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ENGINEER HEADQUARTERS, FIFTH ARMY
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28 February 1945

ENGINEER TECHNICAL BULLETIN NO. 28

I N D E X





## I. MINES, BOOBY TRAPS, AND DEMOLITIONS

1. Explosive Coal (Ternkohle): (Source: Special Intelligence Bulletin No. 195, OCE, ETOUSA.)

a. General: Several pieces of explosive coal were found recently in the possession of a German agent captured in Seventh Army sector.

b. Description: Explosive coal consists of pieces of imitation coal of various sizes and made entirely of high explosive. It has a coating of fireproof lacquer to keep it from burning before the fuse is ignited. In spite of this, great care must be taken while handling it (no smoking). There is a 3/8 inch hole in one of the flat surfaces of the coal into which the fuse and detonator are fitted. A combustible paste made of a special priming substance (black powder) and "collodion" solution is used to cover the 3/8 inch hole. The coal is not all of the same shape, but is fairly uniform in size, containing about 1 and ½ pounds of explosive. The coal is skillfully made and casual examination will not reveal the deception. The black coating, however, is not a complete covering, and the blue-gray color of the explosive itself can be seen upon close inspection. The detonator is the standard No. 8 German cap and has a 3.7 second fuse. The cap can be detected by the German mine detector (WIEN 41) up to a distance of only two inches. If the presence of explosive coal is suspected, it can be quite easily detected by inspection of individual pieces. Actual coal is comparatively hard and brittle. If punched with a sharp tool or an attempt is made to cut it with a knife, this characteristic is obvious. Explosive coal, on the

other hand, is not brittle, actually can be cut, and will give off a dull thud rather than a metallic sound if punched with a sharp tool. The depth of the fuse-well may vary in some of the pieces of coal. For such cases, special detonators with an especially long fuse are issued in addition to the one with the normal length fuse cord. These can be used by cutting them to size.

c. Operation: Flame will ignite the combustible paste, which in turn lights the 3.7 second fuse and detonates the cap and explosive.

d. Neutralization:

(1) Immerse in a container of water.
(2) Rub off the coal dust coating.
(3) Search for the 3/8 inch hole on one side of the flat faces.
(4) Carefully remove the paste covering the hole.
(5) Remove the fuse and detonator.

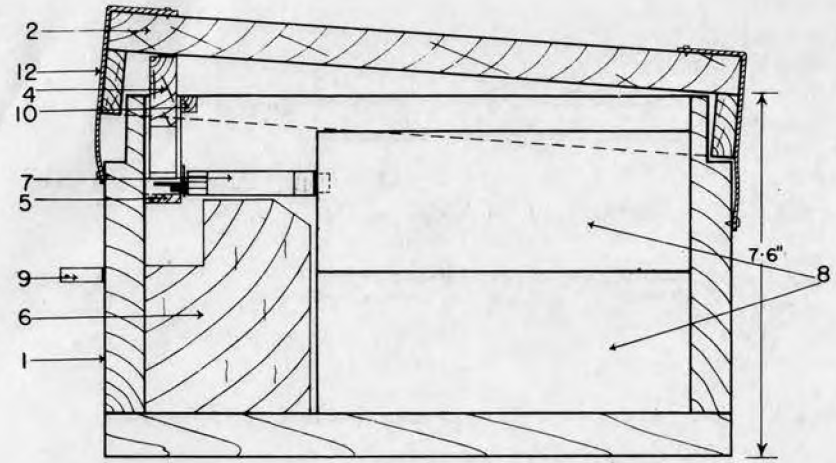
2. German Improvised Wooden Box Mines: (Source: 17 B.D. Co., R.E.) Nine German improvised wooden box mines, as described below, were found in the vicinity of PIETRALA (Q8610).

a. Description: The mine (see Plate L) consists of a rectangular wooden box and lid, made of 3/4" timber, with a canvas carrying handle (9). The woodwork is not jointed but held together by nails. The main component parts and dimensions are:

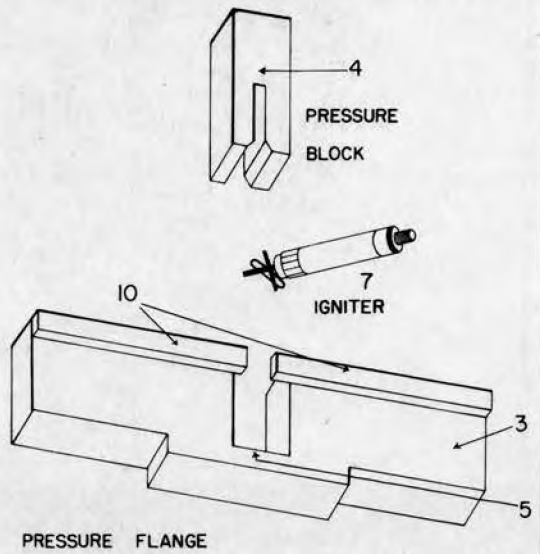
(1) Rectangular box - 13" x 11 and 1/2" x 7 and 3/5".
(2) Lid - 13 and 1/5" x 11 and 1/2" x 2 and 3/10".
(3) Pressure flange - 9 and 2/5" x 2 and 2/5" x 3/5"
(4) Pressure block -
(5) Shear platform -
(6) Igniter support -
(7) Firing mechanism - ZZ 42 Bakelite igniter
(8) Explosive filling - 3 x 3-kg prepared charges.
(10) Pressure block supports * (9) Carrying handle
(11) Hole for anti-lifting device.
(12) Canvas strips
(13) Nails.

Total weight of mine - approx. 38 lbs.
Weight of explosive - approx. 20 lbs.

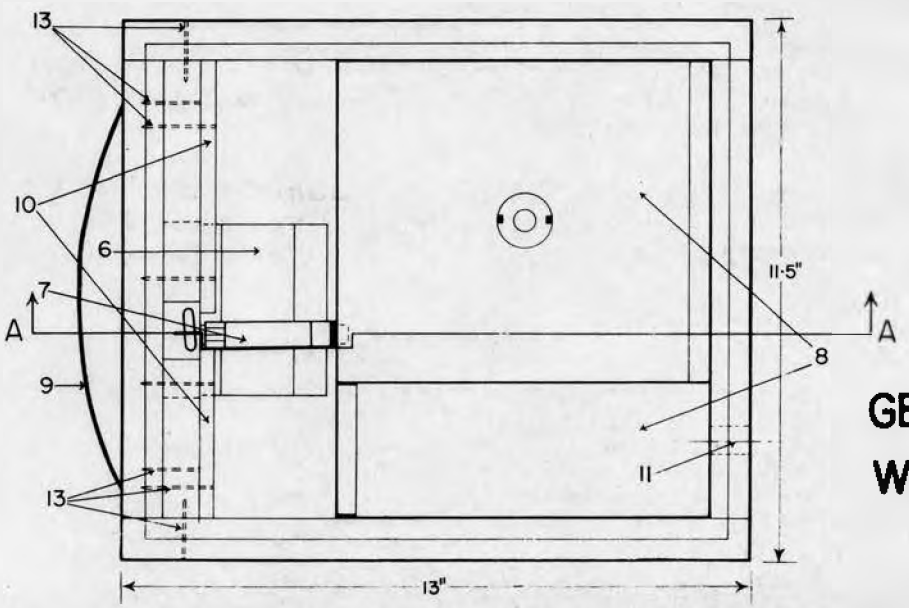
The box (1) is recessed to a depth of 1 and 1/2" around the top, leaving a wall thickness of 1/3", thus permitting the lid to sit flush with the outside walls of the mine. The pressure flange (3) is a shaped piece of wood, housing the pressure block (4) and forming shear platform (5), secured by nails inside one end of the mine. Two wooden strips (10) nailed to this flange retain the pressure block. Pressure block (4) is recessed to receive striker spindle of igniter. The 3 x 3-kg charges (8) are arranged in such a manner that one of the subsidiary igniter sockets is positioned against one of the inner walls, thus permitting an anti-lifting device (11) to be fitted through each side of the mine.




SECTION ON "AA"




PRESSURE FLANGE




PLAN

# GERMAN IMPROVISED WOODEN BOX MINE

PLATE I

Reproduced from drawing by 17 B.D. Coy. R.E.

The ZZ 42 (7) screws into one of the prepared charges; the actuating pin rests on top of the shear platform (5). The body of the igniter is supported by igniter support (6). (Without this support the igniter would probably break once pressure had been applied to the mine). Once the whole assembly is completed the pressure block projects 4/5" above the level of the mine; the lid (2) is then placed in position, giving a raised effect at the pressure flange end. At either end a strip of canvas (12) is nailed to both lid and box, thus holding the two as one assembly. (This canvas may be waterproofing agent).

b. Operation: Pressure on the lid is transmitted to shear platform through pressure block. The platform being 1/3" in thickness shears and falls away; actuating pin of igniter is forced out thus freeing spring loaded striker, thereby firing cap and bringing about detonation of detonator and main filling.

c. Method of Laying: Depth, 2"; spacing, 12'-0" in staggered rows. Mines were actually laid in a field by blown culvert where by-pass would be expected.

d. Neutralization & Lifting:

(1) Look for and neutralise any anti-lifting devices.
(2) Break canvas and carefully remove lid.
(3) Remove pressure block.
(4) Unscrew igniter.
(5) Remove detonator.
(6) Lift mine.

e. Markings: None.

f. Observations:

(1) The mine is of robust construction, probably of base workshop manufacture. This being the case it may quite easily be encountered on other sectors.

(2) The firing pressure has not been ascertained but a man weighing approx. 180 lbs. did not fracture the pressure platform when walking over the mine. (The mine in question had been laid for two months).

(3) It is assumed that the mine is definitely anti-vehicle.

(4) In our opinion the mine could be buried for quite a considerable time before the weather affected it. The explosive charge will not be affected.

(5) By arranging the 3 x 3-kg charges in a certain manner it would be possible to have at least two anti-lifting devices.

(6) Mines recovered were located by prodding.

(7) Tests carried out at this H.Q. with Polish Mk. II Detector detected the mine at depth of 3".

3. Anti-removal Igniters with Topfmines: (Source: Engineer, Third Army). A Prisoner of War interrogated by the 2893rd Engr. Tech. Intell. Team, stated that Topfmines are now being armed with anti-removal igniters, similar to the Tellermine igniter 43. Details regarding the mechanism were vague but the PW was under the impression that it was based on the lever principle and that there were no metal parts in the igniter. He further stated that when the igniter assembly was screwed into the mine, the breaking of two glass lugs, apparently an arming mechanism, could be distinctly heard. Further information and confirmation of the use of such igniters is awaited.

4. Large Type German Stockmine: (Source: Engineer, Third Army). The 2942nd ETIT reports that interrogation of a Prisoner of War indicates that the Germans have a large type Stock-mine which contains 2 or 3 Bohrpatronen (100 gm charge) instead of the usual one charge. The mine is said to be about three and a third feet in length and is used in swampy or snow-covered ground. It is also said to be especially effective in hilly sections where a soldier in climbing would seek some object to grasp in order to help his climb. Any pull igniter could be used with this mine. The same Prisoner of War stated that he had heard of a mine which resembled the S-Mine 35 and was made of bakelite. He had also heard of, but had never seen a pull and tension release igniter which was made of bakelite.

5. Russian Time Bombs Activated by Radio Signal: (Source: 1st Canadian Army TIS No. 56). A Prisoner of War reports the use of time bombs activated by radio. These bombs were used by the Russians against the Germans. Explosions in movie theaters, administration buildings, canteens and other public buildings where German soldiers were likely to gather, were quite frequent. After exhaustive investigations, the Germans learned that the Russians left special bombs in buildings in evacuated towns, such as STALINO and KHARKOV. These bombs were equipped with a clock device and a radio set which functioned as a receiver for a short unspecified period of time. The batteries in the set had a life of approximately sixty days. When the set received a certain signal or call sign, it set in operation a device which caused the bomb to explode. Upon occupying the city of STALINGRAD, the Germans had special details whose function it was to jam all suspected Russian radio traffic for a period of sixty days. In this manner they were able to save many bridges and buildings from destruction. COMMENT: It is possible that the Germans might also adopt the demolition methods described above, particularly in view of their intimate knowledge of the effectiveness of such measures.

6. Marking of German Topfmine Fields: (Source: Special Intell. Bull. No. 231, OCE, ETOUSA).

a. New markings for German Topfmine fields have recently been reported from several sources. The markings consist of single green paint stripes on prominent landmarks such as signposts, tree stumps and trees in the vicinity of minefields.

b. One report, made by an engineer unit, described an area at the intersection of two trails which had been laid with Topfmines. It was investigated after a U. S. half-track had been blown up at this intersection. A sketch of the area is shown below. Upon investigation, the engineers found:

(1) A signpost on the German side of the minefield marked with a vertical stripe of green paint 3 inches long and 3/4 inches wide. This sign pointed in the direction of the minefield and also in the direction of the next town.

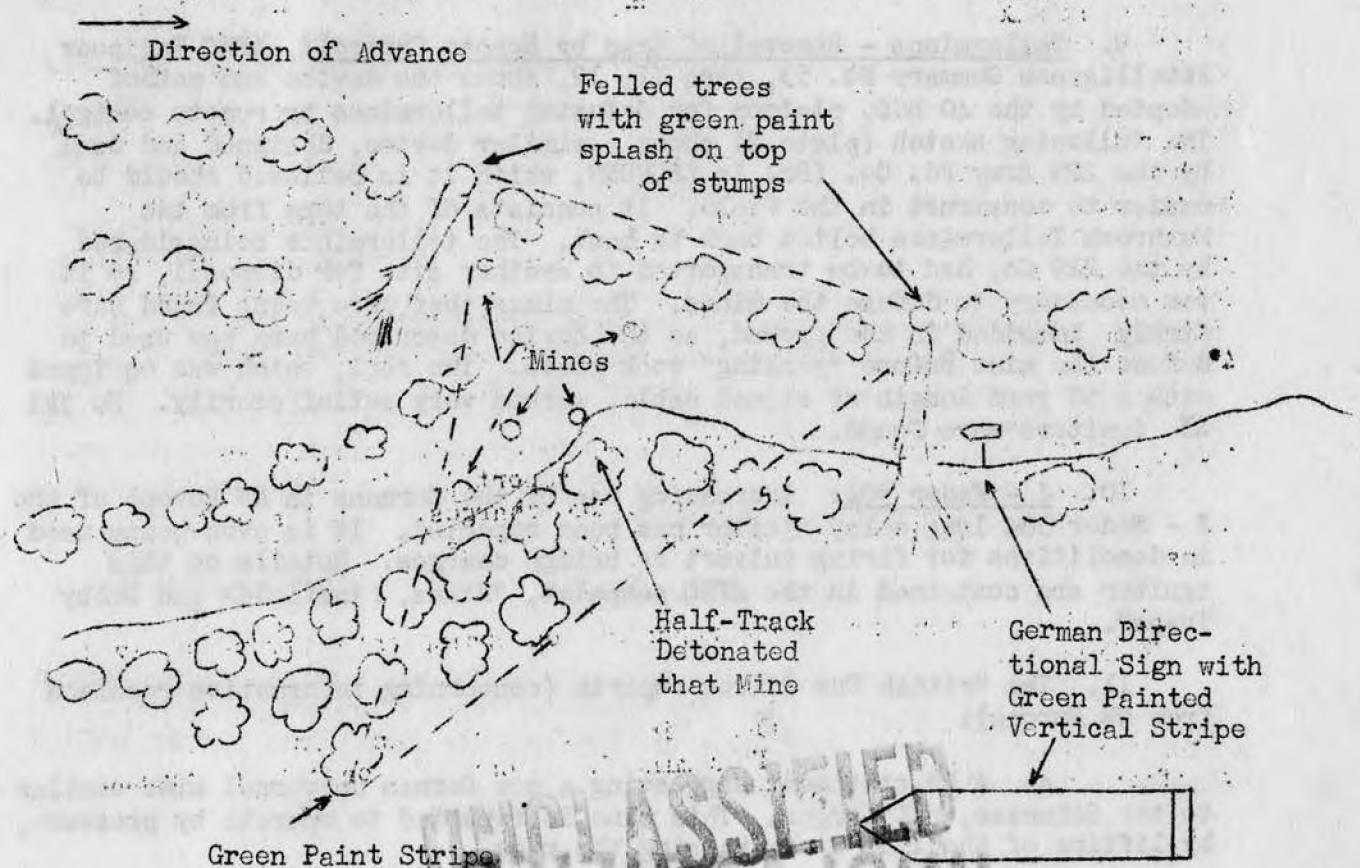
(2) Two felled trees with green paint splashed on the stump of each.

(3) A tree on the other side of the mine barrier with a green stripe on its trunk.

(4) The painted tree and stumps formed the corners of a triangle which roughly enclosed the mined area.

(5) The painted signpost was visible from the German side of the front, a short distance from the first of the felled tree markings.

c. No precise information is available regarding the other instances reported, nor is it certain whether the other instances pertained only to Topfmines, or other types as well.



7. Use of Drifting River Mines: (Source: EIS No. 57, Ninth Army). The following information has been translated from a German Training Manual, Construction Engineers, Battalion 5, Swabian Command:

a. Used against: Bridge pillars, locks, dams and pontons.

b. Laid from: Upstream by airplanes (50 mines from one plane).

c. Types (new types and changes to be expected):

(1) Cylindrical form, 10 kg charge.

(2) Cylindrical form, 60 kg charge.

(3) Spherical form, 11.5 or 17.5 kg charge.

d. These mines, if provided with stabilizing rods, can be found floating just above the bottom of the river.

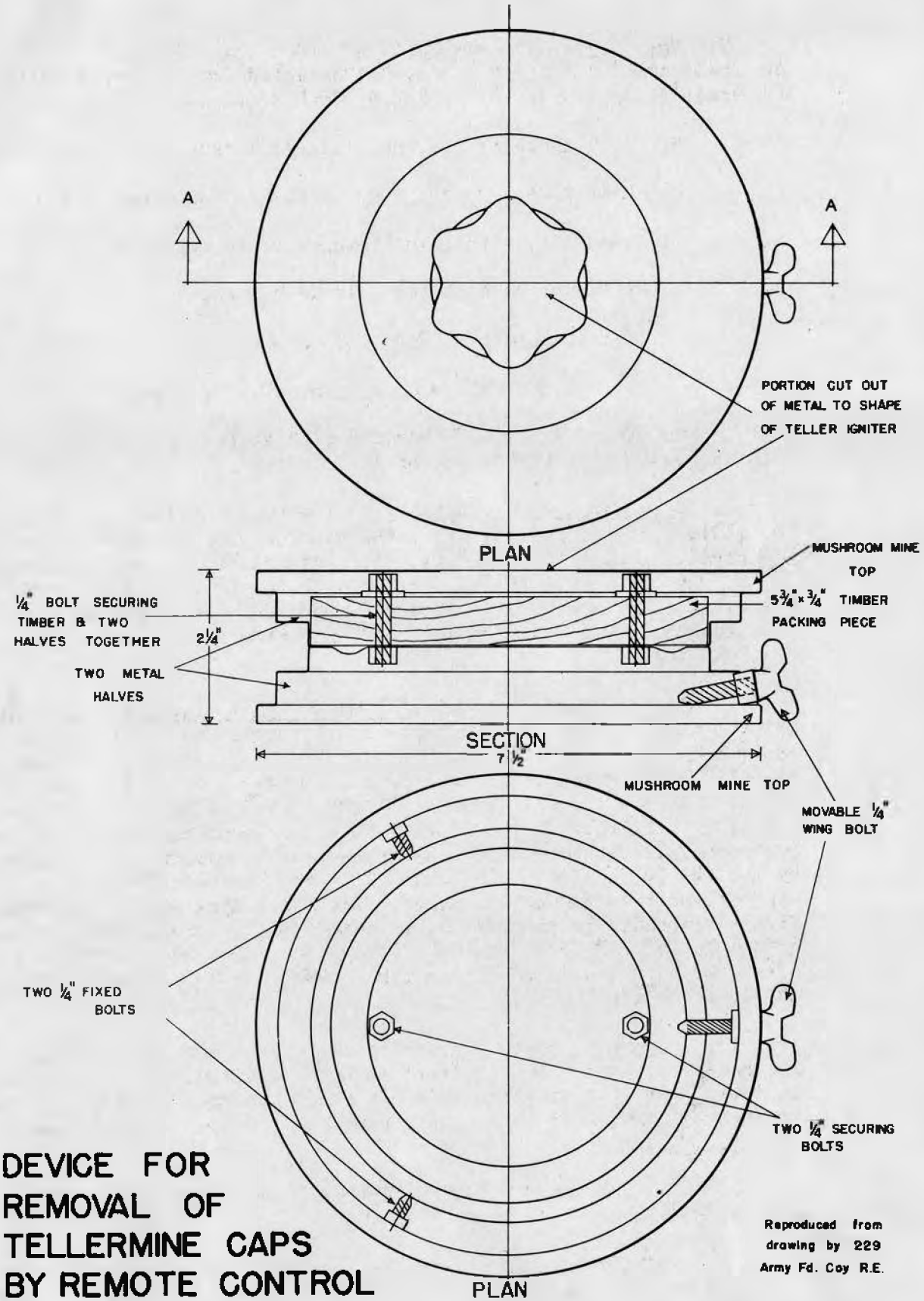
8. Deterioration of Topfmines: (Source: British War Office TIS No. 158). Reports indicate that the outer casing of Topfmines may deteriorate rapidly when laid in wet ground. This might lead to the crystallization of the booster charge in the igniter socket, and the threads into which the glass plug is screwed. This may prove dangerous when an attempt is made to unscrew the glass cap. Low temperatures are also reported to "weaken" topfmines.

9. Tellermines - Removal of Caps by Remote Control: AFHQ Engineer Intelligence Summary No. 53, para II, 12, shows the device and method adopted by the 40 B.D. platoon for defusing tellermines by remote control. The following sketch (plate 2) shows a similar device, designed and used by the 229 Army Fd. Co. (Br) in LEGHORN, which it is believed should be easier to construct in the field. It consists of the tops from two Mushroom Tellermines bolted back to back. The tellermines being cleared by the 229 Co, had to be transported to another site for disposal, so it was necessary to defuse the mines. The mines that were being found were firmly imbedded in the ground, so the device described here was used to defuse the mine before "yanking" took place. The reel, which was equipped with a 50 yard length of signal cable, worked very satisfactorily. No TMi 43 igniters were found.

10. J - Feder 504: Increasing use by the Germans in NW Europe of the J - Feder 504 long delay igniter has been reported. It is even being used in demolitions for firing culvert or bridge charges. Details on this igniter are contained in the AFHQ pamphlet, "Mines, Minefields and Booby Traps".

11. The British War Office reports (concerning information received from NW Europe):

a. A PW statement suggesting a new German universal mine similar to the Schumine, but larger. This mine is reported to operate by pressure, by lifting of the lid, or by raising the mine.




# DEVICE FOR REMOVAL OF TELLERMINE CAPS BY REMOTE CONTROL

Reproduced from drawing by 229 Army Fd. Coy R.E.

PLATE 2

b. Improvised anti-flail mines are being met in increasing numbers. One type of an anti-flail mine is an anti-tank mine connected by detonating fuse to an explosive charge in such a way that when the flail of the tank hits the igniter the tracks of the tank should be over the explosive charge.

12. New Methods used by the Enemy in Recent Operations: (Source: 317th Engineer Combat Battalion).

a. The enemy has another way of using anti-tank and box mines to defeat the detector and the probe. Mines are buried in depths ranging from 36" to 48" beneath the surface, stacked in multiples varying from 4 to 6 mines high. Contact with the uppermost is made by means of a peg or other extension device. When pressure is applied to the peg the top mine is activated causing the remainder of the series to "go off" by induced detonation. (See sketch page eight)

b. The enemy has found another use for trip-flares. The flares are set up with trip wires attached, always in a place most likely to be crossed by our attack. The flares are of various colors; a certain color indicates a definite position. When the wire is tripped and the flare goes up, the enemy is able to place artillery fire on the exact precalculated location.

## II. OTHER FIELD DEFENSE WORKS

Nothing

## III. COMMUNICATIONS (ROADS & RAILROADS)

1. Snow Clearance - Fifth Army Road Post System:

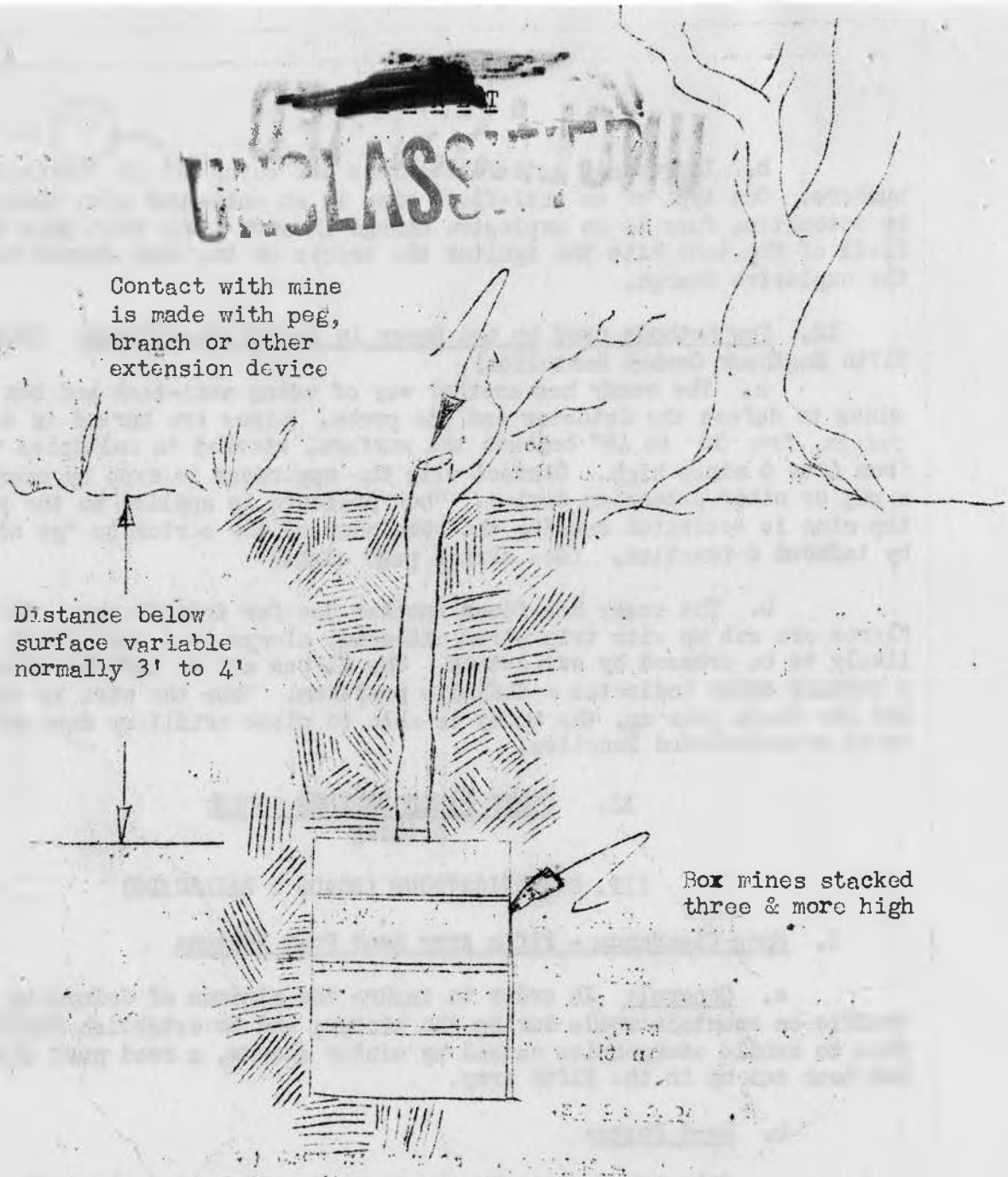
a. General: In order to insure the minimum of delays to traffic on mountain roads during the winter, and to establish facilities to handle emergencies caused by winter storms, a road post system has been set up in the Fifth Army.

b. Road Posts:

(1) Locations: Four main road posts and twelve sub-posts were established on the M.S.R. through the mountains (See plate 3). These posts were located after a study of local weather and road conditions which indicated that areas above 500 metres were subject to considerable snowfall; that sections of road above 800 metres had frequent blocks resulting largely from drifts. Roadposts are under the operational control of the Engineer unit assigned to maintain the section of road on which the post is located.

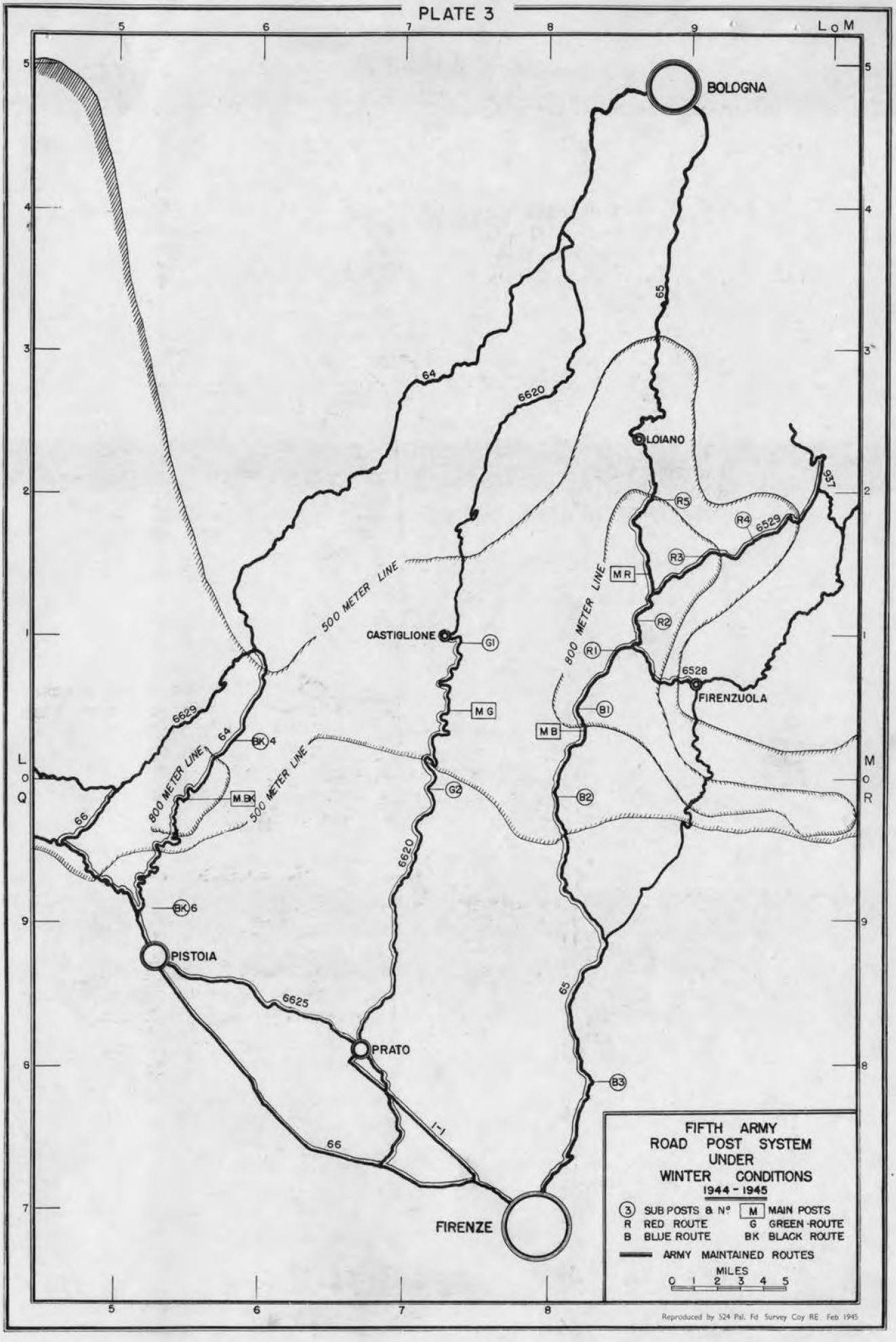
(2) Personnel of Main Road Posts:

1 Post Commander, Officer (Engr)
1 Transportation Officer or NCO (T.C.)
2 EM, Rotary snow plow operators (Engr)
4 EM, Heavy truck drivers (Engr)




This method is applicable to other types of mines, making detection most difficult -

PLATE 3


L o M
BOLOGNA
LOIANO
CASTIGLIONE
FIRENZUOLA
PISTOIA
PRATO
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64
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6529
937
500 METER LINE
800 METER LINE
G1
G2
MG
MB
MR
MBK
R1
R2
R3
R4
R5
B1
B2
B3
BK4
BK6
L o Q
M o R
FIFTH ARMY
ROAD POST SYSTEM
UNDER
WINTER CONDITIONS
1944 - 1945
(3) SUB POSTS & N° M MAIN POSTS
R RED ROUTE G GREEN-ROUTE
B BLUE ROUTE BK BLACK ROUTE
ARMY MAINTAINED ROUTES
MILES
0 1 2 3 4 5
Reproduced by 524 Pal. Fd Survey Coy RE Feb 1945

2 EM, Heavy wrecker drivers (Ord).
2 EM, Radio operators (Signal).
1 EM, Mechanic (Engr).
1 EM, Cook (Engr).
2 EM, First Aid (Surgeon).
Additional EM (Engr) to operate supplementary equipment as required for 24 hour operation.

(3) Personnel of Sub-posts:

1 NCO in charge (Engr).
2 EM, Heavy truck drivers (Engr).
2 EM, Heavy wrecker drivers (Ord).
1 EM, Cook (Engr).
2 EM, First Aid (Surgeon).
2 EM, Radio Operators (Signal).
Additional EM (Engr) to operate supplementary equipment as required for 24 hour operation.

(4) Initial Equipment Drawn for Main Road Posts:

1 Rotary snow plow with attachments for a 4 T or 6 T, Truck, 6 x 6.
1 V-Type Snow plow with wing blade and attachments for grader, road, motorized.
1 Truck, 6 T, 6 x 6, prime mover, w/winch (Ord).
1 Truck, 10 T, 6 x 6, heavy wrecker, M1 (Ord).
2 Truck, ¼ T, 4 x 4 (Ord); 1 for Engr O and 1 for T.C.O.
12 Shovel, long handle.
6 Pick, drifting, Class "E", handled, 5 lb.
6 Pot, oil flare.
1 Kit, first aid, medical privates.
6 Lantern, Kerosene, hand.
1 Outfit, Cooking, 20 man.
1 Radio set, SCR-188.
1 Telephone, EE-8-A.
3 Lantern, hand, electric, portable.
6 Flashlight, TL-122.
1 Stove, tent, M41.

(5) Initial Equipment Drawn for Sub-Posts:

1 V-Type snow plow with wing blade and attachments for grader, road, motorized.
1 Truck, 10 T, 6 x 6, heavy wrecker, M1 (Ord).
1 Truck, 3/4 T, 4 x 4, W/C (Ord).
12 Shovel, long handle.
6 Pick, drifting, Class "E", handled, 5 lb.
6 Pot, oil flare.
1 Kit, first aid, medical privates.
1 Outfit, cooking, 20 man.
6 Lantern, Kerosene, hand.
1 Radio set, SCR-543.

3 Lantern, hand, electric, portable.
6 Flashlight, TL-122.
1 Telephone, EE-8-A.
1 Stove, tent, M41.

(6) Supplementary Equipment Drawn for Main Road Posts:

1 or 2 - 2½ Ton truck plows depending on requirements.
1 - 4 or 6 ton truck plow.
1 - ¼ ton (Jeep) plow.
1 or 2 - Graders, road, motorized, Diesel, 12 foot moldboard.

(7) Supplementary Equipment Drawn for Sub-posts:

1 or 2 - 2½ Ton truck plows depending on requirements.
1 Grader, road, motorized, Diesel, 12 foot moldboard, if available and conditions require.

(8) Additional equipment on call from the unit responsible for normal road maintenance by the Post Commander included:

All bulldozers.
All graders.
All trucks.
All small tools, etc.
of

c. Operation/and Facilities Available at Posts:

(1) Snow Removal: Snow is removed as quickly as possible by the use of snow plows, motorized graders, dozers and by hand. Every effort is made to remove snow before it becomes packed by traffic and to prevent drifts from developing.

(2) Icy Roads: Crushed stone is stockpiled along the M.S.R. for spreading over icy sections. The unit responsible for maintenance usually "sands" the slippery sections. Road post trucks to which the snow plows are attached, are loaded with crushed stone to "sand" short dangerous sections as they develop.

(3) First Aid: First aid men are available at all road posts to render first aid.

(4) Food and Shelter for Stranded Personnel: Each post maintains a stock of 100 C-rations with extra coffee, tea, sugar and milk for serving to bona-fide, stranded military personnel. The rations for the detachment are normally drawn by the unit maintaining the section of road. At some road posts, the personnel rations with a nearby unit instead of preparing their own mess. No special provisions are provided to sleep stranded personnel.

(5) Furnish Information on Road Conditions: At 0900, 1400 and 2000 hours daily, each sub-post reports to its respective main

road post by radio as to the condition of its assigned road section. In turn, at 1000, 1500 and 2100 hours daily, each main road post reports to the Engineer Headquarters, Fifth Army, by radio as to the condition of its assigned road network. The report also includes if and where chains are recommended, as well as the condition of the weather. Transportation Section has an officer on duty at Engineer Headquarters to act as liaison officer. Road condition reports are then passed on to this liaison officer, who in turn notifies Movement Control, Transportation Section. Normally during periods of fair weather, the main radio station, Engineer Headquarters, Fifth Army, keeps its receiver open continuously between 0900 and 2400 hours daily, but during periods of inclement weather, the receiver remains open continuously for possible emergency calls from the main road posts. The radio sets of the road posts are only open during the scheduled road report periods and for emergency calls to Engineer Headquarters, because the sets at these stations are only provided with small portable generators. Telephone connections are also provided for all of the main road posts and most of the sub-posts to assure communication with Engineer Headquarters in the event of radio breakdown or poor reception.

(6) Recovery of Wrecked or Stalled Vehicles: As a further measure to keep traffic moving, wrecker service is provided at each road post and sub-post. Wrecked, stranded or stalled vehicles are hauled to a hard standing or to the nearest road post where minor repairs can be made or the unit concerned is notified of the location.

(7) Repairs: Repairs to wrecked, stranded or stalled vehicles are limited to minor repairs such as changing tires, cleaning gas lines, etc., as spare parts are not stocked at road posts.

(8) POL: A small stock of POL is maintained at each road post for use in emergencies only.

(9) Assistance in the Movement of Traffic: The officers in charge of road posts keep Transportation Control Post representatives informed of road conditions in their respective road net. The NCOs in charge of sub-posts maintain direct liaison with the nearest T.C.P. or indirectly with the Main Road Post T.C.P. representative through the Road Post Commander. The Road Post Commander makes every effort to assist convoys and casual vehicles to move without interruption, such as removing wrecked, stalled or stranded vehicles from the road, emergency repairs, removing road blocks, "sanding" icy surfaces, notifying parent units of vehicle casualties, procurement of fuel, etc. In emergencies, the posts may act as T.C.P's to control traffic. Road patrols operate continuously from the road posts to facilitate traffic, and to check road conditions, particularly at night and during the hours of heavy movements.

d. Sitreps: Main Road Posts submit to Engineer Headquarters by messenger before 1200 hours daily, a consolidated report for the period from 0800 to 0800 hours, giving:

(1) General condition of road network.
(2) Period when road was closed to traffic.
(3) Mean depth in inches of snow on road at post.
(4) Vehicle casualties.
(5) Medical casualties.

e. Engineer Unit's Responsibilities:

(1) To assist and supplement the equipment and personnel of the road post in keeping the main supply routes open. The employment of several hundred Italian civilians has assisted materially in keeping the shoulders and ditches free of snow and ice.

(2) Erection and maintenance of eight-foot poles at intervals of about 200 feet on tangents, and 50 feet on curves along the edges to serve as snow guides. Scotch Lite tabs are tacked to each pole to aid in night driving.

f. Operations Section of Engineer Headquarters:

(1) Collects and serves as a central source of road information.
(2) Directs the operations of Engineer units.
(3) Passes on to the liaison officer of the Transportation Section all road condition information.
(4) Alerts all road posts of special or unusual movements as informed by the Transportation Section liaison officer.
(5) Makes such inspections as are necessary.

g. Observations:

(1) Equipment:

(a) V-Type Snow Plows: The V-plows, to date, have served no useful purpose in keeping the M.S.R. open. Their value decreases after the first cut has been made. As every effort is made to remove the snow as it falls, other equipment has proven more useful. In areas where traffic is light and only one-way is required, this plow may be of value. A machine with this plow cannot pass over a Bailey bridge.

(b) 2½ Ton Truck Plow: This plow has proven very effective under most conditions. It can be fitted to a truck in a very short time and is easy to operate. However, it is of light construction and can be damaged easily, especially on rough mountainous roads. It has been necessary to reinforce all of these plows now in operation by welding another angle iron behind the one rotating on the bumper frame.

(c) ¼ Ton (Jeep) Plow: Generally speaking, the ¼ ton plow has not proven very popular. It has proven effective on smooth pavement, but not on mountainous roads and where several inches of snow has fallen. Unless it is pushing a light load, the damage that it does to a jeep does not justify its use.

(d) 4 Or 6 Ton Truck Plow with Wing Blade: For moderately heavy work, this plow has proven very popular. It can

# SNOW CLEARANCE

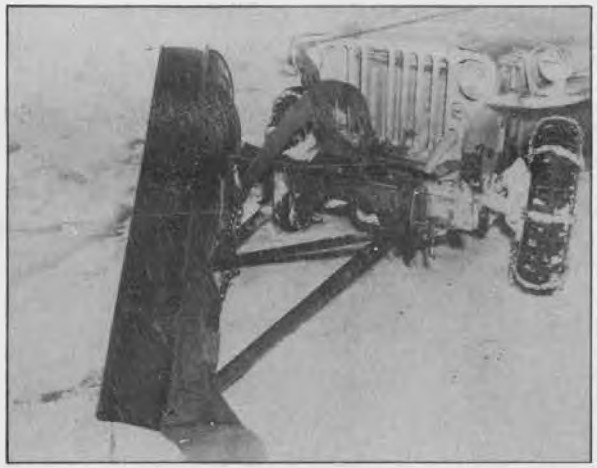


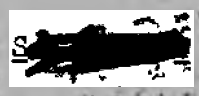
FIG. 1 JEEP SNOW PLOW

FIG. 2 ROAD GRADER

FIG. 3 ROTARY PLOW

FIG. 4 VEHICLE RESCUE

PLATE 4



clear a wide section of road where the snow is several inches deep. It is of heavy construction and can withstand ordinary treatment; however, its use is not recommended on rough mountainous roads. It is suggested that this plow be mounted on a 6-ton, rather than a 4-ton truck, because of its size, shape and weight. Loading the bed with crushed stone is desirable.

(e) Rotary Plow: The rotary plows are mounted on 4-ton trucks, with dual front wheels and the bed loaded with ballast; however, a 6-ton truck would be more desirable. The dual front wheels make the vehicle much more difficult to steer. Several undesirable features developed during the early use of this plow. Fist, the three bolts holding the rotary fan sheared. This was remedied by tightening the bolts after every hour of operation, and by keeping a supply available in the truck. Also it was found that operation on mountainous roads resulted in rocks being whipped up into the rotary. Limiting the use of this machine to operation on paved roads eliminated much of this trouble. Further, as every effort is made to remove the snow as it falls, with light equipment, the snow on the road is not generally deep enough for the rotary plow to be effective. For that reason, its use is principally to pick up the bladed snow along the shoulders and cast it over the edges of the road.

(f) Motorized Road Graders: The grader has proven to be the most effective machine for snow clearance under average conditions. The original plan was to use the grader for mounting the V-plow with wing blade attachment; however, for lack of use, the V-plows have now been detached, for the most part, and the grader with the wing blade is used extensively in combination. This provides wide clearance. On many of the M.S.R.'s, traffic has been heavy during and after snowfall and resulting in many instances, of packed snow which cannot be cleared by standard snow plows. The grader helped simplify this problem. Clearance up to 12" can be made of fresh snow.

(g) Bulldozer: The bulldozer, particularly the angledozer, has proven indispensable in removing snow drifts on M.S.R.'s where traffic is heavy and the roads must be kept open at all times. The hydraulic dozer, on the other hand, is particularly effective in shaping roads coated with hard packed snow and ice because of the downward control of the blade.

(h) 3/4 Ton Weapons Carrier: It is suggested that a weapons carrier be provided in similar setups at main road posts for patrolling and general housekeeping.

(i) Mechanics Tool Kit: A kit of small mechanics tools should be provided at the Main Road Posts for 1st and 2nd echelon repairs of road post equipment and vehicle casualties of the M.S.R.

(2) Personnel: Operations of the posts to date have indicated that only one First Aid EM is needed at each road post.

(3) Operations: It is particularly important that all snow be cleared from the roadway as rapidly as possible to prevent it from becoming packed or forming into ice. Clearing the edges and ditches of snow assures a controlled run-off of the water after subsequent thaws. If packed snow and ice is left on the surface, chained traffic will eventually wear the middle portion down until a low center is formed. Thaws that follow result in runoff water being confined largely to the center portion and possible failures in the road. On one route, ruts developed during and after a rain. The freeze that followed left one-way ruts and traffic was unable to pass. One-way traffic had to be established until graders could shape the road and eliminate the ruts.

## IV. BRIDGES (FIXED & FLOATING)

1. German Underwater Bridging: Underwater bridges have been reported used by both the Germans and the Russians. See para VI, 3, Fifth Army Engineer Technical Bulletin No. 24 for details of a German underwater bridge used on the ARNO River. The Germans have been reported by partisans to have constructed underwater bridges across the PO River. Below is the translation of a German document on underwater bridging, followed by information regarding an underwater bridge encountered during operations in the West. (Source: Ninth Army EIS No 67)

a. "Due to the introduction of mass-bombing, the enemy has been successful in the complete destruction of bridges. For the same reason, work on reconstruction of these has been considerably prevented. Efforts must now be made to prevent the enemy from observing bridges, and to this end the underwater bridge, used so successfully by the Russians on many occasions, offers the best solution.

b. Underwater bridges are bridges having their roadway anything up to 1'-4" below water level; they could be termed "artificial fords". Their use is strictly limited to hours of darkness. It should be ensured that approaches to this type of bridge do not betray the site; camouflage of these must therefore be so well accomplished by daybreak that the enemy cannot follow them up and therefore discover the bridge site. In order to mislead the enemy, numerous other dummy sites should be chosen and tracks made leading up to the banks to give the impression that underwater bridges are in use at those points. Success can only be achieved by good camouflage both in the initial construction and subsequent use of the bridge. Discovery of the real bridge site will therefore be denied to enemy air reconnaissance.

c. For the construction of such bridges, the following guiding principles are laid down.

(1) River and canal stretches: The most suitable are stretches of rivers and canals, the water level of which can be lowered 5'6" at will (by damming upstream and running off downstream) - this for purposes of building.

(2) Bridge sites: These should be well removed from existing bridge sites. Level, firm banks, preferably in well vegetated areas are the most favorable when enhanced by well camouflaged approaches to the site.

(3) Lower structures: Trestle should be pile driven, or supported on mudsills if the river or canal bed is capable of taking the load. In order to reduce the height of the structure, piles and trestles should be small but plentiful. Under water, only construction with bolts is possible, as hammering of nails is difficult and lashings cannot be relied upon.

(4) Superstructure: Roadbearers should be steel girders, as these do not require so much depth as timber bearers. The girders should be well secured to the timber seats by means of rail spikes (continental railway method). Decking should be of oak and fixed only by wire lashings and ribands. The upper surface of the ribands in still water should be at least 8" below water level. In flowing water, this figure should be increased so that rippling - "breakers" caused by the ribands - does not give away the bridge position. All parts should be painted a dark color.

(5) Construction: Where the water level can be lowered (as in (1) above), the normal methods of construction can be used. Where this is not possible, the following methods can be employed:

(a) The roadway can be built on floats or small boats, then brought to the bridge and fixed to the trestles or piers. If possible, provision should be made to allow the bridge to be broken for passage of river traffic.

(b) In deeper water, the superstructure, inclusive of the timber seats, can be floated to the site and hauled down to the trestles and piers by means of blocks and tackle and then secured. This can only be carried out in deep water by the use of diving equipment.

(6) Extensive results of previous experience are not available. Only through the practical construction of these bridges can the most useful methods be devised. A bridge of this type capable of taking Class 60 loads was built near ABBEVILLE by a Russian engineer unit. A report of the construction of this bridge will be forwarded.

(7) Chief of General Staff is to be informed of any proposed building of underwater bridges, and experiences encountered are to be reported as they occur." (End of translation.)

d. The bridge referred to in paragraph (6) above was almost completely destroyed when reached by allied troops. From P/W and other sources which now appear to be reliable, however, various information has been collected.

(1) The total length of the bridge was about 90'-0" and approximately 64'-0" of this was built on piles which had first been driven, then cut down until the tops were about 2'-8" below water level. Piles were 1'-2" in diameter, driven in three rows at 6'-6" centers across the gap, the piles in each row being at 3'-3" centers. As stated above, a gap of about 26'-0" was left clear in the stream. A bolt set vertically in the top of each pile served to locate the pier cap sill.

(2) Superstructure consisted of a combination of steel and timber road-bearers, fixed by means of bolts and wire lashings. Decking of two layers of 4½" square baulks was laid and ribands fixed, the tops of the latter being about 1'-0" below water level. Construction of the 26'-0" gap which was left to allow passage of river traffic is somewhat obscure. Apparently, however, some form of submersible ponton was used with superstructure to seat the rest of the bridge. This section could be removed when necessary and then floated in and resubmerged, the whole process taking about 1 hour.

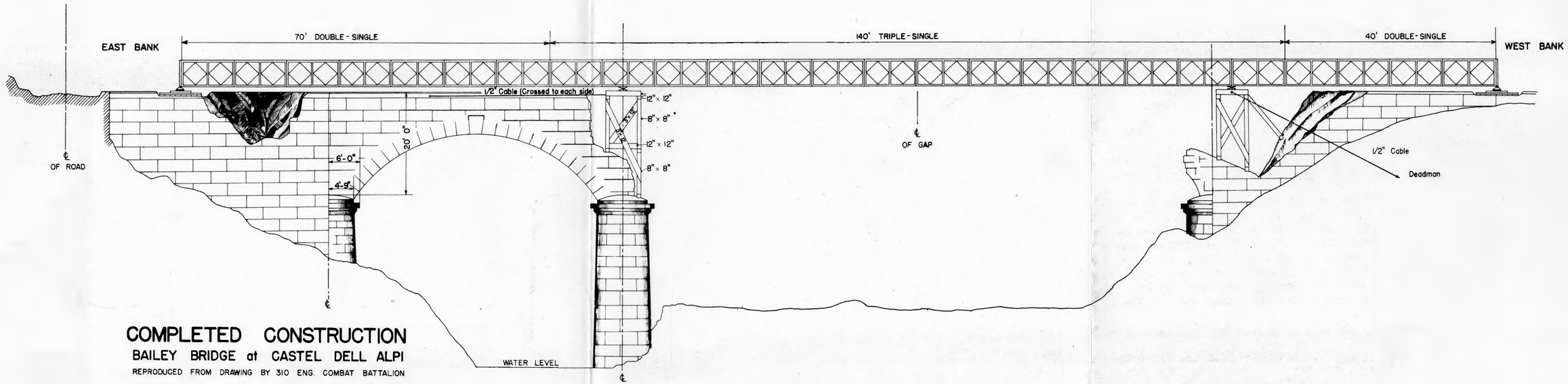
(3) Judging from the remains of the bridge, allied sources estimated the load capacity as being about Class 30, but P/W statements claim Class 100. It seems, however, that Class 60 is more probable, as borne out by the document reproduced above.

(4) Attempts had been made to deceive allied reconnaissance by the provision of two dummy sites upstream of the bridge. The "approaches" had been strewn with chalk which showed up as a white stretch on air photographs. Round timbers strutted out over the river were intended to simulate the line of bridge. Study of air photographs, however, proved that these were dummy sites, and the real bridging site was also visible on the photographs because of stakes left in the river to mark the limits of the bridge on either side of the roadway.

2. Three Span, 250 ft long, Continuous Bailey Bridge:

a. Conditions: In November 1944 the 310th Engineer Battalion, less one company, was detached from the 85th Infantry Division and placed under the Engineer II Corps for corps work. As part of its task the battalion was ordered to construct a Class 40 Bailey bridge across the SAVENNA River at CASTEL DELL 'ALPI. The river at this point had been spanned by a 4-span masonry arch bridge approximately 224 feet long. One pier and two of the spans had been demolished completely and the abutments at both ends extensively cratered. To insure that the loads would be carried safely, it was decided to clear the partially demolished masonry and build from the solid piers only. Although the first arch on the east bank was intact, it was decided not to rely on it, as it was felt that it would not transmit any appreciable thrust to the supporting pier.

b. Piers: In order to give stability to the center supports of the bridge, it was decided to utilize the full width of the concrete and masonry piers and to construct double timber bents 6 feet apart

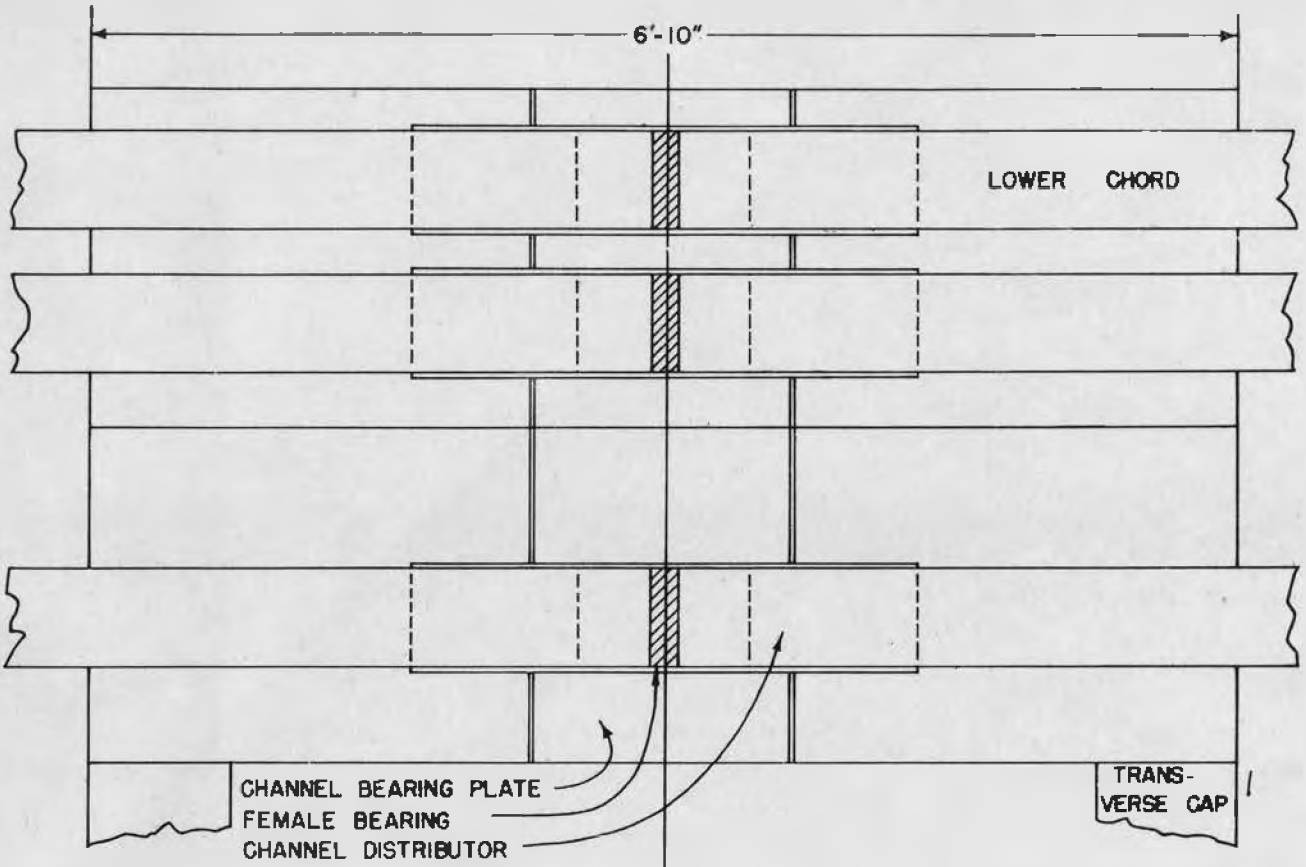



# COMPLETED CONSTRUCTION

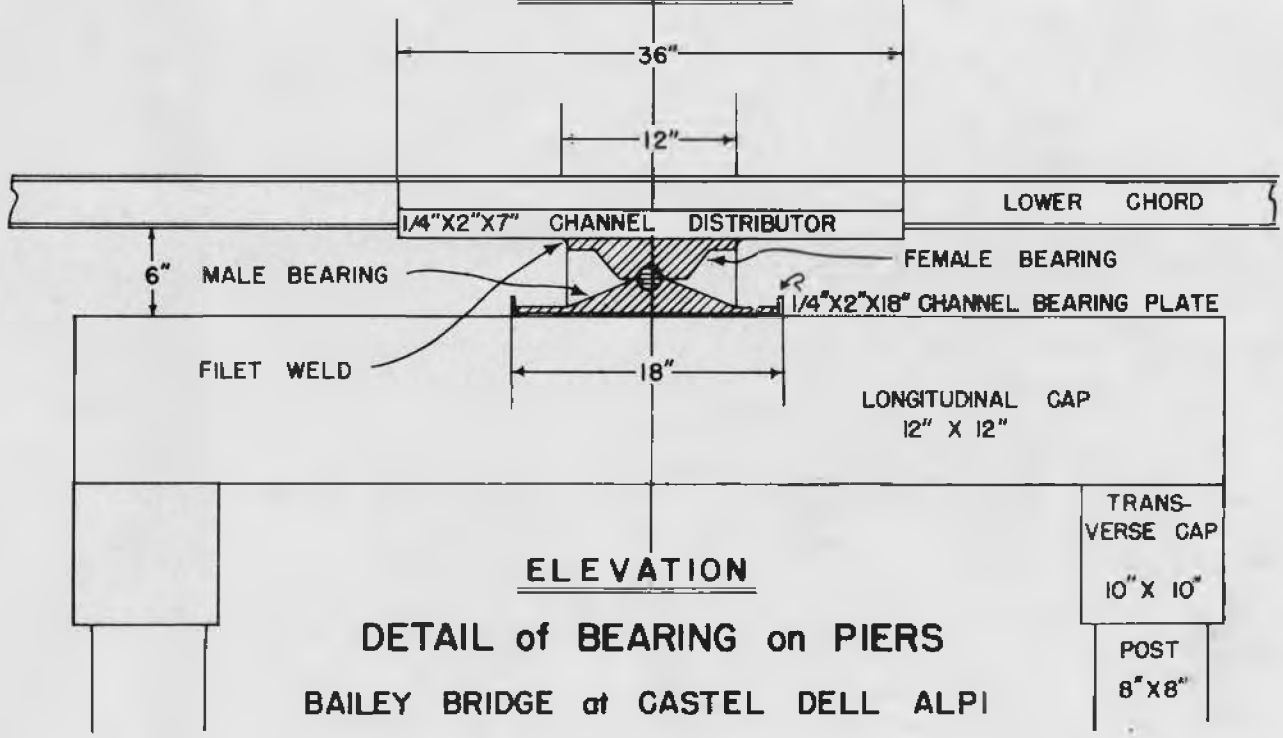
## BAILEY BRIDGE at CASTEL DELL ALPI

REPRODUCED FROM DRAWING BY 310 ENG. COMBAT BATTALION

PLATE 5




HALF PLAN




ELEVATION

# DETAIL of BEARING on PIERS

## BAILEY BRIDGE at CASTEL DELL ALPI

PLATE 6

# BAILEY BRIDGE AT CASTEL DELL ALPI

FIG. 1

FIG. 2

BLOWN GAP

FIG. 3

FIG. 4

COMPLETED BAILEY

PLATE 7

over each pier. The design of the bents follow standard practice with the availability of timber affecting the choice of members used. Since the load on the completed bents would be almost entirely on the outer extremities of the caps, the posts were so spaced as to have two posts on either side directly under the longitudinal 12" x 12" members which were designed to transmit the load from the bearings to the caps.

c. Bearings: The bridge load was transmitted to the piers by use of the special female bearing supporting a 3-foot channel section, ¼" x 2" x 7". The standard bearings under the three trusses of each side were seated in another channel 18" wide and long enough to insure distribution of the load over all four of the 12" x 12" longitudinal members. The total live and dead load on the east pier was computed to be just over 81 tons. The bearings at the abutments were placed on timber grillages eight feet square built up from 3" x 12"'s.

d. Trusses: A launching nose of 7 bays of SS was used and was followed in succession by 40 feet of DS, 140 feet of TS and 70 feet of DS. From east to west the spans were 84 feet, 116 feet, and 50 feet - total of 250 feet. The bridge was launched from the east bank and no particular difficulty was experienced in the launching. A winch was used to supplement manpower in pushing the bridge across the gap. Approximately 50 working hours were required to construct the bridge, about 1/3 of which were used to clear the masonry rubble away so that work on the pier could be begun.

COMMENT:

To insure a better transmission of load, it is recommended that a distributing girder 9'-0" be used under the lower chords when the special bearing is used particularly when the panel point is not positioned directly over the center of the bearings. A timber 12" x 12" x 9'-0" can be used as a substitute.

When changes in girder construction are necessary, continue heavier construction over and past the pier for ¼ of the shorter span; a minimum of 2 bays if change in story and 3 bays if in truss.

In order to relieve stresses over first piers, it is recommended that base plates be raised and not kept in the same plane as the remainder of the bridge; the limit being 6 inches for Class 40 when end spans are 80 feet or more.

3. Reinforcing a Dual Carriageway Bridge:

a. General: On 29 December 1944 the 337th Engineer Combat Battalion was ordered by the 1108th Engineer Combat Group to effect changes on the dual carriageway bridge on Route 67 at S. LORENZO Q736685, to give a Class 70 one-way, Class 40 two-way bridge, by strengthening the floor system, underslinging the upper central panels, and removing outer panels from the Class 40 side. Actual work was not commenced on the bridge until 2 January 1945 and the major part of the

work was completed by 5 January 1945. Traffic was maintained on both bridges as much as possible, shutting off the vehicles only while changing the bridge flooring. The final work was completed on 7 January 1945.

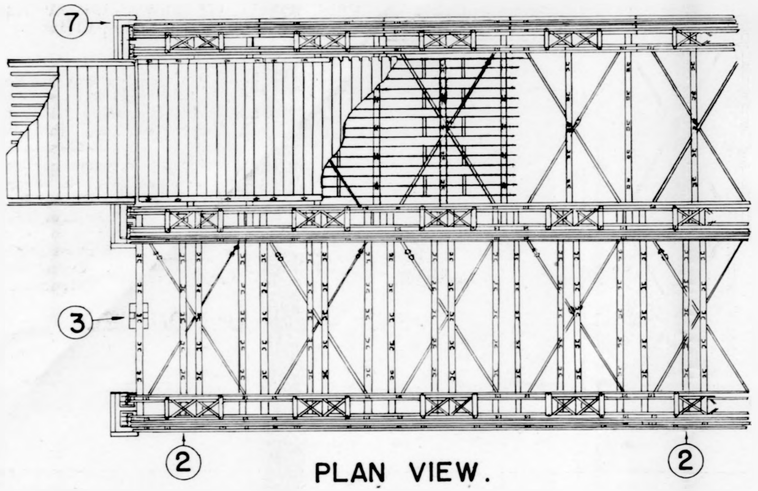
b. Description: The existing dual carriageway bridge as constructed consisted of two Class 40 bridges built with a common center truss. The two outside trusses were triple-single Bailey trusses, while the center truss was triple-double construction. The total span of bridge was 160 feet with a wooden trestle pier at mid-span making the longest unsupported span 80 feet. It was necessary that no truss could be higher than five feet above the roadway to allow passage of wide vehicles. The additional panels needed to make one bridge Class 70 were to be underslung on the two trusses of that bridge. The original bridge was point-supported on the center of the timber trestle pier, but it was also packed up under the horizontal chord at each edge of the pier about five feet from the mid-point support. It was deemed necessary to remove the packing so the bridge could articulate.

c. Details of Construction:

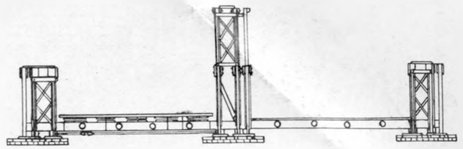
(1) Bailey Panel Trusses: Because of the requirement that there be a single story truss above the roadway, the first step taken was to underslung the necessary panels on the center truss before any of the second story was removed. This order of work was followed so the bridge would not have undue sag before the lower story was attached. Since the bridge consisted of two eighty-foot continuous spans, it was only possible to strengthen six bay lengths between the abutment and pier. This made the center truss a triple-single for the first bay length, triple-double for the next six bays, triple-single for the two bays over the pier, triple-double for the next six bays and triple-single for the bay resting on the far bank abutment. (See drawing.) The center truss was constructed in this fashion so it could take the stress caused by both bridges simultaneously loaded to the max at the same point in the span. The end of spans were considered safe in shear for the total loads. The outside truss of the Class 70 bridge was strengthened by underslinging two panels per bay on the center four bay lengths in the middle of each eighty-foot span. In effect, this made a double-double truss in the center, although there was still the third row of panels on the main truss. The outside row of panels on the outside truss of the Class 40 bridge was removed leaving only a double-single truss construction.

(2) Reinforcing the Floor System: Every Class 70 Bailey bridge must have four transoms per bay in the floor system. On single Baileys this causes little difficulty. However, with the dual carriageway Bailey, trouble was encountered placing the reinforcing transom on the center truss because the position was occupied by the transoms of the Class 40 bridge. No information was available to solve the problem, so it was decided to insert the extra transoms right next to the one extending in from the Class 40 bridge. This meant that the transom would be supported on the horizontal chord about six inches away

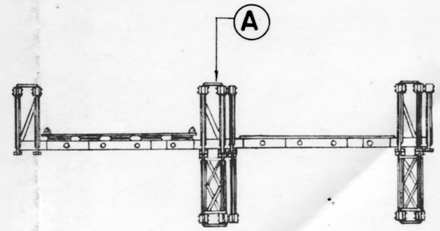
# PLAN FOR REINFORCING S. LORENZO BAILEY BRIDGE ON ROUTE 67.



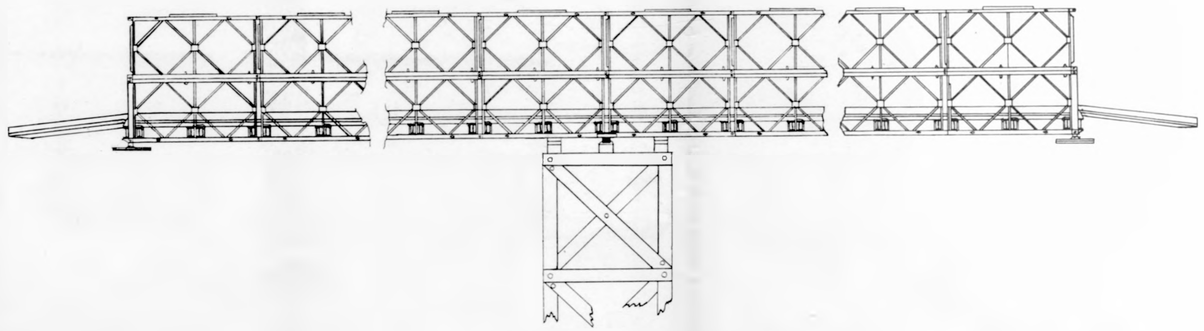

PLAN VIEW.



END VIEW- UNMODIFIED



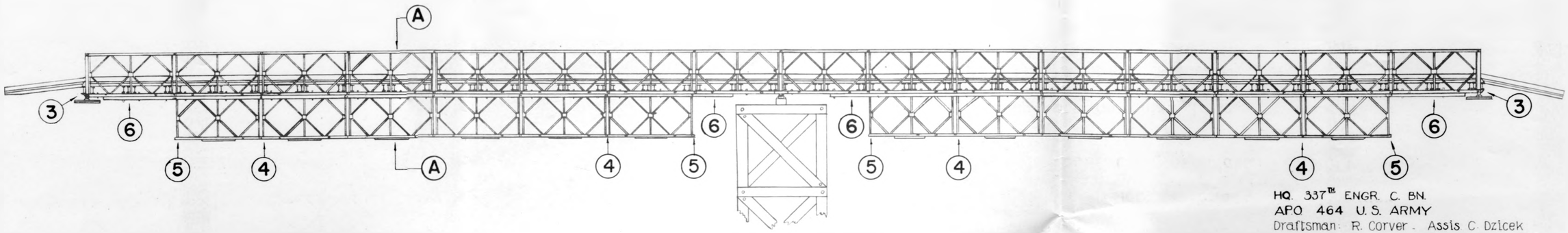

END VIEW — MODIFIED.



SIDE VIEW — UNMODIFIED.

NOTES:

1. Red indicates modified bridge.
2. Spacer of 1/4" steel plate added under transoms colored red of class 70 side of bridge on plan view.
3. Packing under both ends of class 70 bridge.
4. Panels stop here on outer truss.
5. Panels extend to here on center truss.
6. Chord added here to strengthen panel chords for extra transoms.
7. Outer truss removed.




SIDE VIEW — MODIFIED.

HQ. 337TH ENGR. C. BN.
APO 464 U.S. ARMY
Draftsman: R. Corver. Assis C. Dzicek
Date: 10 Jan 1945 Sup & Checked - [illegible]

Reproduced by 524 Pal. Fd Survey Coy RE Feb 1945

# S. LORENZO DUAL CARRIAGEWAY BAILEY

FIG. 1 BRIDGE PRIOR TO REINFORCING

FIG. 2 UNDERSLUNG REINFORCING PANELS

TOP VIEW REINFORCING CENTER TRUSS

FIG. 4 COMPLETED BRIDGE

PLATE 9

from any vertical member. The Bailey bridge technical manuals stated that the horizontal chords of the panels could not support any vertical load six inches from a vertical member without reinforcing. The panels of the bays that had panels underslung were considered to be reinforced, but on the bays next to the abutments and pier some other means of reinforcing had to be devised. The plan decided upon was to use chord members cut from salvaged Bailey panels and bolt them by means of chord bolts to the bottom chord of the panel. The normal position of the transoms in the panels has a "transom seat". This seat is made of ¼-inch steel plate with a steel dowel for locating the exact position of the transom. Since the reinforcing transoms were placed in an unorthodox location, it lacked having the floor beams of the bridge resting on them by ¼-inch. To eliminate this trouble steel plates of that thickness and 4½ inches wide were inserted between the transom and the panel chords. These plates were held in place by spot-welding them to the transoms. No special clamps were used to hold the transoms in place because the floor beam guides on the member kept it from sliding.

(3) Support Over the Pier: Special female bearings were already under the bridge over the pier, but the bridge could not articulate because packing was still under the trusses at each edge of the pier. The packing consisted of 3" x 12" blocks spiked to the trestle cap. These blocks were easily chiseled out leaving only the bearing supports. Packing was placed under the transoms at each end of the Class 70 bridge to support the ramp stresses under max loading.

(4) Equipment Used:

Normal Bailey bridge wrenches and jacks.
Block and tackle rigging.
1 Arc Welder.
1 Actylene cutting torch.
2 4-ton Wreckers.

4. Reinforcement of Scoured Concrete Base Pier:

a. General: In January 1945, the 337th Engineer Combat Battalion was ordered by the 1108th Engineer Combat Group to reinforce the scoured concrete pier base at SAN LORENZO bridge on Route 67 at Q736685. Actual work began on 5 January 1945 and was assigned to one company. The general plan was: first, to pack up under pier base with sacked concrete; second, to drive 15" x 10'-6" channel irons around base of pier (allowing 2'-0" to 2'-6" distance away from pier); third, to pour concrete between pier base and piling to create a seal against any further scour. During first phase work was carried on during daylight hours only with platoons working on four hour shifts. However, while driving the channel irons and pouring the concrete, work was executed on a 24-hour day basis, floodlights being used. Job was 100% complete as of 1700 hours, 14 January 1945.

[redacted]

b. Description: The original pier for the Bailey Bridge at SAN LORENZO consisted of two timber bents supported on a concrete footing 40'-0" x 14'-0". This footing was not poured on the river bed but was mounted on top of the road surface concrete slab which fell into the river when the bridge was destroyed by demolition. The slab extended across the wetted channel practically blocking the flow of water under the bridge. While working on the Bailey Bridge, it was noticed that the slab of the down stream side of the footing was unsupported due to the scouring of the water. The scouring was probably caused by the flow of water over the bridge slab laying in the river bed during flood stages. The pier footing was considered very unsafe because it was impossible to tell how much of the old road slab was supported on the river bed. Preliminary investigation showed that water was actually flowing under the road slab at several points. This situation required immediate attention before high water came and washed the foundation so badly that the entire pier be shifted down stream.

c. Details of Construction:

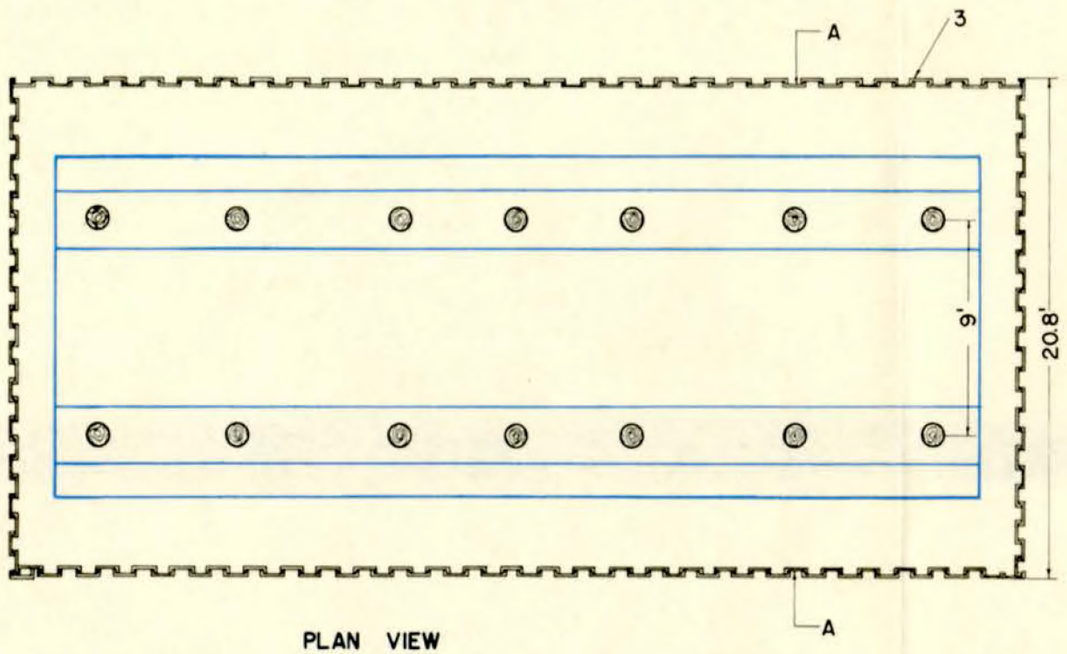
(1) Clearing of River Channel: To facilitate inspection of the bottom of the slab directly under the concrete footing, the first phase of reinforcing the footing was to cut the old concrete slab close to the base of the footing and remove all of it from the river channel. To accomplish this work, three compressors were used for breaking the concrete and one oxy-acetylene welder was kept close at all times to cut the reinforcing rods. The concrete was cut off one foot out from the face of the footing while the reinforcing extended one foot beyond that to give a method of securing the concrete to be used as reinforcement to the whole footing. Little trouble was encountered during this phase of construction and work progressed until the arrival of the channel irons.

(2) Driving of Channel Irons: A certain amount of difficulty was found at the start of this particular job. One Quickway, with pile-driving attachment, was used during this phase. The cap which came with the pile driver could not be used as the channel irons were too large. Also, the full length of leads could not be used because of lack of head space for crane. Both these factors necessitated using the hammer by itself in the first instance and home-made leads (2" x 8" bolted to one section of the normal leads) in the other. Therefore the straightness and the plumb of each channel iron was difficult to obtain. After driving four or five, worked progressed fairly well. Each channel iron was pointed by means of the oxy-acetylene torch to facilitate driving.

(3) Pouring of Concrete: No difficulty was found during this phase of the job. A portable concrete mixer was obtained and placed at road level. A wooden chute was made to convey concrete to river bed. From there wheel barrows transported it to pier base. Course sand and gravel were found near at hand.

[redacted]

PLATE 10

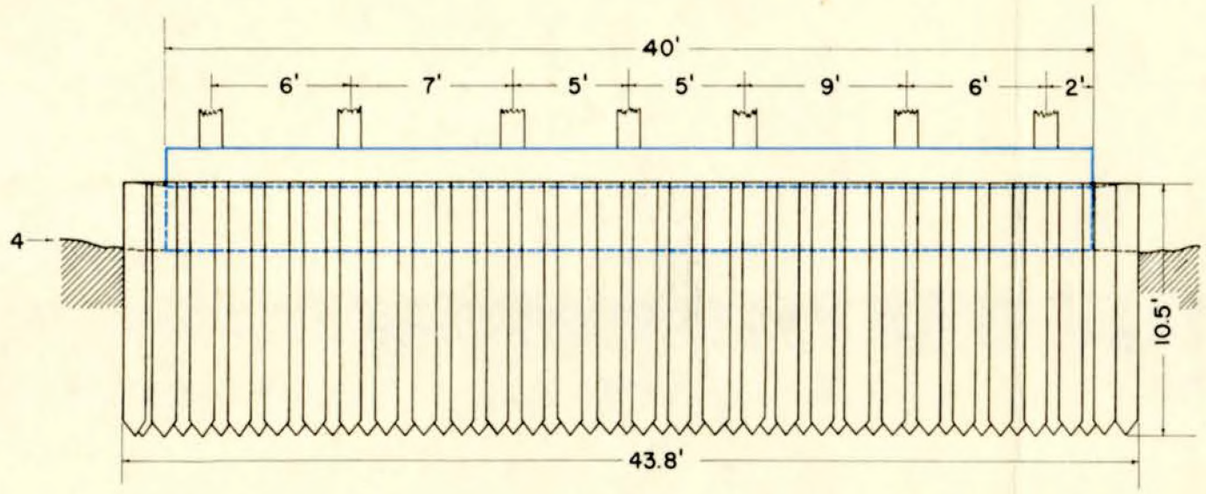



PLAN VIEW

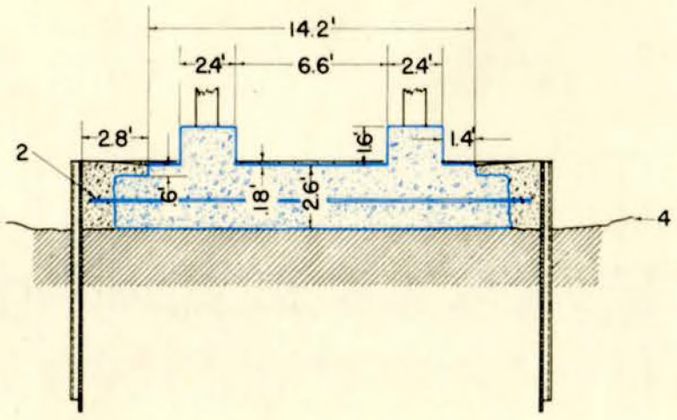
1. BLUE INDICATES OLD MASONRY CONSTRUCTION
2. REINFORCING STEEL PART OF EXISTING FOOTING
3. PILINGS INTERLOCKED AS INDICATED
4. GROUND LEVEL

CONCRETE MIX

EARTH




SIDE VIEW




CROSS SECTION A-A

| | | | | |
|---|---|---|---|---|
| HQ 337 ENGR C. BN. A.P.O. 464 U.S. ARMY | | | | |
| REINFORCEMENT OF FOOTING S. LORENZO BRIDGE PIER. | | | | |
| SCALE 25" = 1.00' | DRAWN BY R. RORVER | CHECKED J. B. H. | APPROVED W. D. A. | APPENDIX "A" |
| DATE | 15-1-45 | 15-1-45 | 15-1-45 | |

# REINFORCEMENT OF SCOURED CONCRETE BASE PIER

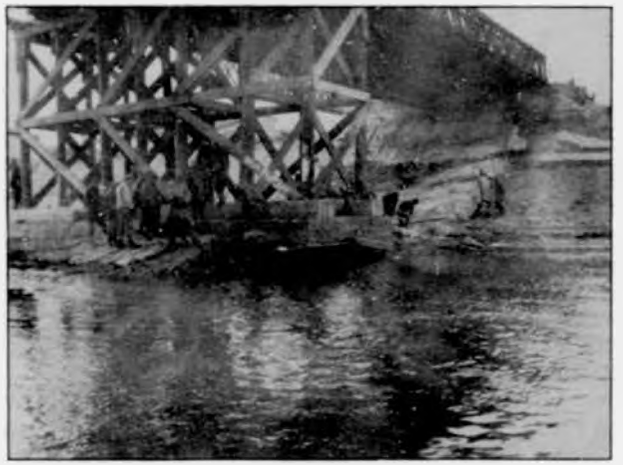


FIG.1 PRIOR TO CLEARING OF RIVER CHANNEL

FIG. 2 POURING CONCRETE

FIG. 3 COMPLETED JOB

PLATE II

(4) Equipment Needs:

3 Motorized compressors.
1 Quickway crane (with pile-driver)
1 Oxy-acetylene torch.
1 Portable concrete mixer.
2 4-ton prime movers.
2 20-ton flat bed trailers.
6 Carbide lights.
1 25-KW generator.
8 Wheel barrows.

5. Improvised Bridges: (Source: Engr, II Corps).

a. Using Bailey Equipment: An improvised foot and mule bridge can be made by pinning single panels of Bailey Bridge together in the normal way and laying them flat and decking with regular chess. This has been done on a 30 foot span using a winch to pull the bridge into place. Such a bridge with two joints unsupported carried loaded pack mules.

b. Using the Footbridge M1938 Equipment: A jeep bridge can be constructed by adding duckboards to the reinforced bridge bay of three duckboards and six floats. By laying a fourth and fifth duckboard upside down on top of the outside duckboards at jeep wheel spacing, a definite track will keep the jeep on center distributing the load efficiently and at the same time preventing it from sliding off the bridge.

## V. WATER SUPPLY

Nothing

## VI. CAMOUFLAGE

1. Enemy Methods: Enemy defenses along the west coast of Italy between VIAREGGIO and FORTE DEI MARMI, included a number of pill boxes and gun emplacements camouflaged to look like buildings. (See Plate 12)

a. At U964864, a gun emplacement was built and painted to resemble a beach restaurant (fig 1). This position was sited to afford enfilade fire along the flat straight beach. The deceptive measure was appropriate, inasmuch as the emplacement was on the beach in front of a large hotel, and therefore a logical location for a beach restaurant.

b. Another position (at U956881) was built like a normal house (figs 2-3). An unusual feature of this building was the painting of ferns on a side wall. This wall could only be viewed from the land side, and the purpose it was to serve is unknown.

c. All of the decoy buildings which were examined contained window and door insents on which were painted dummy frames, shutters,

etc. Buildings were of reinforced concrete. Wire entanglements and mines were scattered along the beach.

2. Own Methods: Experiments have been carried on in connection with the concealment of forward artillery positions located in the snow covered APENNINES:

a. Problem: To conceal a battery of 155 mm guns.

b. Conditions considered included:

(1) Ground expected to have permanent snow cover until spring.

(2) Limited visual enemy air reconnaissance; photographic flights practically nil.

(3) Enemy nuisance planes fly at dusk looking for targets of opportunity.

(4) Enemy mortar and artillery fire is used against our positions.

c. Three methods of concealment were employed in the experiments (see Plate 13)

(1) Camouflage net garnished with strips of white cloth.

(2) Gun and interior of position painted white.

(3) Mound made of steel wool camouflage material painted white and supported by poles placed over position.

NOTE: White cloth which is recognized as the best camouflage aid, was not used inasmuch as it is not available.

d. Observations were made from the ground, air, and with air photographs by camouflage officers and the following results were noted:

(1) Camouflage net with white garlands:

(a) Ground: Position showed up plainly as it failed to match snow texture.

(b) Air: At less than 3000 ft. from a slow moving plane (cub) the position showed up clearly; at over 5000 ft. the position showed up as a blur and it could not be determined if position were occupied.

(c) Photographic: On 1/10,000 scale photo, position showed up plainly but close scrutiny was necessary to determine occupancy.

(2) White painted position:

(a) Ground: Excellent; from distances exceeding 300 yards position could only be detected by activity.

(b) Air: From less than 300 ft., in a slow moving plane, the gun could be identified due to darker coloration of pit; from over 5000 ft., position appeared as a blur.

# ENEMY CAMOUFLAGE


FIG. 1 GUN EMPLACEMENT AS DECOY RESTAURANT

FIG. 2 GUN EMPLACEMENT AS DECOY HOUSE

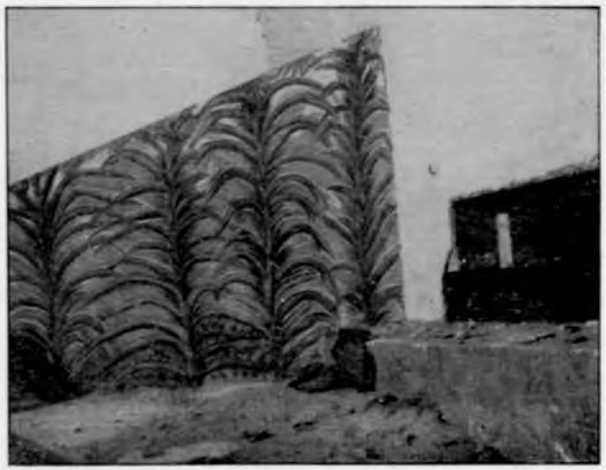


FIG. 3 CLOSE UP OF PAINTED FERNS

PLATE 12

# SNOW CAMOUFLAGE (155mm. GUN)

FIG. 1 CAMOUFLAGE NET WITH WHITE GARNISHING MATERIAL

FIG. 2 GUN PAINTED WHITE

FIG. 3 WHITE STEEL WOOL NETTING

PLATE 13

(c) Photographic: Position could readily be identified under stereoscope, but occupancy appeared doubtful.

(3) White steel wool mound:

(a) Ground: Fair; texture and color did not match glazed snow.

(b) Air: From 2500 ft. upwards position appeared as a blur.

(c) Photographic: Position showed up plainly; gun barrel could be seen.

NOTE: Mound was not strong enough to withstand snow load of more than an inch. It is doubtful if it is practical to build a framework strong enough to withstand a snow load of more than three inches.

e. Conclusions: A field artillery position cannot be concealed in open snow country from the airphoto interpreter. Positions can be made inconspicuous from visual air reconnaissance by use of overhead screening or nets. White painting of gun and other dark areas helps render the position inconspicuous both from the air and ground. Tracks should be controlled as much as is consistent with operating conditions.

## VII. GENERAL CONSTRUCTION

Nothing

## VIII. ENGINEER SUPPLY

Nothing

## IX. EQUIPMENT

Nothing

## X. PUBLICATIONS

Below is a list of recent acquisitions to the Engineer Headquarters Library. These documents are available on a loan basis to all Fifth Army engineer units for a period not to exceed five days. Only one copy of each is available and prompt return of borrowed documents is necessary in order that all interested parties may benefit from available information. Requests for items should be accompanied by the document title, number and/or date.

| | ENGINEER BOARD REPORTS | DATE |
|---|---|---|
| | Monthly Report on Development | Nov 1944 |
| No. 868 | Demolition and Exploratory Drilling Tests With Model 43-S Airborne Rotary Well-Drilling Machine. | 18 Sept 1944 |

| | | |
|---|---|---|
| No. 886 | Tests of Wallace and Tiernan 2-QM Water Purification Unit. | 3 Nov 1944 |
| No. 888 | Equipment for Passage of Enemy Minefields Fifth Interim Report. | 1 Nov 1944 |
| No. 882 | Mobile Self-Launching Bridge. | 28 Oct 1944 |
| No. 859 | Protection Armor on Construction Equipment | 26 Aug 1944 |
| No. 894 | Sixth Interim Report - Equipment for Passage of Enemy Minefields. | 1 Dec 1944 |
| No. 891 | Materials and Methods for Reducing the Reflection from Glass Surfaces. | 25 Nov 1944 |
| No. 903 | First Interim Report Snake, Demolition, River Crossing, T-1 | 1 Jan 1945 |

TECHNICAL MANUALS

| | |
|---|---|
| T.M. 9-2800 | Standard Military Motor Vehicles. |
| T.M. 5-1310 | Bulldozer, Tank Mounting, Hydraulic Operated, La Plant - Choate, Model BM4 for M4A1 - A2 and A3 Medium Model Tanks. |

OTHER PUBLICATIONS

| | |
|---|---|
| German Minefield Doctrine - Information Sec, Intelligence Division, O.C.E., HQ, ETOUSA. | 29 Dec 1944 |
| German Mine Warfare In Winter - Infor. Sec, Intelligence Division, O.C.E., HQ, ETOUSA. | 7 Jan 1945 |
| Report on The Floating Mine Barrier - Seventh Army River Crossing Schools. | 17 Dec 1944 |
| ETOUSA Publication on British Two Inch Conger (Liquid filled canvas hose for clearing lane in minefield) | 14 Aug 1944 |
| Report on Ferrying Experiments - Seventh Army River Crossing Schools. | Jan 1945 |

## XI. MISCELLANEOUS

1. Fire Fighting: The following data on combatting gasoline fires is the result of experiments conducted by the Fifth Army Fire Department on 28 December 1944, and of observations made at fires involving petroleum products during the past year.

[redacted]

a. Five gallon gasoline cans will generally burn in the following manner: External heat and fire will cause the gasoline to vaporize and expand developing a high internal pressure in the cans. If the gasket does not burn through and let the gas vapor escape the pressure will generally blow a portion of the gasket out. Gas vapors escaping under pressure will burn similar to a torch if free combustion (sufficient air) is available. In a stack of cans there is generally insufficient air and the vapors will combine with the vapors from other cans and combine with the air resulting in a billowing flame.

b. Filled cans will not burn or explode. However, the gasoline will vaporize rapidly when heated as stated in paragraph a. When cans are nearly empty the vaporization often becomes so rapid that the gas pressure ruptures the can resulting in an explosion of the vapors. Warning is usually given of an imminent rupture by a bulging of the sides of the can. Explosions sometimes hurl the cans more than fifty yards. Vapor pockets formed in stacks of cans also explode, hurling the cans through the air.

c. Techniques employed on small stacks (10 cans) of burning gasoline using American fire fighting apparatus resulted in the following conclusions:

(1) Low velocity semi-high pressure fog from applicator delivered by Class 135 Crash Truck is satisfactory only for a few cans.

(2) High velocity semi-high pressure fog from 1" fog gun delivered by Class 135 Crash Truck is not satisfactory for stacks of cans, being best suited for sweeping surface gasoline fires.

(3) 2½" low velocity fog nozzle with 6'-0" applicator is not satisfactory for areas exceeding 10'-0" across. The 2½" hose line is difficult to handle, not having sufficient maneuverability, and thereby making it difficult to put out all the flames. Clean water must be used to prevent fog tip from being clogged by stones.

(4) 2½" high velocity fog at 100 to 150 psi nozzle pressure provides excellent protection for fire fighting personnel from heat and flame. Excellent results are obtained on surface fires and small stacks. Fog cover is not sufficient to extinguish blazes involving standard stacks (1000 cans). Fires on 2½ ton cargo trucks loaded with gasoline cans have been successfully extinguished with high velocity fog using less than 300 gallons of water. Clean water must be used to prevent fog tip from being clogged by stones.

(5) 1" foam-generating nozzle using liquid foam produces an excellent foam at weak and medium nozzle pressures (30 - 50 psi) at a rate exceeding 100 GPM, but the short range requires fire fighting personnel to work in so close that they are in danger of being cremated.

(6) 1½" line with a foam-generating nozzle does not produce a good foam (too watery) apparently due to the small sized diameter of the foam compound pickup tube. Removing the sediment screen produces a somewhat better foam but it appears more practical to reduce 1½" lines to 1" lines for the last length of hose and use the foam nozzle off the 1" line.

d. A captured European foam generating nozzle, similar to the British No. 2 foam generating branch pipe, converted to fit American

[redacted]

[redacted]

2½" lines and using liquid foam compound produced the following results:

(1) At medium nozzle pressure (50 - 60 psi) 600 to 800 GPM of excellent foam was produced.

(2) Foam could be rolled into build-up a blanket from 50 to 75 feet away from the stack.

(3) Foam could be lobbed in from a distance exceeding 100 feet if need be.

(4) A good foam will stick to vertical surfaces enabling a blanket to be built around and on top of cans, successfully extinguishing the fire.

e. Conclusions: Due to the uncertain behavior of gasoline fires, no definite conclusions can be drawn, but the following can normally be assumed:

(1) Gasoline cans when subject to fire will burn around the filling spout like a torch due to gasoline vapors escaping under pressure.

(2) Cans partially empty that have been subject to heat or fire for periods of fifteen minutes or longer, may rupture their seams, resulting in gasoline fume explosions that may hurl cans as far as fifty yards. Cans bulge noticeably prior to rupture.

(3) High-velocity, large-sized (2½") fog and 2½" foam-generating nozzles are the safest and most efficient means for combatting large petroleum fires.

(4) As an emergency measure dirt can be thrown on the flames from 15 to 30 feet away and is very effective.

(5) Dozers can be used effectively for banking earth and smothering the flaming gasoline cans.

(6) Dispersion of storage stacks is the principle fire-control measure available to military authorities. Stacks should be at least 50 yards apart.

(7) The firing of small arms ammunition into burning gasoline stacks is of questionable value. Bullet holes will enable the pent-up gasoline vapors to escape before the cans rupture. Great care must be used in order to avoid hitting anything other than burning cans. Incendiary or tracer bullets should not be used. The Fifth Army Fire Department does not favor this practice.

NOTE: Any description of only enemy equipment or methods, contained in this bulletin, or in any previous edition of the Fifth Army Engineer Technical Bulletin, may be extracted and reproduced with the classification of "RESTRICTED".

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