 lb.

Bank heights.—1 ft below to 5 ft above water level.

Water required.—2 ft depth at about 8 ft from ramp end.

Construction drill

(*a*) *The working party consists of one NCO and ten men who should be numbered off and told that where applicable odd numbers work upstream and even numbers downstream.*

(*b*) *Stores required for one raft are* :—

One set of superstructure raft A tk gun Mk II (*see Appendix* C), *two assault boats complete with their own equipment* (*Sec* 8, 2).

Initial preparation

7. The maximum preparation should always be carried out before the approach to the river is made. The stores if possible should be carried in one lorry and arranged with the tracks loaded against the lorry sides, small stores in the middle and two boats on top. Where the boats have been previously used by infantry as troop ferries, the best adaption of this drill possible must be employed. The initial preparations to be carried out are :—

(*a*) Two trestle baseplates in position in each boat.

(*b*) Two painters removed and breastlines fixed in their place and coiled down in each boat.

(*c*) One tent rope type guy hooked to bow ring of each end of each boat.

(*d*) Chocks placed in correct place in deck tracks.

(*e*) Ramp guys are fixed at one end to ramp tracks.

(*f*) Erection party numbered off from 1 to 10.

(*g*) Two ferrying ropes prepared to attach to the ends of the raft, each of sufficient length to cross the river with 10 ft to spare.

Erection drill

8. The party required for erection and for operation is one NCO and 10 men. The drill varies slightly, depending on whether the raft is being ferried by three of the crew hauling on each bank pulling rope or being paddled.

9. Whenever possible the stores lorry should reverse up to a point 10 yds from the bank, otherwise it will come up as close as possible and stores will be carried to the bank.

Unload.	1 & 2.	Unload one maul each.
	3 & 4.	Unload one picket each. 1 and 2 knock in pickets held by 3 and 4.
	5–10.	Unload boats and trestles.
	1–6.	Open boats, place trestle inside each and launch parallel to bank. 1 and 2 become breastline men.
	7–10.	Unload superstructure and remainder of stores, and lay out.
Deck tracks.	3 & 4.	Get in offshore boat } and fit guys loosely
	5 & 6.	,, ,, inshore ,, } to trestles.
	7–10.	Carry upstream deck track and pass it, assisted by 5 and 6, to 3 and 4 who fit to trestle. Repeat with downstream track.

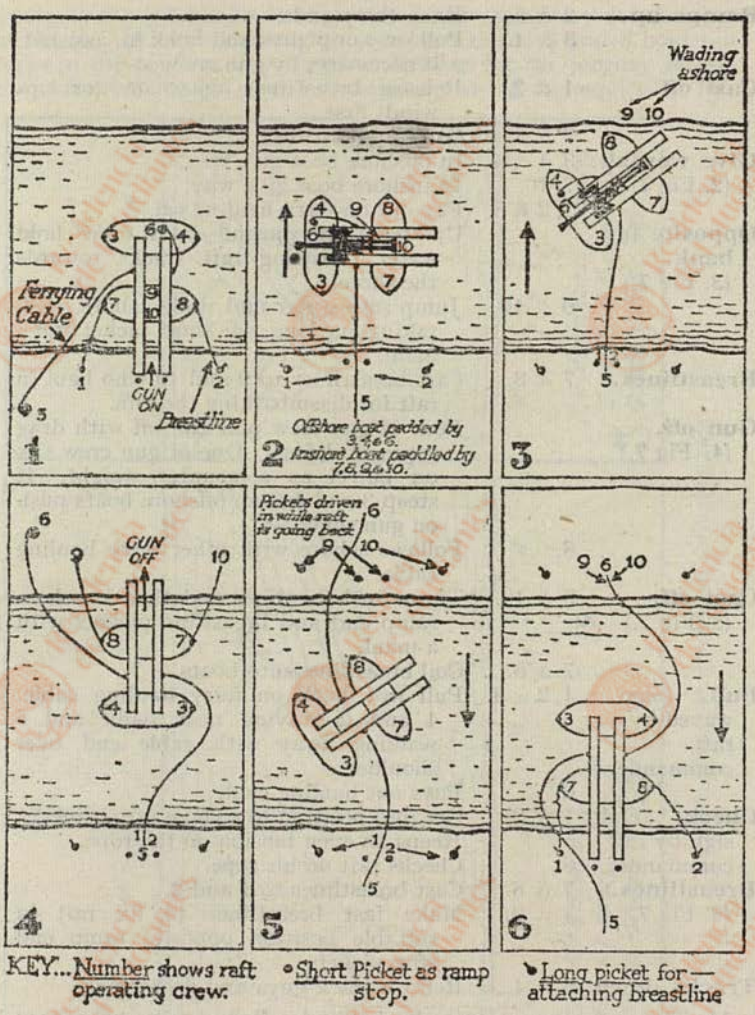
Boom out.	7–10.	Two men to each track boom out offshore boat.
	3 & 4.	Adjust guys on trestle.
	5 & 6.	Raise trestle of inshore boat and fix first upstream then downstream tracks to it. (Breastline men assist where necessary to adjust anchor of offshore boat.) 5 and 6 adjust guys.
	3 & 4.	Come ashore over tracks.
Tracks.	7–10.	Fetch downstream ramp and hold till 5 and 6 have fixed it. Repeat with upstream ramp.
	3*.	Fixes end of upstream (or upwind) ferry hauling rope to central trestle sleeve on upstream (or upwind) track.
	4.	Carries paddles to offshore boat.
	3 & 4*.	Carry aboard offshore boat the other ferry hauling rope. Remain in boat as ferry crew.
Push out.	1 & 2.	Pay out as necessary on breastlines.
	7–10.	Push out on tracks until boats are suitably afloat for gun.
	9 & 10.	Drive in short pickets as ramp end stops.
Man raft.	5.	Stays ashore as part of near shore party.
	6.	Gets into offshore boat; will eventually become one of far side shore party and will take ferry hauling cable ashore on arrival at far bank.

* Only necessary when ferry hauled; omit if raft is being paddled.

Operation (Fig 7)

10. The following drill is based on the assumption that the first trip over will be paddled and subsequent trips will be hauled. If the wind or current is very strong it may be necessary to get the haulage rope across first by other means such as a single assault boat.

Gun on. (1, Fig 7).	Gun crew.	The gun crew, pulling on drag ropes, will get the gun to the ramps and get the gun on to the deck tracks against chocks. 3 and 4 put in rear chocks. (Hand brake not used.) Gun crew kneel on deck tracks to reduce wind resistance. If steep, 3 and 4 from offshore boats pull on drag ropes led forward of gun.
	9 & 10.	Embark in inshore boat.



Direction of Wind or Stream whichever is the stronger

FIG 7.—Operation of A tk gun raft with ferry ropes

Ramps up.	2 & 5.	Raise ramp ends.
	3 & 4.	Pull on ramp guys and hook in, assisted, if necessary, by gun crew.
Cast off.	1 & 2.	Release breastlines upstream (or upwind) first.
	7 & 8.	Coil up breastlines.
Give way all. (2. Fig 7.)	3, 4 & 6.	In offshore boat give way.
	7–10.	In inshore boat give way.
	1, 2 & 5.	Pay out on ferry hauling cable.
Opposite far bank. (3. Fig 7.)		Upstream or upwind boat crew hold water to swing raft tracks towards the shore.
	9 & 10.	Jump into water and wade ashore, each taking one long, one short picket and a maul.
Breastlines.	7 & 8.	Cast breastlines to 9 and 10 who haul in raft for disembarking the gun.
Gun off. (4. Fig 7.)		Four of gun crew pull gun off with drag ropes trail first. One of gun crew sits on barrel as a counter weight. If steep 3 and 4 from offshore boats push on gun shield.
	6.	Follows ashore with other ferry hauling cable.
Cast off. (5. Fig 7.)	9 & 10.	Throw in breastlines and then knock in ramp end and breastline pickets with a maul.
	7 & 8.	Coil breastlines into boats.
Pull. (Sign waved by raft commander.)	1, 2 & 5.	Pull raft back on ferry hauling cable. 1 and 2 staying near bank and 5 walking away with cable end over shoulder.
	6.	Pays out hauling cable.
Check. (Halt sign by raft commander.)	1 & 2.	Get into position to receive breastlines.
	5.	Keeps an even tension on the rope.
	6.	Checks raft on his rope.
Breastlines. (6. Fig 7.)	7 & 8.	Cast breastlines to 1 and 2.
	1 & 2.	Make fast breastlines to fix raft in suitable position opposite ramp end stop pickets.
Tracks down.	3 & 4.	Release track guys and drop track.

11. The cycle then repeats by hauling. Round trips have been completed over 150 ft gap in a light wind by this method in 4½ minutes with ease including loading and unloading the gun.

When reference is made to upstream or upwind then whichever is stronger, wind or stream, denotes the direction that is meant. Rafts should be swung with ramps downstream or downwind.

Swinging the raft can be done quickly as shown in the three sketches in Fig. 8. If when the tracks have been raised 3 and 8 hold the ropes in the position shown in the sketches for the journey across, the raft when pulled will automatically swing as required. The

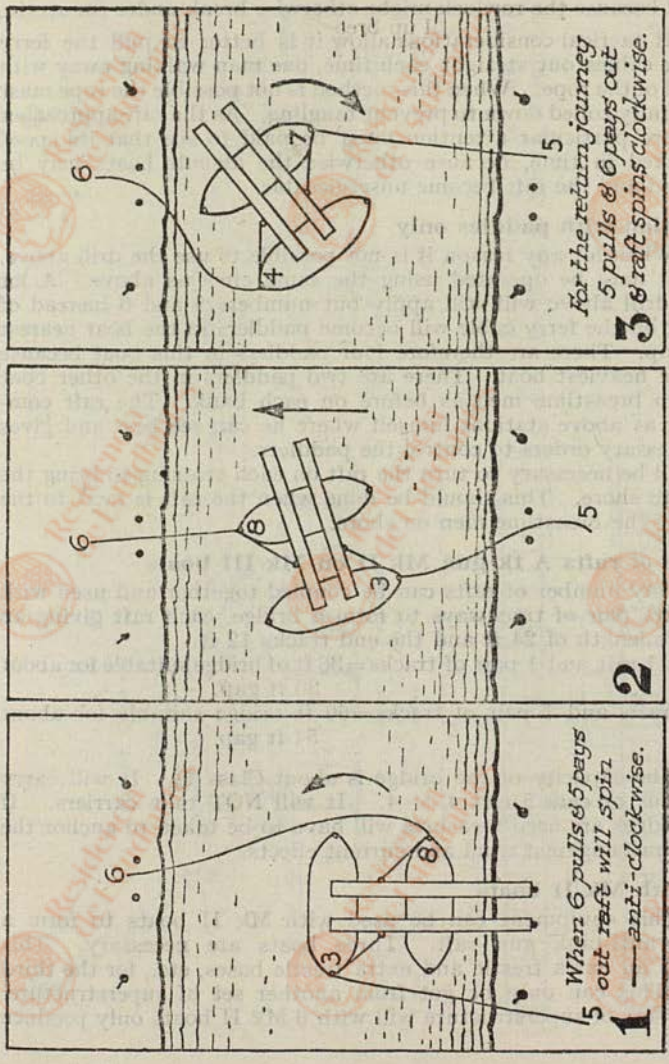


Fig 8.—Simple method of swinging raft

swing can be controlled by 3 and 8. For the return journey 4 and 7 reverse the process. During unloading, when these numbers may have other duties, the ferry ropes may be looped round the rowlock as shown, but when hauling is in process the ropes must be held because the rowlock might otherwise break under the strain.

12. If tactical considerations allow it is better to pull the ferry hauling cables out straight each time, one man walking away with the end of the rope. When this method is not possible the rope must be carefully coiled down to prevent tangling. As the raft approaches the shore particular attention must be paid to see that its speed is checked in time, because otherwise the assault boats may be damaged and the raft become unserviceable.

Operation with paddles only

13. When for any reason it is not possible to use the drill above, the raft may be operated using the same crew as above. A lot of the drill above will still apply but numbers 5 and 6 instead of hauling on the ferry cable will become paddlers in the boat nearest the ramp. There are therefore four paddlers in this boat because it is the heaviest boat. There are two paddlers in the other boat and two breastline men as before on each bank. The raft commander as above stations himself where he can see best and gives the necessary orders to control the paddlers.

It will be necessary to turn the raft on each crossing to bring the ramps to shore. This should be done when the raft is next to the bank by the breastline men on shore.

Bridge of rafts A tk gun Mk II on Mk III boats

14. Any number of rafts can be coupled together and used with one extra pair of trackways to form a bridge, each raft giving an effective length of 24 ft and the end tracks 12 ft.

Thus 1 raft and 1 pair of tracks = 36 ft of bridge suitable for about 30 ft gap.

and 2 rafts and 1 pair of tracks = 60 ft bridge suitable for about 54 ft gap.

15. The capacity of the bridge is about Class 1½. It will carry 6 pr guns or cars 5 cwt 4 × 4. It will NOT take carriers. If long bridges are used measures will have to be taken to anchor the central rafts against wind and current effects.

Use with Mk II boats

16. This equipment can be used with Mk II boats to form a similar anti-tank gun raft. Three boats are necessary. This involves an extra trestle and extra trestle bases, etc., for the third boat. This can only be got from another set of superstructure. Thus 3 sets of superstructure will with 6 Mk II boats only produce 2 rafts.

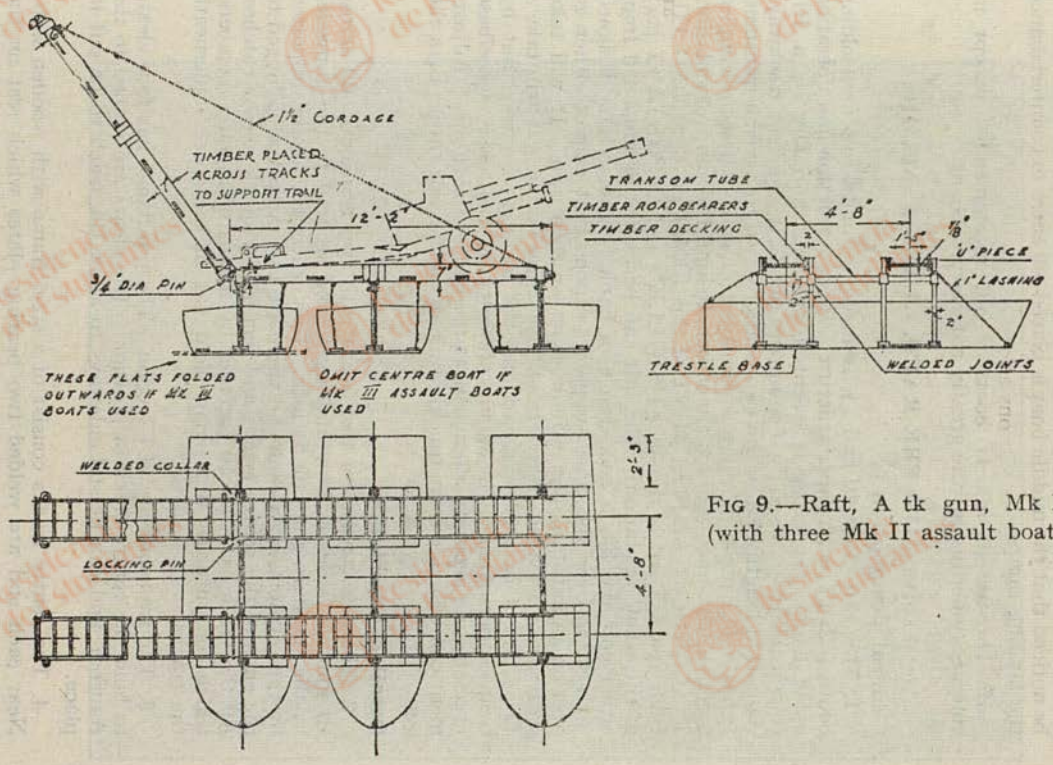


FIG 9.—Raft, A tk gun, Mk II (with three Mk II assault boats)

17. In this case the ferrying ropes can be tied round the top of the trestle in the centre boat.

18. The details shown in Fig 9 will be self explanatory. It will be noticed that the middle boat is placed offcentre to counterbalance the landing ramps.

19. The use of Mk II boats is not recommended except in emergency because of the greatly reduced freeboard.

Section 11.—FBE RAFT, CLASS 5, MK III

General description

1. This raft, Figs 10 and 11, is made up of two normal folding boats with a special superstructure. Its construction and operation make trained supervision essential and will normally be a RE responsibility. Generally it comprises two 12 ft long deck trackways supported lengthwise on the two boats by two transverse transoms. It has a similar pair of ramp trackways each end. These are coupled together with a set of bracing members to limit the ramp articulation. The CORRECT ADJUSTMENT of this LIMIT on the LONG TIE BAR (para 5 (*a*)) is the MOST SKILLED and IMPORTANT part of the whole operation. The raft can be loaded or unloaded from either end and has a good range of bank heights. It is designed for getting over the close support weapons that cannot either go over on an anti-tank gun raft or swim on their own. It will take a carrier or a loaded 15 cwt truck or a 2-ton portee. It will take a 17-pr gun if care is exercised and the loading is carried out by trained personnel. The main difficulty is the great wheelbase necessitating accurate alignment at the end of the ramps. Adjustment can be made more quickly by moving the raft rather than the gun.

Detailed description

2. The raft consists of two boats with two transoms laid across all four gunwales at bow and stern, and secured to the gunwales by the standard gunwale fittings. Two centre tracks are supported by the transoms. At each end there are two ramp tracks hinged to the ends of the centre tracks and secured by quick release catches. All the tracks are braced together by means of bracing members, which for purposes of carriage fold flat in the space underneath the tracks.

3. The transoms are of I-section. The top flange has four cleats to hold the centre track in position. The cleats are pinned to the transom, and can be slid sideways to allow the track to be put in place.

4. The centre tracks consist of a steel frame with wooden slats. Near each end are welded two bearing plates which rest on the transom cleats, and two projecting pins which fit into the vertical

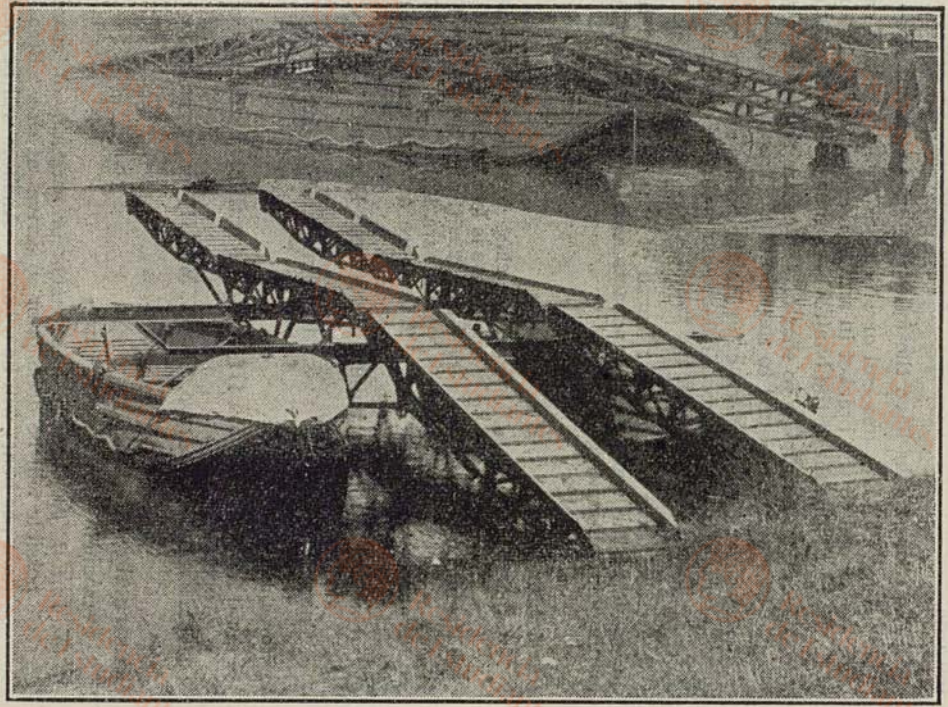


FIG 10.—FBE raft, Class 5, Mk III

slots in these cleats. The bracing members underneath the track consist of two tie-bars and two A-frames. The latter are pinned to lugs welded to the web of the transom just below the cleats. Care must be taken to place the transoms with these lugs facing inwards.

5. The ramp tracks have the following bracing members :—

(*a*) A long tie bar, one end of which has eight holes and can be pinned to the bracket in any of these positions, according to the height of the bank ; the other end is pinned to—

(*b*) An A-frame similar to that on the centre track, but with its upper ends pinned to the end of the track frame ;

(*c*) A short tie bar which connects the points of the centre and ramp track trusses. This tie bar is carried strapped to the long tie underneath the track.

6. At the shore end a short length of channel is welded to the underside of the track frame and acts as a shore transom during loading and off-loading.

Particulars

7. Capacity.	Any class 5 vehicle whose wheel-base is less than 11 ft.
Useful bank heights.	0 to 4 ft. (For extremes, *see* Fig 11 and para 13.)
Water required.	2 ft depth at 8 ft out from ramp end.
Number of men to build and operate.	1 NCO and 11 men.
Time to build.	10–20 minutes by day.

Stores required :—

Two folding boats Mk III, complete with boat accessories, *see* Appendix C.
One set Superstructure, Class 5, Mk III, *see* Appendix C.

Construction drill

8. Personnel—1 NCO and 11 men.

(*a*) *Initial preparation.*—As much preparation of stores as possible will be done prior to arrival at site. Breastlines (two per boat), will be secured. Anchors will be made up with cables, buoys, and buoylines, and carefully stowed.

Erection party will be numbered off from 1 to 11 and instructed in their duties. Odd numbers will work upstream, even numbers downstream.

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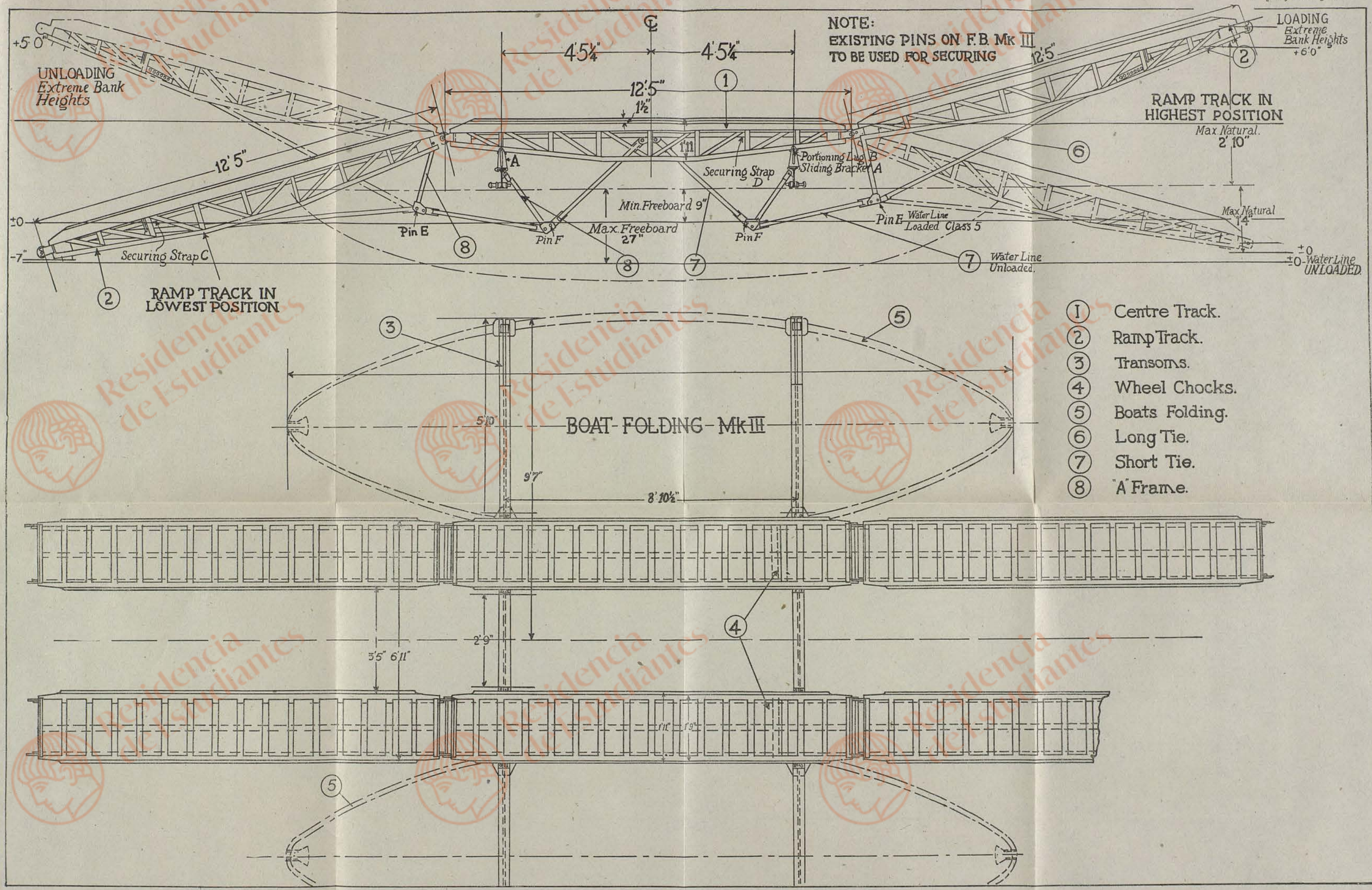

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FIG 11.—FBE raft, Class 5, Mk III

(*b*) *Offloading.*—It is assumed that all stores are loaded in transport and are driven up within 30 yds of river bank. As the method of loading is not fixed, no unloading drill can be laid down. Stores shall be offloaded and laid out as per Fig 12.

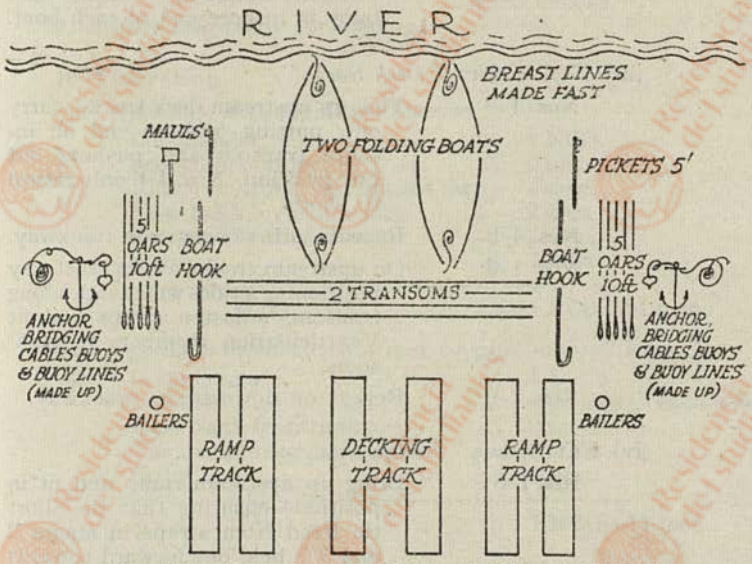


FIG 12.—Stores layout, FBE raft, Class 5, Mk III

(*c*) *Construction*

(i) NCO orders "*Form raft*".

All Nos.	Open up folding boats, place in each one boathook and launch boats.
Nos. 10 & 11 (breastline men)	Will pick up breastlines and make fast to two 5-ft park pickets 10 yds up and downstream from boats. Boats will be held with axes at right angles to the stream.

(ii) NCO orders "*Transoms*".

Nos. 1 & 3 2 & 4	Get in to up and downstream boats respectively and lie down in inshore bows.
Nos. 5–8	Bring up first transom, parallel to shore, and pass it over heads of 1–4 who stand up and carry out and fix in offshore position.

No. 9	Unfastens canvas straps on raft end of ramps, pulls out short tie rod and re-fastens straps.
Nos. 5–8	Above repeated for second transom. Put one made-up anchor and buoy in inshore end of each boat.

(iii) NCO orders "*Deck tracks*".

Nos. 1–6	Pick up upstream deck track—carry out, putting offshore end on inshore transom and pushing out into position. Nos. 4–6 only return to shore.
Nos. 4–9	Repeat with downstream trackway.
Nos. 1–3	On upstream trackway, fit trackway positioning guides which slide along transom, unfasten straps and fit V articulation members to transoms.
Nos. 7–9	Repeat on downstream trackway.

(iv) NCO orders "*Ramps*".

Nos 1–6	Bring up upstream ramp and fit in position—ensuring that the short tie freed from straps in stages 2 and 3 is held out forward towards the boat (otherwise this cannot be brought into position as it fouls the ground).
Nos. 1–3	Remain with ramps to fit short tie to knuckle joint below deck trackway. Adjust ramp heights to suit estimated height of far banks.
Nos. 4–9	Repeat with downstream ramp and fit short tie as above.

(v) NCO orders "*Swing raft*".

All Nos.	Push raft offshore and swing round to bring ramps offshore.

(vi) NCO orders "*Ramps*".

Stage (iv) is repeated for the second pair of ramps. Ramp heights are adjusted to home bank height.

(vii) All Nos. Put in each boat :—

5 oars.
2 dodgers (if available) (Fig 10).
2 wheel chocks.

9. Raft is now ready for loading.

10. **Operation**

(*a*) *Operation with two Seagull motors.*

Commander	1 NCO.
Seagull operators	2 men.
Raft, breastline, and anchor men	4 men.
Near bank breastline men ...	2 men.
Far bank breastline men ...	2 men.
Spare	1 man.
Total	1 NCO—11 men.

(*b*) *Operation by hand.* (Current or wind under 2 knots.)

Commander	1 NCO.
Rowers	6 men (3 in each boat).
Near bank breastline men ...	2 men.
Far bank breastline men ...	2 men.
Spare	1 man.
Total	1 NCO—11 men.

11. Whether operation is by motor or by hand, the method is to have two men on each bank to hold the raft into shore while the load goes on or off. This point is very important because then the boat tends to push out from the bank. The breastline men should take two or three turns of the breastline round a picket driven firmly into the bank. The ramps are self raising, being operated by the load itself on the centre track. The ramps can be adjusted to different bank heights by lengthening the long struts and altering the position of the pins in the short struts at the shore end of the ramp.

12. The crossing can then be carried out by oarsmen or by the Seagull motors as shown in para 10 (*a*) and (*b*). A ferry rope should always be attached if possible for ease of handling, especially in a strong wind or current.

13. It should be noted that for loading and offloading at maximum heights the slope of the ramp will be approximately 1 in 4. Help may be necessary with rope tackle in loading to prevent the load slipping on to the raft too fast and damaging it, and in offloading to assist the load to climb the slope, which may be slippery.

SECTION 12.—CARRIER FLOTATION

General

1. With suitable bank conditions carriers can be floated across water gaps with their full battle load by either of the methods described in paras 10 and 11. Commanders must have full knowledge of the capabilities of carrier flotation and drivers must have as much practice as is possible to get the best results. In the succeeding paragraphs general limitations and hints on how to overcome them are given for both methods. These are brought out in Fig 13.

Before flotation sets are fitted, certain preparations are necessary to waterproof the carrier. This applies more to the earlier marks of carrier than to the later, which were constructed with flotation in view. Further reference to this is made in Appendix D.

Limitations

2. The ideal entry is a gently sloping bank with a hard bottom, but carriers controlled at a very slow speed will enter deep water down a bank with a maximum safe slope of 1 in 3½. The worse the entry the more important it is that the carrier should enter very slowly and steadily. Carriers will not enter deep water over a vertical bank much higher than 6 ins, as the carrier tips forward and plunges its nose into the water and fills.

3. The carrier, with engine running at full speed, by the rotation of its tracks can propel itself through water at a speed, depending on the gear used, not higher than 2–2½ miles per hour. If impellor cowls are fitted, the speed can be increased to 3½ miles per hour. This speed involves changing gear. If the engine does stall while afloat, it should be restarted as quickly as possible to avoid getting water into the exhaust pipe.

4. The carrier is steered in water as on land by braking on one track. As with a boat care must be taken to check a turn early or the carrier will overswing. If there is a fast current, carriers will want assistance to cross the gap.

5. The carrier should be driven squarely at the bank, and requires an underwater slope of 1 in 7 for the tracks to grip. If only one track grips, the carrier may not get out. The " way " of the carrier will often help it to overcome any small underwater obstruction and similarly a pull on a rope attached to the carrier by 3 or 4 men on the bank will give it the added track grip necessary to start to climb. Once the tracks have gripped, the carrier is capable of its normal cross country performance.

6. It follows from the last paragraph that a carrier unaided cannot get out up a vertical or nearly vertical bank from deep water. It may, however, be assisted in this by attaching tow ropes

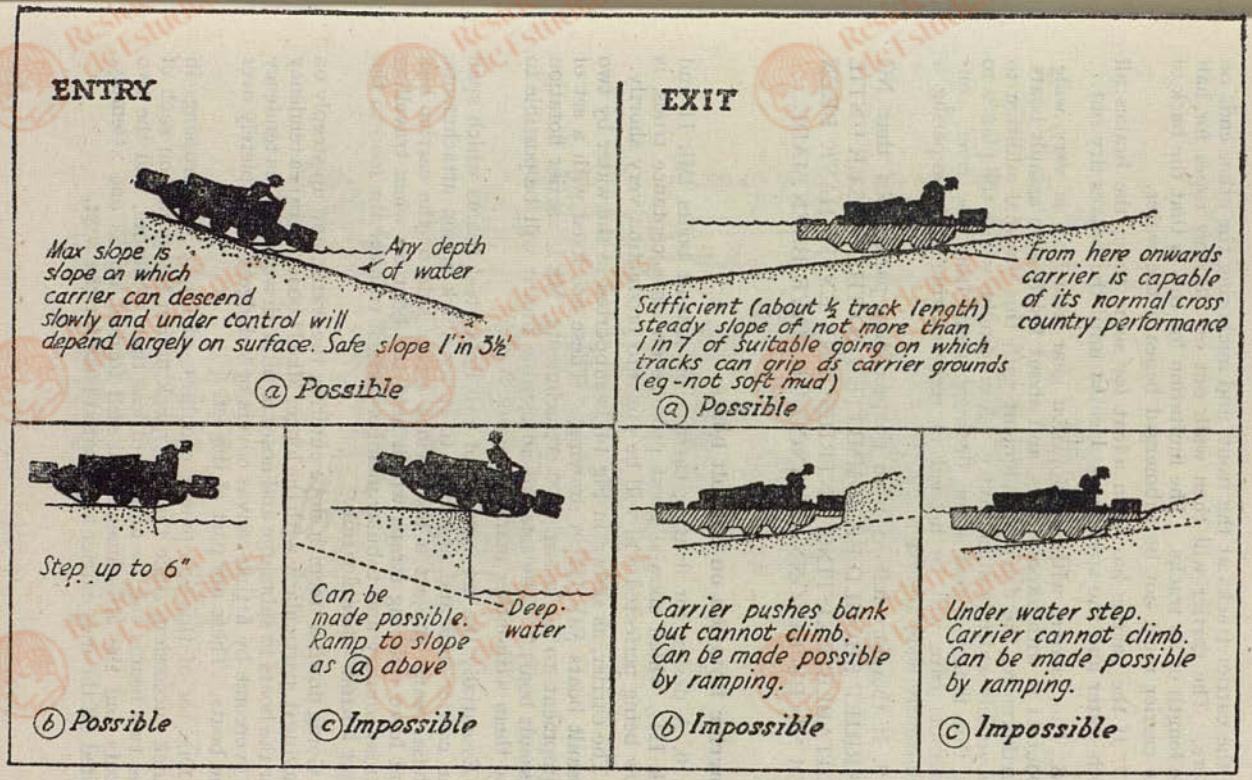


FIG 13.—Carrier flotation limitations

to the carrier tracks at the front, and anchoring the other ends on shore. The carrier will then walk out on the tow ropes for half the length of its tracks. The limitation for this is that the back of the carrier must not be submerged beneath the water.

7. If the carrier has been afloat for some time, the brakes fill with water and the steering is affected until the brakes dry out.

8. The carrier, with its flotation gear attached, is very wide, about 11 ft with kapok floats, and about 19½ ft with assault boats. Furthermore, the driver's judgment with this unusual addition to his vehicle width is often faulty. Accordingly, where the plan is to fix this flotation gear some distance away from the river, considerable care will be needed in reconnoitring and preparing a sufficiently wide approach.

9. It therefore follows from the preceding paragraphs that NO CARRIER SHOULD BE COMMITTED TO THE WATER UNTIL SUITABLE EXISTING ENTRIES AND EXITS HAVE BEEN FOUND BY RECONNAISSANCE OR HAVE BEEN MADE.

Carrier flotation on assault boats

10. A design for floating carriers on assault boats (Mk II and Mk III), which showed great promise on its acceptance trials, is now being perfected and will be put into production very shortly.

The carrier, as shown in Fig 14, is supported in the water by two assault boats (Mk III in drawing). These are fixed with a set of equipment to be known as " Attachments, Mk I, carrier flotation (assault boat)." The sets are adjustable and it will be possible to use them with either mark of assault boat.

Essentially the set consists of two light steel beams which span the carrier hull and are fixed to it by quick action attachments. These beams project a boat width either side of the carrier hull and have webbing straps which hold the boat up when travelling across country and tubular members which transfer the load to the boat bottom when floating.

Going down a steepish slope entering the water, and up steeply on leaving it, particularly with the longer Mk III boat, there is a tendency for the boats to submerge and noses to fill with water. This tendency is overcome by fitting canvas covers or " dodgers " completely over the boats. These are part of the set.

One set of this equipment can be used for several crossings in quick succession, since the two quick action fastenings on each of the two beams can be undone in less than a minute, and the two boats and the attachments, all still formed up as one assembly, lifted off the first carrier and floated back for the next.

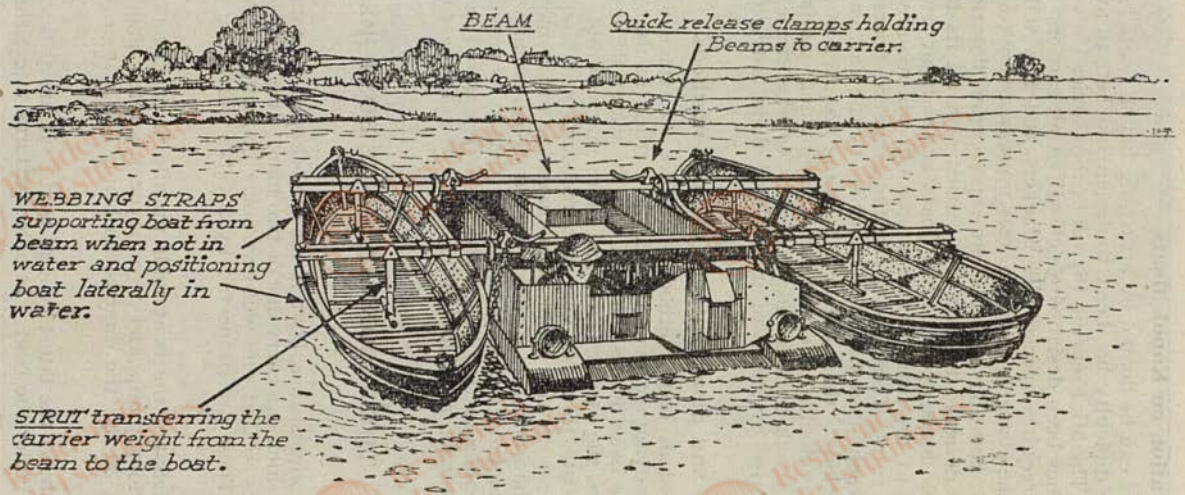


FIG 14.—Flotation of carrier with Mk III assault boats

Carrier flotation on Kapok floats

11. Carriers can be floated by attaching kapok floats as shown in Fig 15. The difficulty has been to design brackets to fit all types of carriers. The Mk I set (Fig 16) will fit the Carrier Universal Mk I. A Mk II set has been designed which will fit all carriers except the T.16, which requires special rear brackets, and the AOP Mk III, from which the charging engine in rear must be removed.

The Mk I flotation set (attachments carrier flotation, kapok method) was designed to float the carrier with all its battle load using 9 kapok floats, spaced three floats at the front, two at each side and two at the rear. An armoured OP will require one extra float at the rear. These floats are the standard floats from the kapok equipment and they are attached to the carrier hull with 8 special brackets ; these differ slightly and are used as follows :— one pair for each side, one pair for the front and one pair for the rear. Each bracket clips independently to the carrier and the floats are secured by means of an attached chain fastening.

Advantages and disadvantages of both methods

12. The assault boat method is quicker to attach and detach and has an advantage over the kapok method in that the set is easier to take back across the gap. In the water the assault boat method makes the carrier faster and more manœuvrable and with the Mk III boats, there is a very safe freeboard on the boats.

The carrier with the kapok attachment is much narrower but longer, and the front and rear floats are apt to foul on uneven ground. The kapok method has the advantage that it is less subject to damage by enemy action before the water is entered and damage does not cause such rapid loss of buoyancy as in the case of a boat.

Section 13.—THE RECONNAISSANCE BOAT (RE ONLY)

Description

1. The reconnaissance boat is an oval-shaped pneumatic black rubber boat which can carry one or two men. It is divided into two compartments so that one will give some buoyancy if the other is punctured. These are connected by a valve which can be opened or shut.

2. When deflated the boat folds up and is packed in a canvas bag with a foot pump and two bayonet jointed paddles. The whole weighs 39 lb., the dimensions being 1 ft 3 ins diameter by 2 ft 6 ins.

3. Fig 18 shows the latest type of boat. It has two seats which stretch right under the boat. In older patterns where they did not

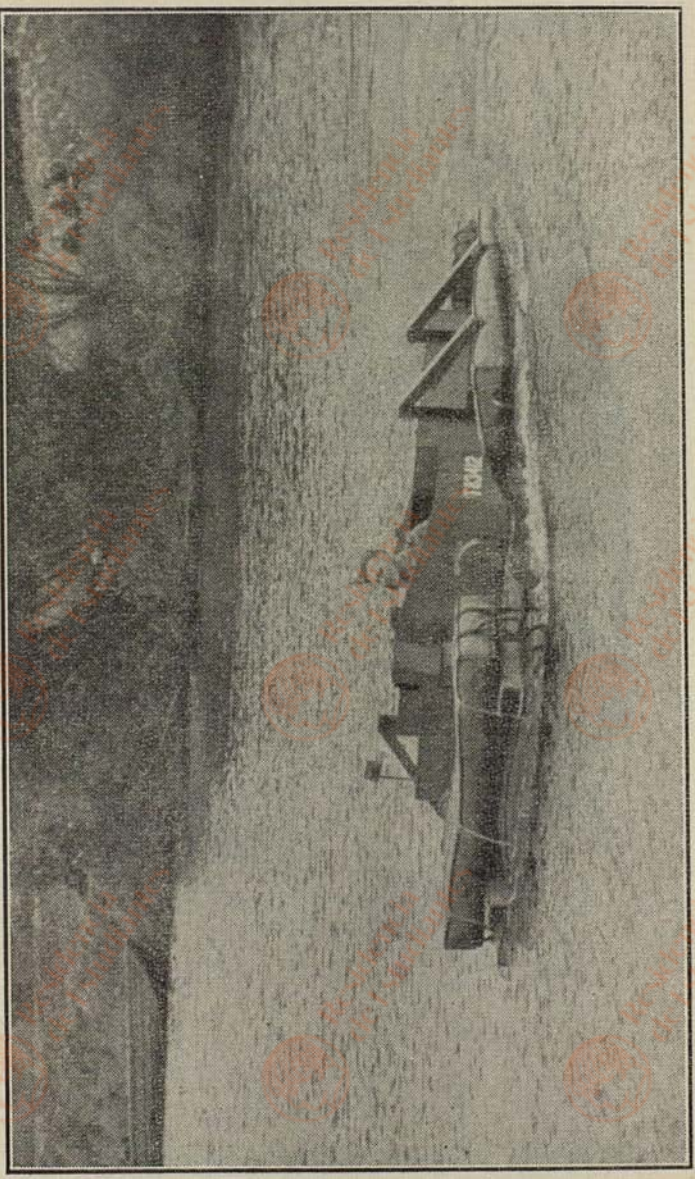


FIG 15.—Carrier flotation on kapok floats (old type attachments)

FIG 16.—Carrier flotation with kapok floats (Mk I attachment set)

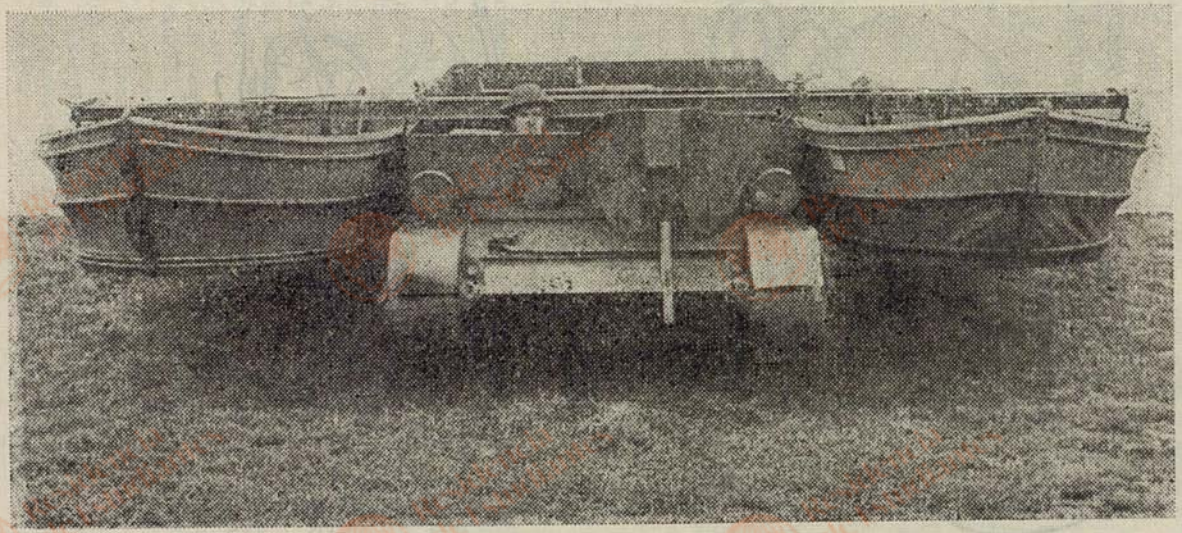


FIG 17.—Carrier flotation on Mk III assault boats (Mk I attachment set)

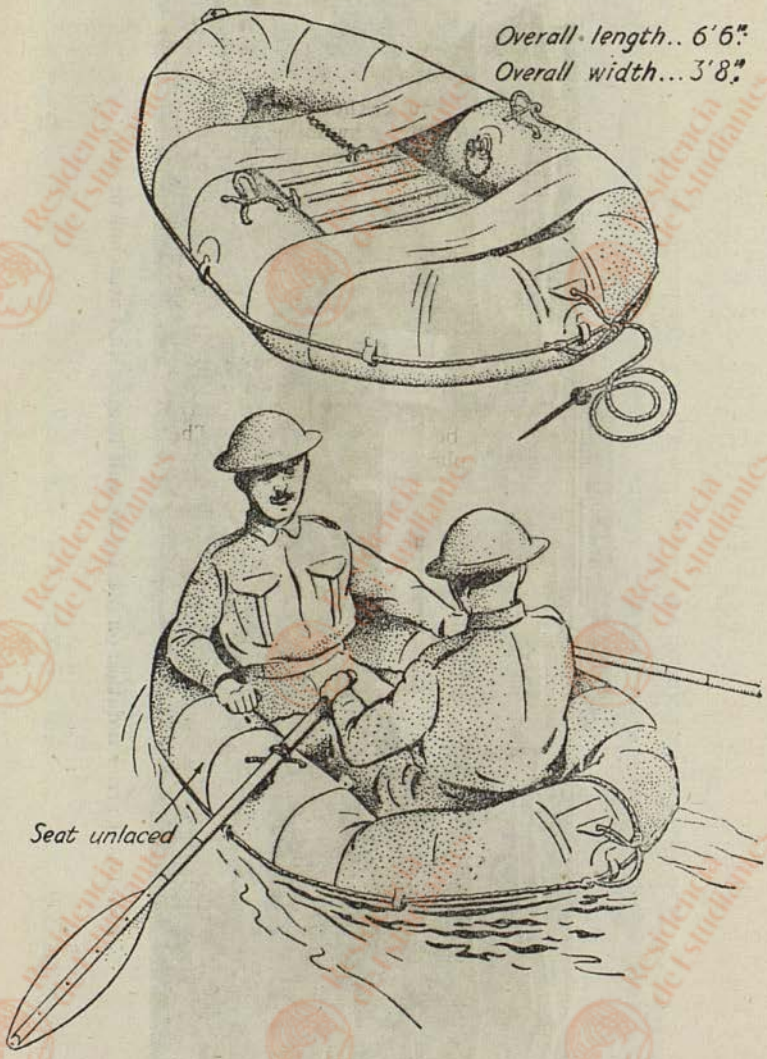


FIG 18.—Reconnaissance boat, Mk II

do so seats were apt to tear out. One seat is laced in the middle and can be undone.

4. There are two rope loops provided inside which interlock to form rowlocks. A mooring pin is attached by a cord to one end and a loop is provided at the other to which a cord can be made fast.

5. A life line is attached round the boat at water level, which may be used for carriage or by a swimmer to hold on to. The buoyancy of the boat (air chambers only) is 650–700 lb.

Carriage

6. The boat is part of the equipment of every RE officer's truck in field units. A reserve of these boats is carried in the assault platoon.

To inflate the boat

7. With the Mk III boat the rubber hose from the foot pump is attached to the nozzle, the valve on the opposite side is opened, and the boat is filled with air. Inflation takes about two minutes and should cease when the skin is taut as no extra buoyancy is obtained and damage may be done to the boat. The foot pump is removed and the cap is replaced. The valve is then turned to the shut position and the air chamber is divided into two compartments.

8. With the older marks of boat the nozzle is at the centre of a tube which is connected through two valves to each side of the air chamber. Otherwise inflation is carried out in the same way.

For deflation remove the cap valve on the nozzles.

Use

9. The boat is used for reconnaissance. It is very light and can easily be carried and blown up by one or two men. It can be used to carry small objects and to take a ferrying cable across a river.

When used by one man he should sit on the laced seat (seat nearest the centre) facing the other seat and row. When it is used by two men the centre seat should be unlaced. One man sits on the other seat facing into the boat and rows. The second man should sit in the bottom of the boat with his back against the end at the opposite end.

Care and maintenance

10. Every effort should be made to avoid damaging the rubber fabric, as only small punctures can be patched and even small punctures if left will soon extend into irrepairable tears. A motor tyre puncture repair outfit type C is provided with each boat. Before packing, the mooring pin should be stowed in the pocket under one seat to avoid the risk of damage, and the boat will be dried as soon as possible, and lightly dusted with french chalk to prevent sticking. In store the boat should be unfolded and partially inflated, and should not be exposed to direct sunlight or heat.

SECTION 14.—THE STORM BOAT
(not in the assault platoon)

General

1. A RE stormboat is a power-driven plywood boat about 20 ft long by 6 ft 6 ins wide. The boats are designed so that they will nest inside one another for transport, the nesting depth being 10½ ins gunwale to gunwale. This boat is designed to be used as mentioned in Sec 8, para 3 (*e*) for an opposed crossing over a wide fast river. The boat is still in its experimental stage. This Section describes the provisional boat on its first trials.

Detailed description

2. The boat has an oak frame and its sides and bottom are of plywood. The seat tracks extending from the stem transom as shown in Fig 19 are of oak and serve both as seats for passengers and wheel tracks for guns, etc. For unloading and loading guns, etc., steel ramps are attached to the forward end of the seat tracks. The ramps are hinged approximately at the centre and the outboard ramps fold inboard for travelling. The outboard ramps may be set in any of three positions relative to the inboard ramps to suit different bank heights from water level to approximately 3 ft above water level.

3. The flooring between the seats is made hinged to facilitate baling.

4. A 55 hp motor (Figs 19 and 20) is used to propel the boat and the stern is cut away to obtain the desired depth of propeller. The motor has no clutch and the propeller is not reversible. A steering angle of approximately 90 degs is obtained. The vertical shaft is hinged on the transom bracket so that the motor tilts on striking the river bed in shallow water. The motor including the transom bracket is supported on the apex of an A-frame, the legs of which are attached inboard. This arrangement enables the motor to be brought inboard quickly if necessary.

5. The motor runs on petrol oil mixture and four 2-gallon cans will be carried under the seats of each boat.

6. Other attachments to the boat include :—

(*a*) Canvas dodgers which will fold under the gunwale when the ramps are in use to prevent intake of water over the bows.

(*b*) Two breast lines with spikes attached which are secured to ring bolts in the stern transom.

(*c*) Wheel chocks which are provided on the seat tracks to stop the guns in the required position and to prevent movement of the gun during crossing.

Carriage

7. The stormboats will be transported in 3-ton 4-wheeled GS lorries stern foremost.

8. Three boats are carried in each lorry, nested in one another, gunwales upwards, the chines of the lower boat resting on a timber

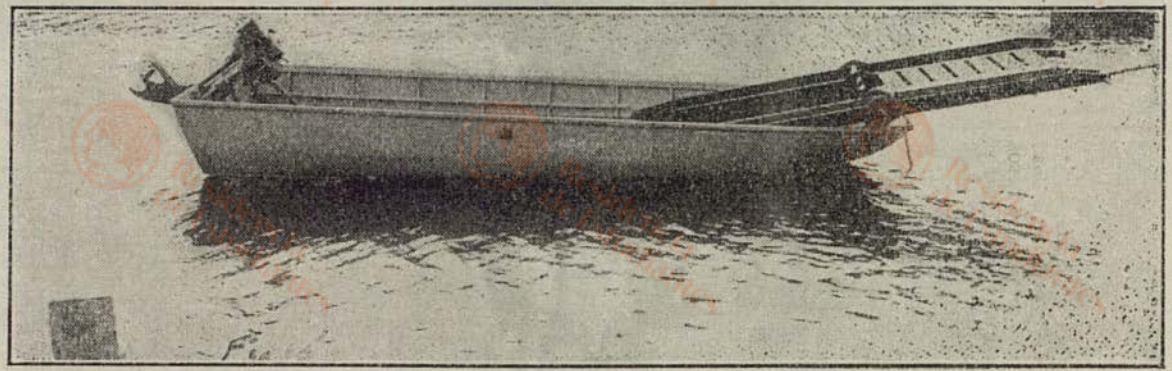


FIG 19.—Storm boat

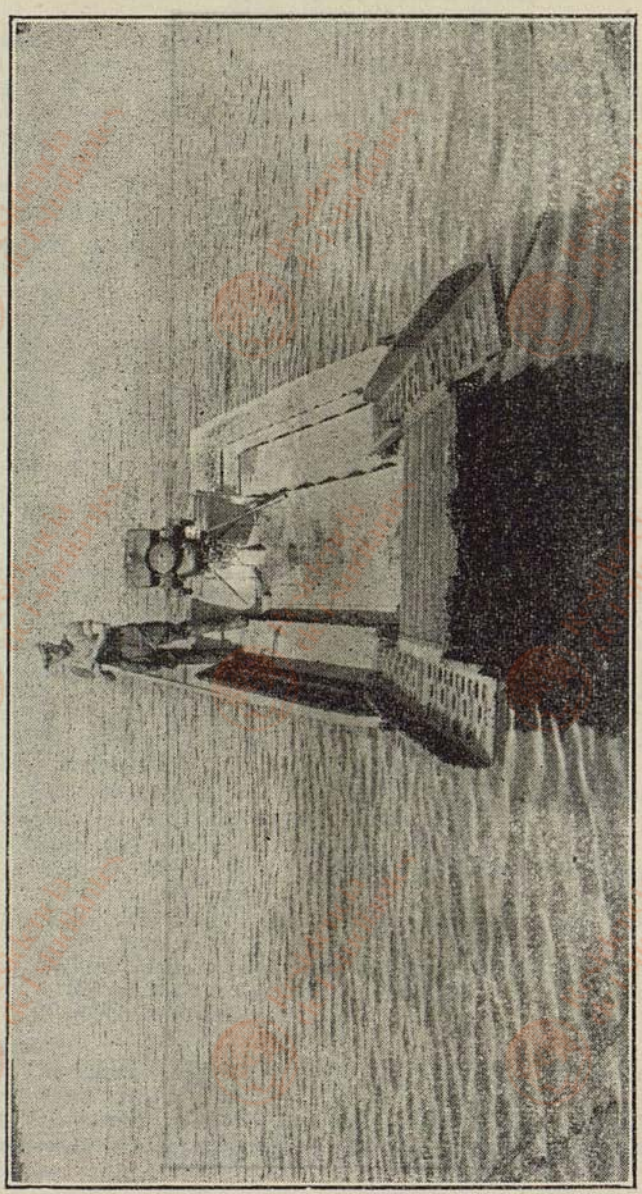


FIG 20.—Storm boat

cradle approximately 18 ins above the bottom of the lorry, thus enabling the sides of the boat to clear the sides of the narrowest lorries.

9. The ramps and three engines will be carried in the top boat. The engines are supported in a timber cradle, the whole being lashed down and covered with a canvas cover.

Operation

10. Trials for carrying the boat and its use have not yet been carried out. Its weight is 800 lb without the ramps and motor, which weigh respectively 250 lb and 180 lb. Its total displacement in reasonably calm water with a safe freeboard is 4,900 lb.

11. It will carry 18 fully equipped infantry in addition to the boat's crew of two men. Alternatively in favourable conditions it will carry a 6 or 2-pr anti-tank gun and crew excluding ammunition, or a peep. Its speed varies with its load from approximately 8 to 10 mph at full load to 20 mph empty.

Loading and unloading 6-pr A tk gun

12. The ramps are set to suit the height of the bank by engaging the pins at the underside of the centre joint in one of these positions as required. The boat is held offshore, allowing sufficient water under the bows to prevent grounding as the load goes on by driving one of the spikes attached to the stern of the boat through the hole in the lug on the downstream ramp. The other spike and line is used as a breast line on the upstream side. If there is no current the boat may be held square with the bank by driving both spikes through the holes in the lugs at the ends of the ramps.

13. The guns are loaded muzzle first. Either one or two gun teams will be required to load or unload depending on the condition of the bank.

14. Wheel chocks must be used to locate the gun in its correct position and to ensure it does not move during the crossing.

15. The correct position for 6-pr gun (Fig 21) and crew is with the axle of the gun 6 ft 1 in forward of the outside of the stern transom, crew forward of gun on seat tracks.

16. The correct position for 2-pr and crew is with the axle of the gun 10 ft 2 ins from the bow transom, crew rear of gun on seat tracks.

17. Care must be taken not to make sharp turns when the boat is fully loaded, or water will be shipped over the sides.

Loading and unloading peeps

18. The ramps are set to suit the bank as for anti-tank guns, but the centre foot ramp is removed and the ramps moved as close to each other as possible to accommodate the narrower wheel track of the vehicle.

The position of the vehicle for travelling should be with the centre of the rear wheels over the end of the seat track.

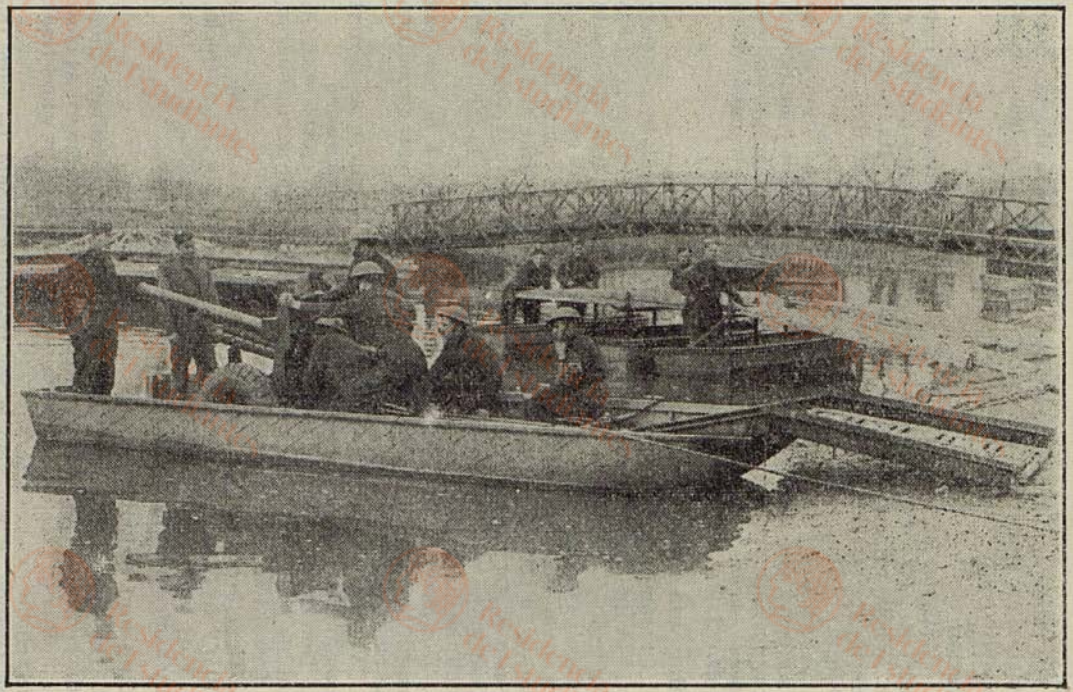


FIG 21.—Storm boat loaded with 6-pr A tk gun

SECTION 15.—MISCELLANEOUS EQUIPMENT (not in assault platoon)

1. "Tracked" bridges

(*a*) Bridges 12-ft, No. 3 (Figs 22 and 23) are provided to carry class 9 loads over small gaps. Two trackways, each weighing between 450 and 500 lb, form the bridge. They are an engineer store and are not carried in field units or in the bridge company.

(*b*) Bridges 20-ft, which are now obsolescent, may be available from RE sources. Their use is an RE responsibility. The bridge consists of two trackways, and two complete bridges are carried on a special 3-ton lorry which can launch them. The bridge can take the following loads :—

Class 12—4-wheeled vehicles.
Class 18—6-wheeled vehicles.
Class 24—tracked vehicles.

2. Covenanter, Bridgelayer (lately known as the Scissors bridge)

This bridge has an overall span of 30 ft. It is carried with its two half spans in a folded position on top of a specially equipped tank, and is launched hydraulically through gearing by means of the tank engine without exposure of personnel. It is a RAC responsibility. The load capacities are as follows :—

Class 12—4-wheeled vehicles.
Class 18—6-wheeled vehicles.
Class 30—Tracked vehicles.

3. Churchill, Bridgelayer

This is a 30-ft bridge designed on a different principle to carry out the same action as above. It is again a RAC responsibility and its provisional load class for tracked vehicles is 55.

CHAPTER 4

IMPROVISED METHODS

SECTION 16.—GENERAL

1. Occasions will arise when improvisation from local resources is necessary, either to supplement the equipment or in special circumstances to replace it when it is not available. The principle involved is that the buoyancy of the raft or boat must be more than the load it has to carry.

2. The net buoyancy of a closed vessel, such as a barrel or petrol tin, is the weight of water it will displace when fully immersed less its own weight. To find the net buoyancy, therefore, the volume

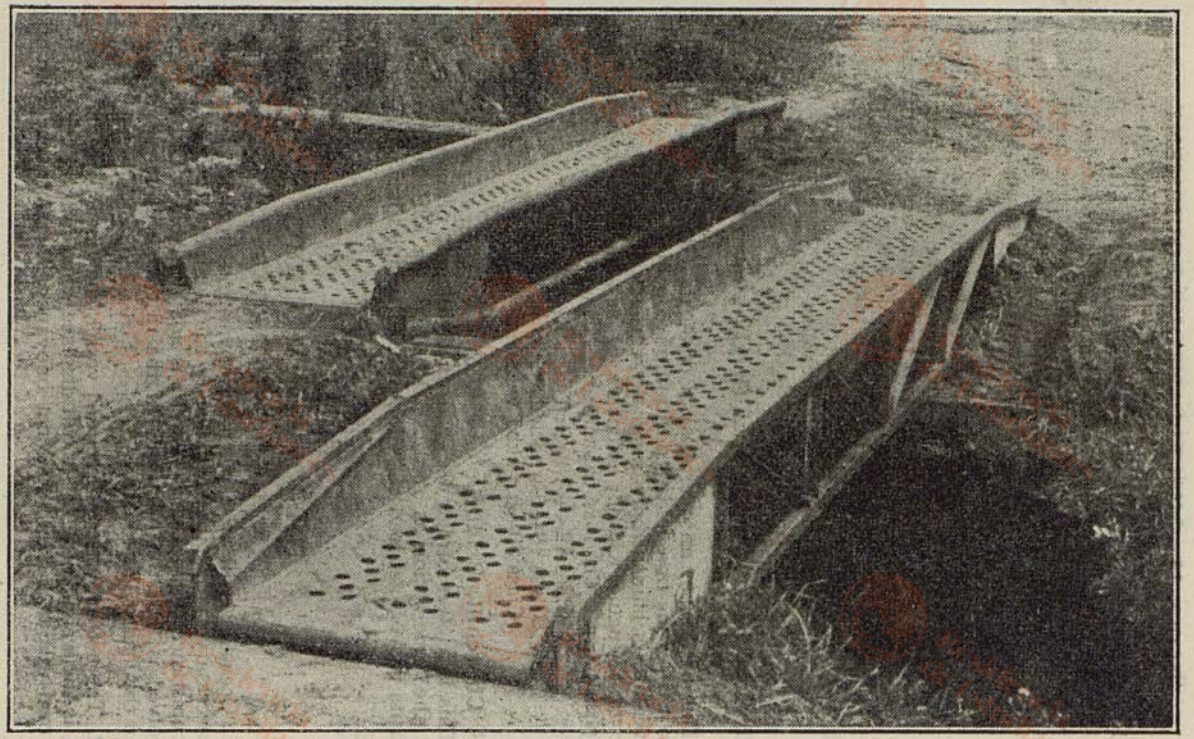


FIG 22.—Bridges 12-ft, No. 3, Mk I, Class 9

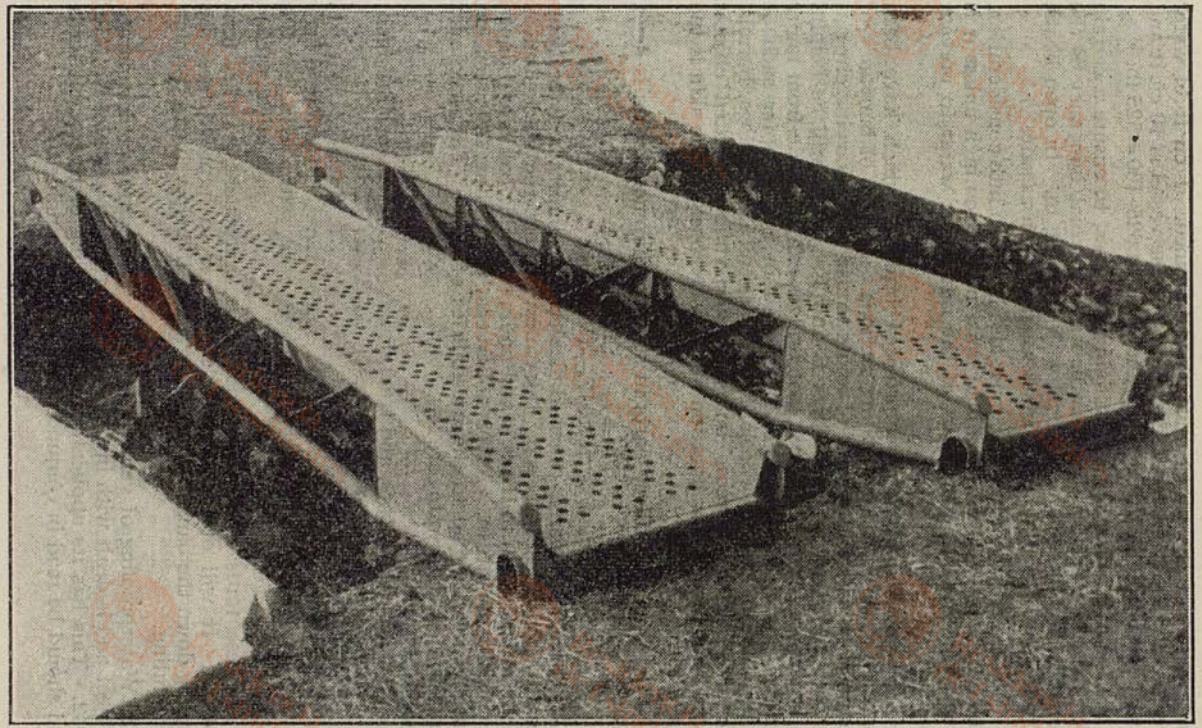


FIG 23.—Bridges 12-ft, No. 3, Mk I, Class 9

and weight of the vessel must be determined. 1 cu ft of water weighs 62·5 lb, therefore if the volume of the vessel is 10 cu ft and its weight is 100 lb, the net buoyancy will be 625–100=525 lb.

3. The safe buoyancy for bridging purposes, to ensure a certain freeboard, is taken as nine-tenths of the actual buoyancy if the vessel is closed, such as a barrel with its bung in. In open boats, two-thirds the actual buoyancy is usually taken as safe.

4. The stability of any raft must also be taken into consideration. The centre of gravity of the load must not be too high unless it is counterbalanced by some part of the raft under water to prevent overturning.

5. Several examples of improvised bridging which have been used are given in the succeeding sections. A table of buoyancy of common objects and a table of knots to use under varying circumstances are given in Appendices E and F. These will be helpful in improvisation. Rafts and foot bridges can be made from many other common materials not mentioned in this Chapter such as inner tubes of vehicle wheels, tail boards, oil drums, logs, barrels, etc. Vehicle tubes, recce boats, or any rubber inflated objects should not be used for flotation of guns, etc, because the skin is too easily torn.

6. Carriage of artillery parts in service equipment boats is dealt with in Sec 24.

Section 17.—FORDS

1. There are many other difficulties in improvised bridging besides getting the necessary buoyancy to float the load, such as getting the load on to the raft and finding suitable banks and depth of water to operate in. As it is not an easy proceeding, full attention must always be paid to the possibilities of fords. The maximum fordable depths of water are :—

Motor cycles	1 ft.
Armoured cars, cars, and trucks	1 ft to 1 ft 6 ins.
Lorries and heavy ambulances	2 ft.
Bren carriers and light tanks	3 ft.
Heavy tanks	3 ft to 3 ft. 6 ins. (depending on the size of the tank)

2. These fords must have good exits, approaches, and a firm bottom. It will often be possible however to improve fords by digging down the banks and laying track or to help vehicles through by hauling.

3. Waterproofing of vehicles for landing operations is a separate subject and is dealt with in Combined Operation Pamphlet No. 41c, 1942. This has its application to the crossing of rivers and fords and should be read in conjunction with this pamphlet.

Section 18.—GROUNDSHEET FLOAT

General

1. This is a method for infantry of crossing a water gap with their own personal weapons and equipment without getting them wet.

The method consists in wrapping the clothing and equipment in the groundsheet in such a way as to form a boat.

Construction

2. The men will work in pairs. Spread one groundsheet on the ground, rubber side down. Next, lay the two gas-capes on top of the groundsheet. Lay the two rifles on the gas-capes, lying the long way of the groundsheet, with the butt of one opposite the muzzle of the other. Space the rifles apart at each end with the haversacks and place the respirators on top of the haversacks. Next place the two pairs of boots and web equipment. (*See* Figs 24 and 25). This will fill in the space between the rifles. The clothing is now laid on top of the boots and web equipment. The gas-capes are then pulled up round the pile, and the second groundsheet is laid over it, rubber side uppermost. Tuck this in evenly under the rifles and haversacks. (*See* Fig 26.) Take the edges of the first groundsheet and lift it up so that they can be laced together over the top of the pile with a piece of string or, failing that, with rifle pullthroughs: bootlaces should not be used. The string must be laced through every eyelet of the groundsheet and the edges drawn as close to the top of the pile as possible. The corners of the groundsheet will have to be carefully "dog-eared," and the collar of the groundsheet will have to receive careful attention to ensure that there is as much "freeboard" as possible to the boat which is formed. Two or three lashings should be taken at intervals round the whole boat, and one fore and aft to help hold the whole securely together. (*See* Fig 27.) Rifle slings can be used for this purpose if string is not available. It is a good thing to cock up the ends of the boat canoe fashion, by means of the fore and aft lashing. Leave 10 ft or 12 ft of string over from the fore and aft lashing with which to pull the boat.

Method of use

3. The float when placed in the water will draw about 3 ins of water, and will have about 4 ins of freeboard. It is remarkably steady, owing to the ballasting effect of the rifles, and has about 30 lb reserve buoyancy. If both men are swimmers, the boat is propelled as shown. (*See* Fig 28.) If one of the men is a non-

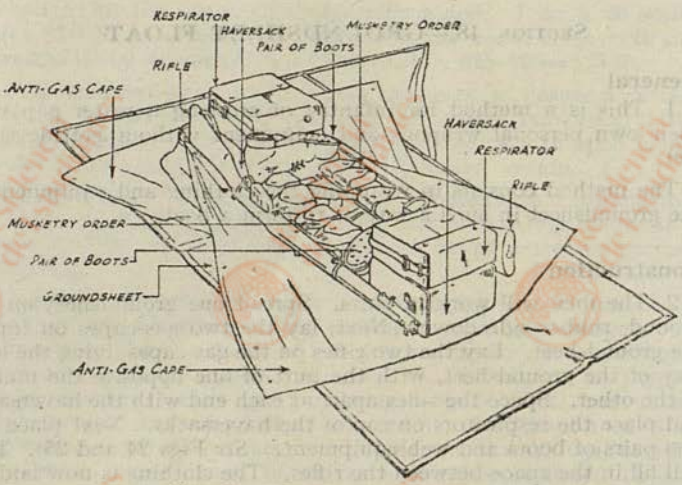


FIG 24.—Groundsheet float

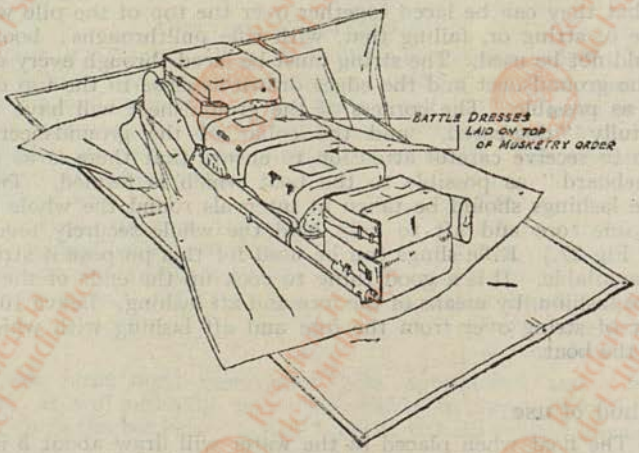


FIG 25 (*see* Fig 24)

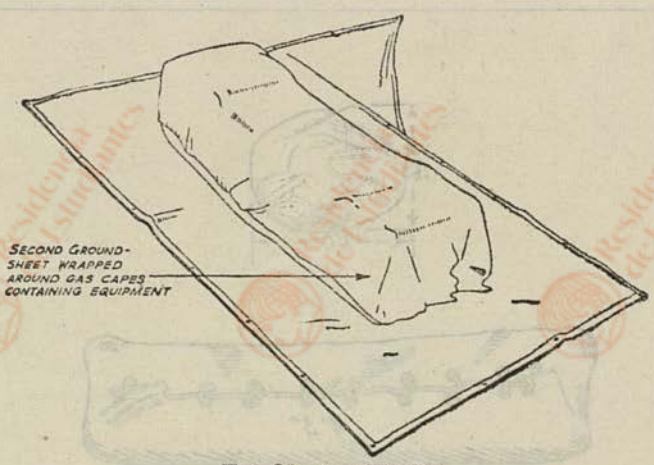


FIG 26 (*see* Fig 24)

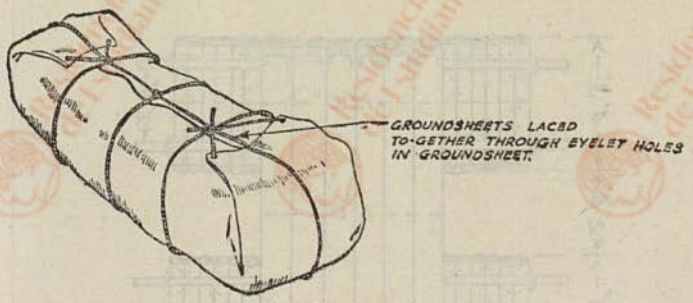


FIG 27 (*see* Fig 24)

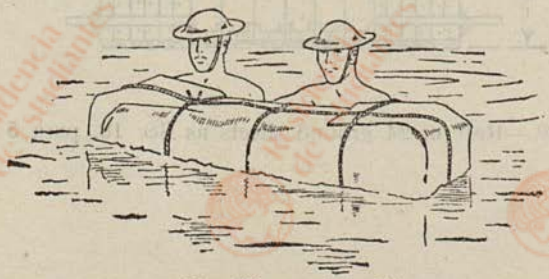


FIG 28 (*see* Fig 24)

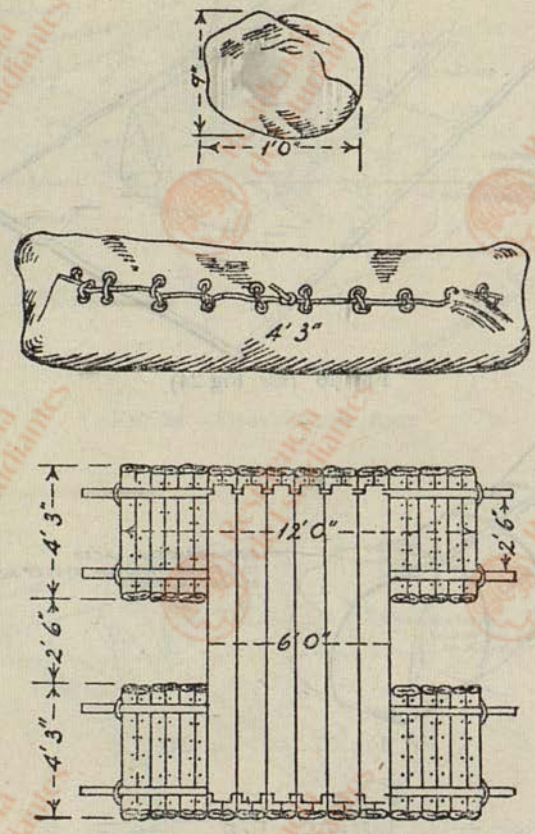
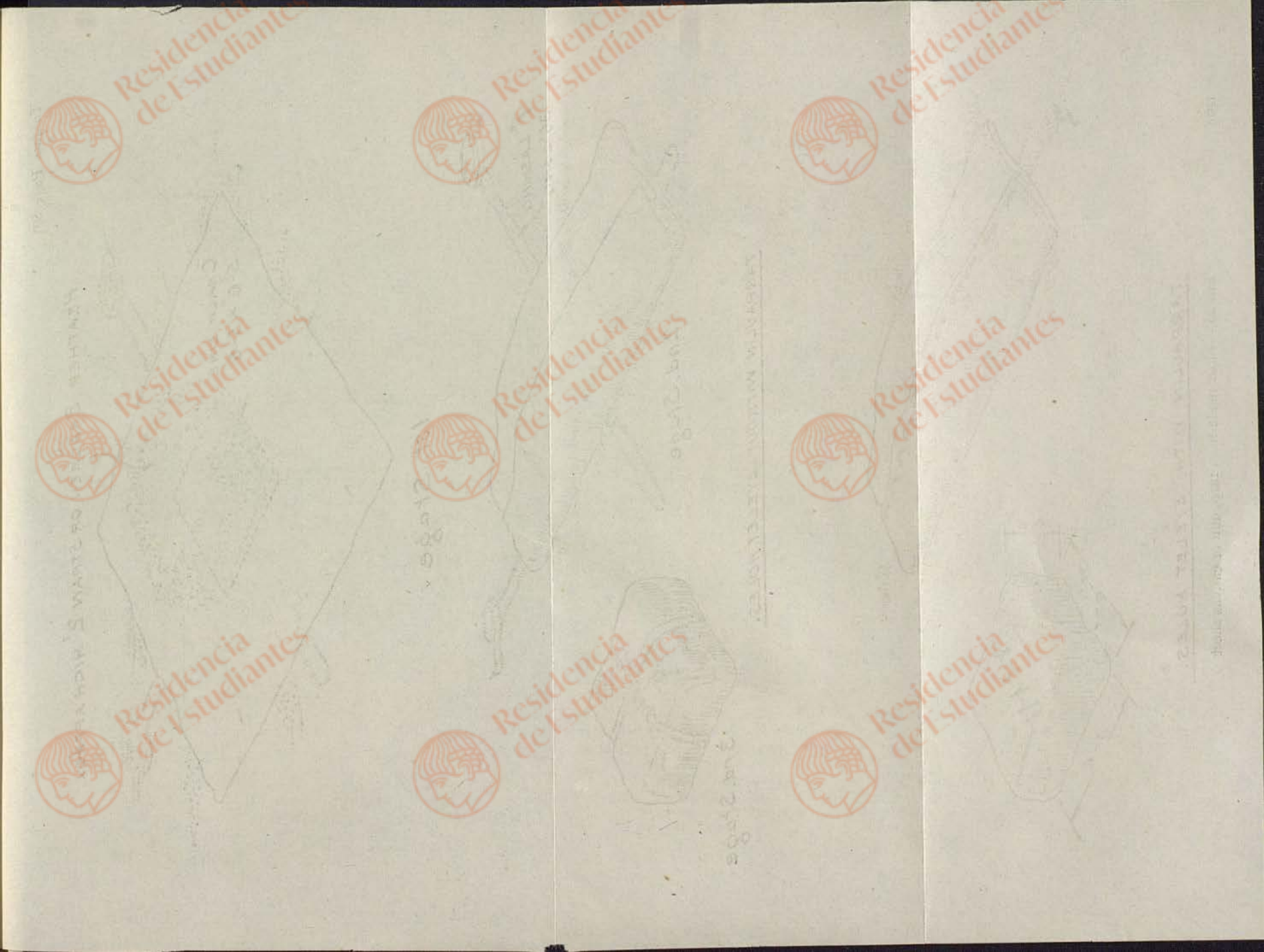
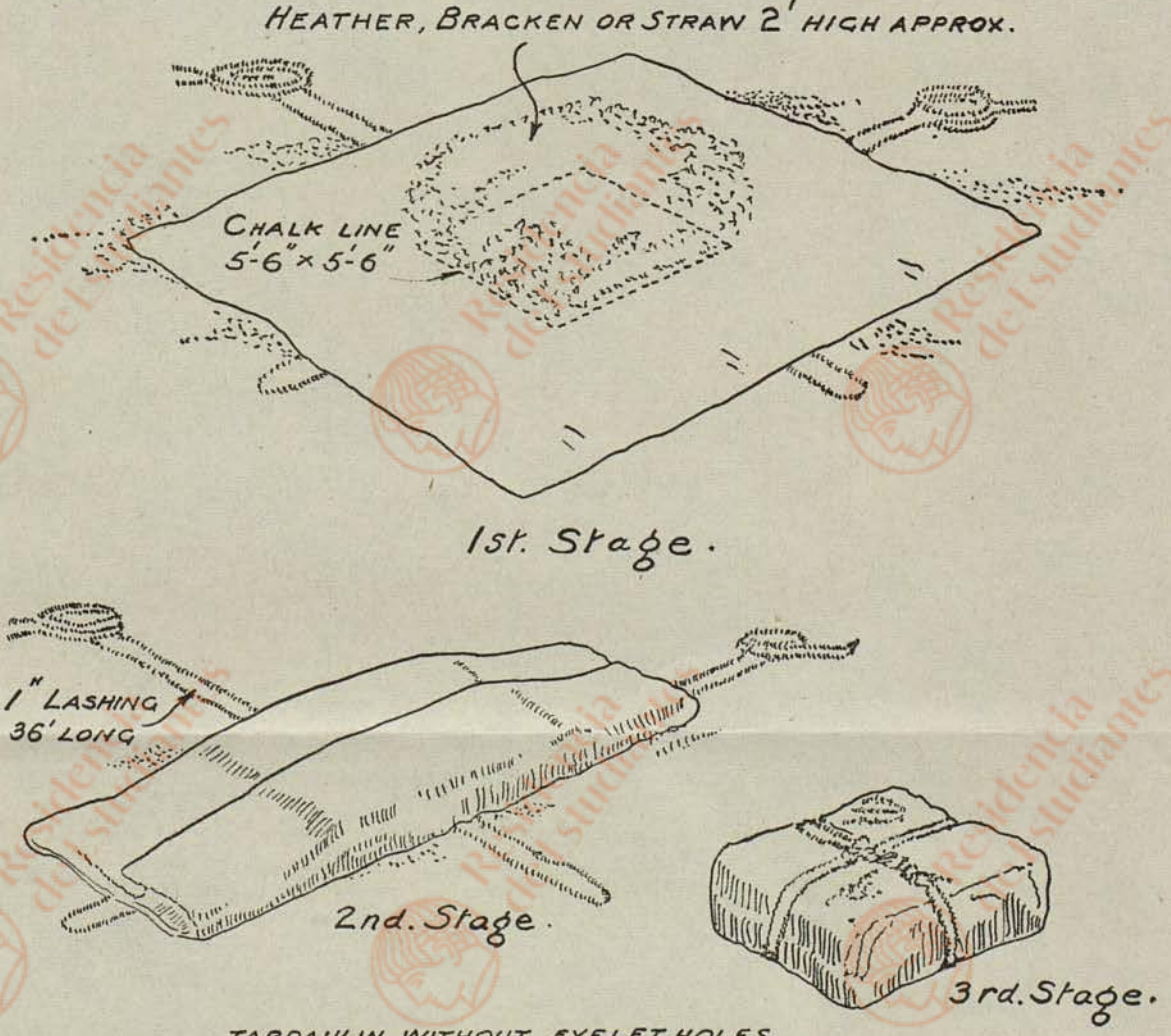
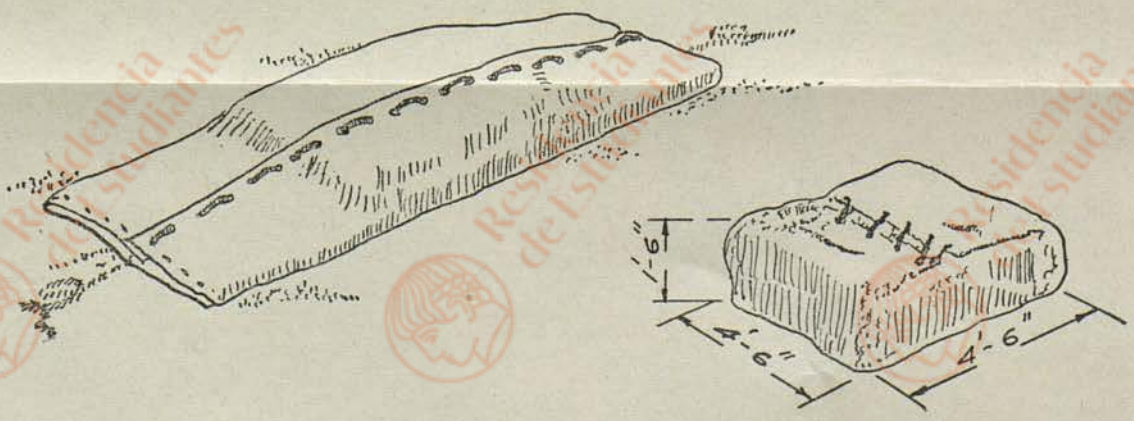


FIG 29.—Raft of 24 ground sheets as Sec 18, para **5**





TARPAULIN WITHOUT EYELET HOLES.



TARPAULIN WITH EYELET HOLES.

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FIG 30.—Float made from tarpaulin or canvas sheet

swimmer, he will lie on his back and kick with his legs; the other member of the pair, who must be a swimmer, pushes the float from the back.

Two such floats are capable of supporting a LMG or 2-in mortar.

Training

4. This float can be constructed by trained men in daylight in eight minutes and by night in thirteen minutes. Since most crossings will be undertaken at night, it is essential that men should be adequately trained to construct the float in the dark.

5. A raft to support 1,800 lb can be made from 24 groundsheets built in the above manner, but filled with straw, tied together into a frame, and decked over as shown in Fig 29. One groundsheet only is used for each float. If the raft has to make more than one crossing two groundsheets should be used for each float. The figure shows an alternative method of tying the groundsheet by means of a cord passed through the eyes.

Section 19.—RAFTS MADE FROM CANVAS AND TARPAULIN SHEETS

1. Canvas and tarpaulin vehicle covers can be utilized to form improvised rafts in many ways. If the condition of the cover is good, and it is folded so that water cannot get in, a raft can be used for approximately 8 hours.

2. Frames can be made in various ways such as opened stretchers or empty petrol cans. Straw and in fact any material that provides bulk but not weight can be used for filling. An example is given below of a straw-filled raft.

(*a*) A canvas or tarpaulin approximately 20 ft by 20 ft filled with straw will carry three men or two men and a 3-in mortar (Fig 30).

(*b*) Lay on the ground at right angles to each other two 1-in lashings doubled; on the top of these lay the waterproof cover. Chalk on the cover a square of side 5 ft 6 ins, and heap straw, etc on to this square until the pile is about 2 ft high. Two men should trample the centre of the filling to form a raised edge. To prevent the lashings biting into the sides lay sticks along the four sides. Fold over the cover and lash tightly. If the tarpaulin has eyelet holes around the edges, it should be secured by lacing the lashings through these. The finished float should measure approximately 4 ft 6 ins by 4 ft 6 ins by 1 ft 6 ins.

(*c*) It can be carried by four men, and can be constructed in 10 to 15 minutes once the filling has been obtained.

It can be paddled, or it can be pulled across a river by means of a rope.

(*d*) Four of the above floats can be joined together (Fig 31) to take a load of 24 cwt across a stream. A suggested method of joining is as follows :—

(*e*) Two floats are lashed together by means of 14-ft spars. This forms half the raft. The other half is made in a similar manner. The two halves are then lashed to one another 3 ft apart by means of four 16-ft spars to act as roadbearers. Sixteen planks 10 ft to 12 ft long are then lashed crosswise between these roadbearers.

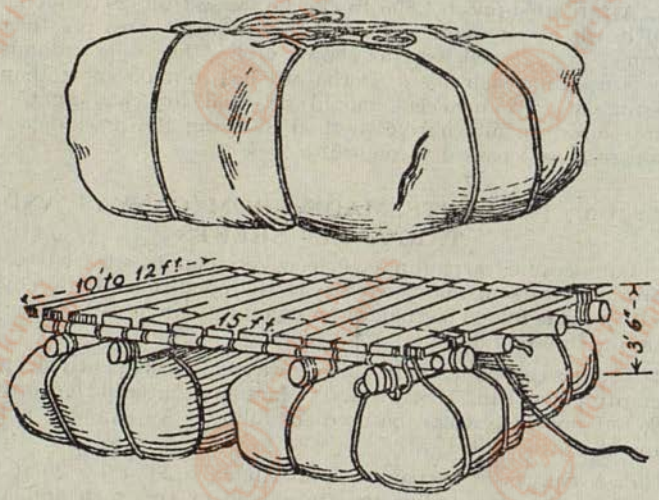

FIG 31.—Raft of four tarpaulin covers or canvas sheets

SECTION 20.—PETROL TIN RAFT

1. Rafts and footbridges can be made from empty four-gallon petrol tins. Unless used with a canvas or tarpaulin sheet as described in Sec 15, the hole in the petrol tin must first be filled. This filling can be done by cutting up one tin to make patches and soldering these across the hole. All tins should be tested for leaks before use. Eight four-gallon tins lashed together with a plank over the top to take the load will form a pier for a footbridge. The decking of the footbridge can be made by duckboards as shown in Fig 32 or with any other material available.

2. The buoyancy of a four-gallon tin is given in Appendix E and suitable rafts can be constructed for many purposes.

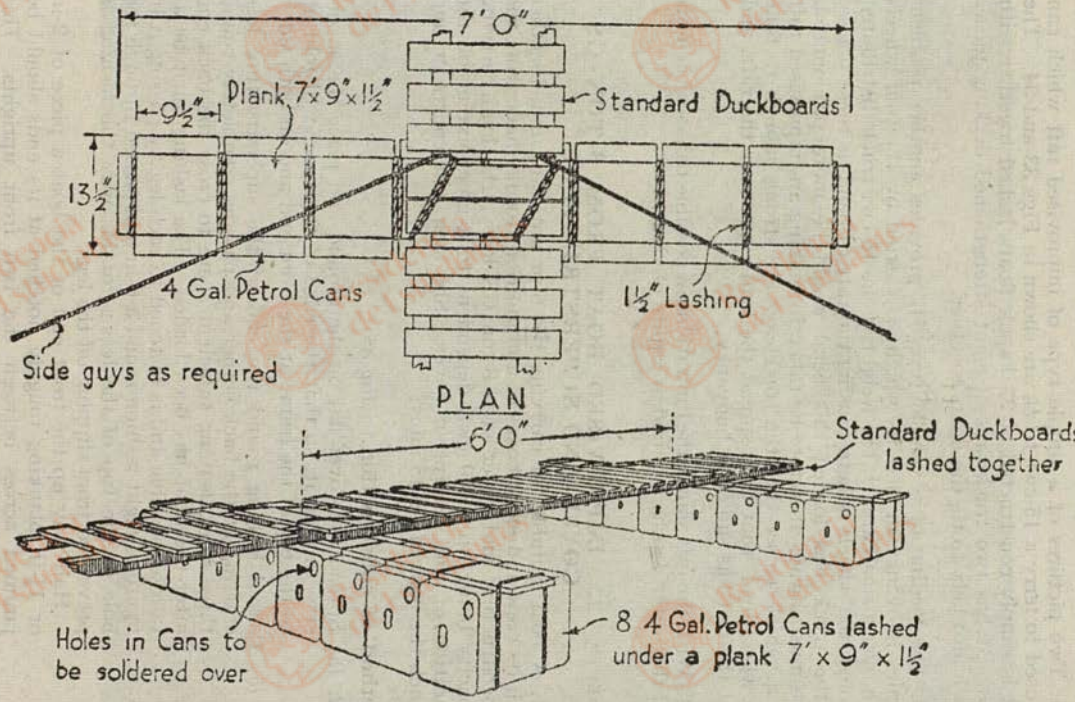

FIG 32.—Petrol tin and duckboard footbridge

SECTION 21.—IMPROVISED RAFT FOR 15-CWT TRUCK

1. Two pictures of a simple type of improvised raft which can be used to ferry a 15-cwt truck are shown in Figs 33 and 34. The raft is simply constructed of 27 kapok floats lashed together with cord. It has two trackways of eight strengthened decking pieces which also help to tie the floats together.

2. The loading of a vehicle (Fig 34) provides another problem besides buoyancy in that its weight is carried by the four wheels each over a small area. The weight of the 15-cwt truck distributed through the wheels is here causing the raft to bend at these places. If the truck was loaded this bend would be more pronounced. Care must always therefore be taken in making an improvised raft for a vehicle to see that the trackways are strong enough to take the wheel load, that they spread the load right over the raft, and that the raft has sufficient buoyancy.

3. With the raft shown the limitations in possible bankseat heights and the water depths required are quite obvious.

SECTION 22.—IMPROVISED BOAT FROM 3-TON GS COVER AND SUPERSTRUCTURE

1. A boat suitable for carrying the 6-pr anti-tank gun together with its crew and eight boxes of ammunition can be made from the superstructure and cover of a 3-ton GS lorry, the load carrying capacity being up to 40 cwt, dependent to a great extent on the condition of the waterproof cover. Six men can construct and launch the boat in 12–15 mins.

Method of construction. (Fig 35)

2. (*a*) Spread the cover flat on the ground and place the superstructure on it, so that the edge of the cover will fold up to the top of the frame at the front end and on both sides.

(*b*) Pass a lashing round the end of the superstructure legs starting at the back corner and passing completely round three sides, leaving sufficient spare to cross the back end after the boat has been loaded. The lashing must be as taut as possible and is fastened to each leg by passing it in figure-of-eight fashion round a 6-in nail passed through the hole in the top of the legs; in this way the lashing is prevented from slipping off the legs.

Half way up the front end of the boat a piece of 2-in or 1½-in planking roughly notched at its ends should be jammed across between the two front uprights. This prevents the legs of the superstructure bending towards the centre as the load comes on.

FIG 33.—Improvised raft for 15-cwt truck

FIG 34.—Improvised raft for 15-cwt truck

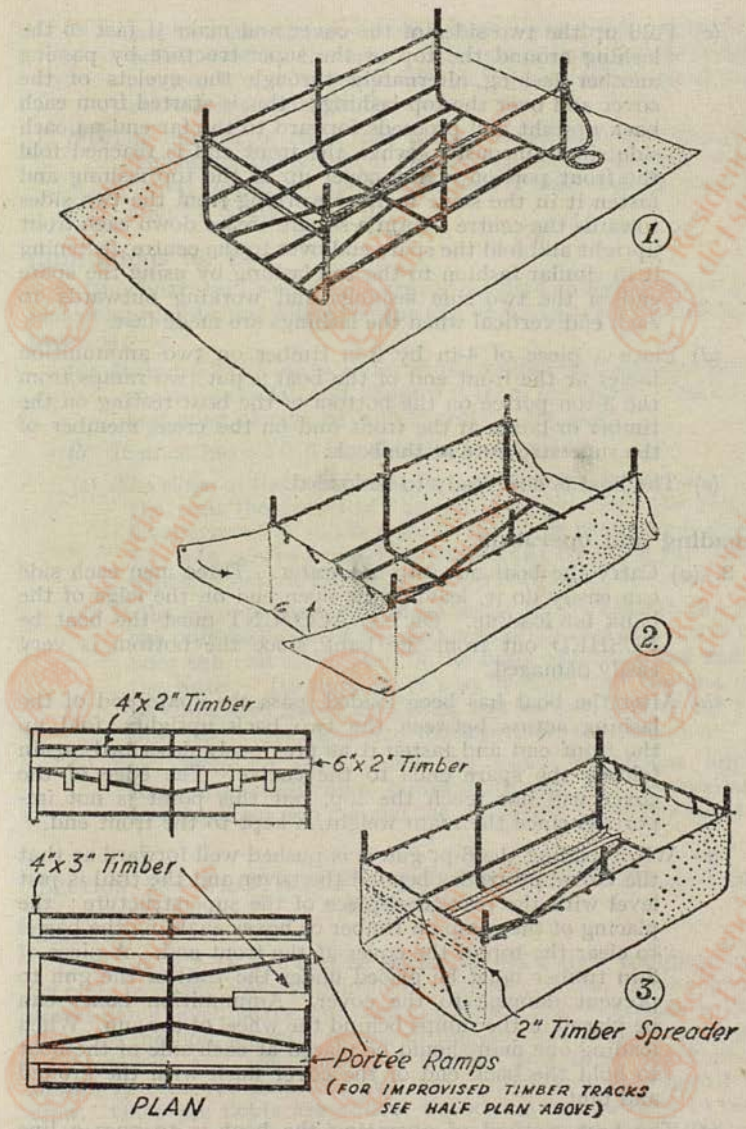

FIG 35.—Boat made from 3-ton GS lorry cover and superstructure

(*c*) Fold up the two sides of the cover and make it fast to the lashing around the top of the superstructure by passing another lashing alternately through the eyelets of the cover and over the top lashing ; this is started from each back upright and proceeds forward to the far end on each side simultaneously ; when the front end is reached fold the front portion of the cover up to the top lashing and fasten it in the same manner working from the two sides towards the centre ; form a square crease down each front upright and fold the spare end over to the centre, fastening it in similar fashion to the top lashing by using the spare end of the two side lashings and working outwards to each end vertical when the lashings are made fast.

(*d*) Place a piece of 4-in by 3-in timber on two ammunition boxes at the front end of the boat ; put two ramps from the 3-ton portee on the bottom of the boat resting on the timber or boxes at the front and on the cross member of the superstructure at the back.

(*e*) The boat is now ready to be loaded.

Loading and operating

3. (*a*) Carry the boat out into the water. Three men each side can easily do it, leaving the open end on the edge of the bank for loading. On NO ACCOUNT must the boat be PUSHED out from the bank since the bottom is very easily damaged.

(*b*) After the boat has been loaded, pass the spare end of the lashing across between the two back uprights, fold up the front end and fasten it as previously described, again folding the spare ends to the centre. The edge of the cover will not reach the top, but this point is not important since the main weight is kept to the front end.

(*c*) When loading the 6-pr gun it is pushed well forward so that the barrel protrudes beyond the cover and the trail is just level with the rear cross piece of the superstructure ; the placing of the ramp on timber or boxes enabling the barrel to clear the top of the cover at the front end. A piece of 3-in timber must be placed under the trail of the gun to prevent damage to the cover. Ammunition boxes can be placed in the ramps behind the wheel of the gun. When loading one man should be placed at each side of the boat to hold the back end of the cover flush with the ground and taut.

(*d*) The best method of operating the boat is to pass a line across the river with an assault boat or by swimming,

and to make it fast on each bank ; the boat can then be pulled over by the crew. It is possible to paddle it with spades, but it is very difficult to keep direction if any current is running in the stream.

(*e*) The number of trips that can be made with one boat will depend on the length of crossing and the condition of the cover, but given good conditions a boat can be used for about 8 hours.

Limitations for use

4. This boat can be used for ferrying the 6-pr anti-tank gun under almost any conditions where the gun can be got to, with the following provisos :—

(*a*) It draws 2 ft 6 ins of water at the loaded end, and this depth must be available at about 9 ft from the bank. The inner end must always be able to rest on dry land.

(*b*) It must have 2 ft 6 ins of water to cross in.

(*c*) The slope of the bank must be such that by bearing down on the trail the barrel of the gun does not foul the raft or level ground at the bottom of the slope as it comes down. The gun can be braked by hand ropes by using the portee winch or with a tow rope attached to a Lloyd carrier.

(*d*) If the bank is sheer with deep water at the bottom the gun can only be loaded if the step is so small that one end of the boat can rest on the top of the bank and the other end in the water. Its slope must also be such that the gun can be controlled down the ramp, and so that it does not run into the bottom end and damage the superstructure.

(*e*) For offloading very much the same limitations apply. Remember only man power normally will be available to offload, so don't make the unloading slope too steep.

SECTION 23.—FLOTATION OF 6-PR GUN WITH KAPOK FLOATS

General

1. The 6-pr A tk gun can be ferried across a river complete with its crew by using eight kapok floats (Fig 36) ; it can also be ferried across using seven floats, but then not all the crew can cross with it. In either method separate means of ferrying the ammunition must be provided, and the telescope, breech, and firing mechanisms should be removed from the gun and carried by a member of the crew. Once the floats are added, the gun is not so easy to man-handle. To save tiring the crew the route and entry to the water and exit from the water should always be reconnoitred. Tactically

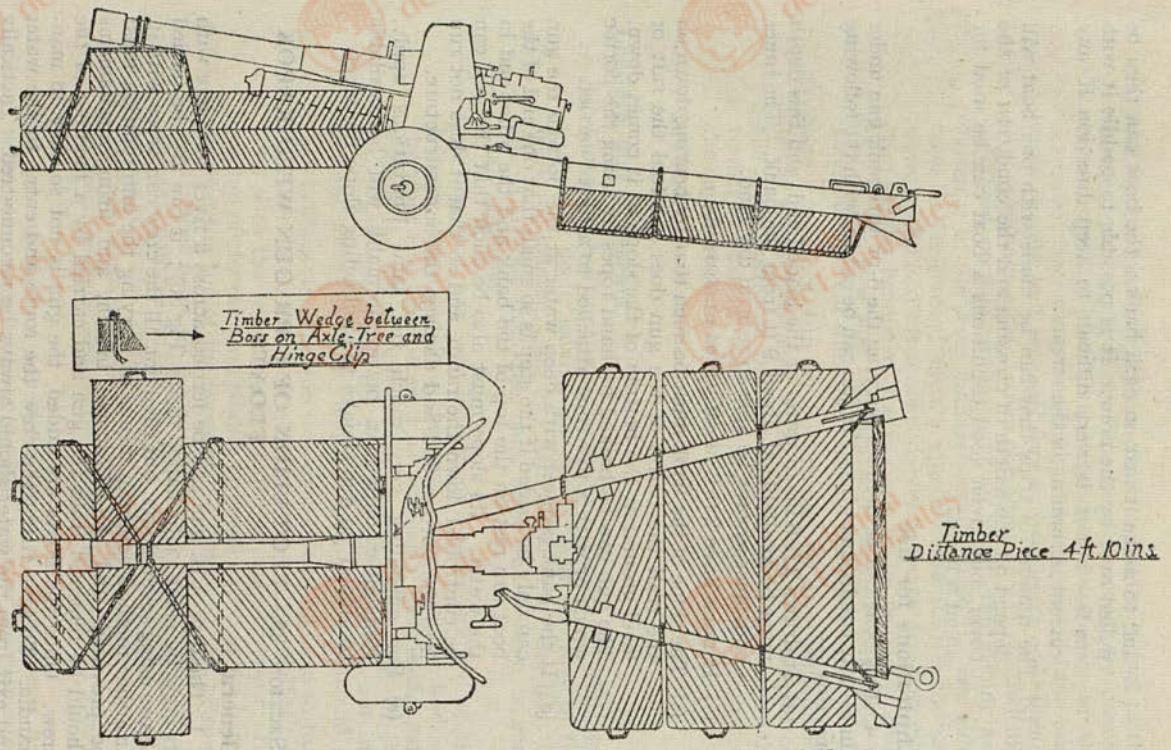

FIG 36.—Flotation of 6-pr A tk gun with kapok floats

it may often be advantageous to fix the floats to the guns under cover some distance back from the river. From the manhandling point of view it will be better if the floats can be fixed to the gun as near to the bank as possible. The trail must be lifted clear of the ground to prevent damage to the kapok floats. A tear in the floats will reduce their buoyancy.

Method

2. (*a*) Open the trail legs and hold them apart at the back end by a timber distance piece 4 ft 10 ins long; small timber wedges are also inserted between the boss on the axletree and the hinge clips, the wedges should have a lashing attached to them.

(*b*) Four floats are placed parallel to the barrel of the gun, two on either side resting on the lip of the gun shield and the ground; the lashings from the timber wedges are passed over the hinge clip and under the axle and made fast to the handle at the back of these floats so that both they and the wedge are held in position. A further float is then placed on top of and at right angles to these beneath the front of the muzzle. The trail of the gun is then lifted and the muzzle depressed until it is resting on the cross float.

A lashing, formed of two drag ropes, is made fast to the muzzle at the centre of the cross float, it is passed round and under all the floats, first in front of the cross float then returned round the muzzle and again round and under all the floats, behind the cross float, in the reverse direction; the whole is pulled taut and fastened to the muzzle at the original position; the spare end is passed through the handle at the front of the four parallel floats and made fast.

(*c*) The remaining three floats are placed beneath the trail of the gun and made fast with a lashing, formed of two drag ropes, which is fastened to the back of one leg of the trail and passed alternately under the float and over the leg of the trail to the front float, it then passes across to and down the other leg in the same fashion, being finally made fast to the back end of this leg of the trail.

Limitations

3. The gun can be launched into the water down a maximum slope of approximately 45 degrees by using the hand brakes on each wheel and holding the gun back with drag ropes.

4. When crossing a river by this method the gun should be pulled across by means of a line from the far bank.

SECTION 24.—CARRIAGE OF ARTILLERY PARTS IN BOATS

General

1. It is possible to strip down guns and transport them across a river in separate parts and reassemble at the far bank. The factors to be considered are as follows :—

(*a*) The buoyancy of the boat will give a guide to the maximum loads that can generally be carried ; but the bulk of the components will be the limiting factor. The maximum load will also depend on how the boat is to be propelled and on the required speed.

(*b*) The height of the centre of gravity of the load will have an effect on the stability of the boat. Parts carried on the floor of the boat will not cause instability when centrally placed.

(*c*) The number of parts carried and the method of stowage must be such that the proper handling of the boat is not interfered with.

(*d*) The allocation of components to each type of boat and raft will be a matter for experiment. There are many possible variations with different combinations of boats.

(*e*) Care must be taken to see that the load is spread over the bottom of the boat and is not balanced in one place, because assault bridging equipment is necessarily very light in construction. If it is only possible to fit a part in in that way, a piece of timber must be placed over the bottom of the boat to spread the load.

2. The tables in para 6 show the component parts, their weight and the types of equipment boat into which they will not fit. Any other type of service equipment boat or improvised equipment whose buoyancy is greater than that of the boats mentioned can be used.

Drills and times

3. Using the men and tools available in a section of two guns, it should be possible to strip equipment into the transportable loads shown in the tables in the following times :—

6-pr	15 mins
25-pr	25 mins

4. With the same facilities the equipment can be reassembled and ready for firing in the following times :—

6-pr	20 mins
25-pr	30 mins

Tables

5. Detailed drills for stripping and reassembling equipments are included in the relevant gun drills.

6. The tables of component parts of the two guns and their weights are given below.

Dimensions and sizes of the boats may be obtained from the relevant Sections, and buoyancies from Appendix E.

TABLE II—6-pr

Component	Length	Height	Width	Approx wt lb	Boats which cannot take component	Special precautions to be taken
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)
Piece with breech mechanism and slipper	8 ft 9 ins	1 ft 6 ins	1 ft 3 ins	840	Recce boat	
Recoil system with cradle and sights	6 ft 0 in	1 ft 7 ins	2 ft 3 ins	308	Recce boat	
Trail with saddle	10 ft 6 ins	3 ft 0 in	2 ft 2 ins	616	Recce boat and assault boat, Mk II	
Main shield	5 ft 0 in	2 ft 6 ins	1 ft 8 ins	140	Recce boat	
Side shields (2)	4 ft 0 in	3 ft 9 ins	—	224	Recce boat	
Shield upper right	5 ft 0 in	3 ft 8 ins	6 ins	84	Recce boat	
Axle with wheels	5 ft 9 ins	2 ft 4 ins	2 ft 4 ins	560	Recce boat	To be secured to prevent movement during crossing.

TABLE III—25-pr

Component	Length	Height	Width	Approx wt lb	Boats which cannot take component	Special precautions to be taken
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)
Barrel with breech mechanism	8 ft 6 ins	1 ft 2 ins	1 ft 3 ins	1,036	Recce boat	
Recoil system and cradle	6 ft 6 ins	2 ft 0 in	2 ft 6 ins	896	Recce boat	
Trail	11 ft 4 ins	1 ft 8 ins	4 ft 7 ins	812	Recce boat and assault boat, Mk II	The load must be placed centrally and as low as possible in the boats and securely lashed in position to maintain stability.
Saddle	3 ft 0 in	2 ft 3 ins	3 ft 0 in	324	Recce boat	
Axle and wheels	7 ft 0 in	3 ft 9 ins	3 ft 0 in	840	Recce boat	To be secured to prevent movement during crossing.
Shield	6 ft 0 in	1 ft 2 ins	4 ft 0 in	168	Recce boat	
Firing platform	6 ft 3 ins	11 ins	—	224	Recce boat	

NOTE.—Appendices A, B, C, D and H will be issued later.

APPENDIX A

ASSAULT PLATOON OF BRIDGE COMPANY, RASC

A general table to show the equipment, its capabilities and how it is carried in lorry units.

APPENDIX B

DETAILED CONTENTS OF LORRY UNITS

A table to show the contents of each lorry unit, showing number of raft or attachment sets and details of any equipment not included in a set.

APPENDIX C

DETAILED CONTENTS OF RAFTS AND ATTACHMENT SETS

A table to show the detailed contents of each raft and superstructure set and of any part of the equipment which is not shown as detailed in Appendix B.

APPENDIX D

WATERPROOFING OF CARRIERS

Information on waterproofing of carriers. This may be very brief, with a reference to the new pamphlet on this subject which is being produced.

APPENDIX E

BUOYANCY TABLES

Object	Net buoyancy	Remarks
Petrol tin	36 lb	
Kapok float	300 lb	In bridge.
Recce boat	450 lb	With about 4 ins freeboard. It will take 650–700 lb when submerged.
Assault boat—		
Mk II	2,300 lb	At 6 in freeboard.
Mk III	4,400 lb	At 8 in freeboard.
Storm boat	4,900 lb	
Folding boat, Mk III	3 tons	At 12 in freeboard.

Barrels	Net buoyancy	Capacity Imperial galls	Length ft	Circumference at ¼ length (ft)	Weight lb
Butt	1,125 lb	108	3·97	8·09	174
Hogshead	567 lb	54	2·76	7·05	119
Barrel	382 lb	36	2·42	6·23	88
Cask	146 lb	14	1·76	4·49	32

NOTE.—Actual buoyancy of a barrel can be worked out from $5C^2L$—W.

Where C = Circumference at ¼ length in feet.
L = Length in feet.
W = Weight in lb.

APPENDIX F

KNOTS AND LASHINGS

1. Knots

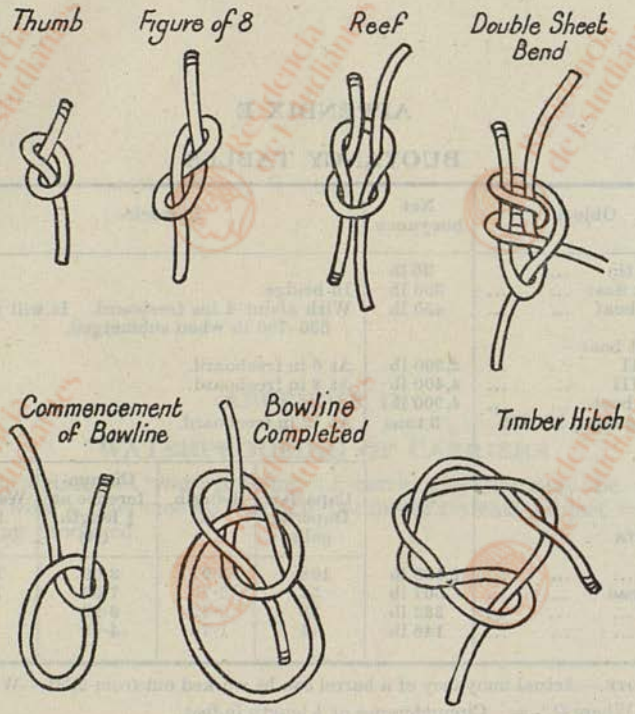

FIG 37

Thumb knot ...	...	To prevent the end of a rope from fraying or from slipping through a block.
Figure of 8 knot	...	As for a thumb knot, but easier to untie.
Reef knot ...	...	To join two dry ropes of the same size.
Double sheet bend	...	To join two ropes very securely, or two wet ropes of different sizes.
Bowline ...	...	To form a loop which will not slip.
Timber hitch	...	To hold timber, etc., where the weight will keep the hitch taut.

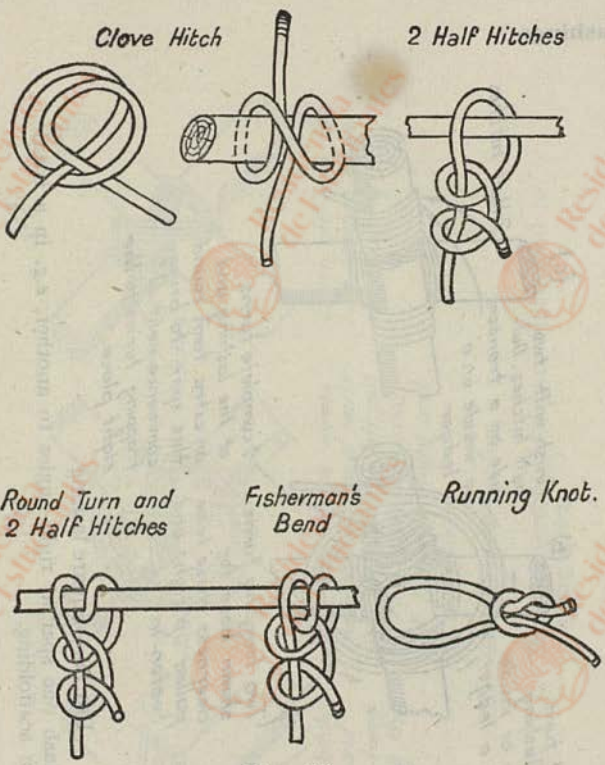

FIG 38

Clove hitch	...	To secure a rope to a spar, etc.
Two half-hitches	...	To secure the running end of a rope to its standing part.
Round turn and two half-hitches	...	To make fast a rope to an anchorage so that the strain on the rope shall not jam the hitches.
Fisherman's bend	...	To make fast a rope when there is a give-and-take motion, *e.g.* an anchor cable.
Running knot	...	To form a loop which will draw taut round an object.

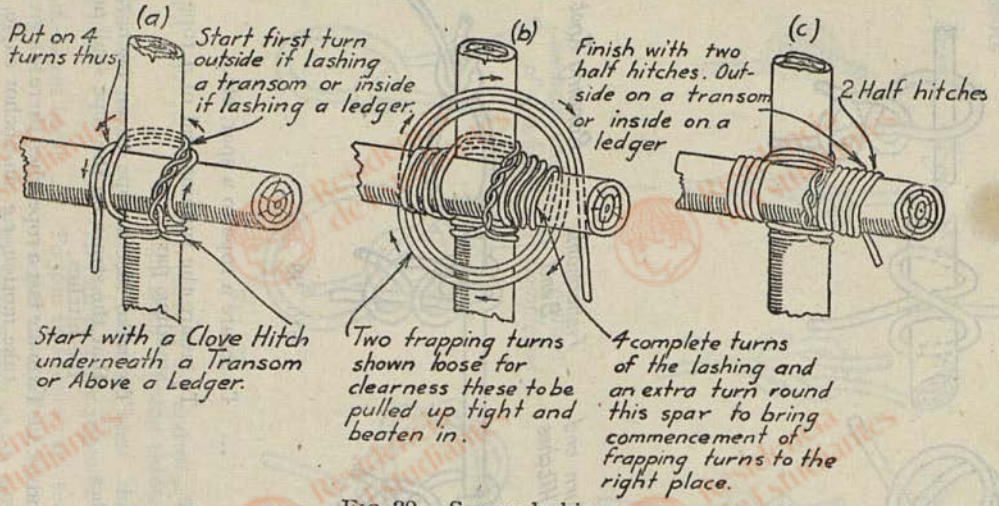

FIG 39.—Square lashing

Square lashing ... To lash one spar at right-angles to another, *e.g.* in a trestle or in scaffolding.

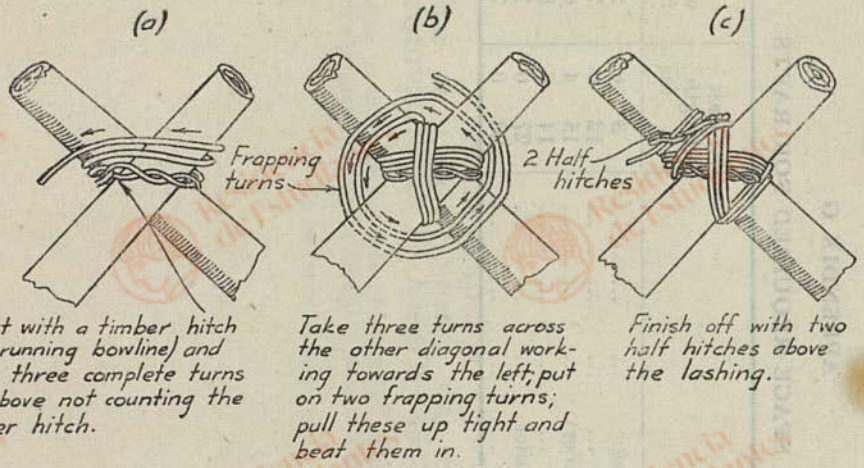

FIG 40—Diagonal lashing

Diagonal lashing ... To lash together two spars which tend to spring apart.

APPENDIX G

DECK SPACE REQUIRED FOR RAFTS

	Raft length ft	ins	Raft width ft	ins
Armed men sitting	3	6	2	3
Bren gun carrier	12	0	7	0
Utility car (Humber)	15	4	6	7
15-cwt truck	14	6	6	6
25-pr gun and trailer	27	0	7	0
3-ton FWD lorry	20	0	7	2

APPENDIX H

EXAMPLE OF A BATTALION'S USE OF THE EQUIPMENT IN AN ASSAULT CROSSING

This table to show an example crossing for a battalion using the amount of equipment normally likely to be available for a battalion.

To be issued later.

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