"Thinking Machine" Aims Guns

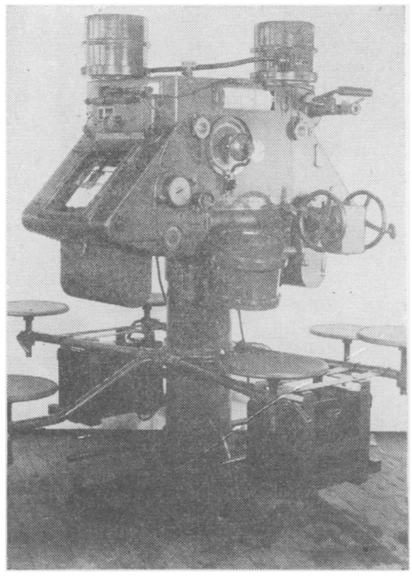
Aviation—Ordnance

By Frank Thone

Robots are the order of the day. Every week or so we read about some new ingenious automatic mechanism, built to do anything from dancing on the vaudeville stage to operating the machinery of a million-kilowatt power station. Some of them, of course, are mere stunt performers, but the majority are hard-working robots, doing an honest day's work in return for their lodging and the ration of electric "juice" that is their only food. Many complicated jobs have been turned over to these machines that can almost think, or that at least have had all their thinking done for them in advance by the engineers and inventors, and their conduct determined for all time by lines graven in tablets of brass.

The art of war now has its robots no less than the activities of peace. Engineers and inventors in the service of the ordnance department of the U. S. Army have evolved many devices that take over a lot of the pencil and paper work that would have to be done in a hurry under fire should war ever come to us again. Having no judgment of their own, these military robots never make mistakes—are never off by a fatal misplacement of a decimal point. And often they can solve in seconds a problem that would take a man "good at figures" many trying minutes, thereby enabling troops to move, or a battery to open fire, when those few minutes mean all the difference between success and disaster.

Perhaps the most amazing "thinking machine" that has yet made its appearance in Army circles is the new fire-direction instrument for anti-aircraft artillery. This device, manned by a few trained operators, can turn its telescopic eyes on a distant airplane and within thirty seconds automatically train on it a battery of high-angle guns, that will harry it with a hurricane of steel and TNT hurled accurately upwards at the rate of a ton a minute. The cannoneers serving their pieces may be half a mile from the eyes that aim the guns for them. They need not even see their target or know what it is; they may be hidden in the deep woods or blanketed under fog or a smoke screen. All they need do is hold the noses of their shells in the fuse-setters for a moment, then slam them into the guns and pull the lanyards. And miles away, and thousands of feet up in the air, some bombing plane, against which they are defending a city or a dockyard or a canal, is going to be in difficulties. It is not well to let an Army robot get too good a look at you.



THE THINKING MACHINE that automatically directs the fire of any number of guns

Like most highly successful things, this new fire-control instrument has been given credit for more than it can actually perform. One legend that gained considerable circulation was that it automatically picked up the sound of an approaching plane, trained the guns on it, and opened fire, all without the touch of a human hand. That is a little too much of a good thing; although one Army officer has prophesied that eventually it will be possible to train a similar instrument on the plane by sound instead of by sight, thereby eliminating the necessity for cumbersome and conspicuous searchlights at night. But even if this comes to pass at all, it is still in the future; and even then the instrument would still require human operators.

The sober facts about the new fire-direction instrument are these: The machine has two telescopic objectives. Both of these are kept trained on the target by operators, one following horizontal movement and the other all changes in vertical position. These two components are combined by means of suitable gears within the instrument, to give a definite direction setting, which can be transmitted to the guns. Other operators, manipulating control dials, feed into the machine other necessary data, such as the range and altitude of the target, the allowances needed for wind and barometric pressure, etc. Corrections for these factors are automatically made.

The setting arrived at by the instrument is transmitted to the gun position by electric cable. Here a synchronous motor mounted on each gun translates the instrumental data into movements of the gun carriage, keeping the muzzle of the piece trained always on the target, with just enough "lead" so that when it is fired the shell will arrive and burst at a designated spot at exactly the same second that the enemy plane arrives there. And since the danger zone around a bursting three-inch shell is about fifty yards in diameter the arrival of fifty or sixty of these messengers in about a quarter of a minute is apt to be somewhat embarrassing for the visiting bomber, to say the least. The command of one fire-direction instrument may, if desired, be extended over several batteries instead of only one.

At the option of the battery commander, this automatic direction of the guns can be cut out, and the pieces handled in the old way, either following the pointer on a dial automatically controlled from the fire-direction instrument, or receiving the data from the range-finding station by telephone. Such a reversion to earlier methods, however, would probably be resorted to only in emergency.

For night defense against bombing raids, sound-locating instruments and searchlights have to be brought into play, before the fire-direction instrument can begin its work. It is probably some confused notion about the function of the sound-locating instrument that has given rise to the legend about the ability of the new fire-direction instrument to shoot "by ear." The sound-locator, which looks like a group of four huge loud-speaker horns, searches the suspected sky at night, and gets the approximate location of the approaching plane. (*Turn to next page*)

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Then the searchlights, to which elevation and azimuth have been electrically transmitted, whip out into the darkness and presently hold the plane in their unrelenting tentacles. It is notoriously hard for a bombing plane to escape from the beam of a searchlight. Once made visible, the plane is picked up by the telescopes of the fire-direction instrument, and in thirty seconds the guns begin to bark. But day or night, the target must be seen before it can be fired upon; the automatic finding and shooting by sound only is still a myth.

The guns that obey the commands that the Army robot sends out along his electric nerve trunks are a far cry from the crude "archies" of world war days. These first anti-aircraft guns were for the most part merely adapted field pieces—French 75's and similar guns cocked up at a high angle on more or less improvised mounts. These could not hold the guns steady under their own recoil, so that each piece had to be laid anew after each shot. The breech-blocks, moreover, were designed for more or less horizontal positions, and made loading at a high angle awkward and slow.

In the new guns all this has been changed. The mounts are rock-steady, so that shell after shell can be put into exactly the same spot even at long range. The breech-locks are designed with an eye especially to loading at any angle up to the vertical; they are also semi-automatic, snapping shut of themselves as the base of the cartridge enters the breech.

An especially efficient mount for mobile anti-aircraft guns has only lately been added to the armory of the newer "archie." The old mounts, on rubber-tired trucks or trailers, had too small a base to be at all steady. The new mount consists of four long, spider-leg girders that spraddle out flat on the ground, with the gun platform at the point where they come together. On this arrangement the guns can sit even on soft soil, and blaze away all day, as accurately as if they were on concrete bases. The legs have hinged joints in them, so that the mount can be folded up compactly, lifted on its wheeled road carriage, and be "ready to roll" in a few minutes. The fire-direction instrument rides on its separate carriage, and a truck-mounted power plant supplies the necessary current for the operation of the battery.

The guns for which these mounts have been designed are also great improvements over the war-time anti-aircraft ordnance. They are a great deal longer in proportion to their caliber; this makes for longer range and higher velocity. The ordnance department designers have also devised a new method by which a gun can have its liner, or inner tube, changed in the field. The liner is the part of a gun that gets the heaviest punishment, especially in pieces that are fired with the rapidity demanded in anti-aircraft work, and the necessity of sending the whole gun back to the arsenal periodically for relining has been one of the big troubles of the "archies". Now the job can be done in an hour in the field that used to require several weeks on the crowded arsenal floor.

The standard gun that has been adopted for both field and fortification work is a three-inch piece, throwing a 15-pound shell to a height of 10,000 yards, with an extreme horizontal range of 15,000 yards. A rate of fire of about 30 shots per minute per gun has been attained with this weapon. This means that a battery of four can hurl at a plane nearly a ton of steel and high explosives in a burst of fire lasting one minute.

The three-inch anti-aircraft cannon has a formidable big brother in the new 105-millimeter, or 4.1-inch, high-angle rifle, a very long-barreled, powerful weapon, that can throw its 33-pound projectile to a height of 12,000 yards and an extreme range of 19,000 yards, or over ten miles. It is a slower speaking piece than the three-inch, firing only 15 times a minute, but the greater weight and range of the projectile, together with the larger danger zone created by its explosion, more than even up the score.

FOUR 50-CALIBER MACHINE GUNS on one mount, can fire 30 shots a second

Because of the great length and considerable weight of the fixed ammunition for this gun, the operations of loading and of ejecting the empty cartridge case after firing have been made almost entirely automatic. The long cartridge, weighing 45 pounds, is laid in a tray extending backward from the breech, and a pneumatic rammer shoves it home. As it clears the breech-lock, the projecting rim at its base trips a trigger, which allows the spring-pulled block to slide up into place and finish seating the cartridge. The gun is now ready to fire. When it is fired, the force of the recoil is utilized by means of an ingenious cam arrangement to open the breech and empty cartridge case, and also to return the pneumatic rammer to compression position, ready to load another charge into the chamber.

The ammunition used in these two guns represents a great advance over that used during the war. Then, because of the unreliability of time fuses, shrapnel was usually employed. This type of projectile fills the air with a shower of leaden pellets, shot-gun fashion, and is an excellent means of attack upon infantry or other scattered targets. But it isn't so good against a narrow target like an airplane, for it was practically necessary to score a hit on the aviator himself in order to bring down the plane.

Nowadays high-explosive shell is used, for post-war development in time fuses has made it possible to make sure of bursts within fifty yards of the target. At this distance the aviator is exposed not only to the flying splinters but the stunning concussion caused by the explosion, which may cause him to lose control of his plane for a few fatal seconds.

A third gun which has been developed for anti-aircraft work is perhaps the most vicious seeming of the whole family when it is seen in operation, though it is only a little one. This is the 37-millimeter rifle, an automatic. It fires shells weighing about one pound at the rate of a hundred per gun per minute. During night firing, when tracer ammunition is used, the trajectory can be seen drawn against the dark sky like a fiery dotted line.

The light shells of this gun differ from those of its larger brothers in that they are designed to burst on contact instead of by a time fuse. That is, a shell must actually hit a plane before it can (*Turn to next page*)

Calls Typhus American Disease

Pathology

North America has developed its own special brand of typhus fever, the Old World scourge that still takes terrific toll of life among the lower classes of Russia.

Dr. Kenneth F. Maxcy of the U. S. Public Health Service has found that a mild form of typhus fever is endemic, that is, occurs repeatedly from time to time, in certain states in the south, notably Georgia, Alabama, North Carolina, Virginia and Florida. In this region it appears to be identical with tarbardillo, the typhus that bobs up with uncomfortable frequency south of the Rio Grande and sometimes above it.

It differs from Old World typhus in that most of the cases occur in summer and fall instead of spring and winter, and in its relatively low mortality.

Contrary to expectation, native white Americans of respectable station have been the principal victims, while negroes remained almost unaffected. An occupational analysis showed that a large percentage of the cases were from among people engaged in handling foods, such as groceries, meats, produce and feed. This circumstance has led to the formulation of the theory that rats or mice act as reservoirs of the disease from which man is accidentally infected by bites of some bloodsucking parasite.

One of the tests that have been developed to help identify this disease, for many of the early cases were confused with other maladies, has recently been found to give a positive reaction for Rocky Mountain spotted fever, a disease of the typhus group, but immunologically distinct.

"'The typhus," said Dr. Moxcy, "which has been occurring in our eastern seaports does not depend upon direct importation from across the sea. It belongs to the North American Continent."

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explode. But when it does, the effect is ruinous. Half a wing, or the whole of the rudder apparatus simply vanishes. So much has been determined by trial on fabric targets, but what would happen should one of these little shells chance to hit a loaded bomb rack had better be left to the imagination.

In addition to these guns that attack with shell, the Army has turned its attention to the possibilities of machine guns. These should be especially useful against low-flying planes that "strafe" infantry and transport columns with machine-gun fire and light bombs. Some of the newer planes designed for this kind of fighting carry light armor about the cockpit, to protect the crew and vital machinery from ordinary fire. To answer this argument, the .50-caliber machine gun has been developed. It is the same in general construction as the .30-caliber Browning heavy machine gun, but it throws a massive cigar-shaped bullet, half an inch in diameter and weighing two ounces. The light plates an airplane is able to carry cannot deny entrance to such messengers as these. And in order to get a high concentration of fire, four of these pieces are placed on the same mount. With such a battery one gunner can direct a veritable hurricane of fire—thirty shots a second.

Both the 37-millimeter automatic and the multiple-mounted machine guns can be handled by means of the new five-direction instrument, to as great advantage as their larger relatives, the 3-inch and the 4.1-inch. In fact, the Army's robot may branch out and make itself useful to the field artillery as well as to the "archies". One problem that has not yet been solved by the field guns is the rapidly moving tank. They cannot follow it fast enough. But, say the anti-aircraft ordnance officers, if we can score hits on a bombing plane flying at 100 miles an hour and having three dimensions to shift around in, it would surely be a much simpler job to score a hit on a tank moving ten or twenty miles an hour, and for all practical purposes limited to movement in two dimensions. In case this fire-direction instrument, or some modification of it, does demonstrate an ability to find the troublesome tank, these new-born military dinosaurs are going to have a harder time of it than they had in the World War. For a direct hit with a 75 or 155-millimeter shell will put out of action the biggest tank going, and it would be impracticable to add armor thick enough to stop such projectiles. It will be a most curious development if a weapon designed for use against hawks should prove useful also against armadilloes.

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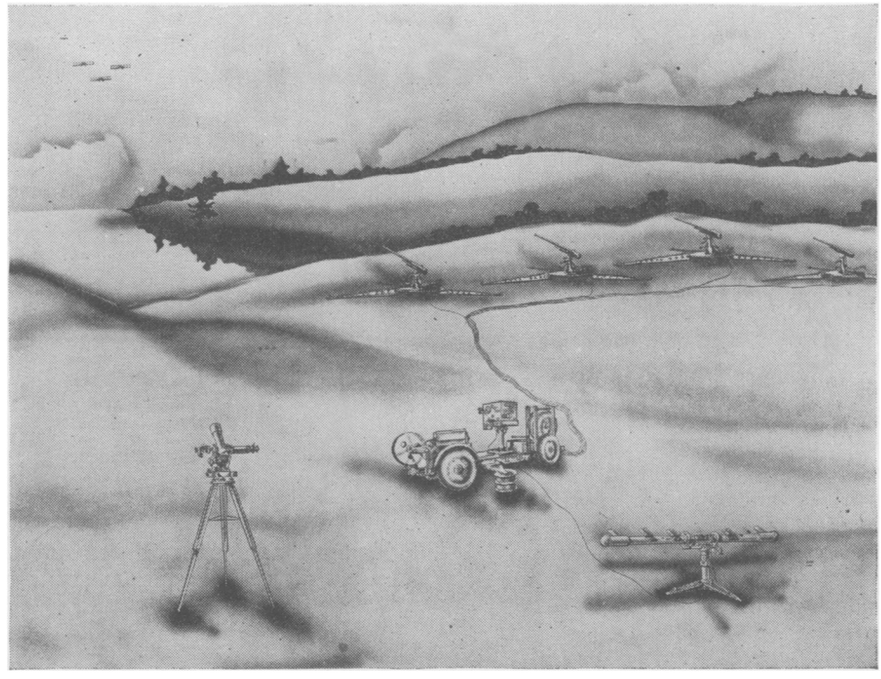

DIAGRAM OF THE NEW RECEPTION COMMITTEE for enemy aircraft. The "thinking machine" is on the trailer in the foreground