

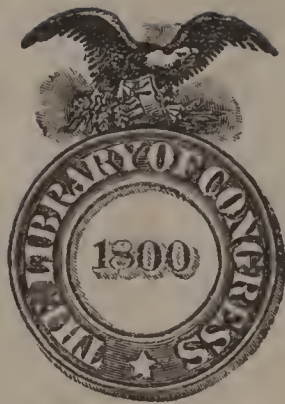
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WARSHIPS

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WARSHIPS



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PREFACE

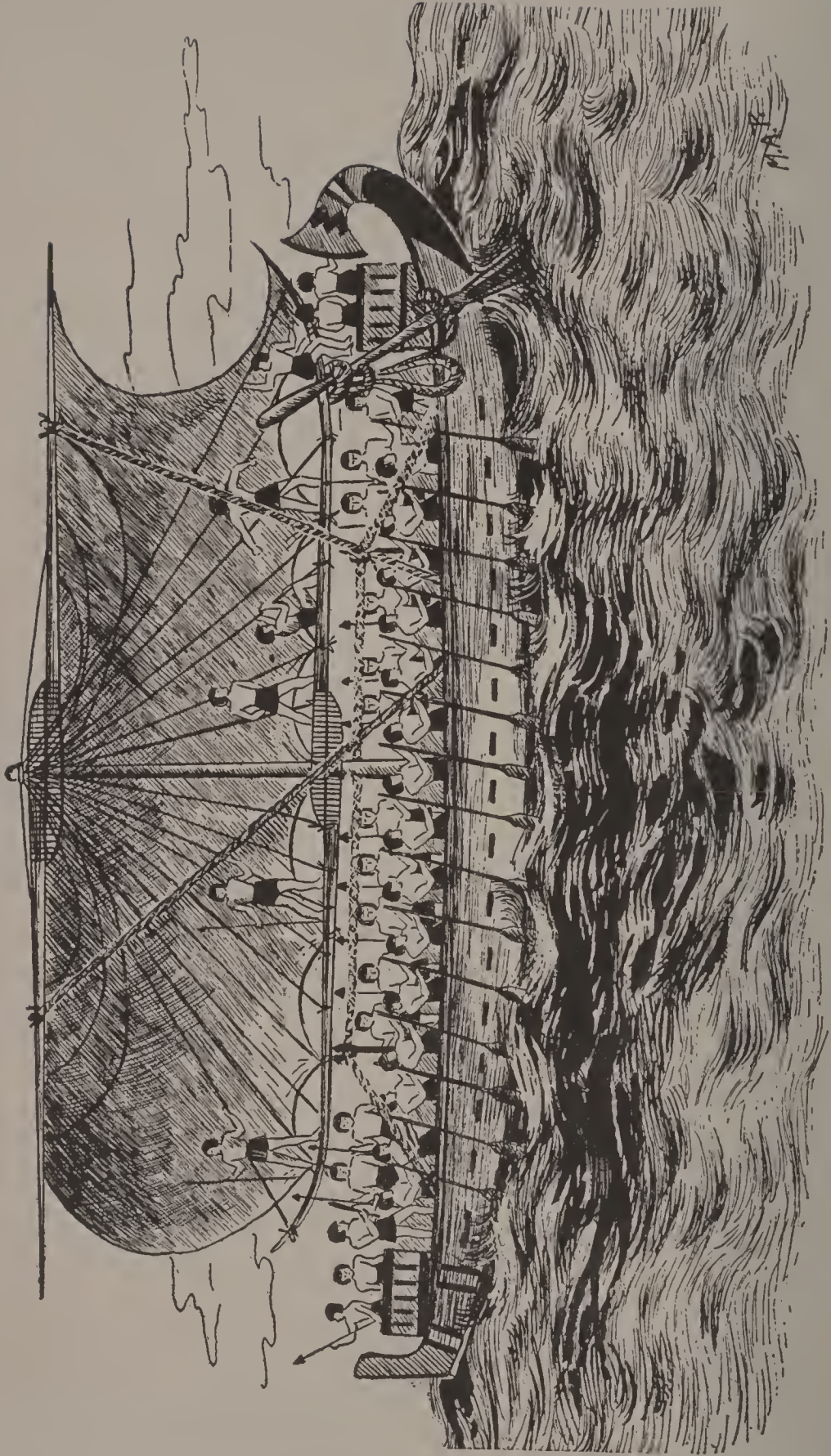
Warships is the ninth in the Children's Science Series. It was prepared by the Philadelphia Unit of the Pennsylvania Writers' Project, sponsored by the Pennsylvania Department of Public Instruction.

This booklet was written by Mark Bartman. It was edited by Katharine Britton of the State office staff.

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CONRAD C. LESLEY
Acting State Supervisor



THE EGYPTIAN GALLEYS WERE LARGE ROWBOATS WITH FRONT AND BACK
BENT UP OUT OF THE WATER.

WARSHIPS

The first ships were never made for fighting. They were made to carry people here and there over the water. But it was not long before men found out that boats could also be used in war.

Although we do not know for certain, we can guess how the people of long ago came to use their ships for fighting. We know that in those days men carried arms wherever they went. When they took goods overland to trade, or even when they just walked in the forest, they needed protection. There might be thieves or enemies waiting behind rocks or trees to attack them.

Now when they began to build ships, they could trade by water. Suppose a ship crossed a river or a lake, loaded with goods. There might be pirates or men of some enemy tribe waiting in hiding to seize the ship or its crew.

Sailors learned to carry arms for protection, just as they did when they walked on land. And so, instead of the pirates capturing the crew and the ship, it sometimes happened that the crew captured the pirates.

But the ships that bore arms were not yet ships of war. They were ordinary fishing boats, or ships of trade. They were round and tubby, so that they could carry a lot of goods.

Much later, slim, fast ships were built for fighting. To fight well a ship had to be able to attack quickly and get away quickly. Its crew had to be able to do more than beat off pirates. They had to catch enemy ships and conquer them.

EGYPTIANS AND PHOENICIANS

The earliest warships which we know about were made by the Egyptians. The Egyptians were building wooden fighting ships almost five thousand years ago.

Egyptian warships seem harmless when we think of the great steel battleships of today. They were large rowboats with the front and back bent high above the water. The front is the bow, and the back is the stern.

Each ship carried one sail. The sail was used only when the wind was blowing in the direction the ship was to travel. For people did not yet know how to sail against the wind.

These were the best fighting ships the Egyptians built. But the Phoenicians, who lived in a country not far away, improved on the Egyptian ships. The Phoenicians became the greatest sailors of their time.

At first the Phoenician galleys had one



THE PHOENICIAN BIREMES COULD MOVE FASTER THAN ANY
BOAT HAD BEFORE.

row of oars on each side, like Egyptian ships. They had one sail, set on an upright pole, which we call the mast.

But soon the Phoenicians got an idea that made their galleys much more powerful. They put two rows of oars on

each side of the ship! This new boat was a bireme.

The bireme could travel faster than any large boat had moved before. More men were needed to row it, but there were plenty of men for that. For the oarsmen were slaves or prisoners of war, or criminals!

Their speed made the biremes safer from pirates and other enemies. But they did not have to depend on speed alone. Some biremes had sharp beaks on the front, or bow. This beak on the bow was placed near the waterline, so it could be used to smash other ships.

A Phoenician galley would catch up to an enemy ship. Maybe it would move to one side a little — and then crash! The beak of that galley would ram right into the enemy ship, making a gaping hole in its side. With water rushing in, the enemy ship would lurch, keel over and become useless.

THE GREEKS AND ROMANS

Meanwhile, other people began to build better wooden ships. The Greeks and Romans built fighting galleys with three, four, or even five rows of oars.

Greek galleys were much larger than those of the Phoenicians. They were good for defending the coast and carrying fighting men. But they were too clumsy to go far with safety. They carried one sail, or sometimes two. But when the men expected heavy fighting, they left the sail at home and depended on their oars. At night they pulled the ship up on the shore, and slept till daylight.

The Greeks too put rams on their ships. But they used one thing that was new in water fighting. They had learned to throw fire. Throwing fire really meant throwing balls of burning pitch.

The Greek galleys would catch up to the enemy ship and try to drive its crew

below deck with a rain of arrows and javelins. Then balls of burning pitch would be cast onto the deck of the enemy ship. The dry wood and sail would break into flames. The ship, with its men, would sink into the sea in a cloud of smoke and flame.

The Romans tried out the idea of three masts on a ship, but found that this made the ship more clumsy. Then they tried two masts, and later decided that one mast was best.

Roman ships were perhaps not much better than Greek ships. But the Romans were good soldiers, and they knew many tricks in fighting. They fastened their shields together side by side with pieces of leather, and hung them around the outside of the ship. This was the first use of armor to protect ships.

The Roman sailors learned to throw not only fire, but large rocks. But most of their fighting was not done in this



ROMAN GALLEYS LIKE THIS ONE DROVE ALL OTHER SHIPS
OFF THE MEDITERRANEAN SEA.

way. They were brave and strong men, and usually fought hand to hand.

In a sea battle, they would row up to an enemy ship and lock the two ships together with big iron hooks or ropes or chains. Then they would leap onto the enemy deck. When they won, they would take the ship and its cargo, and share the prizes of war.

After a while the Roman ships had sunk or driven off the Mediterranean Sea nearly all other ships. But their vessels were not sturdy enough to sail safely beyond the Mediterranean. A new kind of ship was needed for ocean travel, and a new way of sailing.

THE VIKINGS

It was the Vikings, men from the cold lands and rough waters of northern Europe, who first made fighting ships for rough seas and stormy weather. These Vikings were great sailors and great

fighters. No hardier, braver sea raiders has the world ever seen.

The Viking ships were shallow and narrow, and were pointed at both ends. Bow and stern rose high like a goose's neck, and often the bow had a snake or dragon head. One large square sail was set on a single mast. But the Vikings depended mostly on rowing, like the men of the Mediterranean. The ship was steered by a large oar at the right side.

The crew rowed to the roared commands of a bearded captain. But they were not slaves or prisoners or criminals. They were free men, and they might even have a share in the ship. They were sailors and soldiers too. They hung their shields along the sides of the ship, like the Romans. When the time came to fight, most of them dropped their oars, took up their shields and weapons, and attacked with fury.

The Viking ships were easier to handle

in rough water. We know that they could make long voyages, too. For one of them carried Leif Ericson all the way across the Atlantic Ocean to America many years before Columbus was born. Usually, however, they were used to attack the coasts of Western Europe and the British Isles. For more than a hundred years the Vikings continued their raids, until the very sound of their name made other people's hearts pound with fright.

Later the people of the North settled down and began to trade. Their boats changed, becoming rounder and deeper. By that time these men had learned a very important thing. They knew how to manage a sail with great skill. Sails were now fixed to the masts in such a way that they could be swung about. By swinging the sails in certain ways, men could make the ship sail partly into the wind as well as with the wind. So they no longer needed to use oars.



THE VIKING SHIPS WERE USED TO ATTACK THE COASTS OF WESTERN EUROPE.

When the ships of the North met ships from the Mediterranean, the best points of each were copied by the others. So fighting ships were improved again and again.

Until this time there had not been a great deal of difference between ordinary ships and fighting ships. A ship for trade was wide, to give more space and greater safety in storms. A fighting ship was narrow for speed.

But there were no warships as we think of warships. A country might build a number of ships for fighting, but when the war was over, the ships would be used for trade.

GUNPOWDER

Then something happened that made men build special ships for fighting. Gunpowder and cannon came into use!

No ordinary trading ship could protect itself against a ship armed with cannon.

A fighting ship had to be stronger now, to stand the cannon balls shot from enemy ships. It had to be large and strong enough to carry its own heavy cannon.

Special warships were planned and built. The word Navy came to mean only those ships which a country built for fighting.

Larger and larger ships were built, with more and bigger cannon. Some ships used to carry as many as four or five masts, and several rows of guns.

By the end of the eighteenth century there were three different classes of warships, or men-of-war. The largest of these was the ship of the line, which had the same duties as our big battleships today. It was a great wooden ship, with three masts usually. And it could withstand heavy cannon fire for quite a time, while its own big guns pounded away at the enemy.

Black stumpy guns glared out from

three or four decks. There were more guns and gunners in two small forts, called castles, at bow and stern. Some ships of the line carried more than 100 guns.

The ship of the line was powerful, but it could not sail fast or change its direction quickly. For scouting, for swift attack, and for protection of trading ships, a faster ship was needed. This was a frigate. The frigate was smaller. It had only two decks and less than 50 guns. But it had more sail for its size, and could outsail ships of the line. It was used in the line of battle sometimes.

The sloop of war, the smallest fighting ship, had only one mast and carried 18 to 32 guns, placed on one deck. It was used for protection of the coasts, or for scouting.

In a sea fight of those days, a captain tried to sail his ship so that most of its cannon pointed at the enemy at one





time, while most of the enemy cannon could not be pointed at his ship. Then his guns would be fired. The guns of the enemy would reply. Sometimes cracked masts with their sails would fall to the deck. Then the crippled ships might retreat.

But sometimes the fight would go on in the style of the early Romans. The ships would approach each other warily and iron hooks with chains would be thrown out to draw them together. One crew would swarm over upon the enemy deck. Swords and guns would flash. Fallen men would lie upon the deck or drown in the sea.

THE USE OF STEAM

These frigates and ships of the line finally had to go the way of other sailing ships. Men had found a better way to make ships move. Steam was the new power.



THE SHIP OF THE LINE HAD THE SAME DUTIES AS OUR BIG
BATTLESHIPS TODAY.

Steam had been in use for ordinary ships a long time before it was used to propel warships. This was partly because the older officers in charge of navies liked the stately sailing ships. They did not want to change. But of course, that was not the only reason.

Another reason, and a very good one, was that the early steamboat was moved by a big wheel on each side. As these paddlewheels turned, they dipped into the water somewhat like oars. So the ship was called a sidewheeler. Both the paddlewheels of the sidewheeler, and the steam engine that turned it, were unprotected. One good shot — and a sidewheeler warship would be in a bad fix.

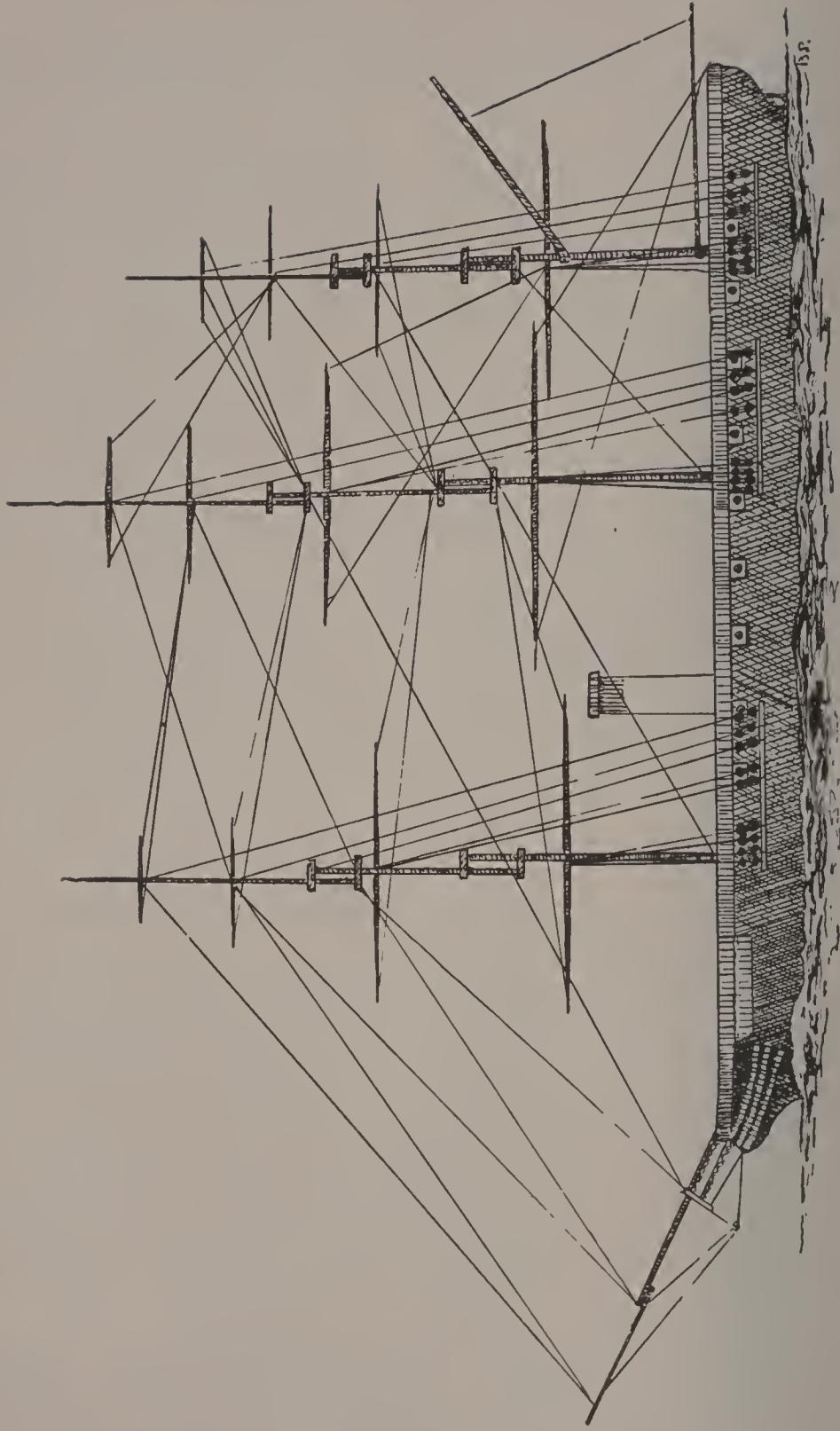
The United States Navy tried out a paddlewheel warship in 1841. This ship, the *Mississippi*, didn't look much like our steamers today. It had an engine, but also three masts with many sails. The Navy didn't trust steam power alone.

The ship had two big guns, and eight smaller guns.

It was not until the invention of the screw propeller that steam was finally used successfully for warships. The screw propeller is a piece of wood or metal that turns like an electric fan. It is placed at the stern of a ship under the water. As it turns it pushes the ship forward. Because it is under water, the propeller is safer from enemy guns. The steam engine that turns it is also safer inside the ship.

The first propeller-driven warship that really was successful was the *Princeton*. This ship was built for our Navy in 1843. It looked much like an old ship of the line, for masts and sails were still carried. It had two big guns and ten smaller guns.

Now it may seem that ships like these were less powerful than earlier ones, because they carried fewer guns. But



THE PRINCETON OF THE UNITED STATES NAVY WAS THE FIRST PROPELLER-DRIVEN WARSHIP THAT COULD BE CALLED A SUCCESS.

the guns were much larger. The big guns were 10-inch or 12-inch guns. That means they shot cannon balls 10 or 12 inches wide. One good shot would go right through the side of an enemy ship, or would knock down the masts and sails.

IRONCLAD WARSHIPS

With the coming of steam, that gave more power, ship builders and naval men began to protect their ships better. Iron plates were put on ships to cover the decks, and the bodies of the ships, which we call hulls. A ship with hull and decks covered with iron was called an ironclad.

The first fight between ironclads happened in this country during the Civil War. This was the battle between the *Monitor* and the *Merrimac*.

The *Monitor* was built by Captain John Ericsson for the United States Government. Its deck was so low that the

waves washed over it. In the middle of the deck was a thing that looked like a huge tin can. It was nine feet high — as high as an ordinary room — and 20 feet across. This was a revolving turret.

Out of the turret stuck two 11-inch guns. Since the turret could be turned, the guns could be pointed in any direction.

The deck of the ship was covered with iron one inch thick. The turret and the sides of the hull were covered with iron at least five inches thick! The *Monitor* carried only 58 men, fewer even than some of the old time Viking ships.

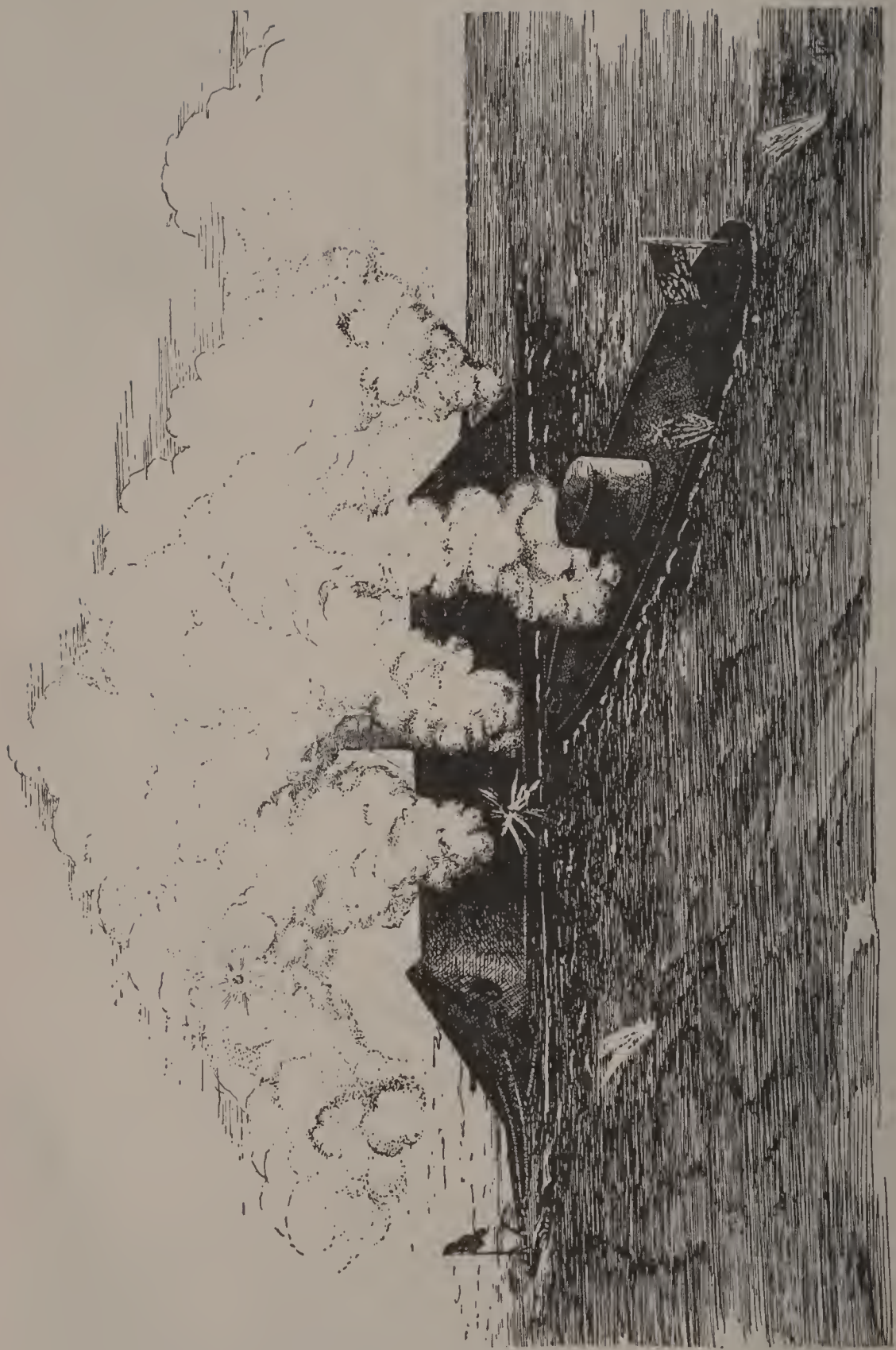
People laughed and called her a "cheese box on a raft." But they didn't laugh long. For the *Monitor* took to sea as boldly as the wooden ships.

And people stopped laughing altogether when the *Monitor* met the *Merrimac*.

The *Monitor* was a Northern ship. The *Merrimac* belonged to the Southern navy. It had a strange life. For it had been a wooden frigate of the United States Navy. The South captured it and began to change it into an ironclad a few months before Ericsson started the *Monitor*.

First, the hull of the frigate was cut off down to the waterline. Then it was built up again with wood 24 inches thick. The wood was covered with iron four inches thick. The ship had ten cannon. But its most powerful weapon was a big iron battering ram. The *Merrimac* might have been too much for the *Monitor* except for one thing. It was too slow and clumsy. It took thirty minutes to turn all the way around!

Both ironclads were started in 1861, and there was a deadly race between North and South to finish first. In 1862 the *Merrimac* appeared off the coast of



THE BATTLE BETWEEN THE MONITOR AND THE MERRIMAC PROVED THAT THE AGE OF WOODEN FIGHTING SHIPS WAS OVER.

Virginia. Though the Northern wooden ships fired cannon ball after cannon ball, they did not harm her. One after another they were damaged or sunk by her fire.

Then the *Monitor* came on the scene. She ran up close to the *Merrimac* with her guns firing as fast as they could be loaded. The two ironclads hammered away at each other with everything they had.

Neither ship won. But it was one of the most important naval battles in history. For it proved to all the world that the age of wooden fighting ships was over. Only an iron ship could stand up to another iron ship in battle. The United States had ironclads, so other countries also built them. A new age for warships began.

Today all fighting ships are made of metal.

SHIPS IN ARMOR

One navy makes a big gun. Another navy makes a stronger ship to stand up to that gun. The first navy makes a bigger gun. The other navy does the same thing, and they both make stronger ships. That's the history of navies. The race has been going on for a long time.

As ships began to wear iron, cannon balls were no longer so dangerous as they had been. Men worked to make guns that would shoot better, and would shoot something that would break the iron. They made shells. Cannon balls were solid iron balls. Shells are pointed at one end and carry gunpowder inside. They are shot from cannon, and are made so as to explode when they hit a ship or other target. Often they go right through a ship's armor and burst inside, tearing great holes in the ship.

With the use of shells instead of cannon

balls, armor had to be improved so that exploding shells could not do so much damage.

At first solid iron armor plate was placed on oak sides, which were usually 26 inches thick. Then it was discovered that solid iron was not so strong as thin iron plates placed one upon the other and fastened together.

Later iron was replaced by steel. Special kinds of steel are made for warships. The steel used in warships today is very hard to crack, for it is twice as tough as the iron used fifty years ago.

BATTLESHIPS AND CRUISERS

The greatest among warships today is the battleship. It carries the thickest armor and weighs the most of all kinds of warships.

Let us take a look at the *Colorado* of the U. S. Navy. It will remind us how much warships have improved since the



THIS BATTLESHIP OF THE UNITED STATES NAVY IS THE WEST VIRGINIA, THE SISTER SHIP OF THE COLORADO.

Romans sailed the Mediterranean in their wooden galleys.

The *Colorado* is 624 feet long, more than twice as long as a football field. It is 97 feet wide. That's a little more than the distance between bases on a baseball diamond. It weighs close to 33,000 tons. Its sides are protected by steel plates 18 inches thick. Even the decks and turrets are covered with armor. It cost 25 million dollars, and took four years to build!

The *Colorado* is run by four electric motors so powerful that it can move over the sea as fast as 24 miles an hour. Electric motors are used because they make it possible to change the direction of the ship's movement more easily at full speed. This helps the ship to escape torpedoes.

The speed of ships is always measured in sea miles, which are a little longer than land miles.

It takes a crew of about 1,425 men to run the *Colorado*. That's as many men as it would take to fill a theatre. The ship is so large that there are rooms for its entire crew. There are kitchens, too, and dining rooms. Besides that, it has a hospital, a post office, a library, a laundry, a barber shop and a motion picture theatre. The battleship is really a small floating town of 1,425 men.

But this floating town is not like land towns. It has only one business. That is to protect its country, and to fight if necessary.

The *Colorado* has 24 guns. Eight of the guns fire shells 16 inches wide. A shell that size weighs about 2,000 pounds — as much as a ton of coal. Yet the big gun can send this heavy shell 20 miles through the air.

These 16-inch guns are placed in four gun turrets. There are two turrets in the front of the ship, and two in the back. One turret of each pair is placed above

and behind the other, so the guns of both can fire at once.

Each turret has two guns, and can be moved in a half circle. So the guns cover the water in all directions. Each big gun can be fired twice in a minute.

The rest of the guns on the *Colorado* are smaller. There are twelve 5-inch guns, and four anti-aircraft guns, which can be pointed up in the air for use against enemy planes.

A warship very much like the battleship is the heavy cruiser. It has lighter armor, and somewhat smaller guns, but is much faster. It can reach a speed of 32 miles an hour. Its heaviest guns are 8-inch guns.

There are light cruisers, too. The light cruiser is a little faster but wears lighter armor than the heavy cruiser. Both are used much as the old frigates and sloops of war were used.

Because the cruisers are so fast, they can bring their guns up to any part of a



THIS IS THE *BROOKLYN*, A LIGHT CRUISER OF THE UNITED STATES NAVY.

battle line much more quickly than the battleships. They can move quickly away out of range of the bigger guns of the enemy battleships. They cannot afford to get into a long duel with the battleships. For a good shot or two from the battleship's big guns would pierce their lighter armor and sink them.

SUBMARINES AND DESTROYERS

The submarine is the slyest of all warships. It can travel under water and so hide from the enemy. It can creep up behind a big ship without being seen, release a torpedo, and then slip away under water.

Those of us who have seen pictures of a submarine know that it is shaped somewhat like a thick, fat cigar. On top, in the center, is a small tower, called the conning tower. This is where the men enter and leave the submarine.

A large new submarine today is over 400 feet long. If it were placed on a

football field, it would extend 50 feet beyond the goal posts at each end of the field. It may weigh 3,500 tons. Some submarines can travel 15,000 miles without having to get more fuel. This is as much as crossing the Atlantic Ocean four times. They can stay under water for almost two and a half days. They can dive safely to a depth of 400 feet, and



THIS UNITED STATES SUBMARINE, THE *PORPOISE*, IS ONE OF THE NEWEST OF THESE DEADLY UNDERWATER SHIPS.

travel underwater at 10 or 12 miles an hour. But they can also travel on top of the water, at 24 miles an hour.

When the submarine is traveling on the surface of the water, it is moved by Diesel oil engines. But once below the surface, it must use an electric motor. That is because the Diesel engines must have air to run. The electric engine does not need air.

The submarine dives by letting water into tanks. As these tanks fill up, the submarine becomes heavier and sinks. When it wants to rise, the water is pumped out of the tanks. This makes the submarine lighter, and it floats upward.

We might think that the crew of a submarine underwater could not see an enemy ship. But they have something which permits them to see the surface of the water in all directions. This is a periscope.

The periscope is a long tube that sticks out above the water from the conning tower. Inside the tube are mirrors, arranged in such a way that the men in the boat can see the surface of the water. The periscope can be turned in any direction. Looking through it from the submarine, an observer can see what is going on above water.

The submarine carries 6-inch guns, or larger. But its most deadly weapon is the torpedo.

The torpedo is a long metal shell, shaped much like a cigar. It is shot by air from a large tube in the submarine, called a torpedo tube. One large submarine has ten or more of these tubes.

A small motor inside turns a propeller on the end of the torpedo, and so the torpedo moves through the water. It carries powder which explodes when the enemy ship is hit, making a large hole. A torpedo has even been known to blow up very large ships.

Submarines sank a great many ships during the World War. But many of them were sunk, too. One kind of warship that did good work against the submarine was the destroyer.

The destroyer carries no armor. It weighs less than one-third what a big submarine weighs. It has only 4-inch or 5-inch guns. But submarines have good reason to fear it. For though its guns are small, they are large enough to sink a submarine. And, like submarines, the destroyer carries torpedoes. If the guns are not able to destroy the enemy, a deadly torpedo may be released from its tube.

But the destroyer is dangerous mostly because of its speed. The submarine is at its mercy. The submarine cannot escape the destroyer, for if it stays on the surface, the destroyer can outrun it. And if it goes underwater, the destroyer has another way of attacking. It uses a depth charge.



DESTROYERS LIKE THE *DUNLAP* OF THE UNITED STATES NAVY
ARE DANGEROUS ENEMIES OF THE SUBMARINE.

A depth charge looks very much like a large barrel. But it is a huge bomb. It is either rolled into the water over the side of a ship, or shot from a special kind of gun. And it is fixed in such a way that it will explode when it reaches a certain depth. The depth charge does not have to hit the submarine to sink it. For the force of the explosion in the water nearby will crush the submarine. Water will rush in and the submarine will sink.

The destroyer is not the only warship that uses depth charges, of course. Most warships carry them in case they should meet a submarine.

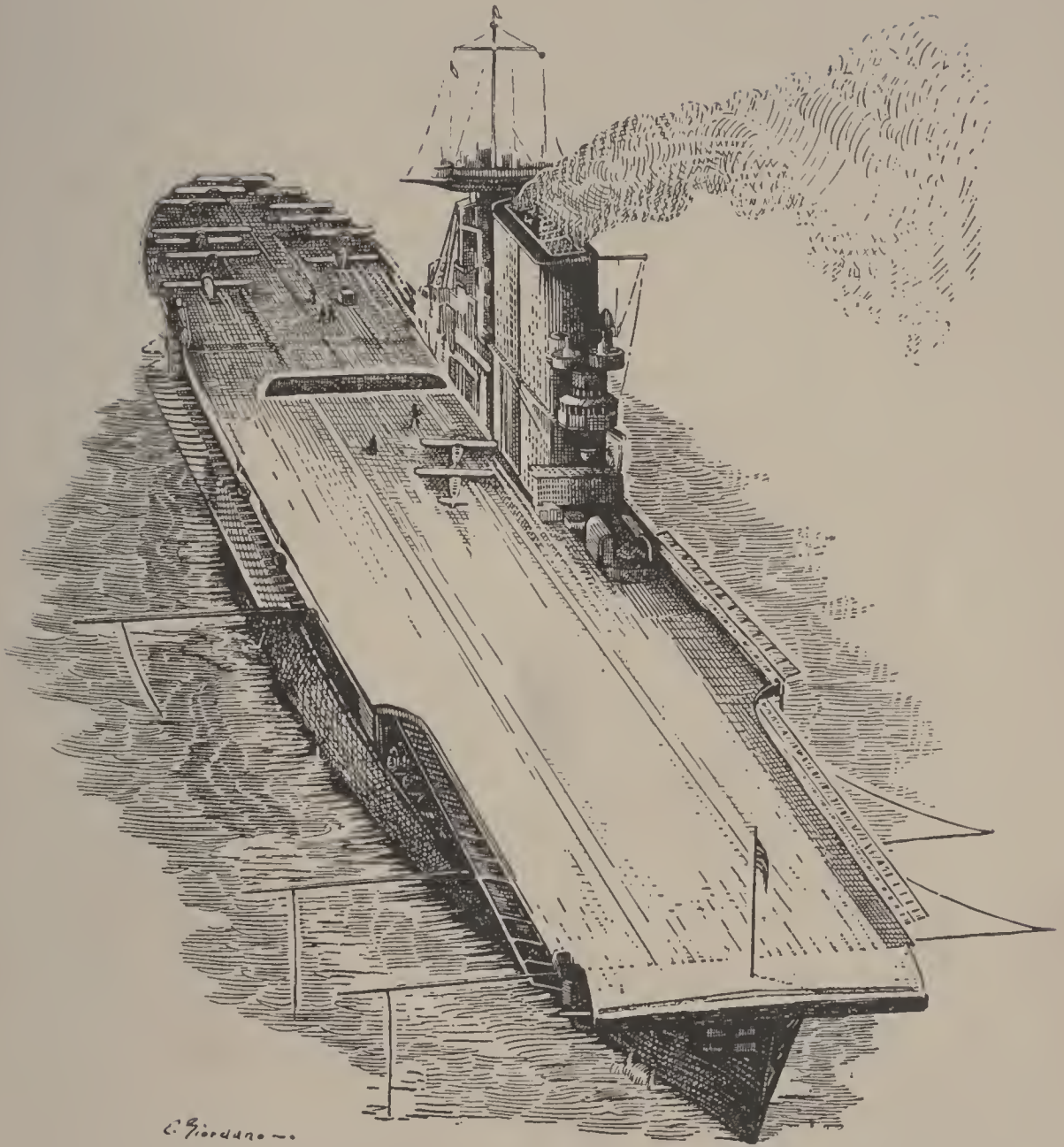
Destroyers are used also to help battle fleets. They can attack under cover of smoke screens or of darkness. They protect the main fleet against submarines. And they are often sent ahead to scout the sea and make certain that the fleet can move ahead safely.

AIRCRAFT CARRIERS

The latest of all ships used for war is the aircraft carrier. This is bigger even than a battleship. The whole ship is covered by a large flat roof, or deck. Here airplanes have space to take off and land. There may be 75 planes on a large carrier. These are kept in a space under the flying deck. They are raised from below by big elevators.

Sometimes the planes just take off from the flying deck as they would from a landing field. But they may be shot into the air by a machine, as a stone is shot from a slingshot. Seaplanes are lowered into the water by a very long steel arm called a crane. Then the planes fly off to scout for enemy ships, or even bomb them.

The aircraft carrier has small guns to protect itself and the planes it carries, but it is not really a fighting ship. It



THE AIRCRAFT CARRIER IS A FLOATING GARAGE FOR AIRPLANES.

is an auxiliary ship, a ship which helps the Navy. There are many other smaller auxiliary ships. These are not so exciting as the big fighting ships, but they are just as important.

There are ships which carry food to the warships. There are ammunition ships, which supply them with shells or torpedoes, — and oil ships, which carry fuel for the warships' engines. There are hospital ships, which care for sick or wounded men. There are transport ships, which carry sailors or soldiers to the places where they are needed. There are repair ships.

Quite often during a war a fighting ship cannot get back to its own country. But somewhere in the ocean, at a secret meeting place, an auxiliary ship can find it and give it the supplies to go on fighting. The Navy could not get along without these faithful servants.

Warships have played an important part in the history of ship building. Many times men learned useful things about building as they worked to make better fighting ships. Then the things they learned were used to make other ships better also.

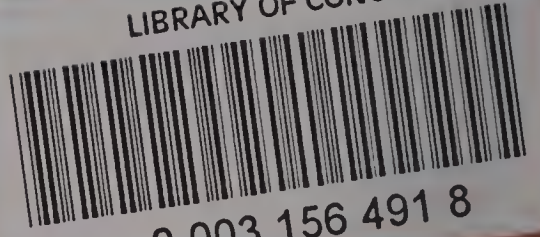
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