

Route of IFF signals from ground station to plane and back to Identifying indicator.

## I. F. F.

### IDENTIFICATION, FRIEND OR FOE

THE device known as IFF (Identification, Friend or Foe) in military circles has been surrounded by such great secrecy that it has not yet been given a name more appropriate for peacetime purposes. The necessity for such a device was determined as soon as radar was adopted for military uses because all types of airplanes give exactly the same response to the radar beam. While radar served to warn of the approach of enemy aircraft when it was known definitely that none of our planes were in the air, it lost its effectiveness in areas where there was continuing air activity by both sides in warfare.

Early in the war, the British devised several means of identifying aircraft by modifying the type of reflection of the radar impulse. Although none of these systems was completely satisfactory, the experimental work indicated the elements which were necessary. These experiments also showed the necessity of a standard system to be used by all the Allied nations.

American work on the device—co-ordinated with that of other United Nations and working to common specifications—was handled by the Belmont Radio Corporation, with the assistance of engineers from Wells-Gardner Co. and Admiral Corp. After six months of intensive endeavor, an IFF system was perfected which gives positive identification and is now used with all radar equipment by the armed forces. IFF is essentially a form of radar, but it also requires a separate ground unit with a directional antenna, as well as a special receiver and transmitter in the airplane.

Here is how the IFF system works:

The radar picks up an approaching plane and indicates its position and range. From this information, the directional antenna on the IFF ground unit is adjusted to point directly to that position. Secondly, the range circuit is adjusted so that the response, in the event it is a friendly flyer, will come

only from the plane previously detected by the radar.

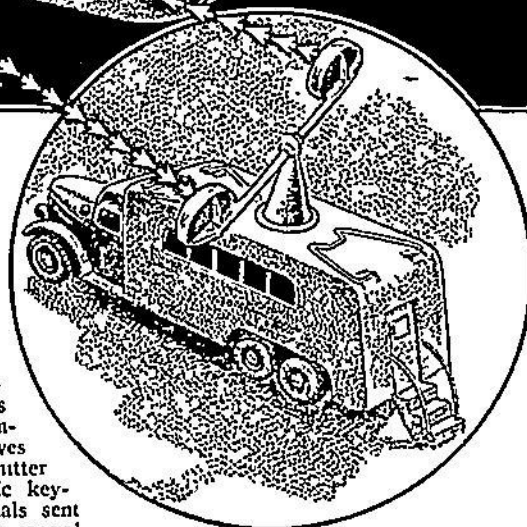
Then the IFF ground unit sends out a pulse of radio frequency energy. If the plane is friendly, it is equipped with a receiver for this impulse. This receiver, when it receives radar signals, sets an FM transmitter which also contains an automatic keying circuit, into action. The signals sent out by the plane are picked up by a special receiver which forms part of the radar equipment and after detection are applied to the vertical deflecting plates of the cathode-ray tube indicator, setting up the special traces below those caused by echoes from the aircraft.

From the nature of the code signal received, the IFF ground unit operator can immediately determine whether the plane under observation is friend or foe.

By means of the IFF, the image which appears on the fluorescent radar screen is not the same when it comes from an enemy plane as when it is caused by a friend. In the former case, the reflected waves produce a line above the horizontal sweep line. But when a friendly plane finds itself in the beam sent out by the radar transmitter, there is in addition to the upright vertical line, another vertical line below the sweep base. This second "pip" is intermittent, modulated in the form of Morse signals. These vary daily according to a pre-established code.

The equipment in the airplane is turned on when the ship leaves the ground and its operation is completely automatic. *No attention from the pilot is required.*

IFF was adopted for a new and important use at the time of the Normandy invasion. The ground units were planted at points inland by Allied secret service agents and the electronic beams served to guide planes and gliders so that paratroopers could be dropped at the most strategic points. Never before in warfare



had parachute troops and gliders been landed so accurately and the means by which it was done remained a mystery to the enemy.

IFF devices were among the topmost secret apparatus of the war; according to some sources being so secret as to prevent full realization of their value. Each of them was said to have been so booby-trapped that any attempt of the enemy to open a captured one would result in an explosion which would—at the least—destroy the apparatus beyond possibility of discovering its purpose.

According to experts in the field of electronics, IFF equipment has a definite application to peacetime aviation. Any plane carrying a small IFF unit can be located almost instantly by its home airport or the airport to which it is flying. If a pilot flew off his course, he could, using regular radio communication, ask the nearest airport to determine his exact location by stating his IFF code. In this case, the IFF operator at the airport would search with his antenna until he received a signal with this code and, from readings on position and range, could advise the pilot of his exact location.

The advantage of IFF is that it does not have the defects of the radio compass because it operates on higher frequencies. At the present time the radio compass is not infrequently affected by climatic conditions which render it subject to considerable error.