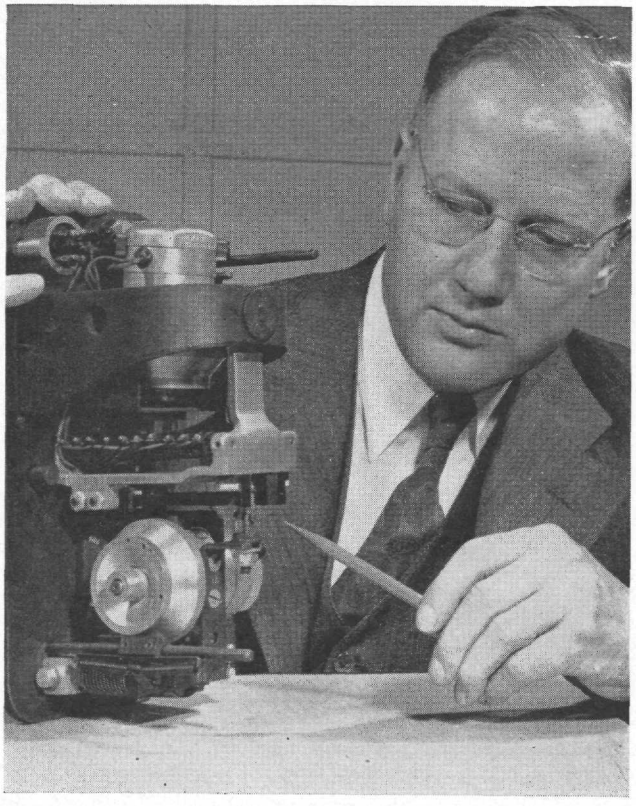
Stabilized Guns for Yanks' Tanks

By WILL SUMMERS, E. E. III

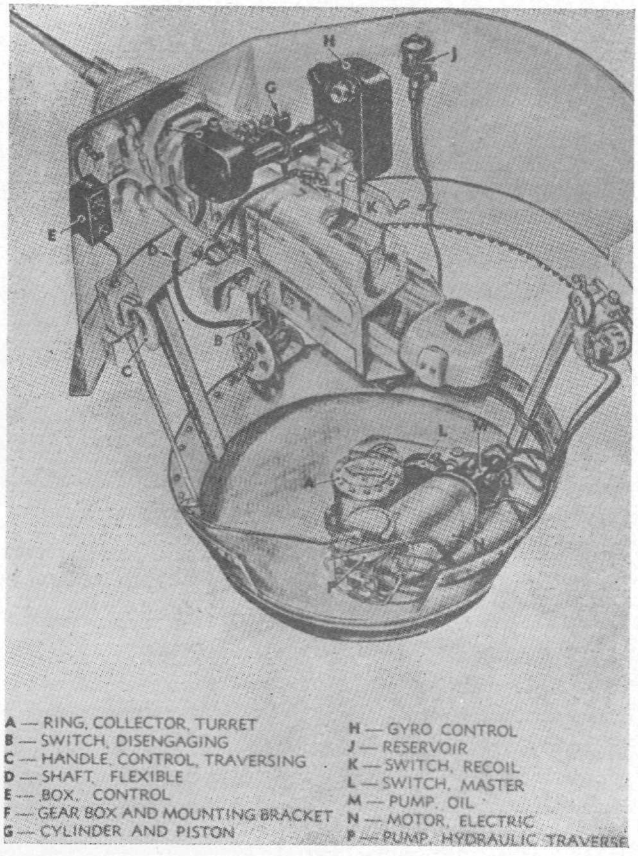
A short time before we entered the war, the Ordnance Department requested research engineers to develop a method for stabilizing the guns in tanks so that they could fire while moving over moderately rough terrain without losing their accuracy. Of course, the rolling and pitching of the tank was the reason why experienced gunners could average only about one percent hits while moving. The small arms in the tank were not so much affected or so important, but the weight and power of the cannon made it imperative for it to be able to fire accurately while moving. This fact alone gave our forces a great offensive advantage.

The Ordnance Department had requested that the gun error should be reduced to $\pm 1/3°$ for tank disturbances of $\pm 2\frac{1}{2}°$ at $1\frac{1}{2}$ cycles per second. However, the stabilizer reduced the error to about one third of that allowed. As finally developed, the stabilized gun had an error of less than $\pm 1/3°$ for tank disturbances of $\pm 2\frac{1}{2}°$ at $1\frac{1}{2}$ cycles per second. Thus, for tank speeds of 15 miles an hour, over moderately rough terrain, a gunner could make better than 70 percent hits at ranges from 300 to 1200 yards.



—*Courtesy Westinghouse.*

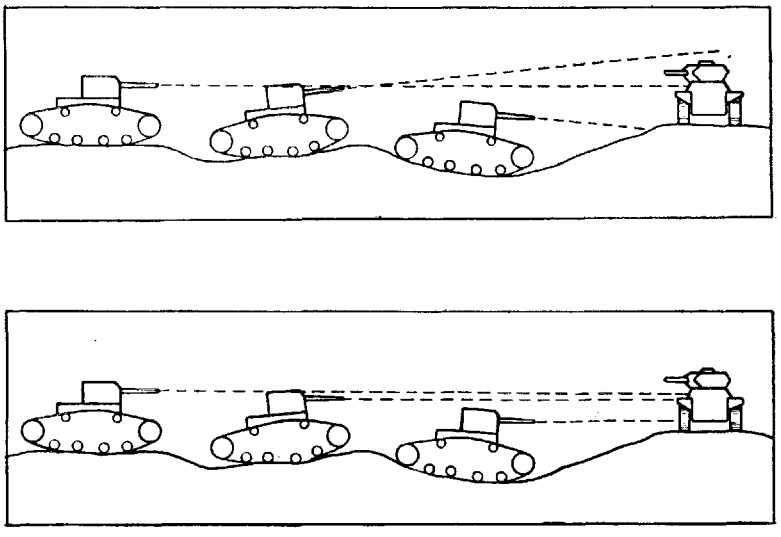
The inventor, Clinton R. Hanna, points to an early model of the stabilizer having two gyroscopes. The Westinghouse engineer later developed an improved stabilizer utilizing only one gyro, called the "anticipating gyro," because it corrects for movement before it can take place.



—*Courtesy Westinghouse.*

Gyro Stabilizer Installation—Placement of parts is shown in this drawing of a gyro stabilizer installation in a tank.

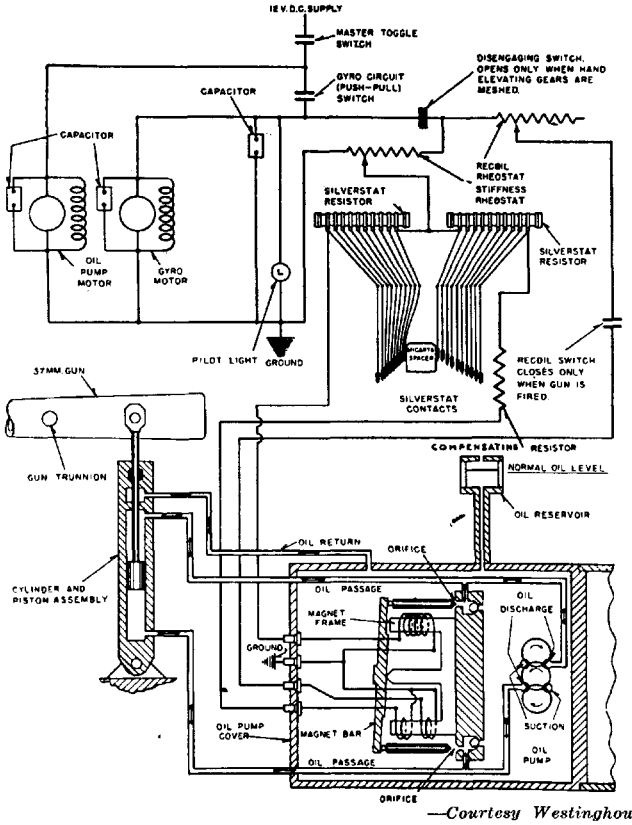
The stabilizer consists of four main parts. First is the gyroscopic control, which furnishes the vertical reference for the gun. Second in order is the silverstat regulator which changes the electrical current flowing through it according to the precession of the gyro. Third is the oil pump and pressure system with its electro-magnetic valves. And last, is the piston and cylinder on the gun. It is compact, since the parts are not



—*Courtesy Westinghouse.*

(above)—What gyro stabilizer does—this shows why tank guns need the gyro stabilizers. The upper sketch demonstrates how an "un-stabilized" tank misses its target when going downgrade and upgrade, while in the lower sketch a tank with a stabilizer hits the bull's eye under all conditions. The stabilizers cost less than $1,000 each.

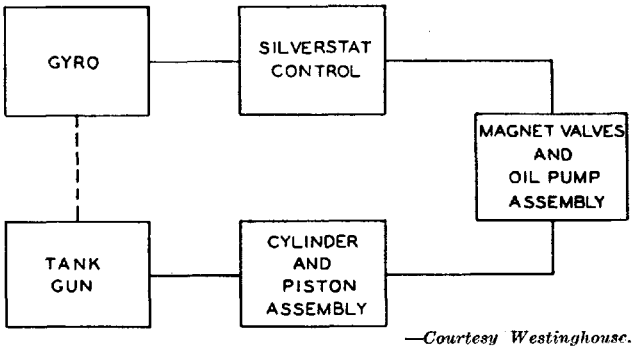
(below)—Mono Gyro Cycle of Operation—The gyro motor is operated from the tank storage battery and runs at approximately 14,000 RPM. Successful operation depends on the accuracy of balance obtained in the gyro.



—*Courtesy Westinghouse.*

bulky, and can be mounted out of the way, which is a necessity in such small quarters.

The gyro mechanism is driven from the direct current system of the tank. It rotates at speeds ranging from 12,500 to 16,000 r.p.m. The flywheel is dynamically balanced and mounted on frictionless bearings. Attached to this gyro mechanism is a Micarta spacer, which, according to the motion of the tank, operates the silverstat regulator. This consists of phosphor bronze leaves across which are shunted fixed resistances. At the free ends of the leaves are silver contacts, which touch when the motion of the tank is enough with respect to the gyro to cause any considerable error. When the resistances are all or partially shorted, the current flowing in them is changed. This change of current in turn operates the electro-magnetic valves, which apply pressure above or below the piston. Thus the piston changes the position of the gun to oppose the original change.



—*Courtesy Westinghouse.*

(above)—Block diagram of stabilizer—The gyro control is mounted on the gun breech. Tank fluctuations over rough terrain cause the gyro to precess, contacting silverstat leaves and changing current flow to magnet valves. The position of the valves in seats is determined by current energizing the magnet coils. As one valve moves away from the seat, the other moves farther into its seat.

The gyro has an hydraulic dampener which eliminates any over-swing or hunting. Thus the system in itself is stable. When the gun is fired, an auxiliary switch closes to overcome breach heaviness due to recoil.

Since the system is relatively simple, it is easily adaptable to mass production and requires small amounts of critical materials. The cost per unit is less than $1,000. A rate of production has been established so that all our tanks are equipped, and units have been sent to Russia and England.

The inventor of this device is Clinton R. Hanna, research engineer for Westinghouse Electric and Manufacturing Company. Mr. Hanna, who is 44

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years old, received the Presidental Citation in 1942 for his work on the first of these devices. However, since then many improvements and refinements have been made.

Even though this gun stabilizer is a war-time invention, it has great post-war possibilities. It is estimated that about three horsepower will stabilize a railroad coach or an automobile. Thus it may be possible to ride at higher speeds than believed possible without all the jolts and bounces as before.
