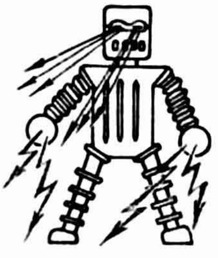
and fats from Ireland, the aid she received from the United States made it easier for her to increase the economic pressure she had been exerting on Eire since the outbreak of war.

Ireland's strength lies in her grim capacity to hold out under all external restrictions of her requirements without forfeiting any of her national vigor and unity; if necessary, the Irish are determined to get along with little bread and without coal or gas, without railways or motorcars. In May 1944 the dissolution of the Dail after a narrow defeat (by one vote) of the Government in a vote of confidence resulted in new elections. The question of neutrality was not an immediate issue in this election; but the successful defense of Eire's neutral status, which had just weathered another storm of USA and British pressure, could not fail to have some bearing, either favorable to the Government or otherwise, on the election. The clear majority of the Government party Fianna Fail (76 out of 138 seats) fully vindicated De Valera's policy and strengthened his position both internally and externally.

* * *

Ireland's struggle for freedom and sovereignty is more than a purely Irish affair. In view of Ireland's significance to the British Empire as well as to a considerable part of the population of the United States, this struggle is a factor affecting world politics.



A part of probability is that there are many improbable things.

Aristoteles.

ROBOTS

By G. PROBST

A recent newsreel from Germany which ran in Shanghai showed a crewless miniature tank in action: the "Goliath Robot Tank," which has been used at the front to destroy enemy obstacles. This recalls to our mind other robots:

"Robot bombs fly to England. . . ."

"Military value of German robot arms admitted by Allies. . . ."

One might be inclined to believe that robots are a modern war invention; but this is not the case, ancestors of these robots having done peaceful work centuries ago. In some parts of the former Austro-Hungarian monarchy, the serf labor that peasants had to do for their lords was called "robot service" (from the Slavic *rabota*, meaning work), and the peasants who were obliged to do this compulsory work were called "robot peasants." A special robot patent issued by Empress Maria Theresa in 1775 regulated the robot privileges, which remained an important constituent of feudal economics up to the nineteenth century. Gradually they were replaced by payment in money or goods, and the robot sank into oblivion. In the large encyclopedias published during the early years of this century, the word is not even to be found.

Technical progress and the movies have lifted the robot from obscurity and have used the word as a designation for fully automatic machines as well as for men employed at soulless, mechanical labor. Inventive advertising agencies have also applied the expression to household devices and cameras, although these are not typical robots. If we look up the word in a modern encyclopedia we find in the Oxford Dictionary of 1933: "Robot is a living being that acts automatically or a machine devised to function in place of a living agent." It goes on to quote Bernard Shaw's characteristic definition: "Robots are persons all of whose activities were imposed upon them and who were not allowed even the luxury of original sin."

Thus the word robot is often used in personified form. Its chief characteristics are mobile, mechanical activity, like a machine; automatic execution of the work entrusted to it, and absence of any free will of its own, like a slave; in short, an organic or mechanical automaton.

THE GOLEM

Men have dreamed for thousands of years of creating artificial human beings. The priests of ancient Egypt experimented with artificial gods with whom they wished to impress the credulous. The alchemists carried out experiments to produce "human substance" up to quite recent times, as witness the manufacture of the homunculus in a retort in Goethe's *Faust*

The Jewish legend of the fearsome Golem has been popularized by Meyrink's novel and by the movies. The origin of this legend was traced to ancient Hebrew tales; perhaps it goes back to old memories of the people of Israel from the time of their captivity in Egypt.

Jakob Grimm of fairy-tale fame described the Golem legend as follows. After prescribed prayers and days of fasting, the Jews fashion the body of a human being out of clay, and when they pronounce the magic formula "Schemhamphoras" over it, it must come to life. Although he cannot speak, he more or less understands what is said and what he is ordered to do. They call him Golem and use him as a servant to carry out all kinds of household work. But he grows every day and may easily become taller and stronger than anyone in the house, no matter how small he was to begin with. When this uncanny Golem grows too strong, he can be destroyed by saying the magic formula backwards; thereupon he collapses and becomes mere clay again. In some places, this legend is firmly rooted among the people; one can still hear it being told in the ghetto of Prague that the soulless clay figure of the Golem is lying in the locked attic of the synagogue.

MODERN ROBOTS IN HUMAN FORM

The present advanced state of technical science, tiny electric motors, and remote control by radio have made it possible to produce mobile robots in human form. They have been built for exhibition purposes and were shown for the first time in 1930 in Chicago and 1933 in London. A doll of human dimensions contained a wireless receiver which transmitted wireless commands to the limbs, which were moved by electric motors. As a result of the invisible remote control, a robot of this kind seemed to act quite on its own, getting up from a chair, bowing to a visitor, turning around, etc. The unsuspecting visitors to the exhibition, so we are told, were greatly impressed; but that was about all the robot could do. Later, it was sometimes used in department stores as a reception robot which opened the door for customers and greeted them with a polite bow.


The Golem

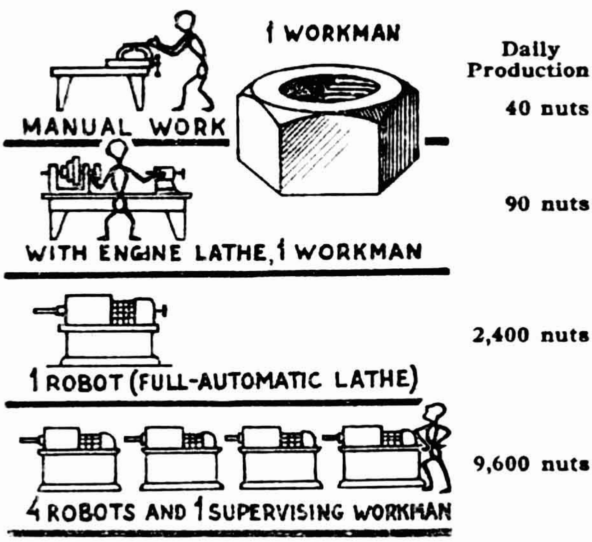
In Germany a similar robot was shown some ten years ago in a movie. The monster was four times life-size, the legs consisted of high porcelain insulators which carried a transformer shaped like a body. The movable arms ended in ballshaped hands which emitted crackling flashes of lightning. The head contained a sort of X-ray tube which sent out death rays through the eyes, these rays killing first the hero of the film and then the wicked inventor. Now the weird creature started off on his own rolling out of the laboratory and destroying the entire factory, finally putting a well-deserved end to himself and the film. The Hollywood version was "Frankenstein."

Such robots in human shape may be very nice on the stage and in horror stories; for all practical purposes, however, the imitation of the human form is futile. What, for instance, would be the advantage of an automatic elevator with press-button operation, if we were to take its "brains" out of the switchbox and put them into a doll dressed like a liftboy who would greet the passenger with a bow, close the lift door with a mechanical movement of the arm, take the lift to the desired floor after having received an acoustic command, stop at the correct level (with the help of the automatic microadjustment), and open the lift door to release the passenger with a bow? We would regard this simply as childish. The mechanical imitation of the human being will always remain a clumsy substitute; for we can hardly grasp the thousands of complicated organic functions of the organism, intelligence, will, or the spiritual forces of the heart and the soul, much less imitate them. The great Master who created these things does not permit us to encroach upon his province.

On the other hand, the robot's great advantage is the very fact that it possesses quite different characteristics from human ones, that it can go on working without becoming tired or irritated, that its speed of work and efficiency can be increased many times, and that it cannot advance beyond the position of a reliable servant with no will of his own. Let us look at a few examples of technical robots.

MANUFACTURING ROBOTS

The productive power of man is disconcertingly low: in continuous work he produces no more than about one tenth of a horsepower, and with his two hands he can at most use two tools simultaneously. If more is demanded of him, his efficiency sinks rapidly as a result of overwork. In order to increase human production in metal-working, for example, the tool is attached to a machine (machine tool), which is driven mechanically with more than human power and which, under the manual direction of the worker, produces more at a greater speed. This is the beginning of a robot, which can be given as many "hands" as you like, so that it can work with several tools—usually up to ten—simultaneously. If there is enough room in the machine it can also work on several pieces at the same time, and at as great a speed and with as much force as the material will stand. The number of tools working simultaneously is merely limited by the available space and the quantity of chips that have to be removed. There are, for instance, high-production robots which work simultaneously on six pieces of steel, each with six tools, i.e., altogether with 36 tools. The movement of the tools, the setting and ejecting of the pieces of steel, is guided automatically by cam discs, so that one workman can generally supervise four of such robots. The result is the same as if the workman were to handle four times 36,



that is, 144 tools simultaneously.

The efficiency of such robots can be shown by a simple comparison with work done purely by hand. Let us consider the manufacture of half-inch octagonal steel nuts from octagonal steel bars. A skilled workman can produce 40 nuts by hand in an eight-hour working day. If he makes use of a mechanically driven lathe he can increase his daily output to 90 nuts. But an automatic lathe for the manufacture of nuts produces 2,400 nuts in eight hours; the output of one workman supervising four such robots rises to 9,600 nuts a day, i.e., to 240 times his manual production.

THE ROBOT TANK

One of the most important weapons of attack in modern warfare is the tank. By means of caterpillar treads, it is able to move across the open field and to carry its well-armed crew, sitting behind the protection of thick armor plates, straight into the enemy's lines. In order to contain its crew as well as weapons, ammunition, propelling machinery, and fuel, the tank must be of sufficient dimensions and strongly armored. The larger a tank is, the greater is its weight, the stronger its motors. Such heavy tanks, weighing up to 80 tons, are liable to quick discovery and form an unmistakable target.

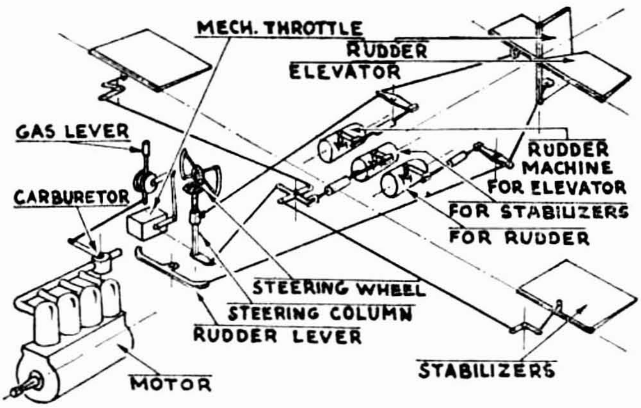
This is where the robot tank comes in. Having no crew, it can be built very small; the armor can be correspondingly lighter, the engines smaller. This mobile dwarf tank can approach the enemy less obviously and exploit the element of surprise. In wooded and hilly terrain, it is steered by remote control, in flat country by a combination of remote control and an automatic pilot. The latter is necessary in case the enemy attempts to hamper the wireless control by radio interference. The German robot tank, known among soldiers as the "Goliath," has been particularly successful in surprise attacks on enemy fortifications and tanks. Fearlessly and rapidly it carries a strong blasting charge right up to the enemy and explodes when it comes into contact with the target. With this suicide attack, the robot has fulfilled its call; it saves fuel for the return journey, and for its short heroic career its organs, its machinery, can be kept within small dimensions.

THE AUTOPILOT

Driving an automobile along a wet asphalt road undoubtedly requires considerable skill. How much more admiration does the pilot of a plane deserve: tossed around by storms and squalls in all three dimensions, in foggy weather or at night he cannot even look to the ground or the horizon for his orientation. To keep a plane on its course under such unfavorable conditions would, one might think, require all the knowledge and presence of mind of a specially trained, highly skilled pilot. But suprisingly enough this is not the case. In addition to his irreplaceable qualities and intelligence, the human pilot has some shortcomings: he becomes exhausted after long hours of blind flying, may feel nervous in squally weather at low altitudes or in mountainous regions, and make errors in reading the instruments indicating direction, altitude, and equilibrium, for all three of which the human pilot has no absolute sense. This has unfortunately been proved by the considerable number of fatal accidents which still occur in such difficult conditions, in spite of blind-flying instructions and the use of modern instruments.

Yet modern air services have to be maintained in all weathers over long-distance routes or to carry out war-time tasks. The skill and courage of our pilots confronted with these difficulties are eminently assisted by the employment of automatic instruments and equipment which exclude the human sources of fatigue, error, and nervousness. Since manual blind flying consists chiefly of a number of mechanical steering reactions guided by indications given by instruments, it was an obvious step to let the sensitive instruments do the steering themselves by means of a robot device. The human pilot is thereby freed as much as possible of all tiring manual control work and can concentrate on navigation and other aerotechnical or military tasks for the solution of which human intelligence and power of decision are required, qualities which cannot be supplied by a robot.

An airplane robot of that kind was developed some fifteen years ago under the name of "Siemens Autopilot" and introduced in the German air services in order to increase the safety of flying. The working principle of the autopilot is shown in the accompanying sketch. The rudder, elevator, and stabilizers are steered as usual from the pilot's cockpit, but at the



The Autopilot

same time they are attached by sprung rods to rudder machines which carry out the automatic steering. The rudder machine consists of an oil-pressure cylinder whose piston moves the steering rods. Attached to the cylinder are a damping gyroscope and a rotary magneto, which pass on the minute steering impulses from the separate steering instruments (remote-control compass, transverse pendulum, speed indicator, statoscope) to the rudder machine whenever the plane changes its direction. By these means the autopilot can be relied upon to keep the plane on the course and at the altitude set for it, automatically carrying out curved, gliding, and ascending flights, and stabilizing the plane against all external and internal disturbances. The robot is independent of the weather, the time and duration of the flight, and neither temperature nor altitude affects its working. Safely it guides the plane through darkness and fog, a faithful servant of the pilot.

ROBOT BOMBS

On June 15, 1944, the world was amazed by the unexpected employment of V-1, a new long-range weapon, by the German Army. The secret of construction of this epoch-making German invention—which the newspapers have called robot bomb, rocket bomb, or winged bomb—has, of course, not yet been divulged; however, German descriptions and neutral reports based on duds provide us with a more or less lucid idea of this weapon. There can be no doubt that the German inventive spirit has succeeded in advancing an important step forward, the consequences of which for long-range weapons and for aviation cannot yet be foreseen.

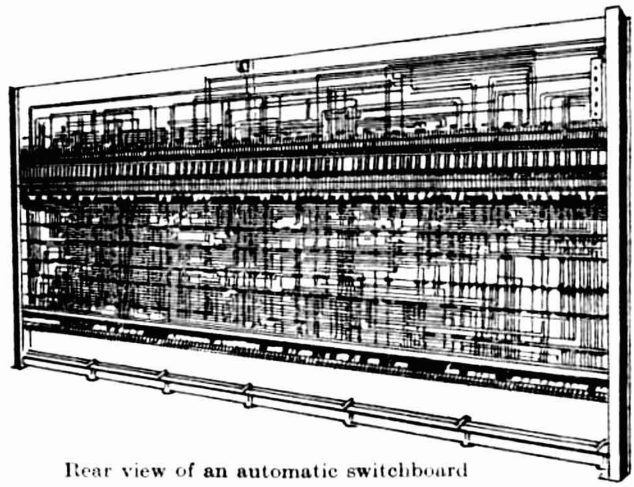
The robot bomb is a crewless, automatically steered miniature aircraft with rocket propulsion. In a Swiss description, the main dimensions are stated as being 7.2 meters for the length and 1.5 meters for the width of the fuselage, with a wing span of 5 meters. The fuselage contains the explosive charge and the robot apparatus, the latter apparently consisting of a fully automatic autopilot with three compressed-air machines for steering the rudder, elevator, and stabilizers. The rocket propulsion is contained in a special equipment above the tail: propulsion is effected by the combustion of gasoline with compressed air. Apparently the robot bomb is started from a catapult and is propelled by the rocket equipment (speed: 500 to 600 kilometers per hour) until a time switch set in advance cuts off the fuel and thus causes the bomb to descend. The charge is said to weigh about a ton: it explodes with particularly devastating force when it hits the ground.

Meanwhile, we have read that V-1 has already acquired a big brother, V-2, which hurtles with an even stronger explosive charge and at a higher speed toward the enemy target to devastate entire blocks of houses at a single blow. We were reminded every day by the German communiqués that these long-range projectiles were being employed without letup; in any kind of weather, day or night, the rocket bombs roared far into the enemy's rear positions, guided merely by a tiny robot which faithfully concludes its service with its own destruction.

ROBOTS IN THE ELECTRIC PLANT

We possess no sense that permits us directly to perceive electricity. We are only able to recognize it by its effects, for instance, when we burn our fingers on the heat it generates or when we get muscular cramps or even apoplexy upon current passing through our body. Fortunately, there are less harmful ways of testing an electric current: by volt- and amperemeters and other electrical measuring instruments. In the electrotechnical field we were compelled from the beginning to rely on machinery and instruments to produce, measure, distribute, and consume electricity, so that it is not surprising that in this field willing robots were designed at an early stage to relieve us of manual and mental labor. We can see huge machine halls, indeed, entire power stations with no attendance, no stokers, no oilers, no switchboard manipulators, no mechanics. Only now and again does an immaculately dressed supervisor look in "just for a visit." To him, of course, the hall does not look so desolate: on every switchboard, in every corner he recognizes the diligent little robots, some of them watching silently for years to pounce upon the fault they have been set to wait for, others buzzing or humming industriously in their continuous work of steering and regulating. Let us look a little more closely at one of these fully automatic robot power plants.

So far it has unfortunately not been possible simply to conduct the electricity contained in lightning and clouds into our lighting system, and we still have to produce electricity from coal or water power in complicated power plants. The rate of production is subject to constant fluctuations, for the consumption of power for light, heat, mechanical and chemical output rises and sinks according to the time of the day and the various seasons (not to mention the recent reduced allotments!). The burning of the coal, the water supply, the running of the machinery and other contrivances, these also require constant observation, regulation, and switching throughout the twenty-four hours of the day. Hence a manually served power plant needs a large staff of experts. Some are kept busy all the time, maintaining, for example, the tension of the generator at a constant voltage and taking care of the fluctuations in the load. Others, however, normally have very little to do, until an unexpected breakdown requires their immediate intervention.


Rear view of an automatic switchboard

It is here that robots were first introduced, since it would require almost superhuman effort to watch every second, hour after hour, week after week, month after month, for some possible trouble to appear in the machine, for instance, a breakage of insulation in the inner winding of the generator. To prevent serious damage, a defect of that kind must be noticed immediately and the machine switched off in a fraction of a second. How easily the robot "generator protector" carries out this task: for years it watches diligently whether everything is all right; and if after five years or more some trouble develops, it recognizes the trouble in less than a tenth of a second, switches off the machine in the prescribed time (usually half a second), switches on the CO_2 fire extinguisher, and quickly applies the brakes to the whole turboalternator. In the old days, when such a breakage occurred, you could stick your fist into the hole burned into the copper winding and laminations of the generator. Today the robot works so fast that it smothers the defect before it has really made itself felt; in the ensuing examination the flaw can only be detected with difficulty, consisting as it sometimes does of some hardly visible pinholes which can easily be repaired.

The defective machine must now be replaced quickly by another, which has to be excited to the correct tension, properly switched in parallel, and then take on load, in order to prevent a breakdown of the entire plant through the overloading of the other machines. Perhaps it is in the evening, during the lighting peak load, when a disturbance of that kind immediately makes itself felt in the entire network. The light begins to burn dimmer, the consumers complain (we assume that this happens in peace time, of course), telephones start ringing, and all this at the very moment when the man in charge of the switchboard and machinery has to concentrate all his attention and needs ten heads, twenty hands, and just as many legs to manipulate the countless steam and water pipes, oil valves, regulators, and switches in the proper order, to forget nothing, and to lose not a moment's time. It has been proved time and again, and it is hardly to be wondered at, that in such a situation mistakes are liable to occur resulting in serious damage to the machinery. This has smoothed the path for the introduction of semiautomatic or fully automatic robots in power plants. Remote stations, particularly those operated on water power, have been equipped to work entirely automatically, the proper functioning of the robot servants being supervised at a far-away central station by means of reporting instruments connected with the robots.

The accompanying illustration shows the rear view of a switchboard for the automatic running of a hydroelectric plant with a 16,000-horsepower turboalternator. The electric connections of the some 50 robots for various duties are comparable to the nerve fibers of the human brain. However, necessary repairs, replacements, and modernizations are more easily carried out in this robot brain than in the human one.

A TYPEWRITER ROBOT

We are all acquainted with the achievements of the modern typewriter industry, and we are no longer amazed at seeing special machines calculating and booking simultaneously or writing musical notes. But these instruments are more or less only auxiliary robots requiring the guiding hand of a master. Some offshoots of this group, however, have been developed into fully independent robots; for example, the teleprinting and telephoto apparatuses which receive short and long signals from a wire or even from the air and turn them into legible print, drawings, or photographs.

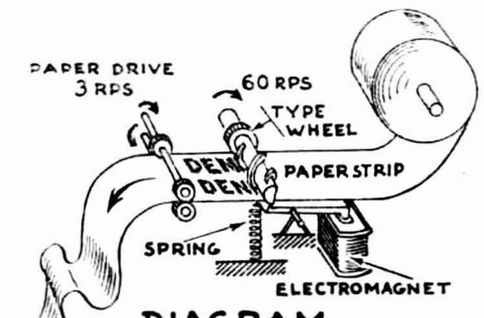


DIAGRAM OF TELEPRINTER

Anyone who has listened to short-wave radio has at one time or another been annoyed by wireless Morse signals, and we can readily believe that a skilled wireless operator is able to translate those dots and dashes into letters and words. But that an insignificant robot no bigger than a portable typewriter should be able to listen to long messages coming through the silent ether and write them down all by itself on paper does seem to us something of a miracle. Yet the principle embodied, for instance, in the Siemens-Hell teleprinter is simplicity itself. The letters used are block capitals, and each letter is composed of twelve short and long vertical strokes. The wireless signals for these strokes are sent out from a central station, say Berlin, like Morse signals, and they can be received with any radio receiver. If the signals, instead of being conducted into a loudspeaker—where they would only produce snorting dots and dashes—are conducted into a Siemens-Hell teleprinter, the following takes place. Whenever the receiver conducts an electric impulse to the electromagneto shown in the diagram, the latter attracts its armature and thereby presses a dull metal edge against the paper strip from below. Revolving exactly above it there is an inked spiral, so that every short attraction of the magneto causes a dot, every long attraction a correspondingly long stroke to be drawn on the paper. The paper moves on, and the next time the metal edge is raised another stroke is drawn. In this way, the spiral draws stroke beside stroke in the rhythm of the wireless signals, 60 strokes—i.e., five letters—every second. In no time at all, a message of several pages has been taken down. When the transmission is ended, the S. & H. teleprinter cuts itself off automatically. When a new transmission arrives, no matter what time of the day or night it may be, a starting switch automatically turns on the printer. On the following morning, when the boss arrives at the office, the message is lying there waiting for him, neatly printed.

* * *

Let us conclude our description of modern robots, although there are hundreds of these little slaves we might still mention. Developments in this field have only just begun and are likely to assume considerable proportions after the war, for these little mechanical slaves do the auxiliary work of our time better, faster, more reliably, and more cheaply than any human being. Here we have the significance and at the same time the social threat of the robot: if it is used not to facilitate man's struggle for existence but merely to deprive him of his job, the inevitable result will be new social upheavals and disasters. It is impossible to halt technical progress; let us see to it that it is applied justly: not for selfish ends, for enrichment, or for antisocial policies, but for the benefit of mankind, to provide it once again with greater freedom and happiness, to help it regain a part of Paradise Lost.

The Difference

A sergeant in an American women's training camp was trying to push one more female recruit into a military bus already filled to capacity with other female recruits. "It can't be done, Sergeant," complained the girl. "The bus is full." "What the heck," said the sergeant, "we always put 18 boys in these cars—why shouldn't 18 girls go in?" Said the squashed girl: "Boys, yes, but they're broad in the *shoulders*!"

Ladies and Gentlemen

The women workers in the Flying Fortress factory in Seattle have become acclimatized so quickly and thoroughly that the management had to put up a notice: "Ladies! Remember your language! There are men around!"

She Got Her Divorce

"He never beat me," declared Sarah Sanders of Los Angeles, when she applied for a divorce from her husband, "but he used to go around and hammer on the doors with his fists, shouting: 'I wish it were you!'"