

INVENTIONS OF THE
GREAT WAR

DEMO

dimensione ridotta

PREFACE

The great World War was more than two-thirds over when America entered the struggle, and yet in a sense this country was in the war from its very beginning. Three great inventions controlled the character of the fighting and made it different from any other the world has ever seen. These three inventions were American. The submarine was our invention; it carried the war into the sea. The airplane was an American invention; it carried the war into the sky. We invented the machine gun; it drove the war into the ground.

It is not my purpose to boast of American genius but, rather, to show that we entered the war with heavy responsibilities. The inventions we had given to the world had been developed marvelously in other lands. Furthermore they were in the hands of a determined and unscrupulous foe, and we found before us the task of overcoming the very machines that we had created. Yankee ingenuity was faced with a real test.

The only way of overcoming the airplane was to build more and better machines than the enemy possessed. This we tried to do, but first we had to be taught by our allies the latest refinements of this machine, and the war was over before we had more than started our aerial program. The machine gun and its accessory, barbed wire (also an American invention), were overcome by the tank; and we may find what little comfort we can in the fact that its invention was inspired by the sight of an American farm tractor. But the tank was a British creation and was undoubtedly the most important invention of the war. On the sea we were faced with a most baffling problem. The U-boat could not be coped with by the building of swarms of submarines. The essential here was a means of locating the enemy and destroying him even while he lurked under the surface. Two American inventions, the hydrophone and the depth bomb, made the lot of the U-boat decidedly unenviable and they hastened if they did not actually end German frightfulness on the sea.

But these were by no means the only inventions of the war. Great Britain showed wonderful ingenuity and resourcefulness in many

directions; France did marvels with the airplane and showed great cleverness in her development of the tank and there was a host of minor inventions to her credit; while Italy showed marked skill in the creation of large airplanes and small seacraft.

The Central Powers, on the other hand, were less originaive but showed marked resourcefulness in developing the inventions of others. Forts were made valueless by the large portable Austrian guns. The long range gun that shelled Paris was a sensational achievement, but it cannot be called a great invention because it was of little military value. The great German Zeppelins were far from a success because they depended for their buoyancy on a highly inflammable gas. It is interesting to note that while the Germans were acknowledging the failure of their dirigibles the British were launching an airship program, and here in America we had found an economical way of producing a non-inflammable balloon gas which promises a great future for aerial navigation.

The most important German contribution to the war—it cannot be classed as an invention—was poison gas, and it was not long ere they re-

gretted this infraction of the rules of civilized warfare adopted at the Hague Conference; for the Allies soon gave them a big dose of their own medicine and before the war was over, fairly deluged them with lethal gases of every variety.

Many inventions of our own and of our allies were not fully developed when the war ended, and there were some which, although primarily intended for purposes of war, will be most serviceable in time of peace. For this war was not one of mere destruction. It set men to thinking as they had never thought before. It intensified their inventive faculties, and as a result, the world is richer in many ways. Lessons of thrift and economy have been taught us. Manufacturers have learned the value of standardization. The business man has gained an appreciation of scientific research.

The whole story is too big to be contained within the covers of a single book, but I have selected the more important and interesting inventions and have endeavored to describe them in simple language for the benefit of the reader who is not technically trained.

A. RUSSELL BOND

New York, May, 1919

CONTENTS

CHAPTER	PAGE
I THE WAR IN AND UNDER THE GROUND	3
II HAND-GRENADES AND TRENCH MORTARS	20
III GUNS THAT FIRE THEMSELVES	41
IV GUNS AND SUPER-GUNS	62
V THE BATTLE OF THE CHEMISTS	85
VI TANKS	107
VII THE WAR IN THE AIR	123
VIII SHIPS THAT SAIL THE SKIES	148
IX GETTING THE RANGE	169
X TALKING IN THE SKY	184
XI WARRIORS OF THE PAINT-BRUSH	209
XII SUBMARINES	232
XIII GETTING THE BEST OF THE U-BOAT	253
XIV "DEVIL'S EGGS"	276
XV SURFACE BOATS	298
XVI RECLAIMING THE VICTIMS OF THE SUBMARINES	310
INDEX	339

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LIST OF ILLUSTRATIONS

	FACING PAGE
Oil-tempering the lining of a big gun	<i>Frontispiece</i>
Lines of zig-zag trenches as viewed from an aero- plane	8
French sappers using stethoscopes to detect the mining operations of the enemy	9
A 3-inch Stokes mortar and two of its shells	36
Dropping a shell into a 6-inch trench mortar	36
The Maxim machine-gun operated by the energy of the recoil	37
Colt machine-gun partly broken away to show the operating mechanism	37
The Lewis gun which produces its own cooling current	44
The Benét-Mercié gun operated by gas	44
Browning machine gun, weighing 34½ pounds	45
Browning machine rifle, weight only 15 pounds	45
Lewis machine-guns in action at the front	52
An elaborate German machine-gun fort	53
Comparative diagram of the path of a projectile from the German super-gun	60
One of our 16-inch coast defence guns on a dis- appearing mount	61
Height of gun as compared with the New York City Hall	61
The 121-mile gun designed by American ordnance officer	68
American 16-inch rifle on a railway mount	69

	FACING PAGE
A long-distance sub-calibered French gun on a railway mount	76
Inside of a shrapnel shell and details of the fuse cap	77
Searchlight shell and one of its candles	77
Putting on the gas masks to meet a gas cloud attack	84
Even the horses had to be masked	85
Portable flame-throwing apparatus	85
Liquid fire streaming from fixed flame-throwing apparatus	92
Cleaning up a dugout with the "fire-broom"	93
British tank climbing out of a trench at Cambrai	112
Even trees were no barrier to the British tank	113
The German tank was very heavy and cumbersome	113
The speedy British "Whippet" tank that can travel at a speed of twelve miles per hour	120
The French high-speed "baby" tank	120
Section through our Mark VIII tank showing the layout of the interior	121
A Handley-Page bombing plane with one of its wings folded back	128
How an object dropped from the Woolworth Building would increase its speed in falling	129
Machine gun mounted to fire over the blades of the propeller	136
Mechanism for firing between the blades of the propeller	136
It would take a hundred horses to supply the power for a small airplane	137
The flying-tank	144
An N-C (Navy-Curtiss) seaplane of the type that made the first flight across the Atlantic	145
A big German Zeppelin that was forced to come down on French soil	148

ILLUSTRATIONS

xiii

	FACING PAGE
Observation car lowered from a Zeppelin sailing above the clouds	149
Giant British dirigible built along the lines of a Zeppelin	156
One of the engine cars or "power eggs" of a Brit- ish dirigible	156
Crew of the C-5 (American coastal dirigible) starting for Newfoundland to make a trans- atlantic flight	157
The curious tail of a kite balloon	160
Observers in the basket of an observation balloon	160
Enormous range-finders mounted on a gun turret of an American warship	161
British anti-aircraft section getting the range of an enemy aviator	176
A British aviator making observations over the German lines	177
Radio headgear of an airman	192
Carrying on conversation by radio with an aviator miles away	192
Long distance radio apparatus at the Arlington (Va.) station	193
A giant gun concealed among trees behind the French lines	212
Observing the enemy from a papier-mâché replica of a dead horse	213
Camouflaged headquarters of the American 26th Division in France	220
A camouflaged ship in the Hudson River on Vic- tory Day	221
Complex mass of wheels and dials inside a German submarine	240
Surrendered German submarines, showing the net cutters at the bow	241
Forward end of a U-boat	256

	FACING PAGE
A depth-bomb mortar and a set of "ash cans" at the stern of an American destroyer . . .	257
A depth bomb mortar in action and a depth bomb snapped as it is being hurled through the air	260
Airplane stunning a U-boat with a depth bomb . . .	261
The false hatch of a mystery ship	268
The same hatch opened to disclose the 3-inch gun and crew	268
A French hydrophone installation with which the presence of submarines was detected	269
Section of a captured mine-laying U-boat	272
A paravane hauled up with a shark caught in its jaws	273
A Dutch mine-sweeper engaged in clearing the North Sea of German mines	288
Hooking up enemy anchored mines	289
An Italian "sea tank" climbing over a harbor boom	300
Deck of a British aircraft mothership or "hush ship"	301
Electrically propelled boat or surface torpedo, attacking a warship	304
Hauling a seaplane up on a barge so that it may be towed	305
Climbing into an armored diving suit	320
Lowering an armored diver into the water	320
A diver's sea sled ready to be towed along the bed of the sea	321
The sea sled on land showing the forward horizontal and after vertical rudders.	321
The diving sphere built for deep sea salvage operations	324
The pneumatic breakwater	325



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Lines of Zig-Zag Trenches as viewed from an Airplane



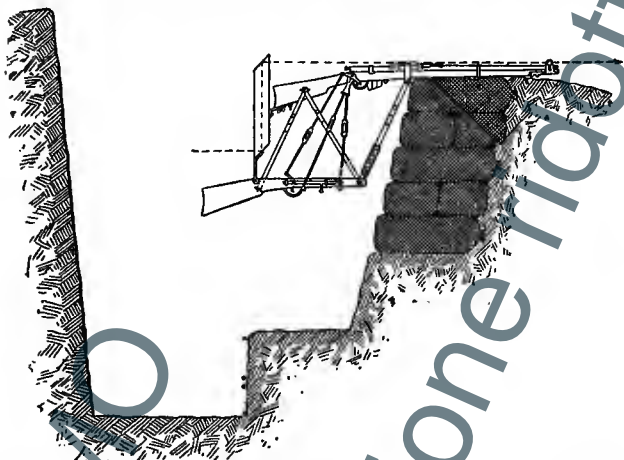
Courtesy of "Scientific American "

French Sappers using Stethoscopes to detect the Mining Operations of the Enemy

to drive the invaders out of the country. The construction of the trenches along some parts of the battle-line was particularly difficult, because of the problem of drainage. This was especially true in Flanders, where the trenches in many cases were below water-level, and elaborate pumping-systems had to be installed to keep them dry. Some of them were concrete-lined to make them waterproof. In the early stages of the war, before the trenches were drained, the men had to stand in water for a good part of the time, and the only way they could get about at all in the miry trenches was by having "duck-boards" in them. Duck-boards are sections of wooden sidewalk such as we find in small villages in this country, consisting of a couple of rails on which crosspieces of wood are nailed. These duck-boards fairly floated in the mud.

Some of the trenches were provided with barbed-wire barriers or gates calculated to halt a raiding-party if it succeeded in getting into the trench. These gates were swung up out of the way, but when lowered they were kept closed with a rather complicated system of bolts which the enemy would be unable to unfasten

rubbish, tin cans, or any object that had been penetrated by a bullet and note the direction taken by the bullet. This would give a line leading toward the source of the shot, and when a number of such lines were traced, they



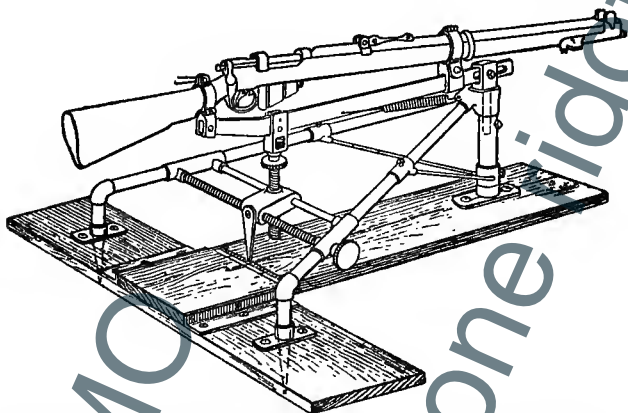
Redrawn from Military Map Reading by permission of E. C. McKay
 FIG. 1. A "sniperscope" with which a sharpshooter could take aim without showing his head above the parapet

would cross at a spot where the sniper or his gun was stationed, and a few shells would put the man out of business. Dummy heads of papier mâché were sometimes stuck above the parapet to draw the fire of enemy snipers and the bullet-holes which quickly ap-

14 INVENTIONS OF THE GREAT WAR

peared in them were studied to discover the location of the snipers.

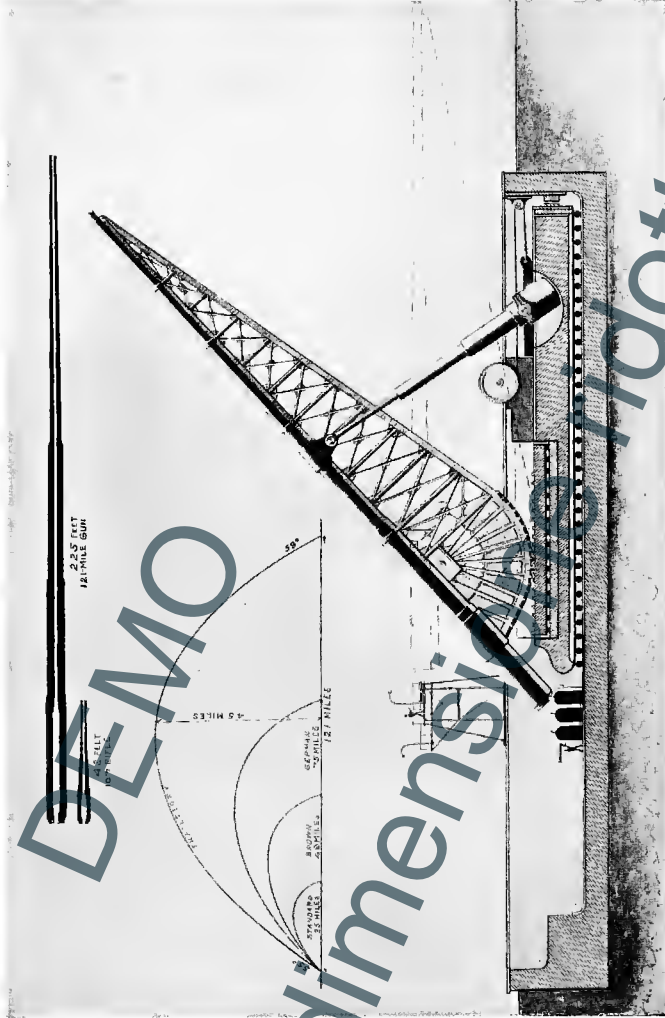
Sometimes fixed rifles were used. These were set on stands so that they could be very accurately trained upon some important enemy



Redrawn from *Military Map Reading* by permission of E. C. McKay

FIG. 2. A fixed rifle stand arranged to be fired after dark

post. Then they could be fired in the dark, without aiming, to disturb night operations of the enemy. Often a brace of rifles, as many as six, would be coupled up to be fired simultaneously, and by operating a single lever each gun would throw out the empty cartridge shell and bring a fresh one into position.



225 FEET
121-MILE GUN

48 INCHES

25 MILES

40 MILES

127 MILES

59°

40 MILES

GERMAN
"50 MILES"

127 MILES

Courtesy of "Scientific American"

The 121-Mile Gun designed by American Ordnance Officers

demonsi.com/rodotta



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American 16-Inch Rifle on a Railway Mount

much more without using some special support for the muzzle end of the gun, to keep it from "whipping" too much. It is likely that the long-range German gun was provided with a substantial support at the muzzle to keep it from sagging.

Every once in a while a man comes forth with a "new idea" for increasing the range. One plan is to increase the powder-pressure. We have powders that will produce far more pressure than an ordinary gun can stand. But we have to use powders that will burn comparatively slowly. We do not want too sudden a shock to start with, but we wish the powder to give off an enormous quantity of gas which will keep on pushing and speeding up the shell until the latter emerges from the muzzle. The fifty-mile gun that was proposed twenty years ago was designed to stand a much higher pressure than is commonly used, and it would have fired a 10-inch shell weighing 600 pounds with a velocity of 4,000 feet per second at the muzzle.

The Allies built no "super-guns," because they knew that they could drop a far greater quantity of explosives with much greater accuracy from airplanes, and at a much lower

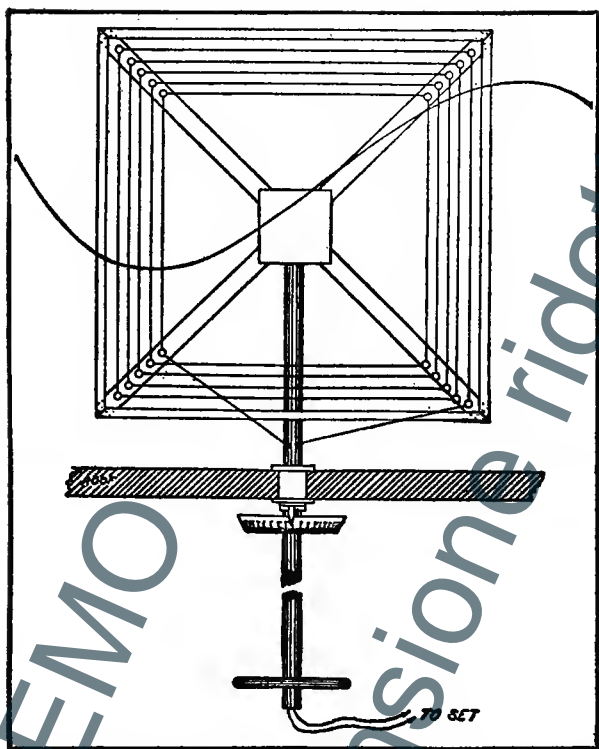


(C) Kadel & Herbert
Liquid Fire Streaming from Fixed Flame-throwing Apparatus

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Courtesy of "Scientific American"
Cleaning Up a Dugout with the "Fire Broom"



Courtesy of the "Scientific American"

FIG. 11. The radio compass turned parallel to an oncoming electro-magnetic wave



(C) Committee on Public Information

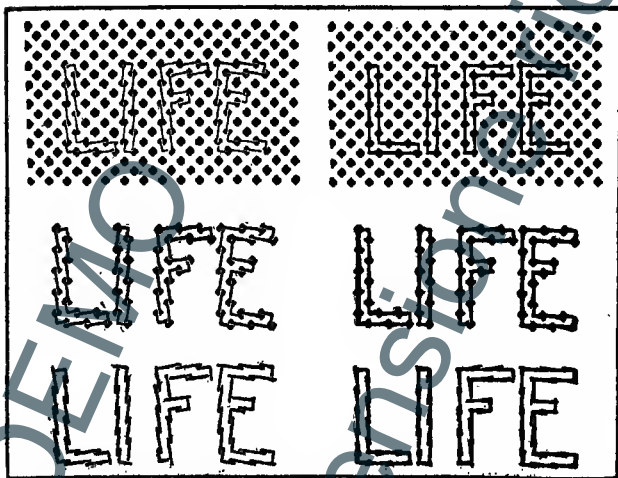
Observing the Enemy from a Papier-Mâché Replica
of a Dead Horse



FIG. 13. Parallel lines that look straight



FIG. 14. Parallel lines that do not look straight



Courtesy of the Submarine Defense Association

FIG. 15. Letters that look all higgledy-piggledy, but are really straight

Fig. 14, and they no longer look straight. Take the letters on the left, Fig. 15. They look all higgledy-piggledy, but they are really straight and parallel, as one can prove by laying a straight-edge against them, or by drawing a straight line through each letter, as shown at the right, Fig. 16. Such illusions were used on ships. Stripes were painted on the hull that tapered slightly, from bow to stern, so that the vessel appeared to be headed off at an angle, when it was really broadside to the watcher at the other end of the periscope.

There are color illusions, too, that were tried. If you draw a red chalk-mark and a blue one on a perfectly clean blackboard, the red line will seem to stand out and the blue one to sink into the black surface of the board, because your eye has to focus differently for the two colors, and a very dazzling effect can be had with alternating squares of blue and red. Other colors give even more dazzling effects, and some of them, when viewed at a distance, will blend into the very shade of gray that will make a boat invisible at six miles. When U-boat commanders took observations on a ship painted with a "dazzle" camouflage, they saw a shimmering

image which it was hard for them to measure on the fine graduations of their periscopes. Some ships were painted with heavy blotches of black and white, and the enemy making a hasty observation would be apt to focus his attention on the dark masses and overlook the white parts. So he was likely to make a mistake in estimating the height of the smoke-stack or in measuring the apparent length of a vessel.

A JOKE ON THE PHOTOGRAPHER

Early in the submarine campaign one of our boats was given a coat of camouflage, and when the vessel sailed from its pier in the North River, New York, the owners sent a photographer two or three piers down the river to photograph the ship as she went by. He took the picture, but when the negative was developed, much to his astonishment he found that the boat was not all on the plate. In the finder of his camera, he had mistaken a heavy band of black paint for the stern of the ship, quite overlooking the real stern, which was painted a grayish white. The artist had fooled the photographer and at a distance of not more than two or three hundred yards!

SEEING BEYOND THE HORIZON

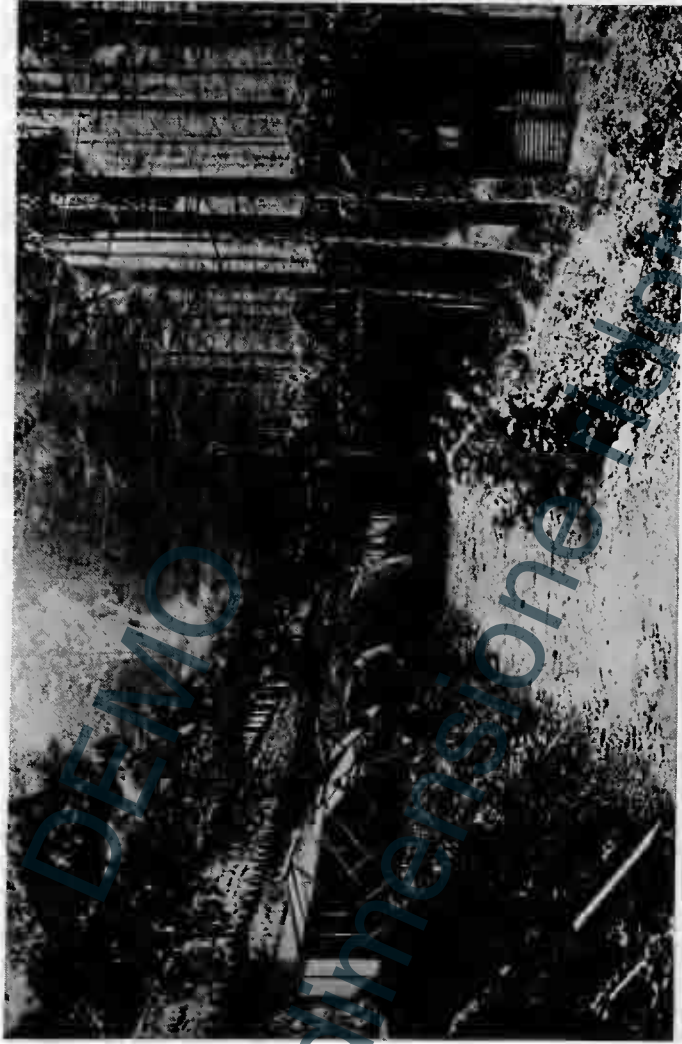
The periscope of a submarine that is running awash can be raised about fifteen feet above the water, which means that the horizon as viewed from that elevation is about six miles away, and if you draw a circle with a six-mile radius on the map of the Atlantic, you will find that it is a mere speck in the ocean; but a U-boat commander could see objects that lay far beyond his horizon because he was searching for objects which towered many feet above the water. The smoke-stacks of some vessels rise a hundred feet above the water-line, and the masts reach up to much greater altitudes. Aside from this, in the early days of the war steamers burned soft coal and their funnels belched forth huge columns of smoke which was visible from twenty to thirty miles away.

When this was realized, efforts were made to cut down the superstructure of a ship as much as possible. Some vessels had their stacks cut down almost to the deck-line, and air-pumps were installed to furnish the draft necessary to

keep their furnaces going. They had no masts except for slender iron pipes which could be folded down against the deck and could be erected at a moment's notice, to carry the aërials of the wireless system. Over the ship from stem to stern was stretched a cable, familiarly known as a "clothes-line," upon which were laid strips of canvas that completely covered the superstructure of the ship. These boats lay so low that they could not be seen at any great distance, and it was difficult for the U-boats to find them. They were slow boats; too slow to run away from a modern submarine, but because of their lowly structure, they managed to elude the German U-boats. When they were seen, the U-boat commanders were afraid of them. They were suspicious of anything that looked out of the ordinary, and preferred to let the "clothes-line ships" go.

THE BRITISH MYSTERY SHIPS

The Germans had some very unhealthy experiences with the "Q-boats" or "mystery ships" of the British. These were vessels rigged up much like ordinary tramp steamers, but they were loaded with wood, so that they



(C) Committee on Public Information
Camouflaged Headquarters of the American 26th Division in France
From Western Newspaper Union



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A Camouflaged Ship in the Hudson River on Victory Day

to destroy them. But occasionally, when conditions permitted, mine-sweepers undertook to raise the mines and reclaim them for future use against the enemy. The work of seizing a mine and making it fast to the hoisting-cable of the mine-sweeper was usually done from a small rowboat. Raising the first mine was always the most perilous undertaking, because no one knew just what type of mine it was and how to handle it with safety, or whether there was any way in which it *could* be made harmless. There were some mines, for instance, that contained within them a small vial partly filled with sulphuric acid. The mine carried no prongs, but if it were tilted more than twenty degrees the acid would spill out and blow up the mine. Such a mine would be exceedingly difficult if not impossible to handle from a boat that was rocked about by the waves.

After the first mine of the field was raised and its safety-mechanism studied, the task of raising the rest was not so dangerous. A water telescope was used to locate the mine and to aid in hooking the hoisting-cable into the shackle on the mine. The hook was screwed to the end of a pole and after the mine was

hooked, the pole was unscrewed and the cable hauled in, bringing up the "devil's egg" bristling with death. Care had to be taken to keep the bobbing boat from touching the delicate prongs until the safety-device could be set.

However, this painstaking and careful method of raising mines was not often employed. Shallow-draft mine-sweepers would run over the mine-field, dragging a cable between them. The cable would be kept down by means of hydrovanes or "water kites" deep enough to foul the anchor cables of the mines. The "water kites" were V-shaped structures that were connected to the cable in such a way that they would nose down as they were dragged through the water and carry the cable under. The action is just the reverse of a kite, which is set to nose up into the wind and carry the kite up when it is dragged through the air. By means of the cable the anchor chain of the mine was caught and then the mine with its anchor was dragged up. If the mine broke loose from its anchor it could be exploded with a rifle-shot if it did not automatically explode on fouling the cable.

FLOATING MINES

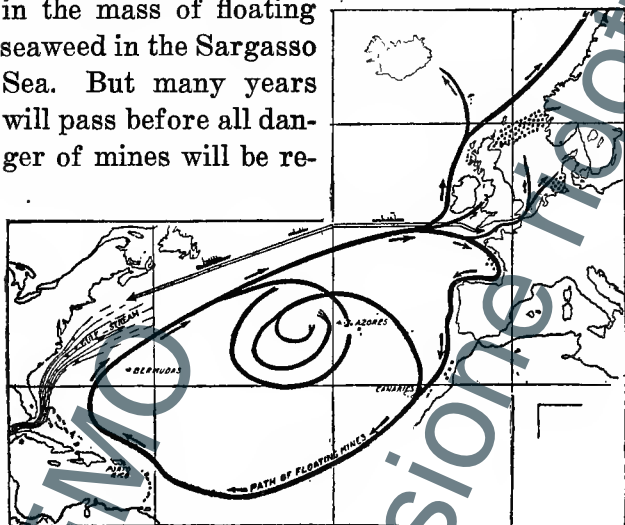
When England entered the war she mined her harbors because, although she had the mastery of the sea, she had to guard against raids of enemy ships carried out in foggy and dark weather. But the mines were no protection against submarines. They would creep along the bottom under the mines. Then cable nets were stretched across the harbor channels to bar the submarines, but the U-boats were fitted with cutters which would tear through the nets, and it became necessary to use mines set at lower depths so that the submarines could not pass under them; and nets were furnished with bombs which would explode when fouled by submarines. In fact, mines were set adrift with nets stretched between them, to trap submarines. Floating mines were also used by the Germans for the destruction of surface vessels and these were usually set adrift in pairs, with a long cable connecting them, so that if a vessel ran into the cable the mines would be dragged in against its hull and blow it up.

The laws of war require that floating mines be

of such a design that they will become inoperative in a few hours; otherwise they might drift about for weeks or months or years and be a constant menace to shipping. Sometimes anchored mines break away from their moorings and are carried around by ocean currents or are blown about by the winds. A year after the Russo-Japanese War a ship was blown up by striking a mine that had been torn from its anchorage and had drifted far from the field in which it was planted. No doubt there are hundreds of mines afloat in the Atlantic Ocean which for many years to come will hold out the threat of sudden destruction to ocean vessels; for the Germans knew no laws of war and had no scruples against setting adrift mines that would remain alive until they were eaten up with rust.

The chart on the next page shows the course of ocean currents in the North Atlantic as plotted out by the Prince of Monaco, from which it may be seen that German mines will probably make a complete circuit of the North Atlantic, drifting down the western coast of Europe, across the Atlantic, around the Azores,

and into the Gulf Stream, which will carry them back to the North Sea, only to start all over. (See Fig. 23.) Some of them will run up into the Arctic Ocean, where they will be blown up by striking icebergs and many will be trapped in the mass of floating seaweed in the Sargasso Sea. But many years will pass before all danger of mines will be re-



Courtesy of the "Scientific American"

FIG. 23. Ocean currents of the North Atlantic showing the probable path of drifting mines

moved. In the meantime, the war has left a tremendous amount of work to be done in raising anchored mines and destroying them.



(C) Press Illustrating Service

A Dutch Mine-sweeper engaged in clearing the North Sea of German Mines



Courtesy of "Scientific American "

Hooking Up Enemy Anchored Mines

THE AWKWARD "EAGLES"

A curious boat that we undertook to furnish during the war was a cross between a destroyer and a submarine-chaser. After the submarine had been driven out to sea its greatest foe was undoubtedly the destroyer, and frantic efforts were made to turn out as many destroyers as possible. But it takes time to build destroyers and so a new type of boat was designed, to be turned out quickly in large numbers. A hundred and ten "Eagles" (as these boats are called) were ordered, but the armistice was signed before any of them were put into service; and it is just as well that such was the case, for in their construction everything was sacrificed to speed of production. As a consequence they are very ugly boats, with none of the fine lines of a destroyer, and they roll badly, even when the sea is comparatively peaceful. They are five-hundred-ton boats designed to make eighteen knots, which would not have been fast enough to cope with U-boats, because the latter could make as high a speed as that themselves, when traveling on the surface, and the two 4-inch guns of the Eagles would have been far

outranged by the 5.9-inch guns of the larger U-boats.

SEAPLANE TOWING-BARGES

When the war on the U-boat was carried up into the sky, many new naval problems cropped up, particularly when German submarines chose to work far out at sea. Big seaplanes were used, but they consumed a great deal of fuel in flying out and back, cutting down by just so much their flying-radius at the scene of activities. A special towing-barge was used. These barges had trimming-tanks aft, which could be flooded so that the stern of the barge would submerge. A cradle was mounted to run on a pair of rails on the barge. The body of the seaplane was lashed to this cradle and then drawn up on the barge by means of a windlass. This done, the water was blown out of the trimming-tanks by means of compressed air and the barge was brought up to an even keel. The barge with its load was now ready to be towed by a destroyer or other fast boat to the scene of operations. There water was again let into the trimming-tanks and the seaplane was let back

into the water. From the water the seaplane arose into the air in the usual way.

Unfortunately, when the sea is at all rough it is exceedingly difficult for a seaplane to take wing, particularly a large seaplane. A better starting-platform than the sea had to be furnished. At first some seaplanes were furnished with wheels, so that they could be launched from platforms on large ships; and then, to increase the flying-radius, seaplanes were discarded in favor of airplanes. Once these machines were launched, there was no way for them to get back to the ship. They had to get back to land before their fuel was exhausted.

On the large war-vessels a starting-platform was built on a pair of long guns. Then the war-ship would head into the wind and the combined travel of the ship and of the airplane along the platform gave speed enough to raise the plane off the platform before it had run the full length of the guns. But as long as aviators had no haven until they got back to land, there were many casualties. Eager to continue their patrol as long as possible, they would sometimes linger too long before heading for home

and then they would not have enough fuel left to reach land. Many an aviator was lost in this way, and finally mother-ships for airplanes had to be built.

THE "HUSH SHIPS"

The British Navy had constructed a number of very fast cruisers to deal with any raiders the Germans might send out. These cruisers were light vessels capable of such high speeds that they could even overtake a destroyer. They were 840 feet long and their turbines developed 90,000 horse-power. The construction of these vessels was for a long time kept a profound secret and it was not until the German fleet surrendered that photographs of them were allowed to be published. Because of this secrecy the boats were popularly known as "hush-ships." They were not armored; it was not necessary to load them down with armor plate, because their protection lay in speed and they were designed to fight at very long range. In fact, they were to carry guns that would out-range those of the most powerful dreadnoughts. Our largest naval guns are of 16-inch caliber, but the "hush ships" were each to carry two



Courtesy of "Scientific American "

Electrically Propelled Boat or Surface Torpedo, Attacking a Warship, under Guidance of an Airplane Scout



Courtesy of "Scientific American"

Hauling a Seaplane up on a Barge so that it may be Towed at High Speed by a Destroyer

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18-inch guns. The guns were monsters weighing 150 tons each and they fired a shell 18 inches in diameter and 7 feet long to a distance of 30 miles when elevated to an angle of 45 degrees. The weight of the shell was 3600 pounds and it carried 500 pounds of high explosive or more than is carried in the largest torpedoes.

At the 32-mile range the shell would pass through 12 inches of face-hardened armor and at half that range it would pass through armor 18 inches thick, and there is no armor afloat any heavier than this.

MOTHER-BOATS FOR AIRPLANES

Armed with such powerful guns as these, the "hush ships" would have been very formidable indeed; but when the guns were mounted on one of the cruisers, the *Furious*, they were found too powerful for the vessel. It was evident that the monsters would very seriously rack their own ship. So the guns were taken off the cruiser and it was turned into a mother-ship for airplanes. A broad, unobstructed deck was built on the ship which provided a runway from which airplanes could be launched, and this runway was actually broad enough to permit air-

planes to land upon it. Under the runway were the hangars in which the airplanes were housed. Other "hush ships" were also converted into airplane mother-boats and there were special boats built for this very purpose, although they were not able to make the speed of the "hush ships." One of these special boats had funnels that turned horizontally to carry off the furnace smoke over the stern and leave a perfectly clear flying-deck, 330 feet long.

TORPEDO-PROOF MONSTERS

As for the 18-inch guns, they were put to another use. Early in the war the British had need for powerful shallow-draft vessels which could operate off the Flanders coast and attack the coast fortifications that were being built by the Germans. The ships that were built to meet this demand were known as monitors, because like the famous "monitor" of our Civil War they carried a single turret. These monitors were very broad for their length and were very slow. At best they could make only seven knots and in heavy weather they could not make more than two or three knots.

To be made proof against torpedoes these

boats were formed with "blisters" or hollow rounded swells in the hull at each side which extended out to a distance of twelve to fifteen feet. The blisters were subdivided into compartments, so that if a torpedo struck the ship it would explode against a blister at a considerable distance from the real hull of the ship and the force of the explosion would be expended in the compartments. The blisters were the salvation of the monitors. Often were the boats struck by torpedoes without being sunk.

Unfortunately, this form of protection could not be applied to ordinary vessels, because it would have interfered seriously with navigation. The blisters made the monitors very difficult to steer and hampered the progress of a ship, particularly in a seaway.

With ships such as these the British bombarded Zeebrugge from a distance of twenty to twenty-five miles. Of course, the range had to be plotted out mathematically, as the target was far beyond the horizon of the ship, and the firing had to be directed by spotters in airplanes.

At first guns from antiquated battle-ships were used in the monitors; then larger guns

were used, until finally two of the monitors inherited the 18-inch guns of the *Furious*. A single gun was mounted on the after deck of each vessel and the gun was arranged to fire only on the starboard side. No heavily armored turret was provided, but merely a light housing to shelter the gun.

AN ELECTRICALLY STEERED MOTOR-BOAT

The British war-vessels that operated in the shallow waters off the coast of Flanders were a constant source of annoyance to the Germans. Because of the shallow water it was seldom possible for a submarine to creep up on them. A U-boat required at least thirty-five feet of water for complete submergence and it did not dare to attack in the open. This led the Germans to launch a motor-boat loaded with high explosive, which was steered from shore. The motor-boat carried a reel of wire which connected it with an operator on shore. There was no pilot in the boat, but the helm was controlled electrically by the man at the shore station. As it was difficult for the helmsman to see just what his boat was doing, or just how to steer it when it was several miles off, an airplane flew high

above it and directed the helmsman, by radiotelegraphy, how to steer his boat. Of course, radiotelegraphy might have been used to operate the steering-mechanism of the boat, but there was the danger that the radio operators of the British might send out disturbing waves that would upset the control of the motor-boat, and so direct wire transmission was used instead. Fortunately, when the Germans tried this form of attack, an alert British lookout discovered the tiny motor-boat. The alarm was given and a lucky shot blew up the boat with its charge before it came near the British vessel.

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CHAPTER XVI

RECLAIMING THE VICTIMS OF THE SUBMARINE

NEARLY fifteen million tons of shipping lie at the bottom of the sea, sunk by German U-boats, and the value of these ships with their cargo is estimated at over seven billion dollars. In one year, 1917, the loss was nearly a million dollars a day.

Of course these wrecks would not be worth anything like that now, if they were raised and floated. Much of the cargo would be so damaged by its long immersion in salt water that it would be absolutely valueless, but there are many kinds of merchandise that are not injured in the least by water. Every ship carries a certain amount of gold and silver; and then the ship's hull itself is well worth salvaging, provided it was not too badly damaged by the torpedo that sank it. Altogether, there is plenty of rich treasure in the sea awaiting the salvor who is bold enough to go after it.

- Mines, paravanes, 288
 Monitors, 306
 Mortars, 79
 depth bomb, 266
 flying, 23
 Mortars, See also Trench
 mortars
 Mother-ships for airplanes,
 305
 Motor-boat, electric, 308
 sea Tank, 299
 Motor torpedo-boats, 298
 Mystery ships, 220

 Net, North Sea, 290

 Ocean currents, 285
 Optical illusions, 215
 Oxy-hydrogen torch, subma-
 rine, 329

 Paint in war, 209
 Papier mâché heads, 13
 Papier mâché horse, 223
 Parachute, 175
 grenade, 31
 searchlight shell, 84
 Paravanes, 288
 Periscope, submarine, 244
 trench, 11
 Pill-boxes, 59
 Pneumatic breakwater, 335
 Pontoons, salvage, 320
 Propeller, shooting through,
 136

 Radio, see Wireless
 Railroad, mine, 294
 Railways, trench, 10
 Range-finder, 170
 Range, getting the, 169

 Range of guns, increasing, 67
 Range, torpedo, 213
 Rats, freeing trenches of, 94
 Rifle grenade, 28
 safety device, 32
 Rifle, machine, 55
 Rifle stand, fixed, 14
 Roads, camouflage, 225

 Salvage, 310
 diving, 324
 ice-tongs, 334
 lifting-magnets, 334
 methods, 317
 pneumatic, 319
 pontoons, 320
 shackles on ships, 333
 submarine F-4, 321
 submarine sphere, 332
 Scouts, airplane, 128
 Sea, deep, conditions, 312
 Sea gulls finding submarines,
 258
 Sea lions locating submarines,
 259
 Sea tank, 299
 Seaplane, 143
 automatic, 145
 submarine patrol, 259
 torpedo, 145
 towing-barges, 302
 Search-light shell, 84
 Shackles, salvage, 333
 Shadowless buildings, 227
 Shell, gas, 95
 grapnel, 16
 search-light, 84
 shrapnel, 83
 Stokes mortar, 39
 Shield on wheels, 114
 Ships, airplane, 304

- Ships, blisters, 307
 camouflage, 211
 "clothes-line," 220
 convoy, 267
 hush, 304
 making visible, 230
 monitors, 306
 mystery, 220
 railroads on, 294
 sunk by submarines, 310
- Ships, see also Salvage
- Shrapnel shell, 83
- Sled, submarine, 330
- Smoke screen, 262
- Sniper, locating, 13
- Sniperscopes, 12
- Sound, detecting submarines, 269
- Sound detectors, mines, 18
- Sound, spotting by, 181
- Sphere, salvor's submarine, 332
- Spotting by sound, 181
- Spotting gun-fire, 177
- Submarine, blindness, 244
 chasers, 255
 construction, 234
 depth bombs, 265
 egg-laying, 287
 engines, 246
 F-4, salvaging, 321
 getting best of, 253
 graveyard, 314
 guns on, 249
 history, 232
 hydrophone, 270
 mine-field, 290
 mine-laying, 287
 net, 290
 oil-tank, 236
 periscope, 244
- Submarine, reclaiming vic-
 tims of, 310
 rest chamber, 328
 salvage vessel, 332
 sea-gulls, 258
 sea-lions, 259
 seaplanes, 259
 ships sunk, 310
 sled, 330
 steam-driven, 250
 torch, 329
 torpedo, 246
 12-inch gun, 251
 vs. submarine, 269
- Super-guns, 62
- Tank, 107
 American, 122
 flying, 139
 French, 119
 German, 120
 one-man, 114
 sea, 299
 small, 121
- Telegraphy, rapid, 199
- Telephone, New York to San
 Francisco, 186
 wireless, 178
- Titanic*, 314
- TNT (trinitrotoluol), 18
- Torch, submarine, 329
- Torpedo, 299
 boats, motor, 298
 electrically steered, 308
 construction, 246
 getting range, 213
 proof ships, 306
 seaplane, 145
- Towing-barge, seaplane, 302
- Trajectory, 22

- Trench, gas-lock, 97
Trench mortar, 36
 pneumatic, 37
 Stokes, 38
Trench railways, 10
Trench warfare, 4
Trenches, 21
 barbed wire gates, 9
 duck-boards, 9
Tunnels, mines, 17
 to observation posts, 12
- U-boats, see Submarines
- Villages, underground, 7
- Walking-machine, 108
War, paint, 209
Water kites, 283
Waves, fighting with air, 334
- Wireless compass, 201
 spy detector, 200
Wireless telegraph, rapid, 199
Wireless telegraphy explained, 188
Wireless telephone, 178
 airplane, 184
Wireless telephony across Atlantic, 192
Woolworth Building, falling from, 135
Wrecks, see Salvage
- Zeppelin and Lowe's balloon, 149
Zeppelin balloon, construction, 156
Zeppelin, suspended observer, 162
Zeppelin's failures and successes, 154

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