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Parkinson's gun director

A dream come true

One of the better-known theories of Swiss psychologist Carl Gustav Jung is that the solution to a difficult problem can somehow suddenly crystallize in the unconscious mind.

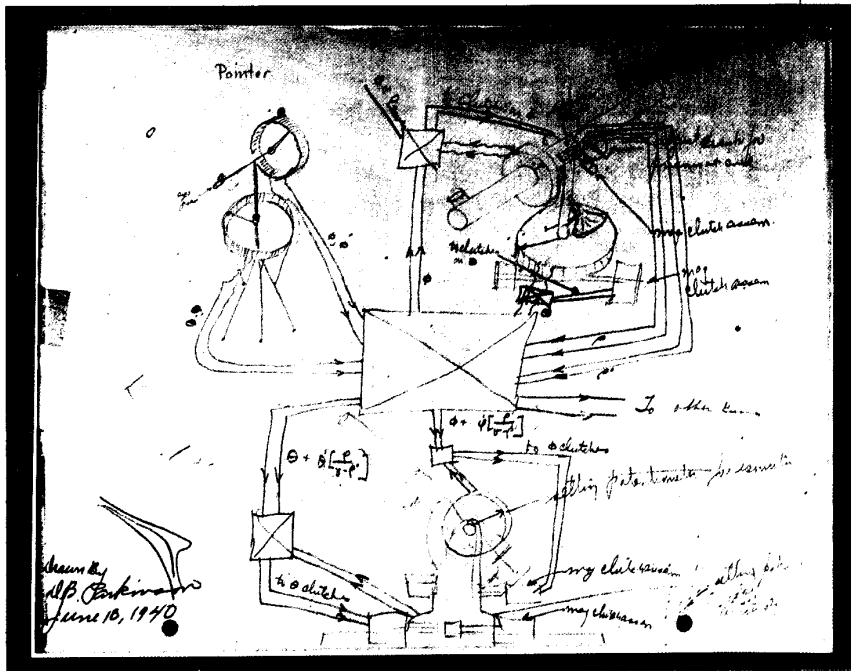
Perhaps the most portentous such revelation was dreamed by an engineer. His nocturnal insight led to one of the most effective pieces of air-defense technology in World War II, and to Presidential Medals for Merit and several patents for him, his boss, and other co-workers.

The engineer was David B. Parkinson; the place was Bell Telephone Laboratories in New York City; and the time was spring, 1940. Parkinson was then a 29-year-old member of the technical staff who specialized in electromechanical design. He was intent on improving an instrument called an automatic level recorder, which used strip-chart paper to plot the logarithm of an applied, rapidly varying voltage. A critical component was a small potentiometer, which controlled a pair of magnetic clutches that in turn controlled the pen.

Meanwhile, the evacuation of hundreds of thousands of stranded British and French soldiers from the beaches of Dunkirk, France, across the Channel into England, was the top story in the U.S. press. Parkinson was greatly concerned by the news, and his dual preoccupations seem to have precipitated a dream, which he later described in an unpublished memoir:

"I found myself in a gun pit or revetment with an anti-aircraft gun crew. . . [A] gun there. . . was firing occasionally, and the impressive thing was that every shot brought down an airplane! After three or four shots one of the men in the crew smiled at me and beckoned me to come closer to the gun. When I drew near he pointed to the exposed end of the left trunnion. Mounted there was the control potentiometer of my level recorder!"

Glenn Zorpette Associate Editor



The next morning, he realized the significance of the dream—that “if my potentiometer could control the pen on the recorder, something similar could, with suitable engineering, control an anti-aircraft gun,” Parkinson said recently in a telephone interview from his home in Cleveland Heights, Ohio. At the time, such guns were controlled by complex mechanical systems, which were not very accurate and could not be mass-produced.

At work that morning, Parkinson discussed his idea with his boss, Clarence A. Lovell, one of the early developers of the operational amplifier. They worked for several days and evenings, writing a report explaining how op amps could be used to integrate, differentiate, and manipulate tabular data. Indeed, of the various patents that were later awarded to Lovell, Parkinson, and other Bell Labs engineers on the project, many were related to the use of op amps to perform arithmetic operations.

After the report was written, Lovell and Parkinson met with Lovell's boss, Edward C. Wente. Parkinson realized that in meeting with Wente, he would need a diagram to explain his ideas. So just before they met, on June 18, he made a quick sketch on a sheet of plain white typing paper [see photograph].

A proposal for exploratory work on an electromechanical system for directing anti-aircraft guns was submitted to and approved by the Army Signal Corps, and an

engineering model was delivered for testing to the Army at Fort Monroe, Md., on Dec. 1, 1941.

Production models began rolling off the assembly lines at Western Electric Co. in Chicago early in 1943, and eventually more than 3000 of the gun directors, designated the M-9, were built.

Inputs to the director—azimuth, elevation, and slant range to the target aircraft—were provided at first by an optical rangefinder and later by radar. The director aimed the gun by taking the data for the aircraft's present position and continuously calculating the future position of the target.

Simple arithmetic, differentiation, and integration were performed in the M-9 by 28 of Lovell's operational amplifiers. The output of the op amps went to three 50-centimeter-diameter cast-iron potentiometers, the output voltage of which in turn drove the gun controls.

With the older, mechanical directors, many thousands of shells were fired to bring down a single aircraft; the M-9 brought the number down to about 100 shells per hit on an aircraft, and about 200 for a hit on the smaller V-1 rockets.

After the war, Parkinson enjoyed a brief period of celebrity when stories of his dream appeared in various publications. And today, hanging in a frame over the mantel of his living room at home, is the drawing he did that morning in June, 1940.