TECHNOLOGY

Ships with Fins Combat Nausea

New age of comfort for ocean travelers promised by gyroscopically controlled "wings" that keep ships from rolling sidewise, the motion that most often causes seasickness.

By ERIC BENNETT

➤ FOR THOSE whose stomachs rise when they go down to the sea in ships the story of the Denny-Brown ship stabilizer brings the promise of a new age of comfort: because this device, perfected after 20 years of experiment and usage, can keep a ship of any size from performing that sideways roll so devastating to digestions, crockery and unsecured grand pianos.

During the war the British navy fitted this stabilizer to 109 ships. Now it is in service for the first time on a big liner, and passengers who once crossed the China Sea clinging to bunks that bucked like broncos play deck games and drink tea from cups that stay on tables when they are put down. The new 24,000-ton Peninsula & Oriental liner *Chusan*, plying between London and India, Singapore and Hong Kong, was fitted with the Denny-Brown device, and her first year afloat has convinced the shipping world of the stabilizer's success.

In the deepest bowels of the ship, some 20 feet below the waterline and just above the keel, is the stabilizing gear. When the captain presses a button, the engineer starts the motors which power the device and the gyroscopes which control it. The captain now turns another switch, and from each side of the ship at its maximum width, a fin slides out into the water a few feet above the ship's bottom. Each fin is rather like a small airplane wing, with a hinged tail flap.

Diminutive Wings

When the fins are fully extended—that is, when the ship's sides have fully sprouted their diminutive wings—the captain moves another switch and the fins come under control of the gyroscopes: they flap up and down like a pair of rudders and within a few seconds the roll of the ship has been ironed out. The *Chusan's* gyrochart shows that a roll of 9½ degrees (that is, 4¾ degrees to left and right of vertical) can be reduced almost instantaneously to a gentle 1¼ degrees (or only ⅝ of a degree each way).

The astonishing thing about the fins is their size in relation to the ships they stabilize. Each fin on the *Chusan* projects only 12 feet from the side of the ship: its fore-and-aft measurement is six feet six inches, compared with the liner's over-all length of 672 feet. When not in use the fins are withdrawn into the steel housings on each side of the hull.

Shipbuilders have tried various devices to counteract roll. The Sperry gyrostabilizer, installed on several large liners, was costly and heavy. The three gyroscopes fitted to the 48,000-ton Italian liner *Conte di Savoia* weighed 250 tons apiece. Their effectiveness did not seem to warrant their cost, weight and space.

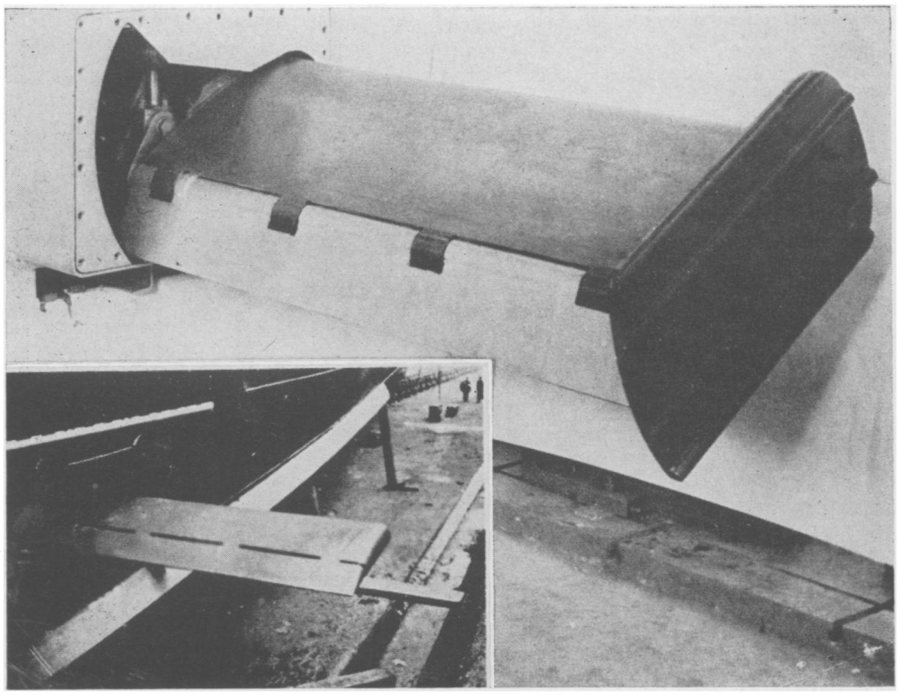
Yet long before all this a Scotsman had thought out the oscillating-fin principle on which the Denny-Brown apparatus is based. In 1890 Andrew Wilson, a chemist of Stirling, took out a patent for an "Apparatus to Control the Rolling and Pitching Motions in Vessels." Wilson's idea was to have fins on each side of the hull to check rolling. It does not appear that his device was ever tried out.

Then, in the early 1930's, Dr. S. Motora, of the Mitsubishi Shipbuilding and Engineering Company, designed a fin stabilizer which was fitted to three ships. But the Japanese device was not successful because it lacked a mechanism which would oscillate the fins quickly enough. To be successful a stabilizing device must begin to counteract the roll of the ship *as soon as that roll begins*. In a small ship, where the roll is rapid, the changeover in position of the two fins must take place in less than a second.

In Edinburgh, Sir William Wallace heard of Dr. Motora's work and put his firm to work perfecting the Japanese device. Sir William (he was knighted in 1951) is chairman and managing director of Brown Brothers & Company, Ltd., a firm with a world-wide reputation as manufacturers of ships' steering gears. Sir William needed the help of a shipbuilding firm which had an experimental tank. He approached the biggest firms in Britain. One after another they turned him down. There was the sound of mocking laughter on Clydeside and in Liverpool. They had had enough of ship stabilizers.

Then he went to Sir Maurice Denny, chairman of William Denny and Brothers, Ltd., of Dumbarton, Scotland. Denny's has the oldest-established model experimental tank in Britain and it specializes in building Channel steamers and packet boats. Sir Maurice finally accepted the proposition. Five years of experiment followed.

By 1936, the Denny-Brown stabilizer was a practical possibility. All its sponsors had to do was to persuade a shipowner to install one. The Southern Railway agreed to have a stabilizer put in the old Channel



STABILIZING FIN—How the "Denny-Brown" ship stabilizing fin looks when the nose of the fin is tilted up is shown in this photograph. The insert illustrates the fin in position on a ship.

steamer, *Isle of Sark*, provided that Denny's and Brown each paid a third of the cost.

That stabilizer was crude compared with the latest model. Today at Denny's and at Brown's they talk in a rather shamefaced manner about that job. But it worked. It worked so well that the Southern Railway paid two thirds of the cost. It worked so well that the Admiralty became actively interested.

Trials Are Convincing

Extensive trials with the naval sloop *Bittern* convinced the Admiralty that they were on a good thing. By 1939 Brown's was told to stop advertising the stabilizer. There was a war in the offing, and it stands to reason that if you can stabilize a ship so that cups don't break and passengers stay upright, you also have a ship which provides a steadier gun platform.

The *Bittern's* anti-aircraft fire, in the Norwegian campaign of May 1940, was so effective that it led to her doom. The Germans concentrated their attack on the sloop and set her on fire.

The gyroscope is the brain of the controlling gear. The spinning wheel indicates the immediate movement of the ship in a roll, and as soon as it shows a lean one way it breaks an electrical contact which moves the fins into the required position. When the ship rolls the other way the gyroscope breaks another contact and reverses the position of the fins.

The continuous control unit now used is based on two gyroscopes: one vertical, with the spinning wheel standing upright, which measures the departure of the deck line of the ship from a flat level, the other horizontal, which measures the rolling velocity of the ship. By a delicate system of electrical transmission these two motions are added together algebraically and the sum is passed on to an oil motor which copies the motion with increased power, eventually operating the valve of the fin-tilting gear so that the angle of the fins corresponds exactly to the gyroscopic signal at every second. Both gyroscopes used in the *Chusan* weigh only 375 pounds, in contrast with the enormous wheels of the old gyrostabilizer, which weighed 250 tons.

Now the big shipping lines are after the stabilizer. The P. & O. directors have decided to make it standard equipment in their fleet which runs between Britain and the Far East. The Orient line, which operates between Britain and Australia, is also ordering the Denny-Brown for some of its finest ships. The Cunard-White Star has ordered a stabilizer for its 13,345-ton transatlantic liner *Media*. On their experience with that ship, this line presumably will decide whether to go ahead and fit the device to the *Queens*.

When great ships meet a heavy Atlantic sea there can be real trouble. In February 1950 the *Queen Mary* developed a roll of 30 degrees. Sleepers were flung out of their berths; tables, chairs and other furniture were overturned and flung loose, and thousands of pieces of crockery were broken. More than 50 persons were injured. The ship could steam only at 19 knots instead of her usual 29 and she was 25 hours late on the crossing. Less than a month later 15 passengers were hurt when the *Queen Mary* again rolled in a heavy sea.

Nothing may be said yet about naval plans, but it is obvious that if the stabilizer can turn a small ship into a steady gun platform—as it did with the *Bittern*—it can make an aircraft carrier almost as safe as a landing ground.

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AERONAUTICS

Refuel Jet Fighter in Air

➤ WITH THUNDERJET fighting planes now rolling off production lines fully equipped with accessories needed so that they can be refueled in the air from flying tankers, the jet aircraft becomes a more efficient war weapon.

The plane so equipped can remain in active combat a larger percentage of the time because it does not have to travel to a distant airport and land for fuel. Tanker planes can circle about in the air in safe zones relatively near the fighting area. Only a few moments are required to load the jet fighter with a full supply of fuel with the modern equipment now used.

Other planes in addition to the Thunderjets are also being equipped for refueling in the air. The Thunderjet, a product of Republic Aviation Corporation, Farmingdale, N. Y., is one of the principal types in active service in the Korean area. It is in the 600-mile-an-hour class. The new version of the plane, in which the refueling equipment is standard, has other improvements that give it longer range, faster climb and provide for easier maintenance.

The refueling of planes in the air is not something entirely new. The American stunt planes that stayed in the air for many days, hoping to achieve records, were refueled in flight but the systems employed were crude. Following World War II, British interests tackled the problem seriously and developed equipment which they expected could be successfully used to refuel long-distance transports on overseas trips. About the same time, the U. S. Air Force started experimental work in air refueling, using both British and American equipment.

In the refueling process, the tanker plane flies above and a little to the front of the craft to receive the fuel. The tanker is equipped with what is called a flying boom. This rigid feeder pipe, which can be lengthened and shortened by telescopic action, can also be moved to the right or the left by the use of V-shaped surfaces known as ruddevators. It is operated by a crewman in the tanker. When its nozzle is inserted in the socket of the receiving plane, fuel is passed through under considerable pressure, greatly lessening contact time.

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