MILITARY SCIENCE

Powerful Little Guns

Uncle Sam Has Armed Himself With Powerful, Mobile Weapons Against Planes, Tanks and Enemy Artillery

By DR. FRANK THONE

SPECTACULARLY devastating as are the big guns—the 16-inch coast defense pieces and the 14-inch railway guns—the center of the stage in the military show just now is being held by the little guns.

There is a reason. The big fellows are terrific, but ponderous and slow. They have to stay far in the rear, and their job is to reach equally far into the enemy's rear, pounding his roads, supply depots, traffic centers generally; trying (if possible) to locate and smash in the very private and special dugouts where the Staff brass hats congregate.

But the little guns go forward with the troops that do the real fighting—up on the front line with the doughboys and machine-gunners, out on the flanks with the mechanized cavalry. They have personal knowledge of where the danger-spots and tough tactical problems are, and they bite directly at them, quickly and sharply.

Of three species are the little guns of the American army, each with its special job. One is designed to stop the charge of the tanks, one to make the air too hot to hold airplanes that come at low altitudes to drop strings of light bombs and to strafe with machine-guns, the third to drop small but effective doses of TNT into subborn machine-gun nests and other strong points on the ground. They are all of newest design, and only now are ready for quantity production to equip all of America's fighting forces.

Anti-Tank Weapon

The new anti-tank gun is the grown-up offspring of the 37-millimeter cannon, of first World War fame. Its barrel is nearly twice as long as that of its predecessor, and it uses a lot more powder to push its projectile. These two factors combine to give it a terrific velocity, even though the shell is double the weight of the World War missile—two pounds instead of one. (*See p. 332*)

This high velocity, combined with the greater weight, does two things: it makes the trajectory or line of flight so flat that any tank closer than 1000 yards is constantly in the "danger zone," and it gives the light projectile such a punch that it is certain to penetrate any ordinary tank's armor, to burst inside with wrecking, deadly effect.

Had the Polish army been able to muster a few hundred anti-tank guns like these, history might have taken a different course in the fatal month of September.

The anti-tank guns can not only shoot fast and hard, they can travel fast and hard as well. They are mounted on balloon tires, which permit them to be towed behind high-speed trucks at 50 miles an hour on any kind of half-way decent roads. The whole piece weighs less than half a ton, so that its crew of four or five men can grab it and hustle it across fields and through woods.

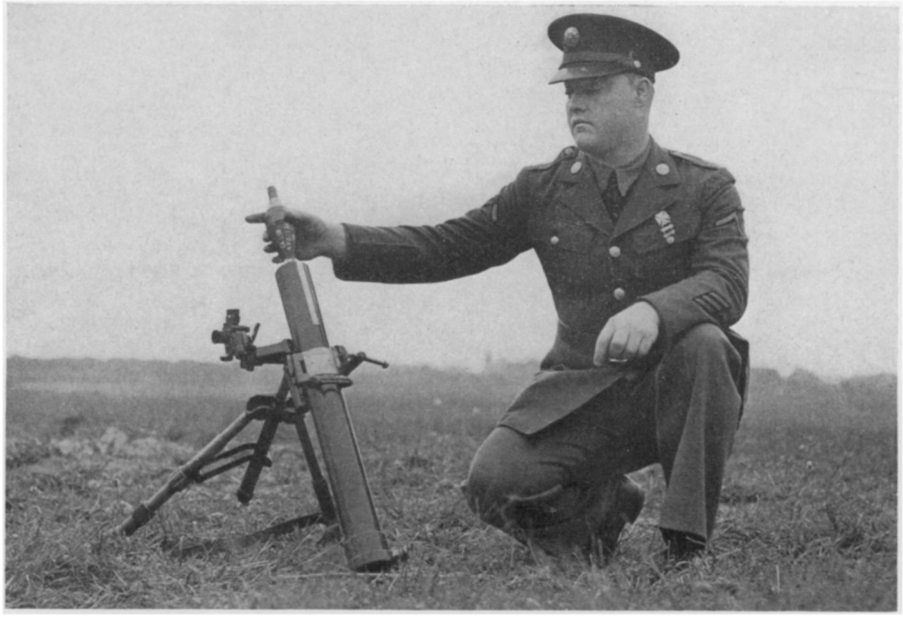
Mobile Anti-Aircraft Weapon

The second new little gun, the 37-millimeter automatic anti-aircraft weapon, also goes to work on a trailer, but it is a four-wheel trailer instead of just the two wheels of the gun itself. To give the gun greater steadiness in firing, the wheels are lifted clear of the ground when the gun is in position, and the base becomes a solid platform, very hard to shift or rock. The change from "march order" to firing position can be made in a few seconds by the well-drilled, quick-moving crew.

Fires 120 a Minute

Once it goes into action, the reason for this insistence on a solid firing platform becomes evident. The gun barks away like an over-size machine-gun, spitting its high-explosive projectiles into the air at the rate of 120 a minute. It can swing clear around in a complete circle, and it can change elevation from flat horizontal to fully vertical, banging away all the while.

Its shells have fuses so sensitive that they will explode the instant they hit the wing of an airplane, or punch through the thin metal skin of its fuselage. Even if a hit does not disable the pilot or wreck the engine, the damage to wing or tail structure is almost certain to bring the plane down out of control. If one of the shells should happen to hit a loaded bomb rack—the conse-



ONE-MAN WEAPON

Newest and handiest of the mortar family is this little 60-millimeter weapon. It can lob its 3.3-pound projectile a little over a mile, with really astonishing accuracy. Weighing less than 50 pounds, it can be carried by one man if necessary.

AIMED ABOVE

Low-flying planes, intent on bombing troops or supply trains, will get a waspish reception from the new 37-millimeter anti-aircraft gun. Its automatic fire spins 120 shells a minute into the air, each one so sensitively fused that it will burst on contact with wing or fuselage skin.

quences had better be left to the imagination.

Advance of all-metal airplane construction has made the destructive task of these small shells easier, rather than more difficult. When Army Ordnance men first began experimenting with shells of this type, fabric construction necessitated a fuse so sensitive that it would cause a burst if it hit a large raindrop. This made lots of trouble. But the use of more rugged material in planes permits the use of a more rugged fuse in the shells intended to destroy them.

Adoption of the new 37-millimeter automatic fills a troublesome gap in defense against aircraft. The Army has for some time had a satisfactory gun for use against high-flying heavy bombers. Machine-guns, even rifle fire perhaps, could do something against very low-flying "hedge-hoppers." But the attack plane, dropping light bombs from low-to-medium altitudes, still lacked an antidote. The new piece promises to take care of this job.

Mortar Used for Short Range

The two 37-millimeter pieces are, as we have seen, high-velocity jobs. Bark and bite are so nearly simultaneous that it simply isn't funny—to the enemy. The third little gun, however, is quite a different breed of cannon.

It is a mortar, a high-angle, smooth-bore weapon that points its muzzle skyward and lobs a slow-flying missile at the enemy at comparatively short range. Its caliber is 60 millimeters (not quite 2½ inches), and the extreme range to which it can heave its 3½-pound projectile is only a little over a mile—1900 yards, to be exact.

The job of a mortar is to go along with the first waves of attackers, and blast out stubborn concentrations of fire power too well entrenched to be reached with rifles and too far away to be within the very short range of hand grenades. This 60-millimeter piece can be used at distances as short as 75 yards, which is just beyond the throwing range of a stout grenadier.

Very Mobile

It is exceedingly light, and hence highly mobile. With all its accessories it weighs less than 50 pounds. One man can lug it alone, if need be; two men can pick it up and carry it along at a dead run. And it is so small and inconspicuous that it can hide in a ditch a couple of feet deep, or behind bushes a few feet high. It makes no smoke at all when it is fired, so that it is exceedingly hard to locate, even at a very short distance.

Unlike its ancestor of 1914-18, the three-inch Stokes mortar, this new weapon is really quite accurate. The Stokes mortar fired ordinary artillery shells by means of a small charge attached to the base. The projectiles tumbled end over end as they sailed through the air, like pieces of stovewood.

After the war, a French military engineer named Edgar Brandt improved the mortar projectile by streamlining it and giving it a set of tail-fins to steady its flight. The U. S. Army adopted his design for their standard infantry mortar, an 81-millimeter weapon, of which the new 60-millimeter mortar is a lightweight brother.

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BOTANY

Plants More Immortal Than "Everlasting Hills"

THE "everlasting hills" are mutable, evanescent; the grass which perisheth has in it the pattern of immortality. This paradox of living as against non-living is pointed out by Donald Culross Peattie in his new book, *Flowering Earth*.

Himalayas and Rockies are creatures of geologic yesterday, Mr. Peattie points out; the Appalachians are of respectable middle age. "But if you want to see really old mountains you must travel to the Laurentians of Canada. Look carefully—you will observe that there are no mountains there any more; just a stump, a boss on the continental shield. The stuff of them has found its grave under the seas. The grave of something that was never alive.

"But that which lives is less mortal. Plants there are today made after the image and the very mold of plants half a billion, and a billion years ago."

Non-living rock, hard and rigid, can only stand still while living things—lichens, mosses, bacteria—pluck at it, while rain and wind reduces it to dust, the author points out.

"But you can batter a seaweed on the reefs for twice ten million years, without changing its inner convictions. All that the surf has been able to accomplish in these eons is to knock the spores out of the slippery fronds—and so set them adrift to colonize some other reef."

In his book Mr. Peattie looks at plant life through a hundred windows—the Harvard laboratory where he first boiled chlorophyll out of a handful of ivy leaves, the mouth of a cave where men cowered in the chill of the Pleistocene, his own house in California where a small bird has woven an exquisite nest out of lichens and lined it with sycamore seed-down. Through its pages, plants from lowly alga to sophisticated orchid insinuate themselves into the reader's consciousness as they have long rooted themselves in his life—whether he has known it or not.

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NEMESIS FOR TANKS

The new 37-millimeter gun that hurls its two-pound armor-piercing shells with the speed and force of small thunderbolts. They break through the walls of their target and burst inside. (See page 330.)

PHYSIOLOGY

Vitamin A Therapy Aid In Matching of Colors

VITAMINS have received advertising promotion almost unequalled by any other science achievement, but here is a story not from a drug house or a doctor, but a factory. Vitamin A therapy, giving of carotene in oil, sharpened the color discrimination of inspectors of porcelain so that more than $5,000 a year was saved on assembly of ranges at Mansfield, Ohio. Fewer changes were necessary because of off-color parts after assembly, less customer complaint. Vitamin A regenerates the visual purple in the eye's retina vital to seeing.

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PHYSICS

To Heat and Air Condition House With Solar Energy

Experimental House Built By MIT Will Try Several Types of Heat Traps and Store Energy in Basement

TRAPPING the heat of the sun as it falls on the roof of a house and storing it in the basement for future use is to be attempted at the Massachusetts Institute of Technology soon, as part of a long-range program on the possibilities of using solar radiation as a direct source of energy.

An experimental house, which the scientists plan to heat during the winter, air condition during the summer and possibly even supply with power, all with the energy of sunlight, has already been constructed and the research is expected to begin at once.

One of the major features of the house is a large, well-insulated water storage tank which is to be used in ironing out the fluctuations in heat which are inevitable with a source as variable as the sun.

The heating system is based on a method of forcing air either over the hot surface of the tank or through the coils of a refrigeration system which is also to be run on energy stolen from the sun.

Prof. Hoyt C. Hottel, who is in charge of the program, plans to try several types of "heat traps," or energy collectors, during the research. First attention will be devoted to a shallow, box-like device which will be placed in a recess in the building's roof.

For a bottom this box has a thin sheet of metal, painted black to absorb as much of the sun's heat as possible. Firmly fixed to this bottom is a series of small, thin-walled metal tubes which are to be heated by contact with the sheet and which will then pass this heat on to water circulating through them.

This box has a series of glass covers, separated by dead air, through which nearly all the sunlight can pass but through which little heat can escape back to the outside. The sunlight is converted to heat as it strikes the metal sheet and the whole arrangement has a layer of mineral wool beneath it to prevent heat escape in that direction.

The warm water in the coils is then piped, through carefully insulated tubes, to the well-insulated storage tank where the engineers expect to keep it hot anywhere from a few weeks to six months, depending on the size of the tank.

Just what size units will be used has not been determined. A large sunlight trap, one big enough to heat the house directly, and thus needing but a small tank, may be used or they may try a small collector which would trap heat all summer with a huge tank capable of hoarding an entire winter's supply of heat.

The best size for these units, the most heat-absorbent paint, the most effective number of glass plates and the best angle at which to slope the roof are among the problems to be investigated. The experimental house, Prof. Hottel pointed out, is more a laboratory than a model dwelling, small but with a large wall surface in proportion to volume. This has been compensated for by extensive insulation.

Prof. Hottel also emphasized that he and his colleagues are well aware that the amount of solar heat in New England would make domestic heating by solar radiation uneconomical in comparison with other heat sources but there is sufficient sunshine in this region to test the efficiency of heating systems for those localities where the climate is less rigorous.