Vol. I. No. 5 July 15, 1918 Price Ninepence

The Lesson of the "Wimmera"

On June 28 the Navy Department issued the following announcement:—

"Early on the morning of the 26th inst., the steamer Wimmera, on a voyage from Auckland to Sydney, was sunk by striking a mine."

The event produced much horrified comment throughout Australasia. A certain section of the Press drew extensively on its emergency vocabulary, and interwoven with details concerning passengers, crew, tonnage, value of cargo, etc., one found superlatives such as "gruesome disaster," "appalling catastrophe," "ghastly calamity," "grim horror," "gross inhumanity."

The loss by enemy action, of a merchantman, carrying, among other civilian passengers, nineteen women and twelve children, is one to be deplored by every right thinking person.

But, to ensure that we retain some sense of proportion and that there be no undue blurring of perspectives, be it recalled that Australasia, prior to the mining of a single Australasian vessel in home waters, had been a belligerent country for three years and ten months.

That our initial loss had been averted until approximately the fourth anniversary of our entry into the war is due alone to the unrelenting vigilance of the Imperial Navy, and the loss, although in every sense lamentable, brings home to many of us the enormity of our debt to the Empire.

In the Imperial Army, simultaneous with the introduction of Conscription, there sprang into notoriety a type of male known as the Conscientious Objector. Military Tribunals and Exemption Boards, deaf alike to appeals and entreaties, handed him over to recruiting officers, thrust him into the King's uniform and escorted him to some training centre in the remote hope of moulding him into some semblance of manhood.

Vain illusion! The "conchie" would hunger-strike, require to be forcibly fed and forcibly clothed until finally transferred into a Non-Combatant Corps, for general duties "at home." Distinctive brass-lettered badges "N.C.C.", gleaming from cap and shoulder straps, proclaim the conscientious objector as of a type apart, and the fighting Australian "has no time" for him.

In a British Hospital early this year the ward orderly, who was of the type above described, spoke with smug superiority of the patients as "silly asses who hop about in the mud till they get 'emselves shot!" Among the patients were four A.I.F. men. The ensuing *fracas* having somewhat subsided, the writer, to a comrade in the adjoining cot, ventured to suggest that right

here in Australia, should military service ever cease to be a matter of individual choice, the conscientious objector might perhaps find his prototype. The suggestion was received with scorn. "Thank God we don't breed anything like that in Ozzie!" came the fervent retort.

But we do.

Among us, and his name is legion, is the man whose alleged sense of duty holds him in Australia "to defend the women and children when the Huns come!"

The Hun has come!

And gone!

The extent of his depredations has yet to be ascertained. From official reports it is known that mine-sweeping operations in Australasian waters have been in progress since the beginning of February.

On February 15, the Navy Adviser announced that an enemy mine had been exploded off Cape Farewell. A second mine was destroyed three days later in Cook Straits. During the next week five more were accounted for. On March 11 another was washed ashore on the eastern coast of the Great Barrier Island, while on May 5 yet another was located in the same area.

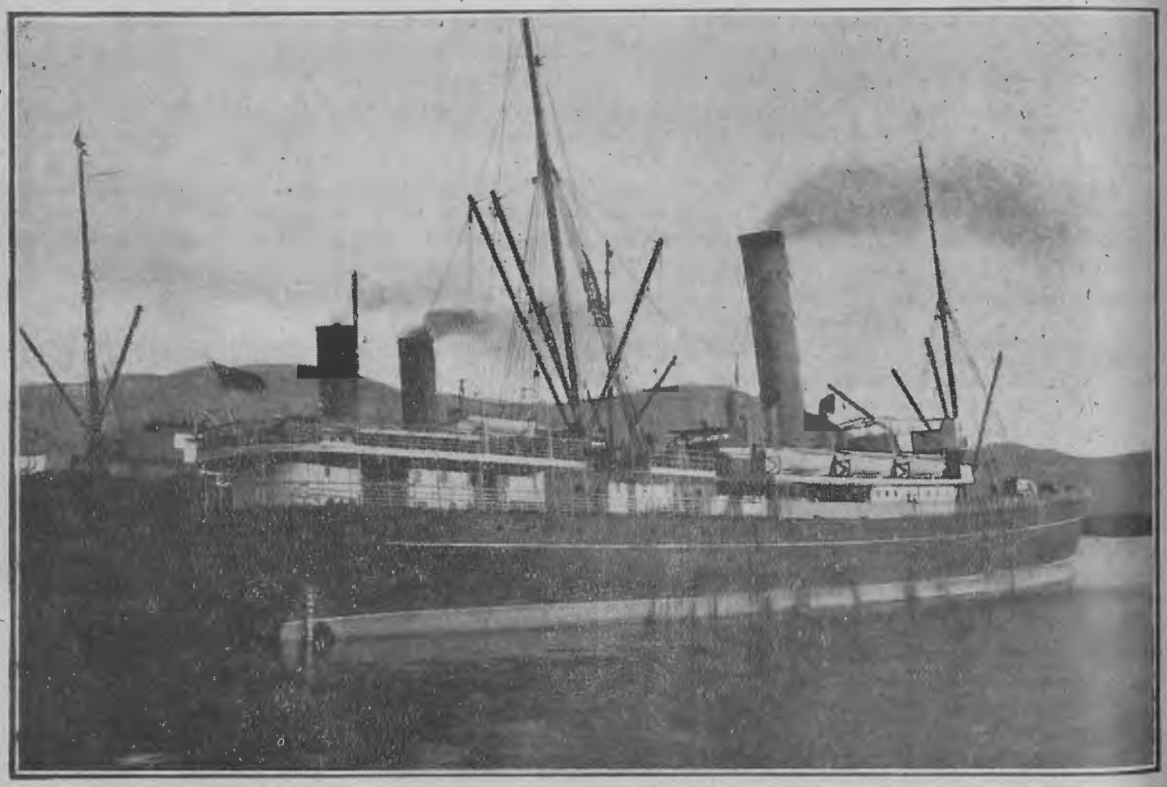
We know, altogether, of twelve such mines, scattered in these waters by the German raider *Wolf*. Eleven have been swept up. Approximately five months after the commencement of mine-sweeping activities the *Wimmera* struck the twelfth—and sank.

And the thirteenth?

* * * * * *

The defence of Australia lies beyond her gates and self-styled defenders are of no practical use within.

May the lesson of the *Wimmera* awaken in our eligible Stay-at-Homes a sense of responsibility to Australia outside Australia.



S.S. WIMMERA AT LYTTLETON, N.Z.

OBITUARY — The Late Mr. ARTHUR BOMONT

There is still, as we go to press, no definite word concerning the fate of Mr. Arthur Bomont, the popular young wireless operator who sailed from Auckland on—and presumably perished with—the ill-fated s.s. *Wimmera*. Personal acquaintance with Mr. Bomont but serves to strengthen the theory that he would remain by his instrument until the last possible moment. He was that kind of man. The faint glimmer of hope that he may even yet be reported as picked up among other missing victims is dimmed by the official announcement a week ago that search had been abandoned—no less than by the fruitless inquiries cabled by Amalgamated Wireless (Australasia), Ltd. to every conceivable source of information.

MR. ARTHUR BOMONT, Wireless Operator, *s.s. Wimmera*.

A familiar and ever-welcome figure at the house from which *Sea Land and Air* is published, Mr. Bomont, barely three weeks ago, sat happy and smiling in the very room wherein his obituary notice is now being penned.

The tragedy of it!

Of "young Bomont" we write as of our own kinsfolk, indeed, to us at Wireless House his loss is as the loss of a "cobber" from one's own platoon "over there."

In publishing his photograph, snapped during the *Wimmera's* penultimate voyage, we append a brief summary of Mr. Bomont's association with the operator's key. Born 23 years ago, in Glasgow, he resided, while ashore, with his parents at 40 Bond Street, Auckland, N.Z. On June 20, 1914, he joined the Marconi School of Wireless, Sydney, and, passing with distinction, was duly appointed operator to the s.s. *Warrimoo* (Union Steamship Company); thence to the *Victoria* (of the Huddart, Parker line and sister-ship to the *Wimmera*). During the ensuing two years he was engaged on interstate and coastal vessels, principally with the U. S. S. Co. Among these were the *Navua*, *Talune*, *Tarawera*, *Monowai*, *Morialta* and *Westralia*. On March 21, 1917, Mr. Bomont was transferred to the *Wimmera*, his conscientious work, coupled with a very attractive personality, securing for him many a lasting friendship during his 15 months' association with the officers and crew of this vessel.

On June 17, 1918, he sailed from Sydney on the *Wimmera's* final run, a voyage which, alas! has now become historical.

TRICK FLYING

The "Stunt" is Handmaid to the Winged Victory

(By Phillips Dwight Rader)

The day that I reported to Brooklands, England, for duty with the Wireless Experiment Flight was typically British. The clouds were about three thousand feet and a twenty-mile wind was blowing. The air had a damp chill to it, and seemed to blow right through you.

I was a sergeant pilot at that time, but had had a considerable amount of flying. After relieving myself of my kit bag and other stuff I went on a hunt for my commanding officer. It wasn't very long before I found him. He, like the weather, was typically British.

I saluted and made myself known, and asked permission to try out the machine which I was to fly. After a lot of "hemming and hawing" he finally produced the inevitable monocle and proceeded to size me up and down, and from all angles.

"It's deucedly bumpy up, y'know," he said, "and, of course, I don't know whether you can handle the bally old 'bus or not!" I ventured to remark that I thought I could handle it, so finally, after much more monocled scrutiny, he consented to allow me to make one circuit of the field.

"If you see me waving my handkerchief, you must alight immediately, as I will know then it is too rough for a sergeant to fly!"

Believe me, I was one angry Yank, as I had flown probably three times as much as he had. I climbed into the seat of the 'plane, adjusted my safety belt, tried out the control, and taxied down the field so as to enable me to take off into the wind.

As soon as I left the ground, I held the nose of the machine down, and made a bee-line for friend officer. I came so close to him that he rolled on the ground to save himself from an inglorious end, as he supposed. Quick as a flash, I realised the breach of discipline I had performed, and had dire visions of reduction in rank, gloomy guard-house days, and a reprimand. I knew also that the only way to vindicate myself was to do some real flying and thus win his admiration.

ONE OF THE INSTRUCTORS WHO TEACHES RECRUITS FOR THE ROYAL FLYING CORPS HOW TO FLY.

The type of machine I was flying was of the B.E. type, with a 70 H.P. engine in it. It was a staunch old 'bus, and I knew that this particular type would loop, although at that early date it had been attempted by very few. I would try it anyhow, but the very thought of it frightened me, and I

guess I was a pretty pale aviator as I climbed higher and higher.

Once or twice I would put the nose down in a steep glide, with the engine full on, and would pull her up suddenly, but I didn't have the courage to flip her over on her back. The more I tried the more desperate I got.

I had reached the cloud level. Wisps of vapor streaked past, and at intervals the ground was lost from sight. This would never do, so I dived for about 500 feet and came into clear atmosphere. I knew then that it was now or never, so I resigned myself to my fate, pushed her nose down, and after a short but fast dive, swirled the "bally old bus" around her arc twice, finishing up with a tight spiral to the earth.

As I got out of the machine I was met by an orderly and told to report to the major. I tremblingly followed the orderly to the major's office.

Much to my surprise, I was not thrown into a dank dungeon, or put into chains, but was mildly and politely informed that if I wished to do stunts of that character, to please keep away from the field, as it was demoralising to the cadets under instruction. I was also informed that the machine was hereafter in my charge, and I could do as I liked with it. That was the start of my stunt flying.

Trick flying now plays the most important part in combat work in the air, and it is the pilot who can manoeuvre his ship most quickly and most prettily that wins the fight. One of the first flyers to make practical use of stunt flying at the front was the famous Lieutenant Immelman, of the German Flying Corps. He invented a quick turn which is now practised extensively over here, and is even known as the "Immelman Turn." It is an execution of control that requires a great deal of practice to perfect, and is the quickest known means of eluding an enemy, as you not only turn in the opposite direction, but dive as well.

Supposing you were flying dead ahead at the enemy. The nose of the machine is slightly down to increase the speed and the engine is full on. Suddenly you have to turn. Instead of turning around as you would an auto on a well-banked track, you simply pull the nose up sharply, kick the left rudder, and when the 'plane is in a vertical position, flip it on its back, and it completes a half loop, coming out in absolutely the opposite direction at a terrific speed. The enemy is completely at a loss to know where his assailant has gone to, as it all happens in the twinkling of an eye.

Another famous trick at the front, which still fools the more experienced flyers, is the "falling leaf."

This is the best imitation of a disabled 'plane known, and requires a great deal of nerve and practice, as the 'plane must appear to be out of control, and yet the pilot must have control at all times.

We'll say that a British 'plane is attacked by four Germans. He sees that the odds are against him and tarries only long enough to pick a fight with one of them and draw fire from the others. Suddenly he appears to be hit. His machine staggers and stalls, and then starts, side-slipped and careening, for the earth, thousands of feet below. It looks for all the world like a maple leaf falling in a high wind. It goes zigzagging downward, now almost stopping and now plunging ahead, and a second later hanging in an upside-down position. The machine loses altitude at the rate of 500 feet per second. The Germans beetle back home with the joyful news that another Britisher has been killed.

But has he? Far from it! Friend Englishman simply rights his machine, turns on his engine and sails serenely away towards his home aerodrome, ignoring the bursting "archies" and cursing the "bally" Germans in general.

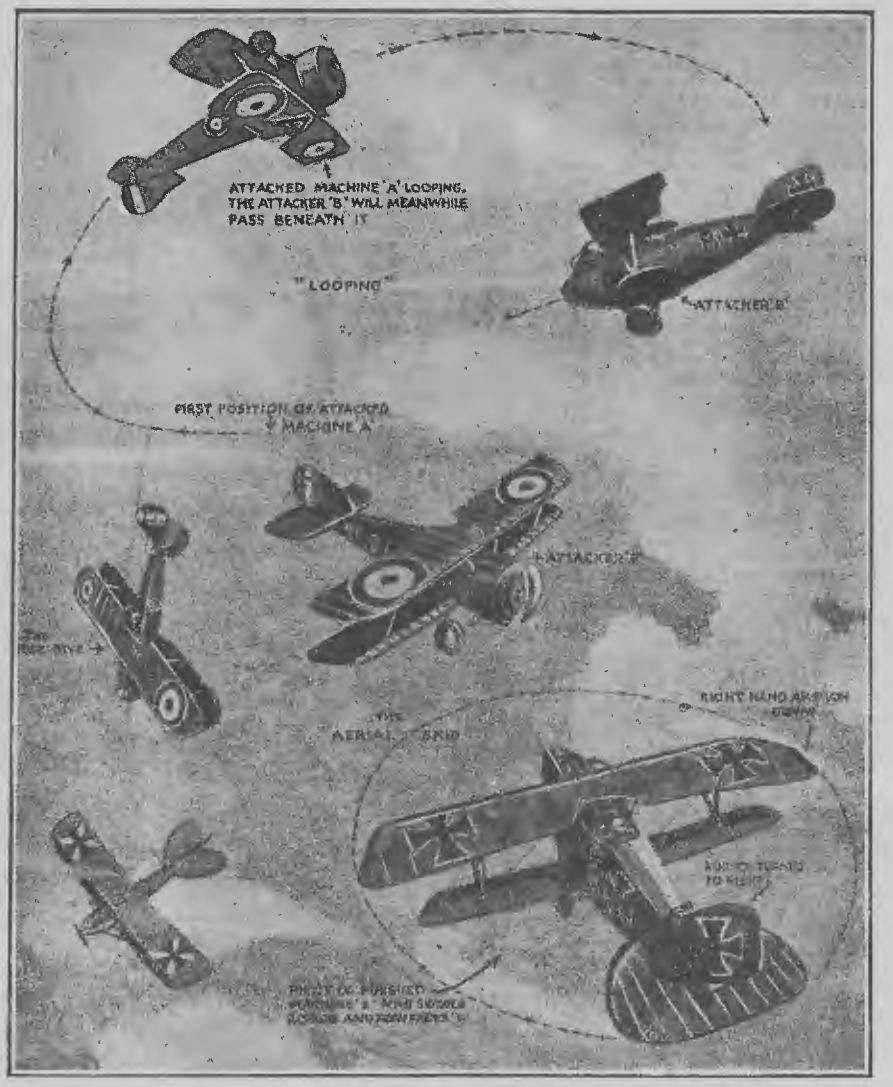
At a famous flying field I know of is a graveyard of broken and wrecked machines. Broken wings, smashed and twisted fuselages, are laid in neat rows and piles. Twisted and gnarled controls and seats tell an even more ghastly story. A splatter of blood here and there tells of work for the base hospital and regimental doctors. The smashed property runs into hundreds of thousands of pounds.

This is nearly all the result of the fatal tail spin, the most dangerous and most simple position for a novice to put a machine into. If the pilot is anywhere near the ground, say under three hundred feet, his chances are slim.

I do not know of a pilot a year ago who would have dared purposely and wilfully to put a machine into a spin. If he did he would not know how to get out of it.

The first man, to my knowledge, to deliberately spin a machine, and get out of it intact was Eddie Stinson, at Newport News, Virginia. He has been the saving of many lives since, by solving this most dangerous problem. Now, it is part of the everyday instruction in the United States army, and also in the corps of the Allies.

The first spin that I ever saw was at Miami, Florida, last winter. An instructor and a pupil were up about five thousand feet. They were banking about some clouds when suddenly one wing dropped, the nose of the machine pointed vertically downward, and it started to whirl madly. The downward speed of the machine did not seem to be so fast, but as it got nearer and nearer to earth, it could plainly be seen that it was dropping terrifically. It was an appalling sight, as the machine looked so helpless and yet so beautiful. Now and then I saw a glint of sun on flippers and elevators, which showed they were trying in every way to bring the machine out, but it kept right on spinning. Just before they lit, at a terrific speed, the pilot yelled to the pupil, "We're going to hit!" and he calmly turned round and said, "Oh, are we?"



"AERIAL SKIDS" AND "SPINNING DIVES."

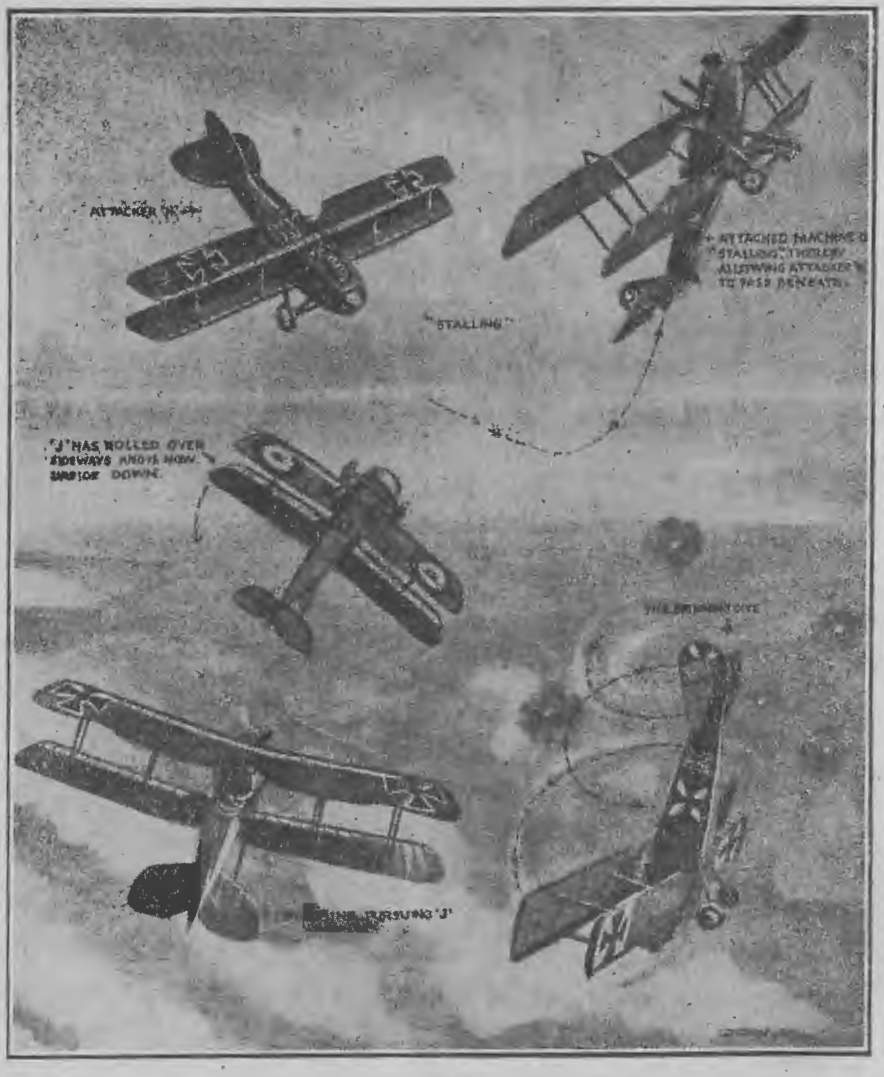
Looping, stalling, nose-diving, and similar tricks all have their special use to a resourceful pilot in a tight corner. Above are portrayed the various "stunts" in actual use. The pilot of machine A, attacked from the rear by a fast fighter, B, may "loop" completely so as to come out of the loop behind the tail of his adversary, and may then "pump lead" into him from an advantageous position. The nose-dive is mainly used for purposes of attack. A machine C, may "nose-dive" from the clouds on to D, an enemy aeroplane, flying at a lower altitude, and, gaining speed in his fall, will be able to make a surprise attack on D from the rear. The "Aerial Skid" is, perhaps, the most interesting "stunt" of the lot. It is said to have been originated by pilots of Albatross "chasers." E is being attacked from behind by a fast fighter, F. The pilot of E, in order to avoid the fire from F, swings his rudder hard round to the right, and simultaneously lowers his right "aileron." This causes his machine to swing round on a pivot in an exactly similar manner to a motor-car skidding on a slippery surface.

Well, luckily, it didn't kill either of them, although one of them goes around now with half his body in a plaster cast, as a memento.

When I asked the pilot what he did to try to stop spinning, he said he did everything except the right thing, the last thing in the world he would think of doing, and that was to *put the nose down further* !

That is my job here at this field to-day, teaching young flyers how to recover from dangerous positions and to drum into their heads that whenever they are in doubt, put the nose of the 'plane down !

Ask any old veteran of the flying game, and he will tell you that the higher you are in an aeroplane, the safer ! I wonder how many times I have had people say to me, "I would love to go for a ride, but please don't take me high !" Yet they were increasing the danger of the ride about 100 per cent. by remaining low. The gliding angle of the average machine is about eight



TRICKS PERFORMED BY FIGHTING PILOTS.

For a second or so the machine, owing to its enormous momentum—130 miles per hour—actually travels backward for a few feet, then comes to a standstill, during which time the pilot can direct the fire of his machine-guns into the engine and tanks of his adversary. He will then dive and right himself in the usual manner. The pilot of G has "stalled" by pulling up the nose of his machine, thus allowing his pursuer, H, to pass harmlessly under his tail. To right himself he simply lets the nose of his machine fall, and, after a short dive, will "flatten out" into a horizontal position. In order to avoid his pursuer, J has performed a "sideway loop," and, having attained the upside-down position, will now dive and come out flying in the opposite direction. In this way he has very effectively given his opponent the "slip." When "Archies" burst too near to be comfortable, pilots often come down a thousand feet or so in a "Spinning Dive." K is for the moment completely out of control, the machine spinning round like a thresher, but will right itself if there be sufficient altitude.

to one. That is, if you are a mile high you can glide, with a dead motor, approximately eight miles, so, you see, if you are only one hundred feet high you have only eight hundred feet to glide, which isn't much if there happen to be a few houses or trees in the way.

My job at present is teaching advanced pupils trick flying. Ye gods! It's some job!

Two years ago, if an officer came up to me and asked me to go up, drop, spin and stall with him, I would have had his sanity examined. If he asked me to let him try it with me as a passenger, I'd have shot him on the spot as a dangerous maniac. Yet that is exactly what I have to do as my daily routine now.

Believe me, some of these student flyers can give you more thrills to the square inch than Beachy could, in the days gone by. The other day, I had one up who was very fidgety and slightly nervous. I repeatedly showed him how to perform a loop and each time he said he could do it.

We would drive the machine terribly and then try to whip it over with a snap, with the result that it would simply get on its back and catapult itself upwards, and all the time absolutely flat upside-down. In the meantime, the dirt and stuff in the bottom of the fuselage or body would come pouring out, the oil and gas from the tanks would drench us, and the machine would quiver and shudder, and go slipping off into a violent side-slip, finally ending up in a spin, in which yours truly would recover the machine from a fateful end. Usually the pupil made himself sea-sick, which added charm to the flight.

Some pupils can take hold of trick flying remarkably well, while others are hopeless as trick flyers, but make good straight flyers. Others are just the opposite, and can do all kinds of stunts in the air, but when it comes to landings and judgment of distance, they are no good at all.

However, it's a good trick flyer that makes the best "ace" at the front, and the man who can skid, slip, dive, stall and loop his machine, and yet keep his mind on his gun and his enemy, is the man who usually wins out!

A tail slide is one of the prettiest evolutions in the air. Its uses are many, and serve in many practical manoeuvres at the front. It is the quickest and most effective way of "putting on the brakes," and is the emergency brake of the air.

For instance, in a formation flight with several other 'planes, you suddenly find yourself in the position you wanted. This evolution is also very valuable in certain kinds of bombing work, and enables the pilot to hit his objective in a standstill position, thereby insuring a more accurate hit. This manoeuvre is a risky evolution near the ground, and should never be practised under one thousand feet.

It is surprising the number of evolutions that can be executed in a modern military tractor, and they can be put in every conceivable position.

Fog is a great deceiver for the young pilot. It is quite amusing to send a new pilot into a cloud bank and then observe the comical angle his machine is at when he emerges. Usually they are on the verge of a stall, and one fellow actually came out on his back.

It only goes to prove that these young men have not yet acquired the touch and feel of the machine, and are still flying mechanically.

Recently I had an experience that I shall not forget for a long time. We had just received a new modified type of the machine we use, but the safety belt was of a different pattern. It had a quick release device, which released too quickly and was really unsafe.

It was a fairly hot day, and the air was pretty bumpy. I climbed up to above 2,500 feet, and then started to put the bus "through her paces." I signalled my passenger that I was going to loop and he grinned back at me.

I do not even know exactly why it happened, whether it was the peculiar design of the machine or whether I just did not have speed enough to get "over the top." But what happened was this:

I remember diving what I thought was plenty, but on the top of the loop the machine just hung there, absolutely upside-down. I started to leave the seat gently at first, but suddenly, as the reverse pressure struck us, I was almost flung out of it. At the critical moment, both belts opened up and I had to let go the controls and grab the bracing wires for dear life. The passenger came out and seemed to be standing on his hands on the centre section of the upper plane. The controls released, the ship just naturally stayed in an upside-down position until the engine choked and stopped. Then it started to settle flatly toward the ground. The bracing wires were pinching my hands and I started to do a sort of backward somersault until I thought my wrists would break. I could not let go to grab the controls, and again I had visions

of a nice lot of flowers and a bunch of walking delegates from the undertakers' union.

Suddenly the ship quivered, stalled and fell off sideways and again I was flying, but this time hard into the seat. I didn't waste a minute getting back to earth.

Not long ago when I was returning home from a long cross-country flight. In Texas they have what they call "northers." That means that the weather suddenly changes and the wind comes up very strong. On this particular day it was almost sunset when I hit for home, and under ordinary conditions everything would have been alright, but half-way home I was struck by a "norther." This pulled my speed down to about twenty miles per hour, and I knew it was a chance as to whether I would make it or not. I figured that I would just have gas enough to complete the journey.

It grew pitch dark, and once again I thanked and blessed the engine for keeping going. I grew pretty nervous, as I was familiar with the country over which I was flying, and knew it to be all marsh and desert land. If I had a forced landing it meant hitting this stuff in a high wind, and the inevitable overturning of the machine. It also meant no help of any kind from any one, as the place was not populated. In case of an injury it would not have been very pleasant.

The cadet passenger was enjoying himself immensely and the sensation of flying in the dark was a new one to him, and quite exciting. He even scared the life out of me by shutting off the engine to tell me how he enjoyed it.

The gas gauge got quite low and I was distinctly worried. I knew the danger we were in, and as I had never smashed up I did not relish its happening out in the desert.

The climax came (concludes the writer in *Sunset*) when the cadet broke out with some sandwiches and tried to offer me one. I almost crowned him with the Pyrene fire extinguisher! In later years, if he does not break his neck, he will appreciate the danger he was in, and maybe the thought of it will come back to him, and he will feel the fright he should have shared with me.

Photo. Copyright by Committee on Public Information.

AN AVIATION SCENE. FIFTEEN HYDRO-AEROPLANES ARRIVING AND DEPARTING.

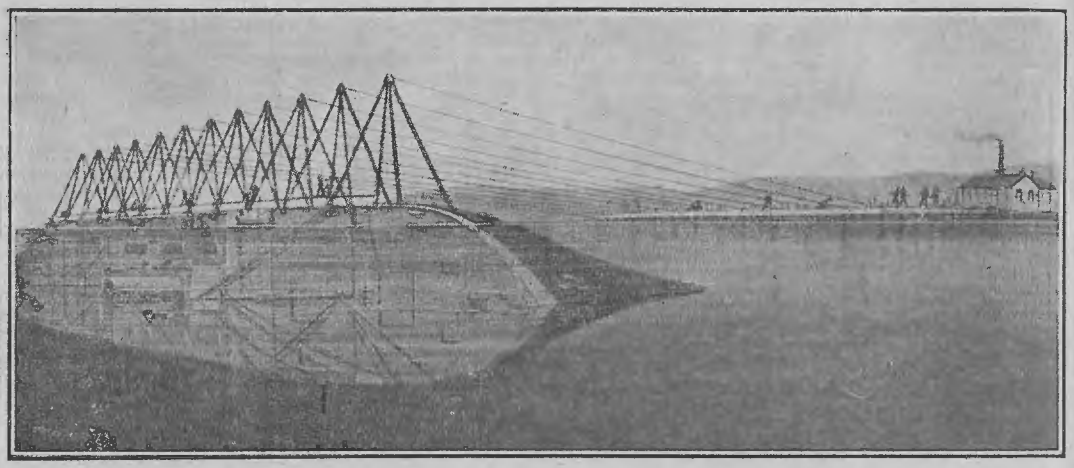
A Sunken Steamer Righted by Application of Leverage.

The present scarcity of ocean bottoms has given an impetus to salvaging operations. Many a sunken ship which in pre-war days would have been allowed to rust and fall apart because of the expense and trouble involved in refloating it, now receives due consideration and in most cases is raised and repaired and re-equipped for service. For one thing, expense is no longer a paramount consideration, so urgent is the demand for ships. And the salvagers are given complete freedom in applying their ingenuity which in the present emergency has been made doubly or trebly keen.

So it follows that interesting and difficult salvaging operations are the order of the day. We may expect many interesting cases along these lines.

Now the Germans are just as anxious to increase their tonnage as the other belligerents, not so much for the present but rather for the future when the seas once more will be unlocked to them. So a German firm was charged in 1915 with the task of salvaging the *Gneisenau*, and this is how they proceeded:

A preliminary study of the conditions (states *The Scientific American*) convinced the German engineers that the steamer would have to be returned to the normal upright position without deepening the river bed; for to deepen the waterway would only render more difficult the pumping out of the hull. Hence it was decided at first to mount a large number of wooden



BY MEANS OF A ROW OF IRON HORSES MOUNTED ON THE UPPER SIDE OF A SUNKEN STEAMER, AND A BATTERY OF POWERFUL HYDRAULIC JACKS, A SUCCESSFUL SALVAGING OPERATION WAS REALISED BY THIS APPLICATION OF THE LEVER PRINCIPLE.

Photo. Munn and Co., Inc.

When the Germans captured Antwerp in October, 1914, the British left the captors a scuttled ship—the North German Lloyd steamer *Gneisenau* of some 9,000 tons. Caught by the current of the river Scheldt, the steamer had grounded on its starboard side in a position parallel with the stream. And since the Scheldt at this point has a depth of 33 feet and the beam of the scuttled ship is 55 feet, at low tide a goodly portion of the port-side showed above the surface.

horses on the boat, fastened in some suitable manner to the port or uppermost side. To the top of each horse was to be attached a cable leading to suitable power plants on shore, so that by the leverage of the wooden horses and the applied power it would be possible to turn the ship to its normal position. In order better to apply the power, a row of piles was driven into the river bed, giving a rigid point for the application of the power and carrying suitable pulleys for handling the cables.

Work was begun in June, 1916, and it was decided then to replace the wooden horses with similar structures of iron. So 12 horses of iron were arranged and rigidly fastened to the port side of the vessel in the form of a skeleton wall. Instead of using an elaborate system of tackles for the transmission of constant power, the engineers resorted to a simple power transmission arrangement making use of a battery of hydraulic jacks. Also there was a modification of the plans in the matter of the row of piles; in the final form this feature was a straight line of piles rigidly held in place in the river bottom so as to offer a non-movable point for the cables. It was estimated that the arrangement could exert a horizontal tractional effort of 3,300 tons.

But in driving the row of piles the engineers encountered the very trouble they had anticipated; namely, the river bottom was of a muddy nature and therefore could not hold the piles in place against the pull which was to be applied when righting the vessel. This predicament was soon got out of, however, by applying broken stone about the piles, stiffening the river bed in the immediate vicinity.

Everything being now ready, compressed air was next fed into the compartments of the steamer, which had previously been made airtight. The buoyancy of the air caused the vessel to rise slightly, while at the same time the pressure served to drive out some of the slime of the river bed which had made its way into the hull.

Then the hydraulic jacks were brought into play, all the while maintaining the supply of compressed air to the compartments in the hull. There were 12 jacks in the battery, each exerting a tractional effort of 275 tons on the steel frames of the ship. Slowly but surely the steamer rolled over, bringing to view the previously submerged part of the hull which in two years of rest on the river bottom had accumulated a mass of mud and a covering of seaweed. During these operations the engineers were confronted with the problem of meeting huge cakes of ice which threatened their equipment, for the work had been carried far into the winter of that year. The steamer was still listing some ten degrees from its normal position, and, needless to say, was still in a rather precarious state. But the ice was safely handled and the work came through without loss.

Then the steamer was tightly sealed by closing every gap in the hull and superstructure, and powerful pumps were set to work emptying the *Gneisenau*, which by now had been pulled over to the row of piles and moored in place. Soon the steamer was floating at high tide. The hydraulic jacks were again brought into action, this time to pull the vessel nearer shore; and when the normal equilibrium was assured, the iron horses, which had been permitted to remain in place in order to act as a counter-weight to the mass of mud and seaweed on the other side of the hull, were removed.

After which the steamer was towed by tugs to a shipyard, there to be repaired and repainted and refitted for eventual service on the high seas.

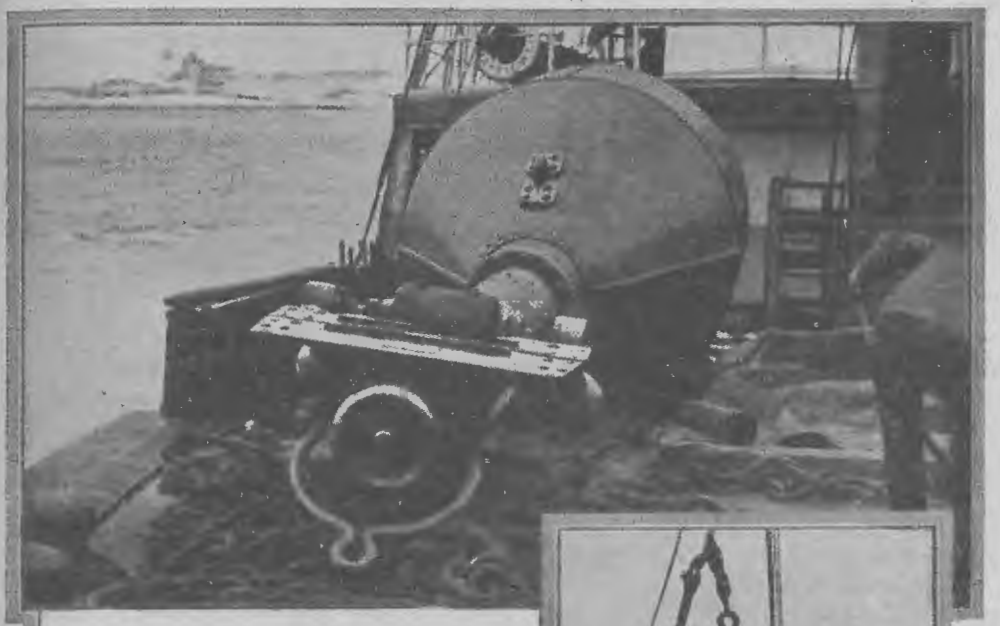
POSTING STEEL SENTINELS

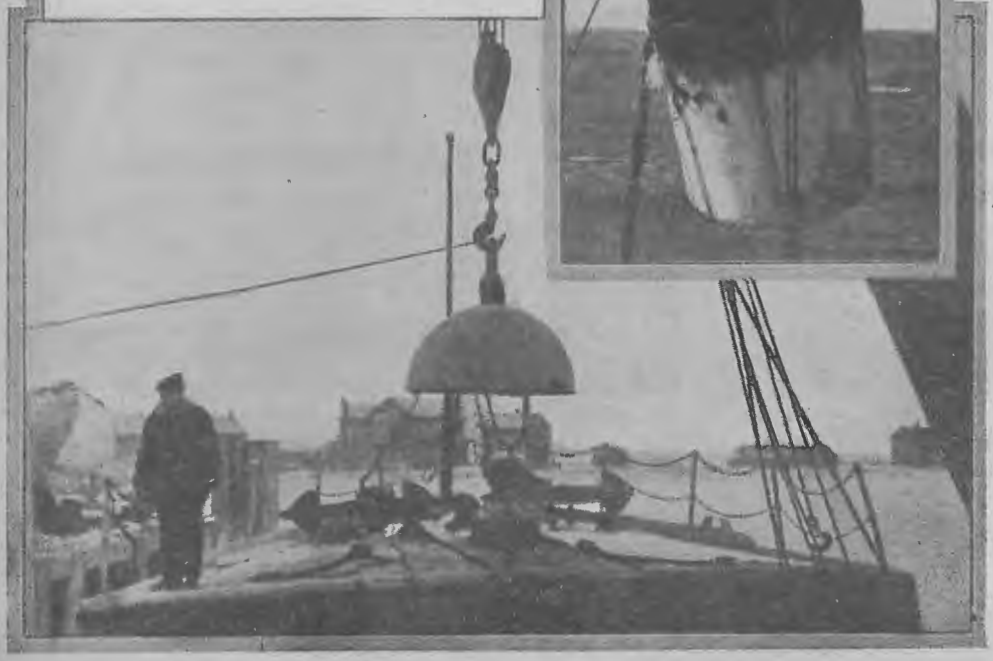
BUOY MENDERS AT WORK.

Winter weather plays havoc with the buoys.

The work of repairing them is dangerous and the light-house tender upon which the task usually falls must face all kinds of rough weather while its crew are engaged in the task. Here a gas buoy is being recharged and another type of buoy is being mended. During calm weather the men sometimes work in a dory.

ALONG THE SEA LANES





REPAIRING THE SEA SIGNALS.

The average buoy is no light object to handle. The submarine bell lying on the deck is up for repairs, as is the huge buoy that is being lifted from the sea. The buoy anchor weighs 6,500 pounds.

WING-BONES OF VICTORY

How the Allied Armies of the Air Depend Upon the Spruce of the American Northwest.

By FRED. W. VINCENT

Although 3000 miles of sea and a continent's width separate woodsmen of the Pacific Northwest from the European battle-front, Oregon and Washington's lumberjacks are playing a vital part in the great war.

They are producing spruce—king of woods for aeroplane construction. Light, tough, strong, it, of all woods and metals known, can best stand the terrific shocks of aerial speed and combat.

Metals buckle, other woods break and shatter under stress or bullet's impact; spruce does not. A shot can pierce it, but it will not split. Should strain bend it too far, the long fibres, like interlaced fingers, hold together at the fracture's point. That's why spruce must bear the nation's wings. The lives of flying men, and those of fighting men below, depend upon its qualities.

But America is not alone in looking to the North Pacific states for spruce. The Allies, England, France, Italy, likewise are wholly dependent upon the west coast for this precious wood. It is their sole source of supply. Aeroplane spruce grows in marketable quantities in only two places in the world—and the other place, by a strange trick of fate, is the German provinces along the Baltic Sea and captured Russian territory.

When Congress last summer passed its appropriations totalling £137,000,000 for aeroplane production and army and naval aviation work, the press waxed enthusiastic and the public counted the programme as done. In the mind's eye great flocks of machines, numbering tens of thousands arose in flight. Even those in charge of the stupendous work gave scant heed to the spruce problem upon which the wings would depend. Indeed, with few exceptions, everyone apparently believed that it was simply a matter of going into the west's great forests and cutting down the trees.

It was pointed out that there is more than 900 *billion* feet of standing timber in Oregon and Washington and 11 *billion* of it is spruce. The Government and Allied requirements called for only 110 million feet annually—an average monthly cut of from 10 million to 14 million feet. With such huge supplies apparently available, the order looked like a mere bagatelle, particularly so in the face of the normal timber cut of about six billion feet each year.

Yet—getting out the spruce is the hardest job the North-west ever tackled. Aside from man-created difficulties, which caused production to lag for six valuable months, nature and the tree itself are in league against the logger.

Unlike other well-known trees, says *The Pacific Monthly*, spruce does not grow in solid stands. Instead it is found scattered widely among other species. *Out of one hundred huge trees, there rarely are more than ten or fifteen spruce.* Of them, generally speaking, less than half are available as aeroplane stock, due to strict requirements that must govern selection of timber for machines.

Perfection is the rule and it is enforced. To pass, the wood must be flawless. There must be no knots, waves in the grain or traces of pitch-pockets. Moreover, most of the lumber must range from 18 feet upward, because its principal service is to form wing-beams. The shorter lengths are used for struts and in the fuselage.

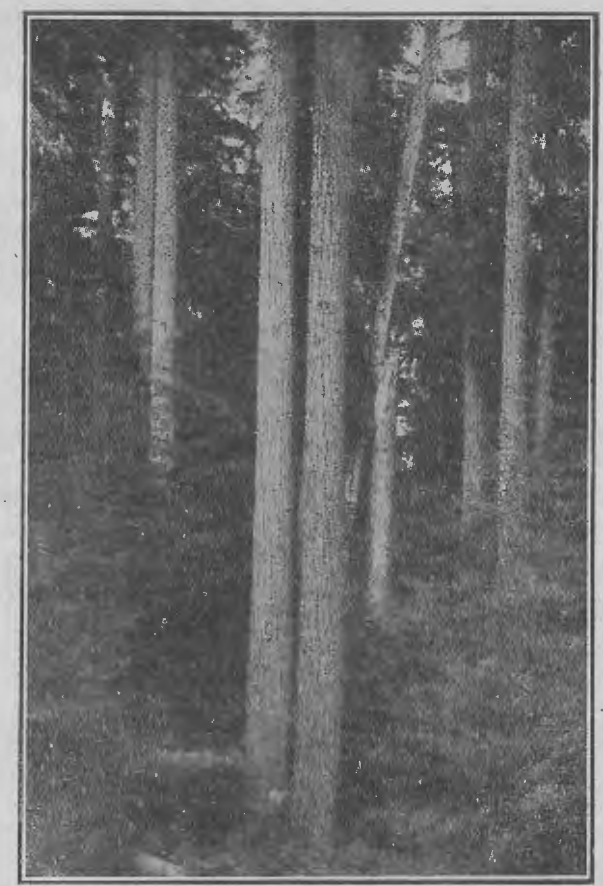
Experience has shown that *about 15 per cent. of a selected tree can be classed as suitable for stock.* The remainder is valueless so far as concerns makers of flying machines; it goes into the manufacture of boxes and other commercial lines.

But the 85 per cent. loss in logging accounts for only a part of the necessary wastage. When the finished stock is turned over to the factories another great shrinkage marks its course. Saws and planes cut it down to fit fine measurements, and *in the end about 167 feet of spruce out of each 1000 feet of so-called stock goes into an aeroplane.*

But heavy as such a handicap is, the problem now being solved would be comparatively easy except for topographical difficulties and the relative inaccessibility of present supplies. Country, rough, mountainous, scarred by precipitous can-

yons, crowned by great peaks and broken by numberless rushing torrents—that is the home of Sitka spruce. The folded reaches of the jagged Olympics, the Coast Range and Cascade mountains guard well their timbered wealth.

Underbrush, so thick that men must slash their paths, impedes the way. On every side are crowded forest giants, towering upward 250 feet and boasting diameters sometimes of fifteen feet. They surround the particular spruce monarchs marked for democracy's service, and bar the way for roads to the mills. These, in brief, are the natural difficulties that face the lumberman upon whose shoulders rests the huge job. And they were no less when America entered the war more than a year ago.



OUT OF A HUNDRED TREES IN SUCH A FOREST, ONLY ABOUT FIFTEEN ARE SPRUCE, AND IN GETTING THESE OUT NATURE AND THE SPRUCE ITSELF ARE IN LEAGUE AGAINST THE LOGGER.

Although the United States had been hovering for months on the brink of the bloody maelstrom into which she later plunged, *war found her with a total of only 135 aeroplanes*, counting everything, and unprepared to build in quantities. For more than three years the Allies had been draining the North-west of its easily available aeroplane stock. Practically every foot of spruce that could be used in construction had been bought by their brokers. Virtually one billion feet had been cut, and more than 100 million of this quantity was suitable for stock. Of this the United States had none.

The trees that had grown along the river shores and on the bottom lands were gone. Those that remained were for the most part back in the timber and accessible only at heavy cost. This was the situation when America took up arms.

Then came the protracted timber-workers' strike, engineered by the *Industrial Workers of the World*, by other labor organisers, and alien enemies, each of whom saw in the nation's need an opportunity to further his own selfish ends. A number of aliens later were seized and interned.

Thousands of men were idle. The *I.W.W.* burned the timber, beat up workers, terrorised the camps, demanded clean bed-sheets, higher wages and shorter hours for men who were already the highest paid timber workers in America.

The National Administration was committed to the so-called basic eight-hour day. The mediator whom it sent in an effort to straighten out matters was a college professor without practical experience in handling men or timber. In keeping with his instructions, he recommended a basic eight-hour day and gave the strikers to understand that they would get it. Immediately afterward the *I.W.W.* announced that they would begin agitation for a seven-hour day.

Thus passed the summer when timber was dry and conditions were best for efficient logging. While chaos reigned and various interests pulled, each against the other, production lagged. The average cut was scarcely two million feet monthly. And for almost five months virtually, none of this was purchased for America's aerial fleet.

Meanwhile the Aircraft Production Board

of the National Council of Defence was having other troubles in Washington. Upon its shoulders has been placed the tremendous responsibility of a stupendous programme—one that included creation and construction of the standardised super-powerful Liberty motor, the mobilisation and expansion of aeroplane plants, assembling of huge quantities of materials ranging from linen to oils—and spruce.

From virtually nothing, Uncle Sam had called for the building of an industry almost as great and complex as the automobile industry.

Against the board were pitted experienced Teutonic builders, schooled by more than three years of war, and who, warned by America's announcement of a huge aerial programme, were bending every effort to construct a flying armada sufficiently strong to meet the advertised invasion.

Last May the board was figuring on a modest programme of 3500 machines, some 8500 less than was decided upon a few weeks later. In answer to inquiries made by the Lumber Committee of the Council, the aircraft board had been told that it would be difficult to secure spruce, as the normal flow of proper stock was not more than 35 million feet annually. Western lumbermen recommended immediate mobilisation of the industry, the elimination of Allied brokers, and co-ordination of effort to supply the needs of America and the Allies.

So far as production is concerned, there is little to record for June and July of 1917. In June, preparations were made to send E. T. Allen, Secretary of the Western Forestry and Conservation Association, who was then in Washington, back to the Northwest to investigate conditions, establish a suitable timber grade upon which to base purchases and to get spruce moving.

Preparations for his departure had virtually been completed between the various boards, when there appeared Charles Sligh, a Grand Rapids furniture manufacturer, and a man of some political importance in his home state, Michigan. He volunteered his services as a wood expert, although he had no practical experience either as a logger or timberman. He was put at the head of the spruce production department. From the first he advocated the purchase of spruce from the mills. Allen opposed him on the grounds that it would place America in competition with the Allies and would not increase output. The demand, Allen pointed out, called for a four-fold increase in production, and the only place the logs could come from were the forests and not from mills. Co-operation, not competition, was necessary, he declared.

June passed and July, before a definite plan was arrived at. Then it was redecided that Allen be sent West as had been planned in May. In August, Allen left for the Northwest under instructions to establish the timber grade, recommend a price, advise the board how to make purchases to best advantage and how to speed up production.

He had scarcely opened up headquarters in Portland, when Sligh wired a dozen mills to cut all their spruce for the Government. He set the price at £21 a thousand feet, based on tentative specifications that had been discussed prior to Allen's departure. As they stood the specifications meant nothing. The mills would have been able to sell all manner of worthless stock at about three times normal values.

Allen protested, pointed out the difficulties, and urged that no contracts on the original specifications be allowed. In addition he ruled that not less than 50 per cent. of the log should be clear of flaws. Sligh responded by ordering all spruce-cutting mills to cut for the Government. Then the trouble started.

Many mills had contracts with brokers representing the Allies. The brokers had contracts with their respective Governments. There was only one thing to do and that Sligh did. He had all spruce supplies at the mills commandeered.

Weeks were spent in unwinding the tangle. It was finally straightened out by allowing the brokers to "reinstate" their contracts on a 60-40 basis, 60 per cent for the Allies, the remainder for America. Europe had to have spruce and got it. During August there was shipped to American factories only a few hundred thousand feet of stock. Uncle Sam's training 'planes—several thousand of them—were being made of *fir*.

In September the output was about 2,000,000 feet. At the month's end Allen's resignation was forced by Sligh, and Russell Hawkins, a prominent Oregon timberman, was installed in his stead. Hawkins followed the policy laid down by Allen until November, when the Aircraft Board adopted Allen's old recommendation by turning over the problem to the military arm of the Government. It was given into the hands of the Signal Corps of the Army. In charge of it was placed Colonel Brice P. Disque, Spanish-American War veteran, who had resigned as warden of the Michigan State

Prison to enlist for service against the Central Powers.

Of spruce, Disque knew little. But he professed a genius for organisation and knew how to handle men. By the middle of November he had plunged into work and did so faced by almost insurmountable difficulties, made harder by red tape and a system that compelled him to submit to rigid control from Washington, three thousand miles away.

Summer had passed. Winter had set in. The loggers had not opened up operations because they did not know where they stood. Labor was sullen and still on strike in spots. The highest output for any month had been 3,000,000 feet in October, and that was due to the sawing of logs stored during the strike in Willipa harbor.

A section of a log in the mill, illustrating how little of the hard-won spruce is actually available.

Photograph by Stella Baker.

This magnificent giant, perfect as it stands in the forest, yields only fifteen per cent. of spruce stock suitable for aeroplanes.

Happily, however, preliminary surveys had been made, and a definite course of procedure outlined, which was effectively followed and subsequently improved upon.

From that time on there was a radical change for the better. Disque shattered red tape. Other influences convinced Washington finally that he needed the widest authority. A commission was sent to Oregon in January and granted Disque more power. At the time Richard Howe, a member of the Aircraft Production Board, said: "It is not entirely a matter of red tape, this delay in the spruce programme. Red-tape hindrance has been exaggerated as a matter of fact. It is largely a matter of distance. One can't carry on telephone conversations very readily with Washington. The matter of distance has seriously delayed the getting out of spruce. You can't run a business 3,000 miles away and speed it up to highest efficiency. It requires management and control on the spot."

The truth of his observations was proved during the next four months. It took Disque just forty-five days to build and put in operation the first unit of what will be the biggest spruce cut-up mill in the world. It is located at Vancouver Barracks on the Columbia River. Each day it can saw into finely measured lengths 20 car-loads of logs.

Through Government effort loggers were supplied with more than £200,000 worth of wire cable; £150,000 worth of steel logging road rails; £300,000 worth of logging engines and other essentials which they had been unable to secure. Where it had taken 50 days to ship stock to Eastern factories, Disque through use of priority orders got the timber through in ten and fifteen days.

Through operation of the cut-up mill the spruce waste was eliminated from shipments and, as a result, an average of 3000 cars were saved on an annual basis. He tackled the labor situation in the same manner. Several Signal Corps officers were sent into the field. They organised the timber workers into the Loyal Legion of Loggers and Lumbermen. From a membership of 150 during the latter part of November, it numbered on April 1 about 70,000—virtually all the men employed in Oregon and Washington's timber. Each was pledged to crush *sabotage* and sedition, to give loyal service and get out fir for ships and spruce and fir for aeroplanes.

The question of the labor shortage was another problem. This was solved by the organisation of the Spruce Division of the Signal Corps—an organisation 10,000 strong, which consists of former loggers and other young men drawn from the new National Army.

Whenever there is need for more workers, squads of these soldiers are sent into the timber. There they work side by side with civilians, they receive the same pay, eat the same food, but live apart under military discipline.

From the beginning, results were apparent. Loggers, under a guarantee of £21 a thousand feet and an additional bonus of £8, extended their operations into hitherto isolated tracts. Logging railroads, scores of them, climbed heights and crossed the canyons in search of spruce. Where roads could not go, operators swung their "high lines" from tree tops and transported huge logs by cable through the forests. Failing in this way they went back to the primitive method of "riving"—that is, splitting logs by hand and then transporting them to stream or logging road by team.

And production climbed. In February it had jumped to 5,000,000 feet. Since then the output has been sufficient to meet factory demands. It took Uncle Sam a long time to get off his coat and settle down to work—but now he's working.

A phenomenally mild winter in the North west did much toward saving the situation. Loggers who usually slow down operations were enabled to continue. The practical employment of the forest service's newest timber-seasoning process, likewise played an all-important part. It reduced the time necessary to season spruce timber, from three months to fourteen days. But the big driving force behind the increasing output is effective organisation and centralised authority. That is the thing that is producing the spruce.

As the work progresses, difficulties will increase and will be met. The forests for hundreds of square miles must be searched for spruce. Of the North-west's eleven billion feet of spruce four billion feet is classified as reasonably accessible. Under efficient manufacture this will yield between 200,000,000 and 300,000,000 feet of aeroplane stock—sufficient for two years. Should the war still continue there are two and one-half billion more feet in large stands, which can be reached at heavier cost. In short the North-west has the spruce, and plenty of it. The problem now is one of men and money.

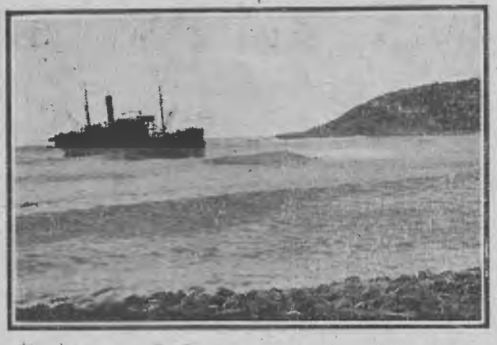
SALVING THE "MAKAMBO"

By JOHN EGAN CLEARY (Wireless Operator on S.S. "Makambo.")

At about 7.30 p.m. on the evening of Friday, 14th June, 1918, in fair weather, calm sea, and 'neath the rays of an unclouded moon, the s.s. *Makambo* (1159 tons register, owned by Messrs. Burns, Philp and Co., Ltd.), hoisted her anchor from the mud surrounding Lord Howe Island, and headed for Sydney.

The monotony of an eight weeks' cruise around the New Hebrides had set us all hungering for an early sight of the Heads, and under the favourable conditions indicated above, it was generally anticipated that we should enter Sydney Harbour not later than Sunday evening, June 16th.

There was, indeed, a certain amount of speculation as to whether we should be "allowed in" that night, or be compelled to "stand by" until daybreak.



AGROUND ON NED'S BEACH, LORD HOWE ISLAND.

With the argument still at its height, the old proverb: "Man proposes, God disposes," justified its popularity—or otherwise—with a suddenness so convincing that many of us were thrown off our feet by the force of the impact. And this at 7.45 p.m., after barely a quarter of an hour under way!

That we had struck—and struck good and hard—was obvious. The reef had been under discussion earlier in the day; inquiry and comment were superfluous. So we got busy.

Lengthy blasts on our siren attracted the attention of the islanders, and we at once prepared to launch the boats, this operation —the assistance of all hands notwithstanding—being much hampered by the tumbling and tossing of the vessel.

The launching of the first lifeboat under these difficulties was attended by the one fatality of the whole adventure.

A passenger, Miss Reardon, was in the act of stepping into it from the boat deck when the *Makambo* gave a sudden roll; the lifeboat swung outwards and Miss Reardon, missing her foothold, disappeared. A persistent search, maintained throughout Friday night and Saturday, proved unavailing.

After a hurried examination of the apparently damaged section of the vessel, the engines were set "full astern," thus releasing the *Makambo* from the reef and permitting her to slide gently back into the bay.

ARRIVAL OF RELIEF SHIPS *CHAMPION* AND *INDUNA*.

As she was admitting water in a greater volume than could be successfully dealt with by our pumps, it was decided to endeavour to beach her. Accordingly, we made for the bay which had been our previous anchorage.

We had, by now, acquired a decided list to port, and one kept one's feet only with the greatest difficulty.

On reaching a comparatively safe position, the remaining passengers, about fifteen in number, were sent ashore, as were all portable goods of value.

This done, the beaching operations were now carried out. Escorted by a party of

islanders in a native rowing boat, and supported by other "emergency" craft, the *Makambo* steamed a few hundred yards further and grounded on Ned's Beach. The beaching was effected to the accompaniment of a distinctly audible scraping of the keel against the solid bottom.

An effort was then made to summon assistance by wireless. Our anchorage was on the eastern side of the island and about a chain distant from the shore. Land, in this instance, consisted of a lofty mountain rising almost perpendicularly from the water's edge.

While unable to describe its geological formation with any degree of accuracy, I may mention, as a matter of passing interest, that the approaches to this mountain were very rocky, and interspersed with reefs of ironstone, thereby creating an absorbing as well as a screening effect between the very great extent. Had the weather come from the opposite quarter our plight would have been considerably aggravated.

Effort was made on Monday, June 17th, to obtain a more favorable anchorage, our present situation being within half a ship's length of a partially submerged rock, which, at low tide, was well out of the water. An anchor, attached to a wire hawser, was carried out some distance, and dropped from a couple of rowing-boats, the after end of the cable being secured to one of our winches. This operation was repeated with a second anchor, and by the united action of these the *Makambo* again floated.

The engines were now set full astern, but, unfortunately, the cable became entangled with the propeller, thus placing our engines temporarily out of action, in addition to severing a cable attached to one of the anchors.

SALVAGE OPERATIONS.

MAKAMBO PASSENGERS TRANSHIPPING TO RELIEF TUG *CHAMPION*.

Makambo and Australian wireless stations and rendering communication extremely difficult. Atmospheric conditions were responsible for further "interference."

Hobart, although thrice the distance of Sydney or Brisbane, was, however, the first to hear our message.

Salvage operations were commenced on the Saturday morning. Barrels of lime juice, cases of fruit, vegetables and other stores were jettisoned. Of these, some were washed up on to the beach, others shattered on the rock-strewn coast. At the conclusion of the dumping process, the surrounding waters presented the appearance of an orchard under flood, oranges, apples, bananas, and other fruit dotting the far horizon.

While aground at Ned's Beach the *Makambo* was badly buffeted by heavy south-easterly seas, though our position on the lee side of the island protected us to a

By careful manipulation of the propeller the cable was finally cut and the engines restored to working order, only a short length of cable now remaining twisted about the propeller.

An hour's manoeuvring, back and forth, brought us into a position some two chains further from the mountain, which was on our starboard side, and about one chain ahead of our former anchorage.

From the new position, wireless communication was less difficult.

On Monday night we received a message stating that the *Champion* had left Sydney earlier in the day to render us assistance. This message was hailed with general satisfaction, as I had been uncertain as to whether my messages had been correctly received. Our engines were in danger of becoming useless, in which case our sojourn at Lord Howe may have been indefinite and our silence a probable source

of alarm to that section of the community which is ever ready to form hasty conclusions.

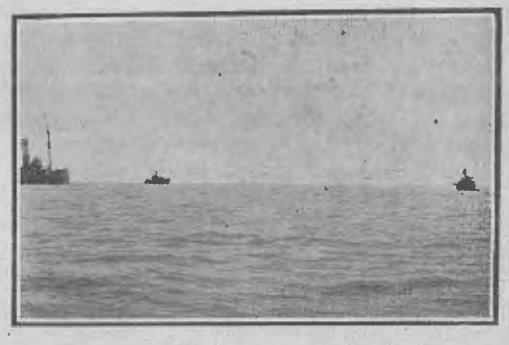
At 10 a.m. on Wednesday, June 20th, the *Champion*, carrying salvage gear and a diver, steamed to our assistance. The diver went "below" and made a thorough examination; pumps were refitted and sundry damages repaired. These matters occupied four days, meanwhile the *Induna* had arrived with stores and more salvage gear. Although not altogether short of food, the stores had already commenced to dwindle and the daily menu had been reduced. The *Makambo*'s tanks having run dry, we procured a supply of fresh water from the shore. This was carted on a sledge in barrels from a Government tank, a system which, although slow and tedious, enabled us to maintain a supply sufficient for culinary purposes. The water thus obtained, having been conveyed in lime juice barrels, the demand for same was by no means general.

On Monday, 24th June, anchors, attached to cables, were again taken out and the operations of the previous week resumed; this time, however, with better results.

That evening at six o'clock the re-floating process was essayed in real earnest, a steady strain on the cables being maintained by means of winches. Several long moments of suspense elapsed before any appreciable motion could be felt, and when the *Makambo* eventually did move its progress was almost imperceptible.

However, by 8 p.m. we were well afloat and moving out into deep water. About half a mile beyond our original position we dropped anchor, to the great enthusiasm of the spectators ashore who set up a tremendous cheer. This was re-echoed by the sirens of the *Induna* and *Champion*, and heartily answered by all aboard the *Makambo* which now manifested a pronounced and continually increasing starboard list. By transferring a large number of portable objects to the opposite side equilibrium was again established.

Further progress was impossible until the next morning, when a second examination by the diver revealed a gap some 3 feet long, in addition to various leaks elsewhere. All other experiments having failed, these damages were temporarily repaired by means of wooden wedges.



REFLOATED AND HOMEWARD BOUND.

At noon on Tuesday, 25th June, the *Induna*, carrying our passengers, departed for Sydney.

She was followed some eight hours later by the *Makambo*, running under her own steam and convoyed by the *Champion*.

Despite her injuries, the *Makambo* maintained a speed of eight knots throughout the return journey, and steamed into Sydney on Thursday, June 27th, just two hours before daybreak.

The Life of an Aviation Engine

The life of an aviation engine is reckoned in hours rather than in months or miles flown, and the time that each engine does is kept careful count of from the moment it passes its bench tests until it is finally crashed in a machine or breaks down completely. There is an enormous variation in the life of aviation engines if one considers this to be the period from its first run until it requires to be completely dismantled and turned up. Stationary engines, on the whole, give less trouble than the rotary pattern, and especially than the old type of rotary engine, which suffered from broken inlet valves and many other small but equally annoying faults. If an engine will run 100 hours without being taken out of the machine for overhaul it is considered very satisfactory. At an average speed of 60 m.p.h. one finds that 100 hours represents 6000 miles, which is about the same distance as a motor-cycle engines does before requiring a works overhaul.

THE PHENOMENA OF SOUND.

By Mrs. SELWYN LEWIS, B.Sc.

PART I.

The word *Sound*, in common language, has two meanings.

When we say we hear a sound, we refer to the sensation which we receive through the ear, and when we say that the velocity of sound increases when it travels in the direction of the wind, we refer to the external disturbance which arouses the sensation when it reaches the ear.

Our aim is to investigate the conditions under which the external disturbance arises, the mode in which sound is propagated from its source, and the variations and nature of the disturbance corresponding with the various sensations we experience.

A vibrating source gives rise to waves in the surrounding air.

If sound be carried from its source to the observer by material substances, then air must be one of these substances.

The velocity of sound in air is one thousand one hundred feet per second; the velocity of sound in iron is about sixteen times as great, while sound is also readily carried by liquids.

We divide sounds into two classes, musical notes—and noises.

There is no sharp distinction between the two; musical notes have a recognisable pitch, while noises have not.

Air is necessary for the transmission of sound, and the rarer the air the weaker the sound. A rifle going off, or a cracker exploding, apparently makes less noise on a mountain peak than in the valley below.

Anything giving off sound is in a state of rapid vibration. The vibrations of a tuning fork when struck are invisible to the naked eye, but if a pith ball suspended by a thread of silk be held against it the violent bouncing of the ball will indicate that the prongs are vibrating. Wave motions of sound occur because the individual air particles are caused to move to and from the radii of the sphere, whose source of explosion is the centre. The actual motion of each air particle is very small, and is called the Amplitude of the Sound Wave; the speed at which this zone of compression moves outwards is called the velocity of the sound wave. In ordinary speech or song the waves are from 2 to 8 feet long, but in the case of a shrill whistle the wave length is from 1 to 2 inches, while that of the deepest note of an organ is 32ft.

That sound waves cannot be propagated without air is demonstrated by placing a musical box beneath the receiver of an air pump; as long as the receiver is filled with air the music is heard, but as the air is pumped from the receiver, the sounds grow fainter and fainter.

Sound is transmitted through liquids; divers can hear a bell which is sounded under the water some distance away, a very simple experiment being by means of a small sheet of cardboard attached to the base of a tuning-fork; set the fork vibrating and the sound will not be very perceptible, but by placing the cardboard on a surface of water the sound will be more than redoubled.

Sound is strengthened as it travels through solids, the old-time custom of putting an ear to the ground to listen for horses' hoofs proving that even the ancients possessed some knowledge of physics.

The energy of air waves is small, yet by virtue of the principle of resonance, the waves are able to excite powerful vibrations in elastic bodies that have the same natural period as themselves.

The old story of the celebrated singer with the powerful voice, who is said to have been able to break a wineglass by singing to it, if true, was, no doubt a case of resonance.

By tapping a winegless which has a natural period, the musical note is given out, and if this note be sung, the glass will be set vibrating and may break.

When a wave of sound travelling through the air encounters an obstacle, it is reflected from it, the sound thus reflected being often more audible than the original, thus is an echo created. Sometimes the reflected sound is reflected again, and curious echoes are produced.

The famous Whispering Gallery of St. Pauls owes its peculiar acoustic properties to the reflection of sound by the walls of

the gallery running round in the form of a circle inside the dome.

Persons at any part of the gallery can readily communicate by whispering near the wall, which can be heard, as the sound creeps around the dome in a thin sheet close to the wall.

Another phenomenon is that of "conjugate reflectors"; when two mirrors are placed a small distance apart, and some sounding body, such as a watch, is placed at the focus of one mirror the sound coming from it will be reflected until it ultimately reaches a point at the focus of the other mirror, where the ticking will be distinctly heard.

Gas burning at a small aperture with high pressure applied becomes a long narrow flame, but if a shrill sound is made near it, the flame will shorten and broaden; should the flame be placed in the focus of one mirror and a very shrill whistle in that of the other, the sensitive flame will be very much affected. It is related that at the Cathedral of Girgenti in Sicily the slightest whisper from the great western door is conveyed to the cornice behind the high altar, 250ft. distant, and that, unfortunately, the focus at the former station was chosen for the place of the confessional, consequently a listener at the opposite focus often heard news never intended for the public ear, and another site had to be chosen. It is on account of refraction that sounds are heard so much more clearly by night than by day.

While a sound wave travels in the daytime, the layers of air lying close to the ground are more heated than those higher up, and since sound travels at a greater rate in warmer air, the lower levels of air transmit the disturbance faster than the higher ones so the lower portion of the wave outruns the higher one, and the sound tends to mount. The reverse takes place at night when the lower levels are the most chilled. A sound wave may have its direction altered by meeting a current of air, or may be entirely lifted up and dropped down again; persons in one district often do not hear a sound, although others further off have done so. The most effective instrument for producing very powerful sound is the siren; this is a tube or horn, having at the bottom a fixed disc, ventilated by means of slits. An outer disc, similarly ventilated, revolves against the first. As the second disc revolves the passage way into the horn opens or closes as the disc coincides or not. When air or steam at high pressure is blown into the horn, the rapid interruption of this blast by the revolving slits causes the air or steam to be cut up into puffs, which, if frequent, produce a very loud sound. The direction of the wind has great influence on the distance at which sound can be heard; a sound audible in calm weather, twenty miles away, would against an opposing wind be inaudible at 1½ miles. In calm weather a low-pitched note carries further than a high one, but in rough weather the opposite would apply.

Then there are the curious areas of silence when all sound seems lost, but further on may be heard again. The velocity of sound was found by watching a cannon discharged at a great distance, the moment the flash is seen is recorded, then comes the report, and that interval between flash and report denotes the velocity of sound. When the huge volcano of the island of Krakatoa burst into eruption on August 27th, 1883, the roar of the explosion was among the loudest noises ever heard, the released gases and vapors creating an air wave which encircled the earth seven times before finally fading away. The sound of this explosion was heard four hours afterwards on the opposite side of the Indian Ocean.

The effect of sympathetic vibration is shown by taking two tuning forks having the same frequency; when one is caused to vibrate the impulses are communicated to the other, and though the vibrations in the former may be arrested, the latter will continue to vibrate. The volume of sound given off by a tuning fork will be much increased if brought over an air column of such a length that its frequency, or proper period of vibration, be the same as that of the fork. The air column will start into sympathetic vibration and reinforce the sound given off by the tuning fork.

When the vibrations of a sound are regular and periodic, it is musical; for instance, the granite pavement of London is 4 inches in depth and cabs driving over this pavement at eight miles an hour produce a succession of noises at the rate of thirty-five to the second, which correspond to a well-known musical note. Yet nothing can be imagined more purely a noise, or less musical than the jolt of the rims of a cab-wheel against a projecting stone, but when a regular succession of such jolts takes place, a musical sound results.

(To be concluded in our next issue.)

"VON TIRPITZ" :: The True Story of a Submarine Hunt.

By JOHN S. MARGERISON.

"And this," moaned Lieutenant Augustine Reginald Batty, Royal Navy, commanding officer of His Majesty's elderly and disreputable Torpedo-Boat O 36, "is what they call a patrol station. In my opinion, it's a blinking refrigerator, and I should like to have ten full unofficial minutes with the bounder who detailed me to look after it."

He snapped out an order to the helmsman which sent O 36 gliding well to the starboard of a monster iceberg, and buttoned his lammy suit closer to his chin in the keen air. His sub-lieutenant and second in command, one Marmaduke Bliss, smiled happily at his senior's outburst. He didn't mind the loneliness at all, and the cold left him unaffected.

"I wouldn't moan about anything at all," went on Batty, as O 36 steadied on her course once more, "but we never see anything worth *strafing*. Now, if only an occasional chance submarine would lose her way and meander in this direction, so that we could *strafe* her, we might bring the fact of our existence to the notice of the powers that be, and get removed to some more exciting beat."

Bliss stiffened suddenly, and flung out a pointing hand to the northward. "What more do you want than that?" he queried. "Old Von Tirpitz himself come to pay you a call."

"Glory be!" exclaimed Batty. "It's actually a submarine, I do believe; though what the dickens she's rigged up with beats me. Give her a round from the forecastle gun, quick, and for the Lord's sake plug her! We haven't had a chance like this before in all our lives."

With the aurora borealis making delicate tracery on the night sky behind her, and with gigantic icebergs encompassing her on almost all sides, lay a German U-boat. In the light the two officers could even see the black-and-white diapered lines on her upper part, and the white-painted U on her conning-tower. But she was not as other U-boats. From her bows, extending on each side and outwards, curved like the claws or pincers of a lobster, were a pair of antennæ, the invention of her own *oberleutnant*, and the means whereby she had up to now managed to cut her way through various nets set to catch her.

Night-time was her favorite period for breathing, and, like other of her sisters, it had indeed proved to be the only safe time for coming to the surface. Therefore, when O 36 called to her with the forecastle six-pounder, she resented the interruption, but stayed not to argue. Deeming the depths safer and more peaceful, she dipped hastily, just as the six-pounder shell, flying wide, exploded near the summit of an attendant iceberg. And the chunks of ice flung apart by the explosion fell crashing into the sea, some even sinking as fast as she did. Indeed, one huge piece, weighing some fifteen tons, dropped clean on the starboard claw of her net-cutter, and snapped it off like a rotten carrot.

O 36's officers swore heartily and unashamedly, and very loudly, at that unlucky layer of the six-pounder.

"Best chance we ever had, and we missed it," they cried in unison, as the boat reached the spot lately vacated by the German. "But he won't get any peace now we've seen him. We'll make his life a mizz."

And they did. Their wireless called to all the other boats of the patrol, reported "Von Tirpitz," and made arrangements to ensure the complete misery of her life thereafter. And by means of their own, possessed by all U-boat hunters, they shadowed that one-whiskered submarine so that she became a fugitive. Wherever she went some craft with designs upon her life showed up and headed her off. A drifter caught her one day, and it was only after three hours' bitter fighting with the bomb-charged nets that the submarine got away. On another occasion a trawler ran a wire-hawser sweep under her keel as she lay on the bottom, and the submarine only got clear in time. Three minutes more, and that red tin of gun-cotton, with electric wire attached, which they slid down the taut wire, would have rested against her hull, and, upon the touch of a button, have sent her sides crashing inward like a squashed bully-beef tin.

They headed her back into O 36's sphere of influence at last, and one night she came up for breath as usual. The six-pounder again snapped angrily, and this time the port leg of her antennæ flew circling through the air, leaving her as any other boat.

She slid downwards rapidly, and pushed blindly southward again at a horrible depth, while her storage-batteries sparked badly and gave off fumes which almost choked her crew. By good fortune she managed to hide herself for one full day in a Scottish inlet; but at the end of that time a scouting motor-boat asked her, *viâ* a three-pounder semi-automatic gun firing twenty rounds a minute—and the motor-boat spoke for a full minute, too—what she wanted.

As "Von Tirpitz" had no convincing answer ready, she evaded the question in her usual way, and added a second bloodthirsty tracker to the list of her immediate foes. For nearly a hundred miles across the North Sea the torpedo-boat and the cockle-shell motor-boat followed her, and the submarine began to hope that at last she was bound for home. But she ran into a long line of more than usually dangerous nets, and turned back disgustedly, running again to the south-east. Although she did not know it, she passed once more from O 36's ken; but the motor-boat, being tied down to no restricted area, accompanied her as if towed. They made the mouth of the Channel, just off Dover, and here a paddle-boat added herself to the chase, an elderly paddle-boat, whose name ended with "Belle," and who had once carried holidaying crowds to "fortified towns" on the south coast, such as Ramsgate and Margate. She ran up alongside "Von Tirpitz" one night, just at breathing-time, and failing to ram her, owing to some trick of tide or helm, tried to drop a lump of dynamite down her open conning-tower hatch. But the light was bad, and the bullets from the German *oberleutnant's* revolver whistled round the skipper's ears; so the attempt failed.

She shook off her trackers, save for the motor-boat, who now became so weather-stained and short of fuel and provisions that she had to appoint another small pigmy craft as her deputy. And some inquisitive vessel, seeing the strange motor-boat on the job, spread a rumor that there were now two submarines instead of one in the hunt, and hopes rose accordingly. The disappointment, when it finally came out that it was still the same old craft who was being hunted, was intense, but made the hunters all the more determined to kill.

Then came a day when "Von Tirpitz" found herself surrounded, quite close to shore, and well within O 36's beat, by a host of small craft—trawlers, drifters, ocean-going tugs, paddle-steamers, mostly from the Clyde and the Forth, motor-boats, and one or two torpedo-boats, who proclaimed their presence hoarsely, and stood aloof to watch or to bear a hand as the necessity arose.

The submarine tried to break through to the open sea; but the snares were too strong for her. Fighting bitterly all the time, she was driven towards the land, over the mud-flats and sand-banks. She tried to dive, but the bottom was too close for safety, and she bumped upwards at an alarming rate. Then she turned, and really, before she knew it, discovered an ancient run-way, unguarded by nets. She promptly took it, leaving behind her periscope—a six-pounder shell from a resentful drifter snapped it off—and emerged at the other end temporarily free, but blind.

Another day of grace was accorded her, during which she rigged her spare eye; but this time wandering coastguards turned her into a rifle-practice target, and succeeded in scoring bull's-eyes on three of her crew.

Followed another week of hunting, during which "Von Tirpitz's" crew grew sullen and discontented, and only their hatred of the hunters prevented their mutinying incontinently and surrendering their craft to the patrols. But their *oberleutnant*, like the sportsman he was, told them it was up to them to see the game through, and read them extracts from German newspapers which stated that all submarine crews captured with their ships were towed astern of their own boats and drowned.

"But" he added, "I have every reason to believe that if the boat is lost, they simply intern the crew till the end of the war; but even that is not good enough for us children of the Kaiser. So, if the end comes, we must destroy the boat. That, of course, means that we shall all be killed outright."

Now, I have said he was a sport, and he did not want his men to be killed. One should die for the safety of the others, he explained. "We will all draw lots," he went on—"I with the rest of you. The man who has the ace of spades"—or its German equivalent—"dealt to him will be the selected man. When the end comes—if we cannot escape—that man will stay below while the others go on deck, and he will have a bomb with an instantaneous fuse ready in his hand. When the hunters come to take off the prisoners, I, or the senior man on deck, will kick hard three times in succession on the hull. Then the bomb

will go off, and if the accursed British get the men, they will lose the boat. Is it so?"

"It is so," growled the crew, and the cards were dealt.

Breathlessly each man grabbed his little pack as they came to him, and a little fair-haired youth gasped with terror. Then he straightened his shoulders and looked his officer between the eyes. "The honor has fallen to me," he said simply. "It is enough. The Fatherland demands it."

For the next day, and the three following that, the little fair-haired Saxon prayed that the God of Battles would see U 72 through the mess. But stores ran short; provisions were giving out at an alarming rate, and the storage-batteries were running dry. U 72—or "Von Tirpitz"—decided to seek another friendly inlet, ignorant of the fact that there were now three motor-boats acting as her shadows.

She sought shallow water, where she could lie secure and rest. But she found it not till the third day, when the battery almost refused to give off enough current to run her motors. And then, with the three motor-boats close on her heels, she ran into shoal water once more. No runway opened to her this time, the bay she had chosen was landlocked, and the way to the sea barred by those three boats.

"The end has come," remarked the *oberleutnant*. "You are ready, Johann?"

The fair-haired boy went to a locker, and removed a small case. From its interior he disinterred a spherical object. He withdrew the safety-pin, and handed it to his superior. Then he placed his thumb on the trigger—the loosing of which would immediately detonate the bomb—and knelt close to the hull.

"I am ready, Herr Leutnant," he said.

"Surface; blow all ballast," ordered the officer. The boat shot upwards, twenty yards away from the trio of hunters. The conning-tower hatch sprang back, and the crew filed slowly out on to "Von Tirpitz's" whaleback. One of the motor-boats' captains seized a megaphone.

"Anybody there speak English?" he commanded.

"I do," replied the lieutenant, sure of the next question.

"Then what about it?" came the words. "Do you surrender?"

The German shrugged his shoulders. "I have little option," he replied. "Yes, of course."

The three motor-boats moved slowly, cautiously ahead, their pigmy guns ready for immediate action at the first sign of treachery. Those men who were not guns' crews loosened their automatics.

Twenty yards away two of the boats slowed and stopped, keeping their guns trained on the U-boat's conning tower. The third shot alongside, a brown-faced officer, R.N.V.R., in the stern-sheets.

"All there?" he asked. "Nobody below?"

"No one at all," replied the *oberleutnant*, as he made to step into the boat.

"Hang on a minute, then," was the order, and the brown-faced young man swiftly counted the Germans. Then, pistol in hand, he clambered to the submarine's whaleback. The *oberleutnant* stepped quickly towards the conning-tower.

"Wait a minute, Herr, I said," interposed the R.N.V.R. officer. "Don't be in a hurry."

He thrust the muzzle of his automatic under the German's nose, and the latter gave back a step.

"Bates," called the Englishman to his coxswain, "just keep your pistol on these chaps, and if any of 'em try to approach the conning-tower, plug him. I'll stand the racket."

He drew himself swiftly to the top of the tower, and dropped within. Inside, close to the hull, he saw a fair-haired youth, crying bitterly, but with his ears cocked for a signal. And in his hand was a bomb.

"Don't drop that thing," said the R.N.V.R. man quietly in German, "or it might go off, and then you'll lose that nice, comfortable internment-camp we've got ready specially for you. Besides, if you do drop it, your mother will miss you ever so much. And don't forget I've got a pistol pointing straight at you. Best come on deck with me, and don't be a ruddy fool."

The fair-haired youngster, at the first words, started. He thought swiftly. The signal—the three kicks—had not come; therefore his comrades were still on deck. If he exploded the bomb he would kill them as well as himself, and that was what he didn't wish to do. And at the mention of his mother he broke down completely.

He stood up, and, with a few words of English at his command, intimated his willingness to accompany the captor. The latter pointed to the ladder with his pistol, and followed close on the Saxon's heels.

"Now then, over into the sea with it, quick!" he ordered, at the top. The explosion drenched the German crew, but did no other harm. The transhipment took three

minutes, the run to shore and the posting of armed guards on the landed prisoners another three, and then the motor-boats returned to the carcass.

They searched "Von Tirpitz" thoroughly. They found quite elaborate plans and charts on board her, some of British ports and others of German harbors; and they also found the huge store of gasolene which she had not been able to use through being kept below the surface by the harriers.

"And that reminds me," said the R.N.V.R. skipper, "I've wired to —— for the torpedo-boat which usually beats in that neighborhood to come and take this boat in tow, and, as we've used quite a lot of Government gasolene in the capture of the packet, I don't see any reason why we shouldn't fill up from these tanks. Anyway, it'll be something to do while O 36 is on her way down here."

The tanks had scarcely absorbed the last drop ere O 36 poked her inquisitive nose into the inlet. Batty was quickly put in possession of the facts and of the "kill," and as he passed a wire-hawser for towing her, even as he rang down for speed on his engines and went ahead, he gave vent to his feelings once more.

"Once in a blue moon we saw a submarine, and worked like devils to catch her. And then, after three weeks of the most harassing work we've ever done, we have to come and take her in tow, somebody else having got the credit and prize money. If there wasn't a war on I'd send in my papers, and start a farm."

"And," chipped in Sub-Lieutenant Bliss, "you'd be back to sea again in a week, even if they sent you Arctic-exploring."

He would have said more (concludes the writer in Chambers' Journal), but a flying log-book took him neatly by the back of the head, and when he had recovered his composure the only words he found handy were profane, and therefore unprintable.

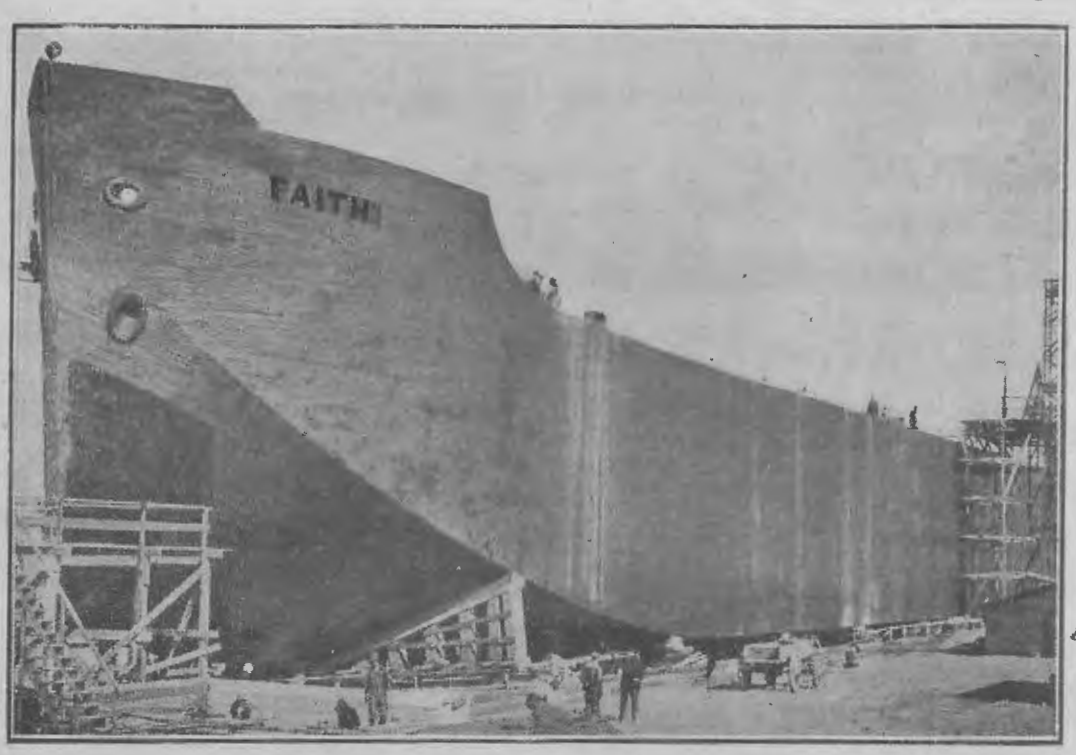
ANOTHER GERMAN SUBMARINE CAPTURED.

Officers and crew of the German Submarine U58 captured by U.S. s.s. *Fanning* are brought into the War Prison Camp at Fort McPherson, Georgia, under marine escort.

Photo. Western News Union.

FAITH, The First Concrete Cargo Carrier

FAITH is the name given to the first concrete cargo carrier built in America, and the career of this vessel has been watched with much interest by marine engineers all over the world. This vessel was built at the yard of the San Francisco Shipbuilding Company at Redwood City, near San Francisco. As soon as she was fitted out she made a voyage to Hawaii, and that voyage across the Pacific proved that those who have pinned their faith on concrete are going to revolutionise ship-building, and that others who insist that concrete is only good for barges and vessels for inland waters are incorrect in their views.



THE FAITH—AT SAN FRANCISCO SHIPBUILDING COMPANY'S YARD.

The new cargo carrier is different in model to the regulation cargo hull. The photograph shows that she is of the scow type, flat on the bottom, straight flat sides, but with what a yachtsman would call a V-bottom at the stem. The sheer is very straight and the board of the moulds shows so plainly on the sides that one would almost insist that it is a wooden vessel.

The *Faith* is a vessel of about 5,000 tons capacity. She is 336 feet long, 44.5 feet breadth moulded, 30 feet depth moulded, and will draw when loaded 24 feet. She is a single-screw vessel, fitted with Scotch boilers and triple-expansion engines of 1,750 h.p., developing a speed of 10 knots. She uses oil for fuel and her tankage enables her to carry sufficient fuel oil for 30-days' steaming.

The frames of this vessel are of steel and are spaced about 4 feet apart. There are interior columns for the support of the two decks, and in addition to the diagonal rod reinforcement in the shell, wire fabric is used $\frac{3}{4}$ inch from the outside surface. The hull is divided into nine watertight compartments by concrete bulkheads. The concrete shell is said to be about 5 inches thick at the bottom, decreasing to 4 inches at the deck, which is $3\frac{1}{2}$ inches thick.

Concrete construction has become so common in building houses, churches and factories, that nearly everyone is familiar with the process, and the concrete ship is built in a method very similar to a house, except that it has no solid foundation to rest upon. It floats in the water and as the

ocean is never still, bridge engineering enters largely into its construction, because the waves will sometimes lift the bow and the stern and leave the centre unsupported, or lift the centre and leave the ends unsupported, so that the vessels have to be strengthened and braced to take up these stresses. To begin with the steel frames are set up and after these have been properly strapped together, wooden moulds are erected into which the cement is poured and allowed to become solid, just as would be done if one were having a bungalow built. The concrete used in ship construction is a carefully prepared mixture of cement, sand and selected gravel, and when this is poured into the moulds the outsides of the forms are hammered to thoroughly consolidate the concrete and produce a dense surface. After the forms are stripped off the hull is sand-blasted, given a coating of gunite and later finished by rubbing. After the frames and forms for the *Faith* had been set up and the concrete poured in, it took just six weeks to finish the vessel and launch it. This was very fast work.

The work on the *Faith* was very carefully watched by R. J. Wig, chief of the division of concrete ship construction of the Emergency Fleet Corporation, and Mr. Wig's report was so favorable that other vessels of this type are being built. Work on three vessels of 7,500 tons each is to be started at once. Congress (says *The Rudder*) is to be asked for an appropriation of $50,000,000 for the building of a fleet of concrete vessels.

There are three experimental concrete vessels now under construction. These are of 3,500 tons, but because there are so many vessels of this size building under the steel and wooden programmes, additional small vessels are not wanted. Experience is showing that larger vessels are more practical and efficient and less costly, particularly for war transport in convoys. The Shipping Board has funds for the concrete vessels authorised, but if the larger programme is undertaken it will be necessary to get more money from Congress. Chairman Hurley has asked the leading naval architects and designers for their opinions on concrete ships, and these are to be laid before Congress.

A new shipyard solely for the construction of concrete ships is to be established soon. It will be in some Southern city, possibly Wilmington, North Carolina, or New Orleans. This yard will have three ways, which will be used for vessels of 3,500 tons, plans for which have already been approved. Upon the completion of these vessels the 7,500-ton vessels are to be built. When this yard is completed there will be five where concrete vessels are building, the others being at Redwood City and San Francisco, Cal., at Jacksonville, Florida, Brunswick, Georgia, and at Detroit.

J. E. Freeman, of the Portland Cement Association, prepared a paper on the "Development of Concrete Barge and Ship Construction," which was read at a meeting of the Engineering Society at Buffalo last February. Mr. Freeman in that paper briefly reviewed the shipping situation and the increasing demand for ships. He said that to "solve the problem requires the rapid development of all methods of shipbuilding and it is for this purpose that reinforced concrete is now being considered and utilised to augment the tonnage under consideration. The first sea-going vessel of concrete has made successful trial trips and vessels of larger tonnage are under consideration both here and abroad." Mr. Freeman then reviewed the progress made in the use of concrete for ship-building.

The first concrete effort was a rowboat, built in 1849 by M. Lambot, of Carces, France. This boat was exhibited at the Paris Exhibition in 1855 and was in good condition as late as 1903. In 1900 a gravel barge, 50 feet long, 13 feet wide and 3 feet deep, was built in France.

In 1899 Carlo Gabellini, of Rome, began the construction of concrete barges and scows in Italy and in 1905 a 150-ton barge was constructed for the city of Civita Vecchia. Later another barge was built for the use of the Italian Navy at Spezia. Before this barge was accepted, it was very thoroughly tested by being driven against piling and being rammed by a steel tugboat. Up to 1912 about eighty vessels had been built by the Gabellini concern.

As early as 1887 small concrete barges of 11 tons capacity were built by the Fabrieck van Cement Ijzer Werken, in Holland, and these were followed by larger craft of 55-tons capacity. In Germany a 220-ton concrete freighter was built in 1909. This vessel had watertight bulkheads. It is said that since the war started Germany has built many concrete barges.

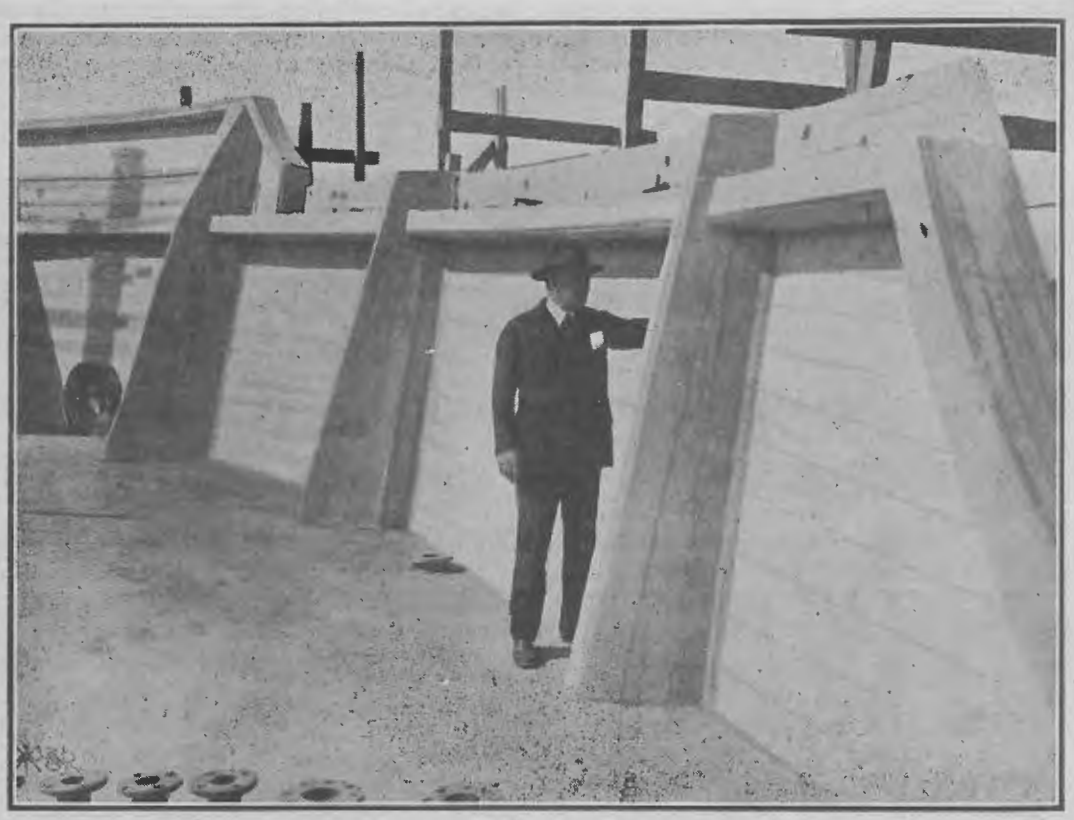
In 1912 a reinforced concrete scow was built by the Yorkshire Hennebique Contracting Company, Ltd., of Leeds. This craft is 100 feet by 28 feet by 8 feet 6 inches

deep. Its capacity is 224 tons and loaded draught 6 feet 6 inches. The hull consists of a series of watertight compartments which will keep the hull afloat if the exterior shell were destroyed.

In 1910 the building of concrete barges was undertaken in the United States. An 80-foot barge of 200 tons capacity, called Pioneer, was built on the Welland Canal for maintenance work. It was designed by J. L. Weller, St. Catherines, Ontario. The barge has a breadth of 24 feet and a depth of 7 feet. The hull is divided into eight compartments by longitudinal and cross bulkheads. The deck, bottom, sides and bulkheads are 2½ inches thick, reinforced in two directions with ¼-inch steel wire and strengthened by the bulkheads and by beams and posts of reinforced concrete 6 by 8 inches in size. This barge has been in almost constant service since construction with practically no maintenance charges and is still in excellent condition.

On the Panama Canal in 1910 three concrete barges 64 feet long were built to carry dredging pumps. These did good work and were followed in 1913 and 1916 by several reinforced pontoons, which were built at Panama; they are 120 feet long.

In England and France the utility of barges and self-propelled lighters of concrete has been recognised. Many have been built which are in constant use on the French rivers and canals, particularly in the war zone. These scows are watertight, do not require scraping, caulking or painting, or maintenance other than repairs to wooden fender system. Some of these barges are built near Bordeaux, others at Ivry-on-Seine, and there has been established a yard for this work at Dundee, Scotland. In addition to these barges, England is building several small coasting vessels varying from 500 to 1,500 tons cargo capacity, which are fitted with heavy oil engines.



BOW OF THE FAITH. BUILDER INSPECTING THE WORK. Western News Union Photo.

In Spain a cargo vessel of 110 feet length is nearing completion at Barcelona. It will carry sails and, in addition, be fitted with a 120-h.p. heavy-oil engine. The company building this vessel plans to turn out this year in standard ships of 300, 500 and 1,000

tons each a total of 40,000 tons. It is also planning to build larger vessels up to 6,000 tons capacity. In Norway the *Nansenfjord* was built last year. This has proved so successful that other vessels of from 600 to 1,600 tons capacity are now building. The *Nansenfjord* was built by the Fougner Steel-Concrete Shipbuilding Company at Moss, and it has a contract for a 4,000-ton ore carrier 154 feet long, equipped with two 300-h.p. heavy-oil engines. This company is also building floating drydocks of concrete, the first of which was for a Christiania firm of yacht-builders, and has a lifting capacity of 100 tons, It has plans for larger docks up to 15,000 tons capacity. The Fougner Company has established an American branch and is reported to have a contract with the Shipping Board for several 3,500-ton ships contingent upon the success of the first vessel. It is stated, too, that the Ferro-Concrete Shipbuilding Company of New York and the Liberty Shipbuilding Company of Boston have similar contracts.

A 126-foot vessel of 350 tons capacity was launched at Montreal last November. Its ribs are of structural steel encased in concrete and spaced about 27 inches apart, the steel sections being 5 inches deep at the top and 14 inches at the base. The shell is of reinforced concrete varying from 3½ to 5 inches in thickness, approximately 50 tons of reinforcing steel being used in construction.

A joint committee of the American Concrete Institute and the Portland Cement Association has paid much attention to concrete ships. In a report, issued recently, it covered points to be considered in designing concrete vessels and submitted a tentative design for a 2,000-ton seagoing barge of the following dimensions: length, 227 feet 6 inches; length between perpendiculars, 220 feet; breadth, 42 feet; depth, 23 feet; loaded draught, 18 feet.

The displacement is estimated at 2,657 tons on an 18-foot draught. The vessel is divided into five compartments by transverse bulkheads, the three centre compartments being for cargo and the other two for tank and ballast. A concrete of 1:1:2 mixture with carefully selected sand and gravel (about ½-inch size) was decided upon and considered to develop an ultimate crushing strength of at least 3,000-lb. per square inch, allowing a maximum stress in concrete of 1,000-lb. per square inch. The spacing of the frames is 4 feet and the thickness of shell 4 inches on the sides and 5 inches on the bottom. Two lines of reinforcement are provided. The deck is 8 inches between hatches and along the line of the hatches and 5 inches thick outside these lines.

An estimate of the quantities gave the following: Concrete, 731 cubic yards; steel, 482,000-lb.; flooring for hold, 30,000 feet B. M.; oak timbers, fender rail, etc., 15,000 feet B. M.

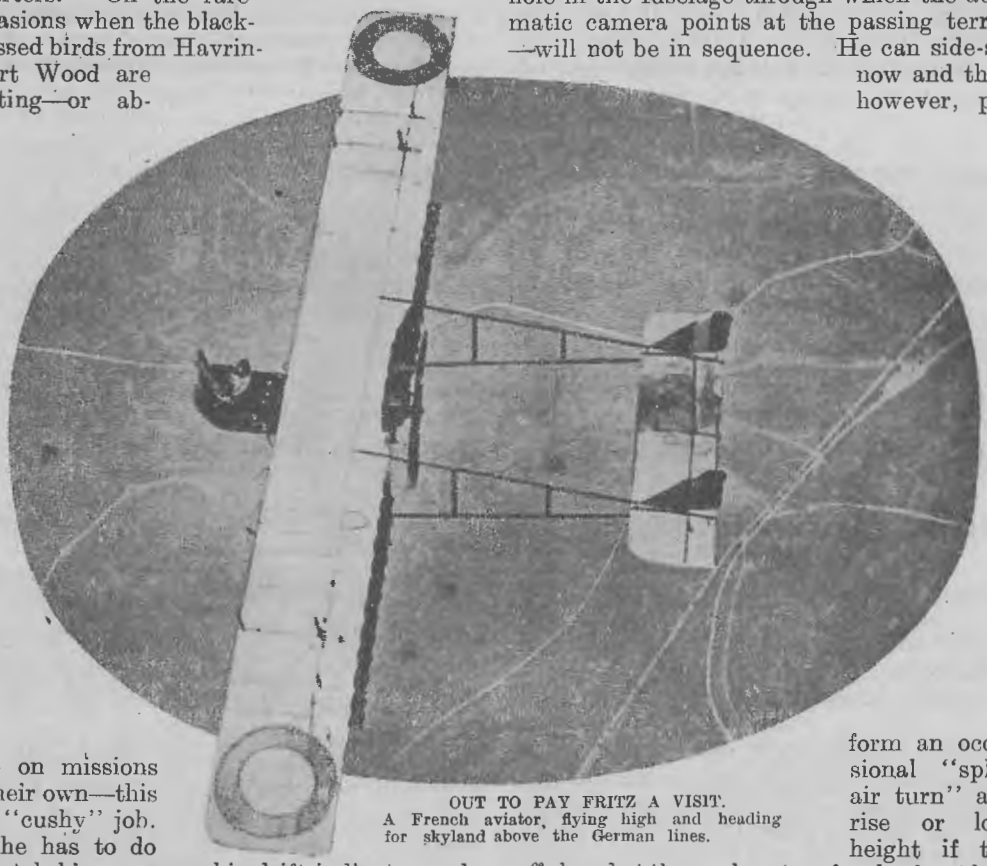
The total weight of the barge was estimated to be 1,647 tons and the carrying capacity 2,028 tons for 18 feet draught. The cost of the hull per ton deadweight was estimated at £13/2/6; the best available figures indicated a cost of steel hull of the same character of £18/15/- to £25 per ton, and the cost of a wooden hull of £14/10/- to £20.

This report said: "A ship must be able to meet conditions which are unlike any to which land structures are subject. In determining the longitudinal strength of a ship, it is customary to assume two conditions. Under the first condition, the ship is assumed to be suspended between two wave crests, the length between the crests being equal to the length of the ship between perpendiculars, the height of the wave being equal to one-twentieth of that length. In this case, the ship as a whole is acting as a simple beam supported at the ends. This condition is termed 'sagging.' Under the second condition, the ship is assumed to be supported amidships on one crest of the same wave. Under this condition, the ship as a whole acts as a cantilever. This condition is termed 'hogging.' It is apparent, therefore, that when a ship is riding the waves both the deck and the bottom of the ship will be required to withstand tensile and compressive stresses alternately—the maximum tensile stress following the maximum compressive stress at very short intervals. In a steel ship the entire cross-sectional areas of the midship section act to resist these stresses, taking into account, in determining the moment of inertia, all of the continuous members, such as continuous scantlings and deck, side and bottom plates. In the concrete ship equivalent strength must be provided. In the case of the concrete ship, however, only the steel reinforcement can be relied upon to take tensile stresses. The concrete, assisted by the steel will take the compressive stresses."

A Bout with a German Ace

By Flight Lieut. Paul M. Haizleton, formerly of the Royal Flying Corps.

The first duty of a reconnaissance pilot is to take his plane over the exact line of flight designated by his orders from headquarters. On the rare occasions when the black-crossed birds from Havrincourt Wood are nesting—or absent on missions of their own—this is a "cushy" job. All he has to do is watch his compass, his drift indicator and certain landmarks in the enemy territory that are—if he be a veteran in skyland—as commonplace and familiar to him as the lamp posts on the streets of his home town.



OUT TO PAY FRITZ A VISIT.
A French aviator, flying high and heading for skyland above the German lines.

"Archie"—slang for anti-aircraft gun—bothers always, but given a free hand and a cloudless sky the pilot can make merry with the white puffs of shrapnel and the black coughs of high explosive the anti-aircraft guns throw up at him from the enemy strongholds. He must not dodge out of his line of flight to any great degree, else the series of photographs being taken by his observer back in the "office"—the cubby-hole in the fuselage through which the automatic camera points at the passing terrain—will not be in sequence. He can side-slip now and then, however, perform an occasional "split-air turn" and rise or lose height if the puffs bracket themselves too closely about him.

This is routine, and after the first three months of independent flying the novelty wears thin. The pilot and observer learn to look for recreation when aloft, though usually recreation seeks them out, often when they least expect it.

This change comes ordinarily in the form of squadrons of Halberstadts, Rolands or Albatrosses, which are the makes now used by German flyers and fighters. Even more indignant than "Archie" is the buzzing Ger-

This is the Sopwith, the Most Feared by the Germans of All British Fighting 'Planes.

man wasp at attempts to photograph his infantry bases, railways, batteries, roads and means and material behind the lines. His main business is to prevent just such happenings. Because reconnaissance patrols are made up of four or more planes, generally, the Boche attacks these with defensive squadrons of ten or twelve lightning fast single-seat fighters.

And this is where the recreation comes in. The reconnaissance flyer, although out for pictures primarily, carries two or three machine guns, placed forward, backward and either up or down, and though he does not look for trouble he does not turn one inch to the side to avoid it. At one of these meetings—but let the story tell itself.

Our aerodrome was situated a dozen miles back of Bouchavesnes on the Arras sector. In the little company usually there were in the neighborhood of twenty-five pilots, ten observers, the commanding officer, and one mechanic for each machine. The number of pilots and observers varied almost daily—for obvious reasons. Fledglings of the air continually came up from the air camps in England to fill the gaps, however.

Promptly at four-thirty on that morning—I still mentally capitalise the occasion—I was awakened by the words, "Just a bit of a Scotch mist, sir. The sun is trying to get out. The flight starts at five sharp!"

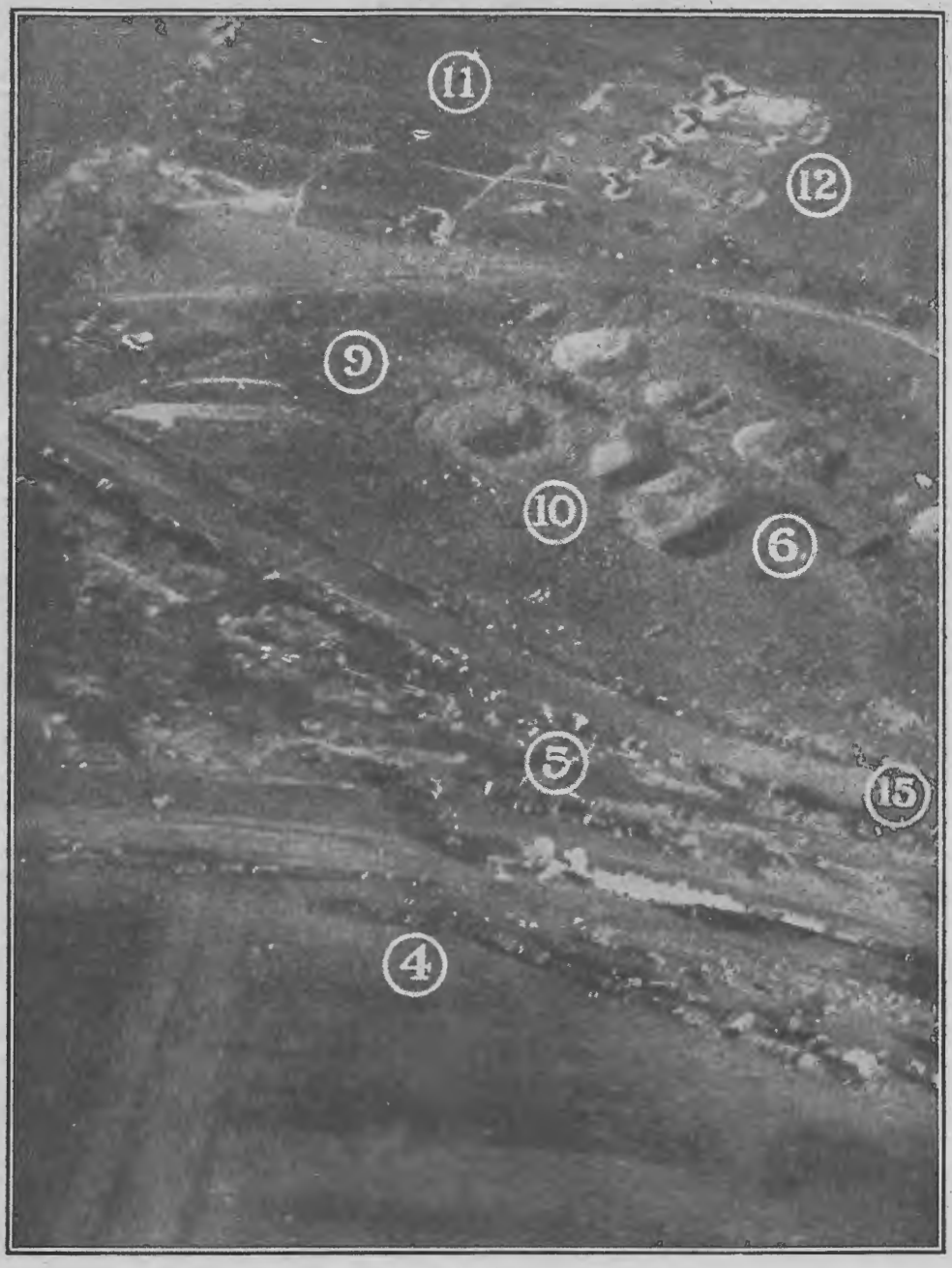
Reluctantly I arose and slipped into my leather suit and picked up the flying kit. Coffee, muffins and fried eggs were waiting, and these dispelled the damp morning's chill for a moment.

"Seven buses go, Captain L—— commanding," was the word passed among my comrades at the mess table. I found that our orders embraced a trip over Vitry-en-Artois, Doiveret, Marchiennes, Tournai, Lerczy, and then a wide circle back which would take us over the main lines of Boche railway communication, and force us to skirt the famous Havrincourt Wood on our return by way of Ephey and La Catelette.

"Hope all your pictures are taken by then!" I remarked briefly to Dessauer, my observer. He nodded understandingly. Except when in fair force Allied reconnaissance machines rather avoid the black, shamrock-shaped forest of Havrincourt, for nestling near its outskirts lie no less than twenty of the largest Teuton aerodromes.

No time remained to talk over the matter, though. Two or three of the pilots already were tuning up their motors, upbraiding the anxious mechanics, or writing short notes home. At ten minutes to five I went out to my bus with Dessauer. The sergeant who woke me had been a good weather prophet; the mist was clearing. He must have mistaken the moon for the sun, however, for as I watched, the first orange rim peeped over the ruined heaps that had been Bouchavesnes. The air was cutting at ground level. I knew that at the rendezvous height, ten thousand feet, it would be next to unendurable.

The commanding officer shrilled his



AEROPLANE VIEW OF A GERMAN RAIL BASE, SHOWING THE MARKS OF ALLIED SHELLFIRE.

Such a photograph as this was the aim of Dessauer, the observer, when he accompanied Flight-Lieut. Paul M. Haizleton on his ill-fated voyage over the German lines. Every detail is laid bare and recorded by the camera as follows: (1) Supply trains running on newly laid tracks; (2) piles of supplies, chiefly consisting of timber for use in building dugouts; (3) rolls of barbed wire; (4) piles of iron stakes for stringing barbed wire;

(5) steel roofing for dugouts; (6) former site of a railway station destroyed by French artillery fire, the spot now being pitted with shell craters, some of them, 60 feet across; (7, 8, 9), remains of former railway tracks; (10) broken railway ties on the edge of a shell crater; (11) piles of supplies, among them perishable goods which are covered with canvas; (12) battery of four guns; (13) the commander's dugout; (14) ammunition dump in which German soldiers can be seen; (15) group of German soldiers walking in the road and watching the French aeroplane from which the picture was taken.

whistle. We climbed in, raced the engines for a moment, and then taxied out over the grass to gain flying speed. My rotary engine was humming in fine shape, for which I mentally thanked Jules, my mechanic, so we rose in less than two hundred yards.

Climbing at the rate of nine hundred feet a minute, we reached rendezvous height just two minutes after the agreed starting time. The commanding officer, far below, evidently was anxious to have us off, in order to start a raiding flight, for the moment we started circling the white canvas was spread out on a green patch of grass — the starting signal.

My hands were nearly frozen by the time I got position behind L——. He was flight commander and as such led the squadron, his machine forming the apex of the "V." I was second on the right hand side, two hundred feet above and five hundred feet in the rear. In proportionate positions the others strung along behind and in the diverging line opposite. Things began happening soon after this, however, that quickened my circulation till I did not feel the cold—or forgot it.

Two Aerial Torpedoes, Hurtling Earthward into the Enemy's Lines from a French Aeroplane.

No real clouds were in the sky, but high above a light haze, remnant of the mist of an hour previous, floated, and this made us the slightest bit uneasy about "Archie." "Archie" proved to be very much awake, too, for two minutes before we spread—deployed, as an infantryman would call it—the rasping tear of his high explosive voice began talking in jarring exclamations around us. L—— paid no attention, though a few brackets of the bursts came near the nose of his machine, but after a short time he raised his signal pistol and sent a smoke rocket sidewise and down, the signal for a spread.

This formation ordinarily means that the "V" is widened to a very obtuse angle, with wider spaces between the 'planes than heretofore. It is used to enable the observers to obtain a set of photographs giving the terrain in full detail. The pictures overlap one another in both directions, for the time of exposure is regulated to the speed of forward flight. In this way headquarters, by piecing together the prints, obtains a complete panorama of the country over which the flight takes place.

A few seconds after spreading, Wilson, piloting the plane on the extreme left, was nipped by "Archie." The burst did not hit him or his observer, but ripped a big hole in his petrol tank. I saw the spurt of liquid falling, and simultaneously he seemed to stop dead in the air. He pointed the nose of his plane down, and signalled "Dud," which in "aeroplanese" means "Engine stopped. Must turn back." Although he did not know it then, he was lucky; he glided back to a point far in the British lines, and over half way to Bouchavesnes.

The work of an observer is two-fold. He

must take the pictures for which he is sent, and then he must watch all levels of the air on three sides to forestall a surprise attack by enemy 'planes. In event of a direct attack he manages a machine gun at all times when either a "blind spot" or the nose of the 'plane is not pointed at the enemy. With all he is busy most of the time.

"Three of 'em! Up toward the sun!" Dessauer called through the speaking tube, which was tied inside my helmet. I glanced over, my smoked glasses allowing me to see them in spite of the light. They were hovering back and above our right wing, hoping for some sort of a split that would give them a chance at even conflict.

This Hun 'Plane with Its Decoration, probably Symbolic of Flying Death, was recently brought down by the Allies.

We had passed Marchiennes, thirty-five miles on our way, when the split came. "Lucy" Ferguson—a brave man and a good flyer, never deserving of his effeminate nickname—began to drop back. It was a gradual process, but the place in line next to me became vacant. I never found out the trouble, but I guessed it then as a missing cylinder. At any rate, Ferguson found himself unable to keep up our one-hundred-mile gait except by losing height. This he tried, until he was four or five thousand feet below us, but it was no use. He turned back.

At this moment the three German 'planes dived. I felt dreadfully sorry for Ferguson, for the three were Halberstadts, fast one-seaters and individually the superior of our reconnaissance 'planes, but there was nothing we, deep in the enemy's territory, could do. The Halberstadts buzzed around him like vultures around a wounded eagle, till suddenly the two-seater heeled over, turned a somersault, and then fell the remaining distance to the earth like a leafy twig falling from a high tree.

Everywhere we went "Archie" pursued us, but because the clouds disappeared quickly before the sun we had an easy time avoiding his sharp tongue. Our observers were clicking off their pictures by the magazine-full. I am sure that if Hindenburg collected all those photos he must have secured a good panorama of his own communication lines.

As I have suggested, our luck was not to hold. Eight or ten miles from the dreaded German base, Havrincourt Wood, six Boche battle-planes dropped on us out of the blue. We were only five in number now, and really not equal 'plane to 'plane because of our comparative slowness. I wished myself in a Sopwith that moment.

L——, met the attack confidently, however. As the white-winged Huns dived he circled and side-slipped quickly. That was all I saw of him, for my attention was engaged. One of the Germans made for me, and as he bore down I caught one glimpse of the under side of his wings. *There, nestling modestly beside the black Maltese cross was a crimson B!* Boelcke, king of all the German flyers! A lump of anxiety that was *not* fear but desperate desire to get this aristocrat of killers, rose in my throat.

I met his rush headlong, raking his craft with a full Lewis magazine, and then heeled sharply to let Dessauer in with his gun while I shifted magazines. Boelcke foiled this. He slipped down and under, coming out on our blind spot on the right rear, and then his bullets zipped through the fuselage and wings. I heard a shriek from Dessauer, even above the motor, and knew that I was alone.

I tried an *Immelman turn, but just as I was reaching for my joystick again he got me. A burst of bullets clipped me in the right shoulder and the arm, and I fell back, dropping the controls.

[*The Immelman turn is described on page 269 of this issue.—Ed.]

(Concluded on Page 322.)

A Battleship at Sea By Lewis R. Freeman, R.N.V.R.

So vivid a description of the watch and ward which the British Fleet keeps round these islands in all weathers has not before been published. Lieutenant Freeman, R.N.V.R., narrates—in "Land and Water" —his actual experiences during a winter cruise on a battleship in the North Sea.

The collier had come alongside a little after seven—two hours before daybreak at the time of year—and I awoke in my cabin on the boat deck just abaft the forward turret to the grind of the winches and the steady tramp-tramp of the barrow-pushers on the decks below.

On my way aft to the ward-room for breakfast, I stopped for a moment by a midships hatch, where the commander, grimed to the eyes, stamped his sea-boots and threshed his arms as a substitute for the warming exercise the men were getting behind the shovels and the barrows. He it was who was responsible—partly through systematisation, partly through infusing his own energetic spirit into the men themselves —for the fact that the *Zeus* held the Blue Ribbon, or the Black Ribbon, or whatever one would call the premier honours of the Grand Fleet for speedy coaling. Not unnaturally, therefore, he was a critical man when it came to passing judgment on the shifting of "Number 1 Welsh Steam" from hold to bunkers, and it was not necessary to be expected that he would echo my enthusiasm when I told him that this was quite the smartest bit of coaling I had ever seen west of Nagasaki, something quite worth standing, shivering tooth to tooth, with a raw north wind, to be a witness of.

"It's fair," he admitted grudgingly, "only fair. A shade over 300 tons an hour, perhaps. 'Twould have seemed good enough before we put up the Grand Fleet record of 408. Trouble is, they haven't anything to put 'em on their mettle this morning. Now, if some other ship had come within fifty or sixty tons of their record this last week, or if we'd had a rush order to get ready to go to sea—then you might have hoped to see coaling that was coaling."

All through my porridge and eggs and bacon the steady tramp of the barrow-men on the quarter-deck throbbed along the steel plates of the ward-room ceiling, and it must have been about the time I was spreading my marmalade (real marmalade, not the synthetic substitute one comes face to face with ashore these days) that I seemed to sense a quickening of the movement, not through any rush-bang acceleration, but rather through gradually becoming aware of increased force in action, as when the engines of a steamer speed up from "half" to "full." In a few moments an overalled figure, with a face coal-dusted till it looked like the face of the end-man in a minstrel show, lounged in to remark casually behind the day-before-yesterday morning's paper that we had just gone on "two hours' notice." A half-hour later, as the gouged-out collier edged jerkily away under the impulse of her half-submerged screw, the commander, a gleam of quiet satisfaction in his steady eyes, remarked that "it wasn't such a bad finish, after all," adding that "the men seemed keen to get her out to sea and let the wind blow through her."

The ship's post-coaling clean up—usually as elaborate an affair as a Turkish bath, with rub down and massage—was no more than a douche with "a lick and a promise." Anything more for a warship putting off into the North Sea in midwinter would be about as superfluous as for a man to wash his face and comb his hair before taking a plunge in the surf.

Once that perfunctory wash-down was over, all traces of rush disappeared. What little remained to be done after that—even including getting ready for action—was so ordered and endlessly rehearsed that nothing short of an enemy salvo or a sea heavy enough to carry away something of importance need be productive of a really hurried movement. Just a shade more smoke from the funnels to indicate the firing of furnaces which had been lying cold, and the taking down or in of a few little port "comforts" like stove-pipes and gangways, forecasted imminent departure.

The expression regarding the fleet, squadron, or even the single ship ready to sail at a moment's notice is as much of a figure of speech as is the similar one about the army which is going to fight to the last man. A good many moments must inevit-

ably elapse between the time definite orders come to sail and the actual getting under weigh. But the final preparations *can* be reduced to such a routine that the ship receiving them can be got ready to sail with hardly more than a ripple of unusual activity appearing in the ebb and flow of the life of those who man her. No river ferry-boat ever cast off her moorings and paddled out on one of her endlessly repeated shuttlings with less apparent effort than the "Zeus," when, after gulping some scores of fathoms of Gargantuan anchor chain into her capacious maw, she pivoted easily around in the churning welter of reversed screws, took her place in line, and followed in the wake of the flagship toward the point where a notch in the bare rounded outline of encircling hills marked the way to the open sea.

Nowhere else in the temperate latitudes is there so strange a meeting and mingling place of airs and waters than where we were. The butterfly chases of sunshine and showers even in December and January are suggestive of nothing so much as what a South Pacific Archipelago would be but with fifty or sixty degrees colder temperature. Dancing golden sun-motes were playing spirited cross-tag with slatily sombre cloud-shadows as we nosed out through the mazes of the booms, but with the first stinging slaps of the vicious cross-swells of a turbulent sea, a swirling bank of fog came waltzing over the aimlessly chopping waters, and reared a vaporous wall across our path.

Line Ahead.

The flagship melted into the milling mists, and dimmed down to an amorphous blur with just enough outline to enable us a sight to correct our position in line. In turn, the towered and pinnacled head-on silhouette of the third ship grew soft and shadowy, and where proper perspective would have placed the fourth was a swaying wisp of indeterminate image which might just as well have been an imminently wheeling seagull as a distinctly reeling super-dreadnought. The comparison is by no means so ridiculous as it sounds, for only the day before a naval flying-man had told me how he once started to bring his seaplane down on sighting a duck (which was really some hundreds of feet in the air) because he took it for a destroyer, and how, later, he had failed to "straighten out" quickly enough because he thought a trawler was a duck in flight.

The lean grey shadows which slipped ghostily into step with us in the fog-hastened twilight of three o'clock might just as well (had we not known of the rendezvous) have been lurking wolves as protecting sheep-dogs.

"Now that we've picked up our destroyers," said the officer who paced the quarter-deck with me, "we'll be getting on our way. Let's go down to tea."

Smoke, masts, funnels, and wave-washed hulls, the Whistleresque outlines of our swift guardians had blurred to blankness as I looked back from the companion-way, and only a misty golden halo, flashing out and dying down on our port bow, told where the flotilla leader was talking to the flagship.

Tea is no less important a function on a British warship than it is ashore, and nothing short of an action is allowed to interfere with it. Indeed, how the cheerful clink of the teacup was heard in the prelude to the diapason of the guns was revealed to me a few days ago, when the commander allowed me to read a few personal notes he had written while the light cruiser he was in at the time was returning to port after the battle of Jutland. "The enemy being in sight," it read, "we prepared for action stations and *went to tea.*" A few minutes later, fingers which had crooked on the handles of the teacups were adjusting the nice instruments of precision that laid the guns for what was destined to prove the greatest naval battle in history.

Tea was about as usual with us that day, save that the officers who came in at the change of watch were dressed for business—those from the bridge and conning-tower in oilskins or "lammy" jackets and sea-boots, and the engineers in greasy overalls. A few words of "shop"—steam pressure, revolutions, speed, force and direction of the wind, and the like—passed in an undertone between men sitting next each other, but never became general. The sponginess of the new "potato" bread and the excellence of the margarine came in for comment, and someone spoke of having rushed off a letter just before sailing, ordering a recently advertised "self hair-cutter." A discussion as to just how this remarkable contrivance worked followed, the consensus of opinion being that it must be on the safety-razor principle, but that it couldn't possibly be worth the guinea charged. All that I recall having been said of what might be taking us to sea was when an officer likely to know volunteered that we would possibly be in

sight of land in the morning, and some speculation arose as to whether it would be Norway or Jutland. A recently joined R.N.V.R. provoked smiles when he suggested Heligoland.

The cabin which I had been occupying in port was one located immediately under the conning-tower, and used by the navigating officer when the ship was at sea, the arrangement being that I was to go aft and live in his regular cabin while we were outside. Going forward, after tea, I threw together a few things for my servant to carry back to my temporary quarters. Groping ait in Stygian blackness along the windward side of the ship, I encountered spray in clouds driving across even the lofty fo'c'sle deck. The wind appeared to have shaken off its flukiness as we cleared the headlands, and, blowing with a swinging kick behind it, was rolling up a sea to match. I did not need to be told by the sea-booted sailor whom I bumped on a ladder that it wasn't "goin' t' be no nite fer lam's" to know that there was something lively in the weather line in pickle, probably to be uncorked before morning.

The grate, robbed of its chimney, was cold and empty when I went in for seven o'clock dinner—half an hour earlier than in port—and there was just the suggestion of chill in the close air of the ward-room. An engineer-lieutenant who started to reminisce about a winter cruise he had once made in the Arctic was peremptorily hushed up with a request to "talk about something warmer." A yarn about chasing the *Königsberg* in the lagoons of East Africa was more kindly received, and a R.N.V.R.'s account of how his ship carried Moslem pilgrims from Singapore to Jeddah on their way to Mecca brought a genial glow of warmth with it. There was something stangely cheering in his account of how, when there was a following simoom blowing across the brassy surface of the Red Sea, the Lascar stokers used to go mad with the heat and jump overboard in their delirium. The air seemed less dank and chill after that story. I ventured a "sudorific" contribution by telling of the way they made "desert storms" in the California movies with the aid of buckets of sand and a "wind-machine." The whole table showed interest in this—probably because it was so far removed from "shop"—and sat long over port and coffee planning a "blower" that would discharge both wind and sand—in sufficient quantities to give the "desert storm" illusion over the restricted angle of the movie lens—at the turning of a single crank. One does not need to be long upon a British battleship to find out that the inventive genius of the Anglo-Saxon race is not all confined to the American branch.

Between officers on watch and those resting to relieve, the after-dinner gathering around what had once been a fire was a small and rapidly dwindling one. As I got up to go to my cabin, the captain of marines quieted the pet cockatoo on his shoulder long enough to say, as we would probably be at action stations early in the morning, I might find it of interest to come up to his turret, where he had a "jolly smart crew." "We usually do 'B.J.2' at daybreak when we're out," he said, "just on the chance that we may flush some sort of a Hun in the early light. Quite like snipe-shooting, you know."

A middy whom I met outside said something about the way the barometer had been chasing its tail on the drop ever since we got under weigh, and when I turned on the light in my cabin I noticed that the arrows on the navigating officer's instrument indicated a fall of thirty points since noon. The keen whistling of the rising wind shrilled with steady insistence, and the wide swinging swells from the open sea were lock-stepping along with a tread that was just beginning to lift the great warship in a swaggering Jack Tar roll.

On the floor of the cabin was a flannel bulldog with "manipulable" legs and a changeable expression. Its name was "Grip" (so "the pilot" had told me), and it had been his constant companion ever since it was presented to him on the eve of his first sailing as a midshipman. The only time they had ever been separated was on the occasion a colleague, who had borrowed it as a mascot in a game of poker, threw it overboard in chagrin when the attempt to woo fickle fortune proved a failure. Luckily, the ship was lying in a river, and the dog floated back on the next tide, and was fished out with no damage to anything but the compression bladder which worked its bark. The navigating officer left the companionable little beast in his cabin, so he explained, to give it the proper home touch for my first night at sea with the British Navy. Cocking "Grip" up in the genial glow of the electric grate in an attitude of "watchful waiting," I crawled into bed, pulled up the adjustable side-rail, and was rocked to sleep to the even throb of the turbines and the splish-splash of the

spray against the screwed-down port.

"We aren't having 'B.J.1' this morning," some one explained facetiously when I reported for "duty" at seven o'clock, "because we already have "B.B.8.'" This last meant "Boreas Blowing Eight," he said, and I was just "nautical" enough to know that a wind of "8" in the Beaufort scale indicated something like fifty or sixty miles an hour.

"No U-boat will want to be getting within 'periscopic' distance of the surface of the sea that's running this morning," said a young engineer-lieutenant who had been in the submarine service, "and even if one was able to get a sight, its torpedo would have to have some kind of a 'kangaroo' attachment to jump the humps and hollows with. Fact is, it's rather more than our destroyers are entirely happy with, and we've just slowed down by several knots to keep 'em from dipping up the brine with their funnels. Hope nothing turns up that they have to get a jump on for. A destroyer's all right on the surface, but no good as a submarine; yet an under-sea diver is just what she is if you drive her more'n twelve into a sea like the one that's kicking up now. Barometer's down sixty points since last night, and still going."

Breakfast that morning had little in common with the similar festal occasion in port where, fresh bathed and shaven, each immaculate member of the mess comes down and sits over his coffee and paper much (save for the fact that the journal is two days old) as at home. Several places besides those of the officers actually on watch were empty, and by no means a few of those who did appear had that introspective look which is so unmistakable a sign of all not being well within the citadel. Even the *Poldhu*—the daily wireless bulletin of the Navy—had a "shot-to-pieces" look where "static" or some other esoteric difficulty was responsible for gaps in several items of the laconic summary. The last word in super-dreadnoughts does not have table-racks and screwed-down chairs. She isn't supposed to lose her dignity to the extent of needing anything in the way of such vulgar makeshifts. The fact remains that if the mighty *Zeus* had chanced to have these things, she would have saved herself some china and several officers from "nine-pinning" down one side of a table and piling up in a heap at the other.

With the staid ward-room doing things like this, it was only to be expected that the mess decks would be displaying a certain amount of shiftiness. I was, however, hardly prepared for the gay seascape which unrolled before me when I had worried my way through the intricate barricade of a watertight bulkhead door in trying to skirmish forward to the ladders leading to the upper decks. For several reasons—ventilation and guns have something to do with it—it is not practicable to close up certain parts of a battleship against heavy seas to anything like the same extent as with the passenger quarters on a modern liner. It is only in very rough weather that this may give rise to much trouble, but—well, we were having rough weather that morning, and that little bit of the Roaring Forties I had stumbled into was a consequence of it.

Oilskinned, "sou'-westered," sea-booted men, sitting and lying on benches and tables, were the first strange things that came to my attention; and then, with a swish and a gurgle, the foot-deep wave of dirty water which had driven them there caught me about the knees, and sat me down upon a pile of hammocks, or, rather, across the inert bodies of two men (boys I found them to be presently) who had been cast away there in advance of me. Clambering over their unprotesting anatomies, I gained dry land at a higher level, and at a tactically defensible point, where a half-Nelson round a stanchion steadfastly refused to give way under the double back-action shuffle with which the next roll tried to break it. With two good toe-holds making me safe from practically anything but a roll to her beams' ends, I was free to survey the shambles at my leisure. Then I saw how havoc was being wrought.

With a shuddering crash, the thousand-ton bludgeon of a wave struck along the port side, immediately followed by the muffled but unmistakable sound of water rushing in upon the deck above. To the accompaniment of a wild slap-banging, this sound came nearer, and then, as she heeled far to starboard under the impulse of the blow that had been dealt her, a solid spout of green water came tumbling down a hatchway—the fount from which the mobile tidal wave swaggering about the deck took replenishment. Two men, worrying a side of frozen Argentine bullock along to the galley from the cold-storage hold, timing (or, rather, mis-timing) their descent to coincide with that of the young Niagara, reached the mess-deck in the form of a beef sandwich. Depositing that delectable morsel in

an inert mass at the foot of the ladder, the briny cascade, with a joyous whoof, rushed down to reinforce the tidal wave and do the rounds of the mess.

I was now able to observe that the sailors, marooned on the benches, tables, and other islands of refuge, were roughly divisible into three classes—the prostrate ones, who heaved drunkenly to the roll and took no notice of the primal chaos about them; the semi-prostrate ones, who were still able to exhibit mild resentment when the tidal wave engulfed or threatened to engulf them; and the others—some lounging easily, but the most perched or roosted on some dry but precarious pinnacle—who quaffed great mugs of hot tea and bit hungrily into hunks of bread and smoked fish. These latter—hard-bit tars they were, with faces pickled ruddy by the blown brine of many windy watches—took great joy in the plight of their mates, guffawing mightily at the dumb misery in the hollow eyes of the "semi-prostrates" and the dead-to-the-world roll of "prostrates" with the reelings of the ship.

Sea-sick Sailors.

If there is one thing in the world that delights the secret heart of the average landsman more than the sad spectacle of a parson in a divorce court, it is the sight of a seasick sailor. Since, however, the average landsman reads his paper far oftener than he sails the stormy seas, the former delectation is probably granted him rather more frequently than the latter. At any rate, the one landsman in Number X Mess of H.M.S. *Zeus* that morning saw enough seasick sailors to keep the balance on the parsons' side for the duration of the war, and perhaps even longer.

I made the acquaintance of one of the "prostrates" marooned on the beach of my hammock island through rescuing him from the assaults of a tidal-wave-driven rum tub. He was nursing a crushed package of gum-drop-like lozenges, one of which he offered me, murmuring faintly that they had been sent him by his sister, who had found them useful while boating at Clacton-on-Sea last summer. Endeavouring to start a conversation, I asked him—knowing the *Zeus* had been present at that mighty struggle—if they had had weather like this at the battle of Jutland. A sad twinkle flickered for a moment in the corner of the eye he rolled up to me, and, with a queer pucker of the mouth which indicated that he must have had a sense of humor in happier times, he replied that he had only joined the ship the week before: "'Tis my first time at sea, sir, and I've come out to—to—this."

I gave him the best advice I could by telling him to pull himself together and get out on deck to the fresh air; but neither spirit nor flesh was equal to the initiatory effort. Looking back while I waited near the foot of a ladder for a Niagara to exhaust itself, the last I saw of him he was pushing mechanically aside with an unresentful gesture a lump of salt pork which one of the table-roosting sailors dangled before his nose on a piece of string.

Three flights up I clambered my erratic way before, on the boat deck in the lee of a launch, I found a vantage sufficiently high and sheltered to stand in comfort. The sight was rich reward for the effort. Save for an ominous bank of nimbus to westward, the wind had swept the coldly blue vault of the heavens clear of cloud, and the low-hanging winter sun to south'ard was shooting slanting rays of crystalline brightness across a sea that was one wild welter of cotton wool. I have seen—especially in the open spaces of the mid-Pacific, where the waves have half a world's width to get going in—heavier seas and higher seas than were running that morning, but rarely—not even in a West Indian hurricane—more vicious ones—seas more palpably bent on going over, or through a ship that got in their way, rather than under, as proper waves should do. And in this obliquity they were a good deal more than passively abetted by a no less viciously inclined wind, which I saw repeatedly lift off the top of what it appeared to think was a lagging wave and drive it on ahead to lace the heaving water with a film of foam or dust the deck of a battleship with snowy brine.

But it was the ships themselves that furnished the real show. Of all craft that ply the wet seaways, the battleship is the least buoyant, the most "unliftable," the most set on bashing its arrogant way through a wave rather than riding over it, and—with increasing armour and armaments, and the crowding aboard of various weighty contrivances hitherto unthought of—this characteristic wilfulness has tended to increase rather than decrease since the war. As a consequence, a modern battleship bucking its way into a fully developed mid-winter gale is one of the nearest approaches to the meeting of two irresistible bodies ever to be seen.

The conditions for the contest were ideal

that morning. Never were seas more determined to ride over battleships, never were battleships more determined to drive straight through seas. Both of them had something of their way in the end, and neither entirely balked the other; but, drawn as it was, that battle royal of Titans was a sight for the gods.

The battleships were in line abreast as I came up on deck, and holding a course which brought the wind and seas abeam. We were all rolling heavily, but with the rolls not sufficiently "synchronized" with the waves—which were charging down without much order or rhythm—to keep from dipping them up by the ton. If the port rail was low—as happened when the ship was sliding down off the back of the last wave—the next wave rolled aboard, and (save where the mast, funnels, and higher works amidships blocked the way) drove right on across and off the other side. If the port side had rolled high as an impetuous sea struck, the latter expended its full force against the ship, communicating a jar from foretop to stokeholds as strong as the shock of a collision with another vessel.

Our own quarter-deck was constantly swept with solid green water, and even the higher fo'c'sle deck caught enough of the splash-up to make traversing it a precarious operation. But it was only by watching one of the other ships that it was possible to see how the thing really happened. If it was the wallowing monster abeam to port, the striking of a sea was signalised by sudden spurts of spray shooting into the air all the way along her windward side, the clouds of flying water often going over the funnels and bridge, and not far short of the foretop. She would give a sort of shuddering stumble as the weight of the impact made itself felt, and then—running from bow to stern and broken only by the upper works, and occasionally, but not always, by the turrets—a ragged line of foam appeared, quickly resolving itself into three or four hundred feet of streaking cascades which came pouring down over the starboard side into the sea. Watching the vessel abeam to starboard, the phenomenon was repeated in reverse order. Save for the swaying foretop against the sky, either ship at the moment of being swept by a wave was suggestive of nothing so much as a great isolated black rock on a storm-bound coast.

Fighting in Bad Weather.

But the most remarkable thing about it all was the astonishingly small effect this really heavy weather had upon the handling of the ships. Evidently they had been built to withstand weather as well as to fight, for they manœuvred and changed formation with almost the same meticulous exactitude as in protected waters. A gunnery officer assured me that—except for momentary interference in training some of the lighter guns—the fighting efficiency of the ship would hardly be affected more than a fraction of 1 per cent. by all their plungings and the clouds of flying spray. Their speed was, naturally, somewhat diminished in bucking into a head sea, yet no lack of seaworthiness would prevent (should the need arise) their being driven into that same head sea at the full power of their mighty engines. The reason we were proceeding at somewhat reduced speed was to ease things off a bit for the destroyers.

Ah! And what of the destroyers? There they all were, the faithful sheep-dogs, when I came up, and at first blush I got the impression that they were making rather better weather of it than the battleships. That this was only an optical illusion (caused by the fact that they were farther away and more or less obscured by the waves) I discovered as soon as I climbed to the vantage of the after super-structure, and put my glass upon the nearest of the bobbing silhouettes of mast and funnel. Then I saw at once, though not, indeed, any such spray clouds or cascades of solid water as marked the course of the battleships that she was plainly a laboring ship. A destroyer is not made to pulverise a wave in the bull-at-a-gate fashion of a battleship, and any exigency that compels her to adopt that method of progression is likely to be attended by serious consequences. If one of the modern type she will ride out almost any storm that blows if left to her own devices; but force her into it at anything above half-speed, and it is asking for trouble. Even before the destroyer I was watching began disappearing—hull, funnels, and all but the mastheads—between crest and crest of the onrushing waves, it was plain that both she and her sisters were having all they wanted; and I was not surprised when word was flashed to us that one of our brave little watch-dogs was suffering from a wave-smashed steering gear, and asked for permission to make for port if necessary. The permission was, I believe, granted, but—carrying on with some sort of a makeshift or other—her plucky skipper managed to stick it out and see the game through to

the end.

There were a number of other ships in difficulties in that neck of the North Sea at this moment, and every now and then—by the wireless—word would come to us from one of them. Mostly they were beyond the horizon, but two were in sight. One (two smoke-blackened "jiggers" and a bobbing funnel-top beneath a bituminous blur to the east) was apparently a thousand-ton freighter. An officer told me that she had been signalling persistently since daybreak for assistance; but when I asked him if we were not going to help her, he greeted the question with an indulgent smile.

"Assistance will go to her in due course," he said, "but it will not be from us. That kind of a thing might have been done in the first month or two of the war, but the Huns soon made it impossible. Now, any battleship that would detach a destroyer at the call of any ship of doubtful identity would be considered as deliberately asking for what she might jolly well get—a torpedo."

Another ship which was plainly having a bad time was some kind of a cruiser whose long row of funnels was punching holes in a segment of sky-line. There was a suggestion of messiness forward, but nothing we attached any importance to until word was wirelessed that she had just had her bridge carried away by a heavy sea, and that the navigating officer had been severely injured. The latter was known personally to several of the ward-room officers, and at lunch speculation as to what hurt he might have received led to an extremely interesting discussion of the "ways of a wave with a man;" also of the comparative seaworthiness of light cruisers and destroyers. The things that waves have done to all three of them since the war began (to say nothing of the things all three have done in spite of waves) is a story of its own.

The barometer continued to fall all day, with the wind rising a mile of velocity for every point of drop. The seas, though higher and heavier, were also more regular and less inclined to catch the ship with her weather-rail down. The low cloud-bank of mid-forenoon had by early dusk grown to a heavens-obscuring mask of ominous import, and by dark, snow was beginning to fall. The ship was reeling through the blackness of the pit when I clambered to the deck after dinner, so that the driving spray and ice-needles struck the face before one saw them by even the thousandth of a second. The darkness was such as one almost never encounters ashore, and it was some time before I accustomed myself to close my eyes against the unseen missiles (when turning to windward) without deliberately telling myself to do so in advance.

Into the Stygian pall the vivid golden triangles of the signal apparatus on the bridge flashed like the stab of a flaming sword. One instant the darkness was almost palpable enough to lean against; the next, the silhouette of funnels and foretop pricked into life, but only to be quenched again before the eye had time to fix a single detail. From where I stood, the heart of the fluttering golden halos, where a destroyer winked back its answer, were repeatedly obliterated by the inky loom of a wave, but the reflection was always thrown high enough into the mist to carry the message.

Returning to the ward-room by the way of the mess-decks, I saw the youth who had offered me the anti-seasick lozenges in the morning. Now quite recovered, he was himself playing the pork-on-a-string game with one of the only two "prostrates" still in sight. The following morning—though the weather, if anything, was worse than ever—all evidences of "indisposition" had disappeared.

* * *

For some days more we prowled the wet seaways, and then, well along into a night that was foggier, colder, and windier than the one into which we had steamed out, we crept along a heightening headland, nosed in the wake of the flagship through a line of booms and opened a bay that was dappled with the lights of many ships. A few minutes later, and the raucous grind of a chain running out through a hawse-pipe signalled that we were back at the old stand.

And since, like all the rest of our sisters of the Grand Fleet, we were expected to be ready to put to sea on *x* hours' notice, there was nothing for it but that the several hundred tons of coal which the mighty *Zeus* had been snorting out in the form of smoke to contaminate the ozone of a very sizeable area of the North Sea should be replenished without delay. A collier edged gingerly out of a whirling snow-squall and moored fast alongside as I groped forward to retake possession of my cabin under the bridge, and I went to sleep that night to the grind of the winches and the steady tramp-tramp of the barrow-pushers on the decks below.

Mentioned in Despatches

A recent cable announces that Sergeant-Major Hector Johnston, attached to the Wireless Section of an Australian Flying Squadron (now in Palestine), has been mentioned in despatches, gazetted as lieutenant and awarded the Meritorious Service Medal.

Lieut. Johnston, whose portrait appears below, is a native of New Zealand and until 1912, was employed in the N.Z. Post and Telegraphs, Wellington: He then joined the *Karoola* as wireless operator, and later, the *Maunganui* and *Ulimaroa*. During the following year, while operating on the *Kulambanga*, he established and maintained a record for long-distance work.

LIEUT. H. JOHNSTON, M.S.M.,
Attached No. 1 Australian Flying Squadron.

In 1914, at the outbreak of war, Lieut. Johnston joined H.M.A.S. *Australia*, and was despatched to Noumea, New Caledonia, where he supervised the erection of a wireless station. On its completion he was appointed assistant instructor at the Marconi School of Wireless, Sydney, being subsequently promoted to travelling inspector of wireless, in which capacity he acted until February, 1916.

Lieut. Johnston then enlisted, and was one of the six men specially selected for the wireless section of the first Flying Squadron to be formed in Australia.

Our second portrait is of Flight-Lieut. Leonard Thomas Taplin, A.F.C., an enthusiastic airman whose excellent work has won him special mention in despatches by Brigadier-General Norton, R.F.C., commanding Palestine Brigade, in addition to securing him the Distinguished Flying Cross. This decoration is of quite recent origin, Lieut. Taplin being among the first four Australians to receive it.

Enlisting in April, 1916, at the age of twenty, as a sapper in a N.S.W. Field Company Engineers, Lieut. Taplin served with this unit in France until May, 1917, when he was transferred to the Flying Corps, granted his commission, and sent to Palestine. Here he won his second star.

LIEUT. L. T. TAPLIN, D.F.C.,
Attached No. 1 Australian Flying Squadron.

Prior to enlistment, Lieut. Taplin, who is a native of Adelaide, was assistant to his elder brother, Mr. H. Eaton Taplin, then engineer-in-charge of the Electric Supply Company, at Parramatta, N.S.W.

Electrical Exhibition at Tokio.

From Mr. Percival Moore Farmer, Inspector of Wireless at Kobe, Japan, we have received the following report of an exhibition of electrical appliances and installations recently opened at Tokio.

The exhibition is situated on the border of Shinobazu Pond and has as background the picturesque park of Uyeno.

ELECTRICAL EXHIBITION. MAIN ENTRANCE.

ELECTRICAL EXHIBITION, SHOWING WIRELESS MAST, 170ft. HIGH, AND SANMAIBASHI POND.

From a spectacular standpoint the most impressive features are the Sanmaibashi Tower, a dignified example of mediæval architecture—and the Tower of Jewels, a dazzling edifice representing the most symbolic mark of the exhibition.

LOOKING ACROSS SANMAIBASHI POND.

The main entrance gate, a magnificent structure ninety feet in height, is illuminated by "Indirect Lighting." By this system a softened glow is radiated in any desired direction without revealing the source of the actual rays.

At night prismatic effects of indescribable beauty are produced by the projection of multi-colored electric flashes upon revolving jets of water, from the centre of which arises a tall column of solid crystal. Upon entering the main building the visitor's attention is at once held by an enormous map of China. On this map are indicated the thousand-and-one electrical enterprises exploited by astute Japanese engineers in the commercial fields of their neighbour.

ELECTRICAL EXHIBITION, TOKIO. GENERAL VIEW OF LAY OUT.

Two large wings of the main building enclose exhibits by the principal electrical engineering firms of Japan. These exhibits represent the cream of modern manufacture

as applied to machinery and scientific instruments. Another section of this building is occupied by an interesting demonstration of the Electrical Colour Scintillator, an exhibit presented jointly by the Navy Department and the Kawasaki Dockyard Company Limited.

Considerable space is devoted to Radio-Telegraphy and Radio-Telephony, of which installations, both large and small, are shown. A demonstration of the Radio-Telephone in operation creates widespread interest. The antennæ used in the Exhibition set are attached to a mast 170 feet high and the signals—which I was able to hear—are remarkably loud and clear.

With the recent introduction of the valve transmitter, rapid strides have been made in Radio-Telephony and this form of transmitter is used on all 'phone sets exhibited. Valve receivers are largely shown, their chief advantages being ease, fineness in manipulation and neatness of manufacture. A laboratory devoted exclusively to Radio-Telegraphy is exhibited by the Department of Communications.

The national appetite for statistics is catered for on a lavish scale by pretentious diagrams and comparative tables dealing exhaustively with the generation, distribution and consumption of electricity. The digestion of these statistics is assisted by an excellently organised display of transformers, generators, switchboards, meters, conducting wires, coils and connecting appliances.

An interesting exhibit of the electro-chemical industry comprises electrical furnaces, machines, electrolysis, and a variety of apparatus relating thereto.

Electrical machines such as magnetic separators, crushers and pumps employed in the mining industry are exceptionally well displayed.

In addition to those above described are scores of minor exhibits among which special mention should be made of those relating to X-Ray, insulators, accumulators, electric vehicles, commercial signs, wires and cords.

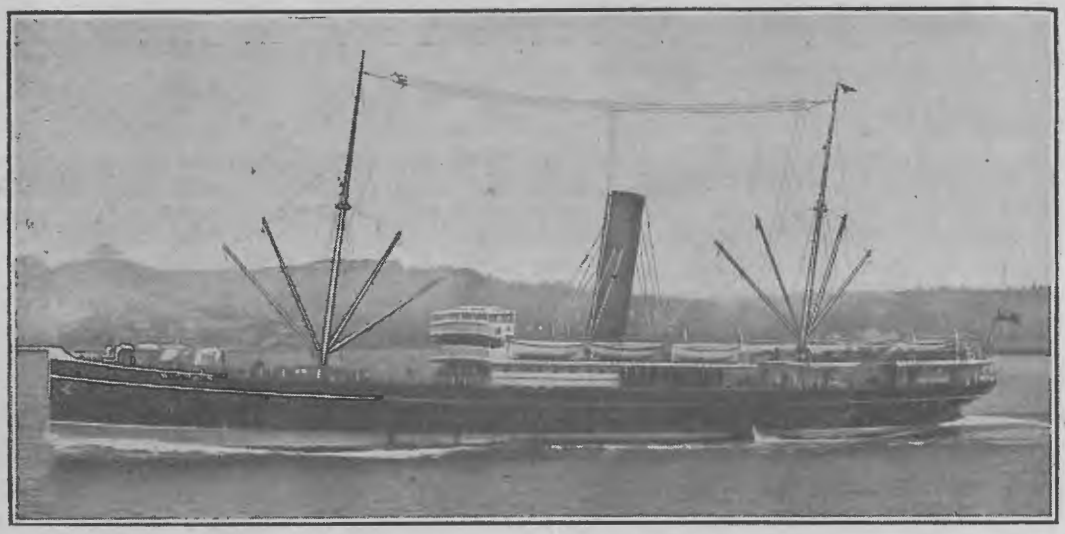
SUBMARINE SIGNALLING TO CONVOYED SHIP. (Photo. Western News Union.)

New Device for Launching Lifeboats.

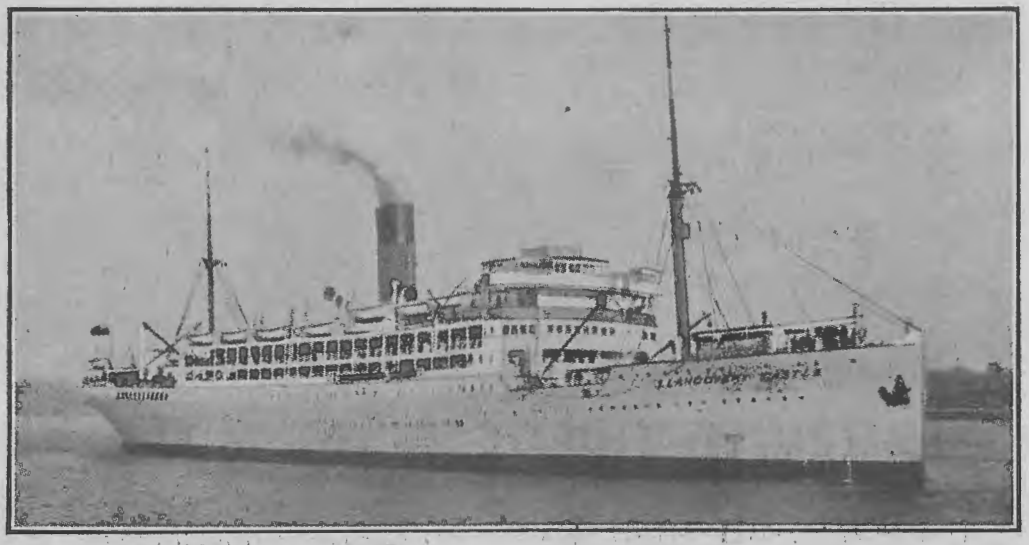
A new device for the safe launching of lifeboats has been invented by J. L. Hyland, an American, who, at the Brooklyn Navy Yard, New York, before a large gathering of Government officials and sea captains, recently gave a demonstration of his invention. Two skids, similar to sleigh runners, set eight feet apart on a big lifeboat and weighing a trifle under two hundred pounds; such is the simple contrivance by means of which the present system of lifeboat launching will—it is predicted—be completely revolutionised. It is further claimed that the skids serve to protect boats not in use, keeping them strong and seaworthy until required for launching.

THE NEW LAUNCHING DEVICE IN OPERATION. Photo. Western News Union.

Two Recent Victims of U-Boat Piracy



S.S. WIMMERA (3022 tons), HUDDART PARKER LINE, MINED OFF NORTH CAPE, N.Z., JUNE 26, 1918.
Photo. Exchange Studios.



H.M. HOSPITAL SHIP *LLANDOVERY CASTLE* (11,423 tons), UNION CASTLE LINE, MINED HOMEWARD BOUND FROM CANADA, 27th JUNE, 1918.

RECORD OF THE DEVELOPMENT OF WIRELESS TELEGRAPHY AND TELEPHONY AND INTERESTING ITEMS IN RELATION THERETO

The record below is intended to constitute, arranged in chronological order, a résumé of the outstanding events in wireless telegraphy, from year to year.

1831.

Michael Faraday discovered electro-magnetic induction between two entirely separate circuits.

1837.

The first patent for an electric telegraph taken out by Cooke and Wheatstone (London) and by Morse (U.S.A.).

1838.

K. A. Steinheil (Munich) discovered the use of the earth return, and suggested that the remaining metallic portion of the circuit might be dispensed with entirely, and a system of wireless telegraphy established.

1840.

Joseph Henry (U.S.A.) first produced high-frequency electric oscillations, and pointed out that the discharge of a condenser is oscillatory.

1842.

S. F. B. Morse made wireless experiments by electric conduction through water across Washington Canal and across wide rivers.

Joseph Henry noticed that a single electric spark about one inch long thrown into a circuit of wire in an upper room could magnetise steel needles included in a parallel circuit of wire placed in a cellar underground thirty feet below with two floors intervening. He was one of many observers prior to Hertz who had noticed curious effects due to electric sparks produced at a distance, which were commonly ascribed to ordinary electro-magnetic induction.

1843.

James Bowman Lindsay, of Dundee, Scotland, suggested that if it were possible to provide stations not more than twenty miles apart all the way across the Atlantic, there would be no need to lay any cable.

1845.

Lindsay began making experiments across the River Tay, his method being to transmit messages by means of electricity or magnetism through and across the water without submerged wires, the water being utilised as the conducting medium.

1849.

Dr. O'Shaughnessy (afterwards Sir William O'Shaughnessy Brooke) succeeded in passing intelligible signals without any metallic conduction across the River Hooghly, 4,200 feet wide, in India, but he found the cost of power prohibitive.

1859.

Bowman Lindsay gave a demonstration of his conduction system to the British Association Meeting, at which Michael Faraday and Sir William Thomson (afterwards Lord Kelvin) were both present. William H. Preece (afterwards Sir William) was deputed by the Electric Telegraph Company to report on Lindsay's system.

1862.

John Heyworth patented a method of conveying electric signals without the intervention of any continuous artificial conductor. Cromwell Varley tried this method, but found it a failure.

1867.

James Clerk Maxwell read a paper before the Royal Society, in which he laid down the theory of electro-magnetism, which he developed more fully in 1873, in his great treatise on electricity and magnetism. He predicted the existence of the electric waves that are now used in wireless telegraphy.

1870.

Von Bezold discovered that oscillations set up by a condenser discharge in a conductor give rise to interference phenomena.

1872.

Henry Highton made various experiments across the River Thames with Morse's method.

1879.

David E. Hughes discovered the phenomena on which depends the action of what was subsequently known as the coherer, which many years later were used in early electric-wave signalling. He found that a tube of metallic filings was sensitive to electric sparks made in its vicinity, and he was able to obtain such effects on a tube connected to a battery and a telephone at a distance of five hundred yards.

1880.

John Trowbridge, of Harvard, systematically studied the problem of propagation of electric current through "earth," either soil or water, and he found that signalling might be carried on over considerable distances by electric conduction through the earth or water between places not metallically connected.

1882.

Graham Bell experimented with Trowbridge's method on the Potomac River, when signals were detected at a distance of 1½ miles.

Sir William H. Preece made an experiment, using Morse's method, to connect the Isle of Wight with the mainland across the Solent on two occasions during the failure of the submarine cable in the Solent.

1883.

Willoughby Smith, in a paper before the Institution of Civil Engineers, London, suggested that electric induction might be employed for railway signalling.

Heinrich Rudolph Hertz became *Privatdozent* at Kiel, where he began studies in Maxwell's electro-magnetic theory.

G. F. Fitzgerald suggested a method of producing electro-magnetic waves in space by the discharge of a condenser.

1885.

Thomas A. Edison, with the assistance of Messrs. Gilliland, Phelps, and W. Smith, worked out a system of communication between railway stations and moving trains by means of induction and without the use of conducting wires.

Sir W. H. Preece made experiments at Newcastle-on-Tyne which showed that in two completely insulated circuits of square form, each side being 440 yards, placed a quarter of a mile apart, telephonic speech was conveyed from one to the other by induction.

1886.

A. E. Dolbear, of Tuft's College, Boston, U.S.A., patented a plan for establishing wireless communication by means of two insulated elevated plates, but there is no evidence that the method proposed by him did, or could, effect the transmission of signals between stations separated by any distance.

1887.

Heinrich Rudolph Hertz discovered the progressive propagation of electro-magnetic action through space, and was able to measure the length and velocity of electro-magnetic waves, and to show that in the transverse nature of their vibration, and their susceptibility to refraction and polarisation, they are in complete accordance with the waves of light and heat.

Hertz employed as a detector of the electric wave a simple nearly-closed circuit of wire, called the "Hertz Resonator," but it was subsequently discovered that the metallic microphone of Hughes was a far more sensitive detector.

A. W. Heaviside established communication by telephonic speech between the surface of the earth and the subterranean galleries of the Broomhill Collieries, 350 feet deep, by laying above and below ground two complete metallic circuits, each about 2¼ miles in length, and parallel to each other.

1889.

Elihu Thompson suggested that electric waves were particularly suitable for the transmission of signals through fogs and material objects.

1891.

John Trowbridge suggested that by means of magnetic induction between two separate and completely insulated circuits communication could be effected between distances.

1892.

Edouard Branly devised an appliance for detecting electro-magnetic waves, which was known as a "coherer." He discovered that these waves had the power of affecting the electric conductivity of materials when in the state of a powder.

Sir W. H. Preece adopted a method which united both conduction and induction as the means of affecting one circuit by the current in another. In this way he established communication between two points on the Bristol Channel, and at Lochness, in Scotland.

C. A. Stevenson, of the Northern Lighthouse Board, Edinburgh, advocated the use of an inductive system for communication between the mainland and isolated lighthouses.

1894.

E. Rathenau, of Berlin, experimented with a conductive system of wireless telegraphy, and signalled through three miles of water.

1895.

Mr. G. Marconi's investigations led him to the conclusion that Hertzian waves could be used for telegraphing without wires, and he made important experiments at his father's home in Italy.

Willoughby Smith established communication by conduction with the lighthouse on the Fastnet.

1896.

In February Mr. Marconi went to England, and on June 2nd lodged his application for the first British Patent for Wireless Telegraphy, No. 12,039 of 1896.

In July of that year he was introduced to Sir William H. Preece, the Chief Electrical Engineer of the Post Office, London, at whose request Mr. Marconi conducted experiments over a distance of about 100 yards before the officials of the Post Office. Shortly afterwards a further series of trials was conducted by Mr. Marconi on Salisbury Plain, when communication was successfully established over a distance of 1¾ miles.

On December 11th, 1896, Sir William H. Preece lectured on "Telegraphy without Wires," Mr. Marconi conducting the experiments.

1897.

In March, 1897, Mr. Marconi demonstrated before the representatives of various Government Departments, communication being established over a distance of 4 miles.

In May further trials were made between Lavernock and Flatholm, a distance of over three miles; and on the 13th of that month the late Professor Slaby was present at further trials, when communication was established over a distance of about 8 miles.

In July Mr. Marconi gave a demonstration of his invention at the Admiralty in Rome, and before King Humbert at the Royal Palace of the Quirinal. Between July 10th and 18th trials were made at Spezia, and on the 17th and 18th communication was maintained between the shore and the Italian cruiser *San Martin* at sea, at distances up to 10 miles.

On July 20th, 1897, the Wireless Telegraph and Signal Company, Limited, was incorporated, with a capital of £100,000, to acquire Mr. Marconi's patents in all countries except Italy and dependencies.

On August 27th, 1897, the late Professor Slaby lectured on Wireless Telegraphy at the Sailors' Home, Potsdam, before the German Emperor and Empress and the King of Spain.

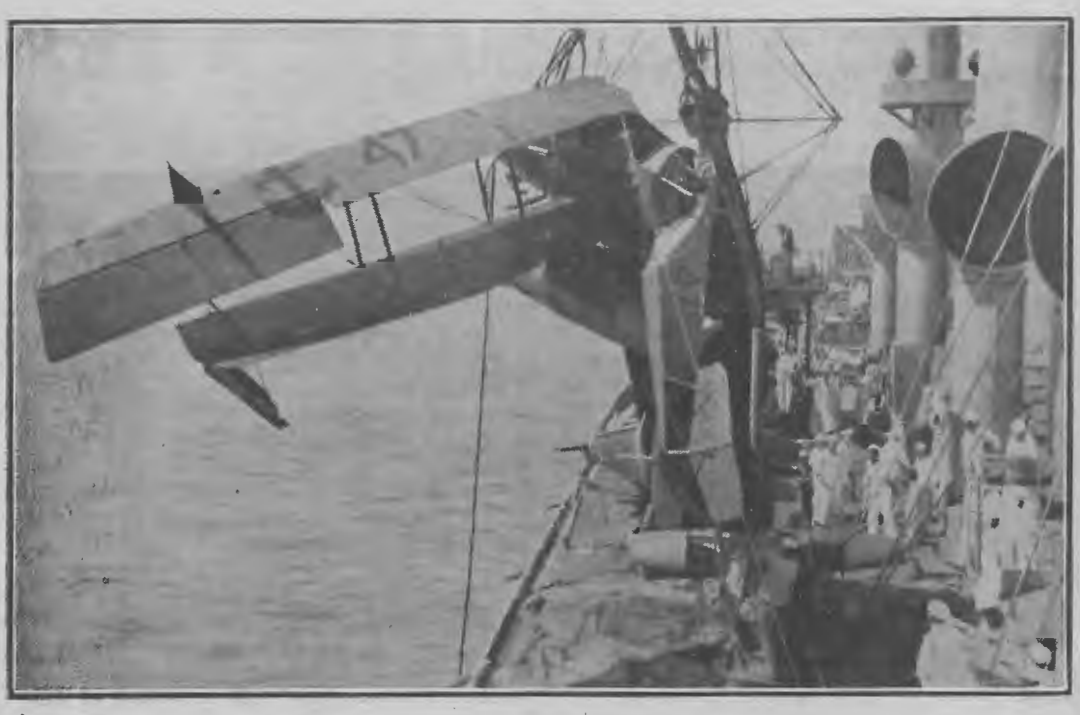
In September and October Mr. Marconi further experimented on Salisbury Plain. Trials were also made by officials of the Post Office at Dover. Apparatus was erected at Bath, and signals received from Salisbury, 34 miles away.

The first Marconi station was erected at the Needles, Isle of Wight, in November, and experiments conducted between that station and Bournemouth, Hants, a distance of 14½ miles.

In December, in the presence of Captain Kennedy, R.E., tests were made between the Needles station and a steamer, readable signals being received up to a distance of 18 miles.

(To be continued.)

U.S. NAVY HYDRO-AEROPLANE NO. 47 MEETS WITH A MISHAP, SOMEWHERE AT SEA.



HOISTING THE DAMAGED MACHINE ON TO WARSHIP. American Press Assn. Photo.

Ancient Air Messengers for Modern War

By NORMAN LE ROC

In spite of modern telegraphy, wireless, semaphores, search lights and other means of communication, the carrier pigeon still holds first place as war's messenger. Germany realised that and was as well prepared in her pigeon service as in any branch of her great fighting machine. It is estimated that she had, at the start of the world war, more than 50,000 homer pigeons in service!

To-day France is said to have almost 30,000 of these winged allies, and England has about the same number. The French officially announced that they had found the homing pigeon ninety-seven per cent. efficient as a courier, adding that when the telephone, the wireless, the war dogs, the rocket, the runner, the wig-wag, or any other system of communication failed, the *pigeon voyageur* could be depended upon to carry the message. And this, after a three-year trial in the most sanguine conflict that the world has ever known!

Practically every scouting or attacking party that crosses "No Man's Land" carries pigeons, knowing that if its wires are cut, if rocket signalling would bring disaster, if the dogs are gassed or if semaphoring or wig-wagging is impossible, the fast-flying messengers will get through. Released in the face of the heaviest kind of a barrage, they will swoop up, circle once to get their bearings and at a height of half a mile, start for their lofts at such terrific speed that no anti-aircraft gun has once chance in a thousand to stop them. Their failure to get through is the exception to the rule.

Up to the present time, tanks have not been able to carry wireless outfits, and as a result their messages are carried by pigeons—crates of the faithful fliers being put in every one of these big war engines before they start on their journeys.

Aeroplanes carry them—and when ammunition dumps, hidden artillery or supply stations are located by the airmen, directions are scribbled on thin rice paper, stuffed in the small capsule attached to the pigeon's leg, and then the bird is liberated. Faster than the plane itself the pigeon returns.

Thousands of tons of steel and explosives are daily hurled under the direction of messages carried by these birds. Both the Hun and the Allied artillery observers depend upon them as couriers.

Behind the French lines the whole country is dotted with pigeon lofts—hidden in out-of-the-way corners and elaborately camouflaged. The uniform French pigeon loft is a piano-box-like arrangement of crates on wheels and looks much like one of our travelling lunch waggons, except that it is disguised from the Hun airman in every conceivable way. These mobile lofts will hold from seventy-five to two hundred birds.

Then, of course, there are the stationary lofts at headquarters—receiving lofts, they might be called. And it is remarkable how these birds unhesitatingly find their own lofts, in spite of the smoke and fire and steel that is hurled about them.

Some of the largest of the French lofts—lofts which might be classed as reserve billets—will hold thousands of pigeons. It is to these lofts that the young pigeons are shipped and then trained or "settled" in the various smaller lofts that are to be their homes.

From the receiving lofts the pigeons are taken in motor trucks, in motor-cycle side cars and by horse to the trenches where they are distributed among the pigeon men who are to carry them "over the top" with the fighters. On the backs of these pigeon men are strapped wicker cages, into which are put from half a dozen to a dozen birds.

When the time comes for their release, these pigeons will fly back to the lofts in which they have been settled, delivering their messages to the men behind the lines.

What value the Hun puts on the pigeon is indicated by the signs that he posted throughout conquered Belgium. "Bring in your guns and your pigeons," he ordered—and threatened the death penalty for any who delayed.

Without the carrier pigeon the spy would be in a sorry plight. And it is true that there isn't an intelligence department in all Europe that doesn't depend upon the feathered messenger. As a matter of fact, if it hadn't been for the pigeons that the

brave Belgians refused to deliver to the Hun—in spite of threats and cruelty—France would never have received the information that enabled her to withstand the invaders in the early days of the war. Nor would the world have learned of the atrocities committed in Flanders.

But it is not only in the army and the intelligence departments that the pigeons have served the battling nations. Without them the navies would have been severely handicapped. They have been the one sure means of communication between the raiding U-boats and their bases. And they have proved

Only one pigeon remained alive in the pigeon baskets and upon it depended the safety of the patrol and its crew. But it breasted the storm that was blowing and battled its way through the heavy clouds, to its shore loft. Half an hour later the patrol and its crew were rescued.

So to-day the pigeon is as much a part of the Navy's equipment as is the compass. Uncle Sam realises the importance of adding these feathered messengers to his fighting forces, with the result that the Pigeon Section of the Department of Signalling is one of our fastest growing branches of service—possessing thousands of birds and hundreds of men, nearly every one of whom is a

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REPORTING FOR THE AEROPLANE OBSERVER.

These feathered Allies return to headquarters faster than the 'plane can fly.

even more valuable to the navies of the Allies. The English fishing boats that do not carry wireless are able to report the location of submarines, German raiders and mine fields by the use of pigeons. Practically every patrol boat in European waters carries these birds.

What service they can render under trying conditions is best told by this incident. A British patrol boat on duty in the British channel was surprised and shelled by a German submarine. It was badly hit, but engaged the U-boat and finally put it to flight. Its own plight, however, was extremely serious; unless help was received it would go down.

pigeon fancier. Every training camp in America has its pigeon lofts and schools for training pigeon experts. At the present time the United States army has over a hundred homing pigeon lofts scattered throughout the United States—and more are being established almost every day. The U.S. Government is calling upon the pigeon fanciers of this country to furnish thousands of this type of bird for war purposes.

However, the only birds acceptable to the Pigeon Section of the United States Army are those of the racing homer stock, and none are accepted that cannot boast of a pedigree, showing not only their family tree, but a list of what their relatives have ac-

complished in flying, both as to speed and distance. That pedigree must accompany any bird that is shipped to America.

And perhaps now may be a good time to emphasise the fact that the pigeons used for carrier purposes are not the real carriers at all. The carrier pigeon of to-day is a large bulky bird, heavily wattled, and has a cere around his eyes. True English carriers, we are told by our Pigeon Section, are almost obsolete now and are found only in fancy pigeon exhibits. For years they have been bred for show purposes, with the result that they have degenerated so far as actual flying is concerned.

The war bird of to-day is the racing Belgian homer—the fastest bird in the world, with the possible exception of a few small hawks. Unlike the heavy English carrier, the homer is built for speed and endurance, having an especially deep breast to ensure lung capacity, but without the bulkiness of other breeds of pigeon; offering a sleek, strong body weighing only ten to twelve ounces when in racing condition. He is the result of centuries of careful breeding and selection; a cross from the English carrier to a tumbler, and then through one of the owl-pigeon breeds.

What is this homing instinct in the pigeon? Why do they return home? How do they find the way?

A thousand theories have been advanced to account for the mysterious working of the homer's brain (which, by the way, is about a fourth larger than that of any other pigeon) but every one has been smashed when put to test. The French call it *orientation*, which describes but does not explain.

So to-day no one has any idea of what power, or sense or instinct the homer has that brings him straight home, almost regardless of distance, direction or conditions.

How then, in view of their love for home, can Uncle Sam break the pigeons he buys of their instinct to return to the United States? That's a fair question, and the answer is—he can't! Once a homer is "settled" it is of no value to America, except for breeding purposes. Consequently, the only birds useful for courier purposes are those that are brought into service before they are old enough to "settle." These are eight weeks old or less and are called "Squeekers."

Nor can the "Squeekers" that are now delivered to the various training camps be used for anything but breeding and training the pigeon experts in the work they are to perform in France. The birds that will be used "over there" are those that are "settled" in the camouflaged lofts behind the lines—birds that are either raised there or shipped from the United States while too young to become "settled."

The training of the young homing pigeon is a fascinating game. Let a pigeon expert, Lieut. William L. Butler, Department Pigeon Officer, Central Department, Signal Corps, United States Army, tell you about it.

"When the birds are old enough to fly," says Lieut. Butler, "which is at about the age of ten weeks, their training should begin. First you let them out on the walk, or landing of their lofts. They must be let alone there, so that they can take their first 'mental photograph' of their surroundings. If you scare a homer away before he gets that 'mental photograph' you may lose him.

"After he is familiar with his surroundings, give him his first flight. First time out take him about a mile. Then two or three miles; then five; then ten, then twenty-five—and after that you can keep lengthening the distance.

"Now as to their speed. They can make two miles a minute, under favorable conditions, up to thirty miles. They have flown as far as eight hundred miles on a single flight.

"At Camp Funston, just the other day, we had a peculiar sort of speed test. We sent messages a distance of five miles—by dog, wireless and pigeon. Which message was delivered first? The pigeon. Sounds impossible, doesn't it? But it's true. The fact is that a fast homer can fly five miles in about two and one-half minutes, and it takes longer than that to relay a fair-sized message and deliver it."

The Meaning of Conscription of Wealth

REVENUE AND TAXATION

Never was there a more mischievous example of the mentally benumbing influence of catch-words than this raucous repetition of "conscription of wealth" as a bait in political flat-catching. Not that it would ever have got much serious notice if it had not somehow been attached to the inner thoughts of the Chancellor of the Exchequer, of all people in the world. That suspicion compels us to attempt the difficult task of arguing the proposition—difficult for the sole reason that nobody has yet been able to explain what it means.

Its origin is quite simple. It arose, says Mr. T. C. Elder in The Engineering Review, during the early opposition to compulsory military service, now nearly three years ago. Conscription of men and conscription of money should, it was claimed, be enforced together. And so they were. Conscription of men is frequently inconvenient, is the occasion of appeals to tribunals, and is sometimes improperly evaded. Taxation and super-taxation are also objected to by some, although most people pay up willingly enough towards the cost of defending their lives and liberty and the rest of their property. Nobody disputes the right of the State to conscript more wealth by taxation of revenue if it becomes necessary. But gradually the expression has come to assume a more sinister meaning. It is hinted that the State may find advantage in annexing capital instead of income, and, as the apologists put it, commuting the taxation of years at one fell swoop. Let us try to follow this line of thought.

A National Bargain Sale.

Wealth, in this connection, can only be described as material property. The term capital is not quite synonymous because there is always room for discussion as to what is and what is not capital. Wealth is less elusive.

Wealth may be War Bonds, or railway shares, or flocks and herds, or machinery, or works of art, or cornfields. Apart from the purely personal enjoyment of possession, wealth can only be valued by calculating what it will fetch in the market. So that if the Chancellor of the Exchequer proposes at some future time to pay off two or three thousand millions of war loan by "conscription of wealth" in this sense, what is really to be contemplated is that tangible property of innumerable kinds will be seized by the Government and sold.

In a small way this would probably be described as a jumble sale, and within limits it is manageable. Someone had what was thought a happy idea recently to invite people to give articles of jewellery for a certain war charity, which signifies in effect that instead of giving your own money you give somebody else's by parting with articles of more or less market value. But it is difficult to imagine such a plan in relation to a miscellaneous collection of property running into thousands of millions. Here it is not a case of raising money between one person's sacrifice and another's greed. Everybody would be dragged in at once. One cannot see where the buyers would spring from.

Three Types of Confiscators.

Do not suppose that any such obligations will check the enthusiasm of your eager confiscator. He has, so far as may be ascertained or surmised, at least three ways of escape from perplexity.

Firstly, there are those who, quite cheerfully and even gaily would confine their attention to the War Loan itself. They would with one heroic stroke chop the interest in half, and leave Tank bond buyers and all the rest with a 2½ per cent. investment which, as they reckon, would effectually relieve the State of half its national debt. So, perhaps, it would—at the cost of the complete collapse of British credit throughout the world, a catastrophe likely to be far more terrible in its economic results than the war itself.

Secondly, there are those who have just enough conscience to keep their hands off the War Loan but who would appropriate profit-earning property such as coal mines, farm land, breweries, machinery, or industrial securities. In other words, they would

transfer to the State a share in active investments. The State would be everybody's detested partner.

Thirdly, there is a subtler class who would merely call on us to make a return on the income tax form model showing what we possess, and we should in due time receive a demand note for, shall we say, one-fifth of its value. It would be left to us to find the money and pay up. We might sell or borrow. The banks would, it is lightly assumed, provide accommodation, and as an equivalent amount of national debt would be paid off simultaneously, the money market would easily right itself. This may seem at first but a cranky conception, this conversion of a State in debt into a State of debtors; but therein is much more controversial meat than has been dreamed of by its supporters. For it is, in effect, a tremendous compliment to individualism.

The million debtor scapegoats would struggle and strive and sacrifice till they had straightened their account again, whereas the State has no such resource or conscious incentive.

The State versus Thrift.

It is unnecessary, however, on this occasion to follow alternative hypotheses any further. What is a better use of space is some statement of the appalling danger of a direct attack on the whole system of thrift. The folly of the spendthrift has been the theme of worldly philosophers from time immemorial. But it will be only fools who will save money when they know that it will be taken from them again by Government acting on behalf of those others who have preferred to spend all their income on personal enjoyment without thought of the morrow.

Ownership of the active capital of the nation is divided amongst many more people than is commonly supposed. It represents money gained by the enterprise or saved by the thrift of a large proportion of the population. But while they are saving and working for themselves they are also saving and working for the nation. It has been the habit of this country to give nothing much in return beyond reasonable measures of security against brigandage. Taxation without protection was our motto, and taxation to meet annual expenses of the State is a necessary provision. Taking a share of everybody's revenue is quite different from seizing the source of that revenue.

The Creative Minority.

The theory on which arguments have always been based in our previous articles touching this group of economic questions is one of simple business expediency from a national standpoint. The theory is that the State has much to gain by permitting its citizens to pursue and acquire and create personal economic security and enrichment in conformity with a certain standard of honest endeavour and purpose. The State thus ensures that there will be a source of taxation. Personal economic effort on the part of the thrifty, energetic and enterprising minority does naturally much more for the nation; but for the moment it is enough to claim that unless you have a few million people struggling and saving you will have nothing to collect for the administrative costs of war or peace. Bluntly stated, it is better to let people make money and then take from them some proportion of their earnings or revenue, and apart from all question of morality this is a paying proposition for the nation, while interfering with their income at its source is likely to be disastrous. They will not build if their building is to be confiscated. They will not save if their savings are to be seized.

It is a curious point, worth pondering, that those who favor conscription of wealth are the same people who support the future accumulation of wealth by our enemies under a restoration of free import conditions.

A BOUT WITH A GERMAN ACE (Continued from p. 301).

L—— told me afterwards that Mix, one of the other pilots, engaged Boelcke—and fell in flames a moment afterwards—but this probably saved my life. I came to from the shock of the bullets to feel my plane slithering down through space. Weakly I pushed the ailerons, and she flattened out. My motor was still going, so I throttled down, and pointed the nose towards the British lines.

During the next few minutes I think I nearly fainted half a dozen times, but at last I saw the parallel ribbons below me that meant the trenches were passed. I pointed the nose down, hardly able to see where I would land.

The next day L—— came to see me in our field hospital. He had two fingers of his left hand shot away, but otherwise he was unharmed.

"You and I and Wilson are the survivors," he told me simply.

"Dessauer?" I asked sorrowfully.

L—— shook his head. "Fell out somewhere. He wasn't with you when you landed in the tree." Without flourishes he told me of the disastrous trip. "I knew all along that it was foolishness getting near Havrincourt with those old buses! The commanding officer has sent out eighteen fighting machines after the bunch. I hope they don't get Boelcke!"

"Why, for heaven's sake?" I asked.

"I want him myself!" he retorted. "As soon as my hand heals I am going after him with a Sopwith!"

Matron and Maid

By PIPPA

As we go Marching On.

In America early last winter the telephone companies commenced enlisting women for service in France. This was a more difficult task than would appear at first glance. Why? Simply because these new recruits, in addition to being experienced switchboard operators, had of necessity to be thoroughly familiar with both the English and French languages.

So many of our girls in Australia get a smattering of French, so few become really familiar with the language that one trembles to think what would be our response were Australia called upon in like manner to America.

In America, as the war progresses, they expect an increasing need for these operators to keep open the lines of communication.

"Each one," says an American journal, "assigned to the American army in France, will wear a distinctive uniform, and in a military sense will occupy a position similar to that of a member in the British Women's Auxiliary Army Corps, which is doing valuable service with the British army commands."

To be eligible for telephone work overseas American women must be between the ages of twenty-three and thirty-five years, with a few possible exceptions in case of the maximum age. They must be able to pass a strict physical examination, to speak French and English with ease. Wives of army men now in Europe, or soon to go there, will not be accepted for military telephone work in France. Salaries of women operators range from sixty dollars to one hundred and twenty-five dollars a month, with allowances for rations and living quarters, such as provided for army nurses.

Women Munition Workers.

In the opinion of a high authority, there is no shortage of labour for machine shops which demands the presence of women in the heavier branches of mechanical work. He finds the prevailing war-time wages are tempting women to leave work which they could successfully perform, to undertake that for which they are, by nature, totally unfitted, and adds warningly:—"While there is no national labour crisis which justifies employment of women in heavy mechanical work, yet some of them have engaged in handling scrap which is physically too heavy and wearying for them. This is all wrong. There are some jobs which are decidedly not women's jobs and never will be."

In some of the factories were women who had previously been nurses,—and again a note of warning was sounded. No class of women were needed to stay on their jobs more than just those two—nurses and teachers, and it was their duty not to be tempted by higher wages into newer fields of labor even by the war.

But, there must be something queer in the general make-up of a woman's character or nature. One manufacturer, who employed about twenty girls, found that even with tempting wages they quickly grew tired and left him at the end of a few weeks. At last he consulted a certain psychologist, who advised him to get a cat and put it in the room with the girls. The journal supplying this information adds that the cat quickly became a diversion and a pet, and that practically every girl caressed and fondled it and became amused at its antics. "This broke the spell of monotony" it says, "gave a little interest to the steady routine of work, provided a play-spell, and served as a physical and mental tonic."

Would not our Australian youngsters love this task. British boys and girls were recently asked by the ministry of munitions to gather horse-chestnuts which, after being dried in kilns, are ground to powder for use in the manufacture of explosives. The school children were very enthusiastic over this war-work. Better than knitting socks and knee-caps, a hundred times! One young collector brought in nearly 3-cwt. of this material for powder.

The Scout's Corner

By CAPT. CUTTLE

Captain Cuttle is eager for news of our Boy Scouts for this their own corner in "*Sea, Land and Air.*" He would like this time to have the news sent to him in the form of a letter. The letter—which must not exceed 150 words in length—should detail the latest doings of its writer's own patrol or troop, be written on one side of the paper only, and be addressed to "Captain Cuttle," care of the Editor, "*Sea, Land and Air,*" 97 Clarence-street, Sydney. It must reach this office not later than 15th August. Name and address of writer to be given, though a *nom-de-plume* may be used for publication. The prize—a postal note for three shillings—will be awarded to the writer of the letter for which Captain Cuttle gives the highest marks. The results of the competitions, which closed July 15th, will be published in our next issue.

TO ERECT A STRETCHER.

Of course, some of you—many of you, let us hope—know how to erect a hasty stretcher. For the benefit of those who are ignorant on this point, however, let Captain Cuttle speak.

Take two strong staves and a piece of stout canvas, or a sack, and lay the ends of the staves on a couple of logs, or stones; keep the staves apart by cross bars, and you have a comfortable bed. But—and particularly in winter time, don't forget to put plenty of blankets beneath you. This bed is the best possible to use when the ground is damp, and you will do well to spread beneath the blankets, some waterproof sheeting, or, if you do not possess any, some newspapers.

Apropos of blankets, always remember to try to take a sufficient number of these desirable items with you on your camping expeditions. They may not merely spell the difference between comfort and misery, but actually that between health and serious illness.

Especially at mid-winter sleeping—or for that matter—sitting on the damp ground is a very dangerous proceeding. If, however, when you are far from home the supply of blankets runs short—as it has a way of doing now and again, provide one never so carefully—then make shift with the thickest paper you can lay your hands on.

MAN OVERBOARD.

(How to be prepared should you hear that stirring cry.)

By Charles Hibbs (Lecturer and Instructor of the Royal Live-Saving Society).

You often see at seaside places and near the banks of rivers, great round white lifebuoys with a length or two of rope attached, either fastened on to walls, or put up on posts, in conspicuous places. Have you ever imagined yourself using one of them for saving someone in danger of drowning?

Think of these cases; and in each case a lifebuoy very near at hand. A person;

(1) Falls from a harbour wall or pier into the sea.

(2) Goes overboard from a steamer or yacht.

(1) Gets out of his depth near the bank of a river.

You would at once secure the lifebuoy (that is if you are not a fairly good swimmer) and get it to the drowning person either by throwing it down to him, or in the third case, by either throwing or wading out and pushing the buoy in front of you.

Now consider three other drowning emergencies.

(1) A person is bathing or swimming in a roughish sea, more than say 15 yards from the edge. A strong wind is blowing from off the sea, and he gets perhaps exhausted or overcome by cramp or illness.

(2) A person is swimming in a smooth sea or river 20 yards or more from shallow water and in a similar manner finds it impossible to get back again to safety.

(3) A line is required to be taken from shore to a boat, or from one boat to another some distance away; or from one side to the other of a swiftly flowing river to save some one (may be two or three) in danger of being carried away by the current.

Now would the lifebuoy be of any real use to you in any of these three cases?

It would be practically impossible for an ordinary man or boy to throw a lifebuoy 15 yards against a strong sea wind, and just as impossible to swim out with one against the breaking waves.

Even in a smooth sea it would not be an easy matter to swim out 25 yards quickly with a lifebuoy to impede your progress.

The Younger Set

Edited by Lilian Turner (Mrs. F. Lindsay Thompson), Author of "Paradise and the Perrys," "The Perry Girls," etc.

Sydney, July 15th, 1918.

My Dear Younger Set,—I am sorry that before I can insert that interesting document, The Letter that Won the Prize, in this column, yet another from me to you must clothe itself in important print. This is, as of course you can guess, because "we go to press" (you understand the phrase, do you not?), before the closing date for the competitions.

In point of fact, we appear on the bookstalls and in the shops, on the self-same day that we draw our roller shutter down upon arriving competitions, viz., July 15th.

At the moment of writing this, that date is not in sight—but printers are as exacting taskmasters as you can imagine. Just like Time and Tide—they will not wait for anyone.

Therefore, instead of being able to send one of your letters to me, to be printed early on the 15th inst., I am having to write one to you, on the—oh, well never mind the exact date.

It is holiday time with you now, and I have seen many of you hurrying mountainwards and seawards, wearing that inexpressible "school forgetting; by the school forgot" expression which convinced me, more than all else, how very hard you have fagged since you made hay at Easter time.

After a while, when you have done some of the feats you have hungered through a long term to do, do write and tell me about them. And these winter evenings, when the curtains are drawn and the lamps (or electric lights) lit, when the fire is crackling merrily, you will attack my competitions in sober earnest, will you not? I cannot say, at this early date, much about the last competitions, but I fear that, numerically, they are going to be somewhat disappointing. Of course, you have had the end-of-the-quarter examinations, and Italy Day, and other matters of importance to attend to. Still, I do expect very shortly to be simply deluged with envelopes marked "MSS. only" on their top left-hand corner. And, by the way, when writing to me, you might first mention the sort of competition you like best.

I am, dear Younger Set,
Your friend,
PEPITA.

COMPETITION CORNER.

(Open to all our readers, of both sexes, who have not yet passed their twenty-first Birthday.)

Competition 1.

Wanted a short paper (not more than 800 words in length), telling the story of a boy who has made his mark in the world. You can take your story from whatever source you like, that is to say, the story need not be original. But you must state, at the end of your paper, the name of the book or magazine from which you obtained your copy. The story must be about the boyhood of a man who has risen or done something great. Prize, a delightful story-book.

Competition 2.

For the best and brightest letter sent to Pepita, the prize of a postal note for 2/6 will be given. Letter not to exceed 150 words in length.

Competition 3.

The prize of a postal note for 3/6 will be given for the best, neatest, and most correct answers, to the following set of questions:—

(1) In what works, written by what authors, do the following characters occur? Maggie Gulliver, Mr. Murdstone, Mr. Rochester, Dobbin, Effie Deans, Alan Breck.

(2) Who wrote and in what poem do these lines occur:—

(a) "The rising moon has hid the stars,
Her level rays like golden bars,
Lie on the landscape green,
With shadows brown between."

(b) "In the beauty of the lilies Christ was born across the sea,
With a glory in His bosom that transfigures you and me;
As He died to make men holy, let us die to make them free,
While God is marching on."

(c) "A veil 'twixt us and Thee, Good Lord,
A veil 'twixt us and Thee,
Lest we should hear too clear, too clear,
And into madness see."

(3)—(a) Where was Shakespeare born?
(b) Whom did Stevenson marry?
(c) Where did Scott die?

Competition Rules

1. No one entering for these competitions must be over twenty-one years of age.

2. The editor's decision is final. No correspondence can be entered upon regarding that decision.

3. All work must be the original work of the competitor. All competitions must be written in ink or typed upon one side of the paper only.

4. Every competitor must enclose one coupon with her or his work (Page IV.).

5. The name, age, and address of competitor to be stated. A *nom-de-plume* may be used for publication if desired, but real name must be given.

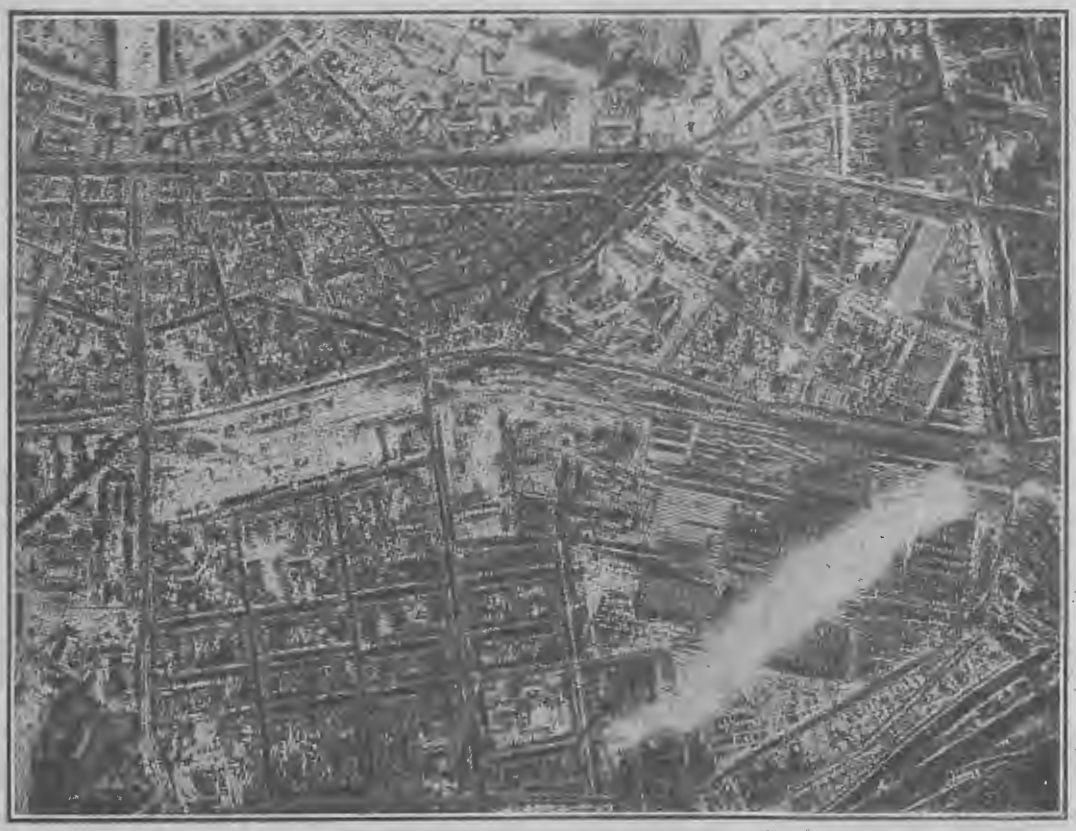
6. All competitions and matters relating to the Younger Set Pages must be addressed to "Pepita," *Sea, Land and Air*, 97 Clarence-street, Sydney; must be sufficiently stamped; have their ends left open for inspection by the postal authorities, and have the words *MSS. only*, written on the top left hand corner of the envelope.

Closing Date.

Closing date for all competitions, August 15th. No competitions after that date can be considered.

Notice.

In the event of two or more competitions being equal as to quality of their work, the prize will go to the one in each class of competition who sends in the neatest and best written paper.



A REAL RAID ON GERMANY, PHOTOGRAPHED BY AN OBSERVER IMMEDIATELY AFTER THE LAST RAID ON KARLSRUHE.

Shipping Notes

Captain W. A. Wheler, of the Peninsula and Oriental Steam Navigation Company, has retired after 54 years' service. Captain Wheler, once a well-known figure in Australian shipping circles, was born in 1843. As a junior officer from the Indian Navy he joined the P. and O. Service in 1864. Among the many ships of his command was the hospital transport *Avoca*, requisitioned for the Indian contingent in the Egyptian campaign of '82, his services in this connection gaining him the Khedive's Bronze Star and the Egyptian Medal.

He commanded the *Geelong*, which, during the second Egyptian campaign ('85), was trooping the Red Sea between Suez and Suakim; also the *Coromandel* as a hospital ship during the Ashanti campaign.

In 1901 he became commodore of the P. and O. fleet, his last ship being the *Persia*. Three years later he was appointed the company's agent in Cardiff, Wales, from which position he is now retiring.

Capt. Wheler last visited Australia in 1890, in command of the *Carthage*.

Mr. Jas. Blair, of the Nippon Yusen Kaisha, read a paper on "Japanese Shipping" before the members of the Japan Shipping Society at their rooms in Hanover Square, London. The paper dealt with foreign trade, commencing in 1896 up to 1916, with slight reference to events in 1917. Mr. Blair mentioned that in 21 years over 144,000,000 *yen* had been contributed for the extension of steamship routes and encouragement of navigation, and over 150,000 000 *yen* for the encouragement of shipbuilding; while 182 vessels of over 700 tons gross, aggregating 637,000 tons gross, had been constructed under the subsidy laws. In 1917 up to 11th August Government permission had been granted for the construction of 554,580 tons, and by September, 35 ships aggregating 154,727 tons gross had been launched. The expansion of the mercantile fleet since 1896 has been rapid. In 1896 Japan possessed 373 vessels of over 100 tons gross, aggregating 334 592 tons; in 1916, 1151 vessels, aggregating 1,847,453 tons, an increase of 550 per cent. in 20 years; while exports and imports combined during the same period increased 650 per cent. Referring to Japanese shipowners, Mr. Blair stated that at the end of 1916 there were 28 steamship companies, the fleets totalling 980 000 tons gross. He stated that Japan to-day ranked third in shipbuilding and fifth in tonnage.

According to latest returns there are on order with Norwegian shipbuilders 169 vessels aggregating 178.000 tons. Of these ships, 20.000 tons are represented by steel motor ships, and 150 000 tons by wooden sailing ships and motor auxiliaries.

Japan now has 113 shipbuilding slips, owned by 42 different firms. In each, a ship of 1000 tons can be built. Sixty-seven ships have been completed and 19 are now in course of construction. The Nippon Yusen Kaisha will build 50 large steamers without delay, adding 400,000 more tonnage to the fleet.

From a recent Japanese Government summary we learn that there are 880 shipyards in the world, of which only 264 are able to build steel ships of over 1000 tons. Of the total given 236 were in Great Britain and Ireland, 58 in the British Colonies, 105 in Holland, 51 in Germany, and 48 in the United States.

BRITISH SHIPBUILDERS AND NEUTRAL SHIPOWNERS.

At a largely attended meeting of the North of England Steamship Owners' Association, held recently, under the presidency of Mr. J. W. Withering-ton, the question of the present and future shipbuilding position of Great Britain was fully discussed, and attention was directed to the very grave outlook for the British mercantile marine after the war, in view of the impossibility, under existing and prospective conditions, of ship-owners being able to replace the serious diminution of their mercantile fleets by new vessels.

Mr. R. S. Dalgliesh moved the following resolution:—"That this meeting of British ship-owners, members of the North of England Steamship Owners' Association, having regard to the national interests, views with deep concern the fact that large orders have been placed with British ship-builders by neutral ship-owners at £25 per ton for delivery after the war, as and when the Government may grant permission, with a further provision that any increase in material or wages over existing costs shall be added to the price of the contract. This is a serious menace to the maritime supremacy of Britain. The price paid represents at least four times pre-war costs and such a capital outlay could only be justified on the assumption that this increased cost is provided out of profits.

"It is well known that neutral owners have accumulated huge funds out of profits, and these contracts prove that such funds are now being ear-marked and used for the development of their mercantile marine. On the other hand, British ship-owners, owing to the exigencies of the war, have had their profits reduced to practically pre-war basis, and at the present time very many are trading actually at a loss.

"The amounts recovered for vessels lost cannot possibly be sufficient to replace tonnage at anything like such a figure. It follows, therefore, that to compete with these neutral owners new capital must be introduced, and this is not commercially practicable. It seems therefore necessary in the national interests that the Government should revise their policy and take such steps as will enable British owners to rehabilitate the British Mercantile Marine. And this meeting urges the Shipping Controller to make such representations to the Government as will render this possible."

Miscellaneous

WAVES IN MID OCEAN.

Waves in mid-ocean are caused entirely by the action of the wind. The adhesion between the rapidly-moving particles of air which compose the wind and the surface particles of the water causes the water's surface to be dragged along with the air. Small ripples are immediately formed, and these soon overtake others near them. They unite, and, due to the friction between the water particles, each succeeding ripple piles up on the top of the previous ones. Just as soon as oil is spread on the water, however, the size of the waves is reduced like magic. The reason for this is interesting. Oil, unlike water, has very little internal friction between its particles. The ripples of oil formed by the wind, therefore, cannot pile upon each other to any considerable height; hence water waves cannot grow in an area of oil placed about a steamer. They begin to fall down instead. By the time these waves reach the boat they will have lost their formative ripples.

SHORTAGE OF OIL-ENGINEERS.

There is a great shortage of marine oil engineers at the present time for commercial work. Owing to the tremendous increase in the employment of internal-combustion engines for war purposes of every conceivable class, the demand for men skilled in the usage and repair of this type of motor has been very considerable, and the result is that nearly every man in this position has been drawn from his normal work, even though he is over military age. Consequently, the number of men remaining in civil employment who are qualified internal-combustion engine mechanics, or even reliable drivers of such motors, is comparatively small, and a good deal of difficulty has been experienced by owners of commercial motor craft to provide an efficient engine-room staff. This applies to all manner of vessels, whilst the motor ship is far from immune, many engineers having left motor ships to take up commissions in some branch of the Army, where a knowledge of internal-combustion engines is essential. Naturally, this fact is inimical to whatever prospects there might be of building commercial motor vessels at the present time, since owners realise the difficulty they will experience in obtaining suitable men to run such craft. The greatest difficulty is being experienced in connection with hot-bulb-engined boats, since there are extremely few men remaining out of the Army or Navy who have a satisfactory knowledge of such engines.

NEW COASTAL STEAMER.

A new steamer built to the order of Langley Brothers, Limited, was launched on 26th June from the yards of David Drake, Limited, Balmain. The vessel is intended for the New South Wales coastal trade, running principally to the Tweed River. She is 133-ft. long, 29-ft. beam, 9-ft. depth mounded, and is built throughout of colonial hardwood, excepting the decks, which are of colonial hoop pine. The boiler and machinery will be installed by Mort's Dock and Engineering Co., Ltd.

As the vessel left the ways she was named *Coraki* by Mrs. A. Langley.

ZEPPELINS DESTROYED.

Mr. G. H. Perris, who is attached to the French Army as a correspondent, has investigated the fate of fifty Zeppelins, and as a result is of the opinion that the fate of those vessels explains in the most satisfactory manner why the English people are no longer afraid of the Zeppelins. Apart from two destroyed before the war, the list may be summarised as follows:—

Destroyed in Germany	5
Destroyed in neutral countries or near the Front	5
Destroyed in England, by the British Navy, or on their way home from England	15
Others destroyed at sea	2
Out of use	5
In use as training schools	4
In use chiefly in the North Sea	9

Considering the millions of pounds spent and the unlimited hopes built upon these monsters, we may regard the result as one of the most conspicuous fiascos in the history of industrial and military science.

THE "SPOTTER."

The "spotting" aeroplane hovers above an enemy target. The observer watches our artillery fire and signals corrections to the battery by wireless. The lines quoted below describe an amusing difference of opinion between "Luku," the wireless man, and the pilot.

Captain Johnny, R.F.C.,
Trying to land a bumble-bee,
Broke an under carriage Vee.

First he blamed the E.L.C.—
Failing that the landing Tee.....
.....what a dreadful liar, he.

O.C. Squadron said "Let's see,
That's the tenth machine that he
Has destroyed most foolishly.
I shall recommend he be
Transferred to the A.S.C."

The moral of this tale is plain,
Speak the truth and shame the devil,
If you're summoned to explain,
Always do so on the level.

"Luku" in an Aeroplane
Is the Pilot's curse and bane.
Faster rise the shells and faster
Preluding most dire disaster—
"Luku" taps and taps away
Seems to really want to stay,
While the pilot sits and sweats,
Muttering abyssmal threats.
Should the pilot strive to turn,
"Luku's" eyes begin to burn—
"Will you keep her still, whatever?
If you'll twist about I'll never
Get them on that ruddy gun,
Don't you move until I've done."
When the bus has reached the sheds,
Flight commanders shake their heads,
"Twenty holes in every plane,
Three days ere she's right again."
"Luku" sadly turns away,
"Had a rotten shoot to-day,
Only got fifteen O.K."