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.

This article was prepared for SCIENCE NEWS LETTER in cooperation with the READER'S DIGEST. It will appear shortly in that magazine.

Science News Letter, August 4, 1951

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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