History cannot tell of a time when men did not wear armor. A cushion to dissipate the force of a blow was known even to Stone Age man, who had an armor built of numerous layers of furry hides. The name cuirass (from cuir, leather) indicates the material of which an early type of armor was originally made. The warrior at all periods has been in pursuit of the same aim—that of making himself invulnerable to his enemy's weapon.

In the evolution of weapons, which is continuous, there is a cycle. By alternating phases the advantage passes from offense to defense and back again. The armored knight on an armored horse could readily trample down foot soldiers. As the weapons of foot soldiers improved, the knight increased the weight of his armor, and as he did that he lost his mobility and became vulnerable. During the first World War, defense was superior, primarily because of the automatic machine gun. But the machine gun had one weakness, lack of mobility. Today, the fantastic mobility of artillery in the plane and the tank has given the offense the advantage. Experience teaches us that this advantage is only a temporary one, and that it will ultimately change sides. In the meantime, human nature does not change. The desire to conserve life and to reduce the chances of injury persists, and personal body armor continues to be a vital part of the American soldier's equipment.

The helmet is of such value that it is considered one of the principal categories of ordnance. In the first World War, the helmet became as much a part of the fighting soldier's equipment as his rifle and gas mask. The model worn by American troops was copied from the British helmet of manganese steel, chiefly because it could be put in immediate production. However, it had obvious defects, and the Ordnance Department took steps to design an improved headpiece. One of the first steps was to turn to the Metropolitan Museum, where a great variety of types was available for study. The Museum's Curator of Arms and Armor, Bashford Dean, was granted a leave of absence and was commissioned a major in the Ordnance Department. Numerous models were prepared under Major Dean's direction; of these a helmet known as type 5A was found to be the most promising, but it was developed too late for adoption in the first war.

Between the two World Wars a thorough study was made of helmets by the Ordnance Department and the Infantry Board. The opinions of soldiers concerning shape, protection, and comfort were prime considerations in designing the new helmet (M1), of which the principal improvement over the 5A is in the liner and suspension, based on those used in football headgear. It is designed to give protection to the sides and back of the head, is well balanced and comfortable. It weighs about three pounds, an increase of several ounces over the earlier tin hat, but it is made of tougher steel and protects much more of the soldier's head.

The Ground Forces, then, had anticipated the need of a helmet and developed this excellent model, standardized during the early years of World War II, and adopted as the standard issue in 1941. The helmet of World War II was a simple and efficient weapon of defense, and the means for the soldier's defense have improved to the point where the soldier who wears the helmet of World War II has a fighting chance.
Brigandine from the Castle of Chalcis at Euboea. Italian, 1400

summer of 1941 and produced by the million each year since. Early in the present war it became evident that the Air Force also needed a helmet and needed it quickly. To meet this pressing need, the Ordnance Department designed Helmet M3, which is a modification of Ground Forces Helmet M1, the principal changes being the addition of ear plates and a different suspension. The Air Force also designed a helmet (M4), which is of minimum size for use in turrets and other combat positions not allowing sufficient space for Helmet M3. A definitive Air Force helmet (M5), developed this year by the Ordnance Department with the co-operation of the Museum, will be described later in this article.

The Air Force needed not only a helmet, but also armor to protect the men’s bodies without hampering their movements too greatly. The Headquarters of the Eighth Air Force had access to drawings and illustrations of armor designed during the first World War, and a British manufacturer was commissioned to make the first lot of flyer’s armor (M1 to M4) for American bomber crews. Subsequently the Ordnance Department was assigned the task of putting it in quantity production and of improving it. For the development activities, the facilities of the armor workshop of the Museum were called upon. For example, the design of Armor Vest M6 (p. 7), which is the latest standardized flyer’s armor, is based on one of the Museum’s brigandines dating from about 1400 (above). The brigandine is built of fifty-three overlapping plates of iron, varying in size from 5 by 3½ to 7 by 3 inches, originally tinned on both sides and riveted to a double thickness of coarse canvas, with openings for neck and arms. The length of the canvas indicates that the brigandine protected the abdomen and loins. The materials used in Armor Vest M6 are a special heat-treated aluminum alloy and nylon backing, the products of industrial research laboratories. The M6 is the ballistic equivalent of earlier flyer’s armor made of manganese steel, and on an equivalent area it is twenty per cent lighter in weight. Thus, with a new design and a new combination of materials, an improved pro-
The latest design of combat flyer’s armor. Armor Vest M6 after test firing
Helmet and colletin of the armor of Galiot de Genouilhac. French, dated 1527

be dislodged by an opponent’s weapon, for they were held closed by eyed pegs and linch hooks, cotter pins and spring pins. In combat the action was vigorous, and it was essential to keep one’s armor on.

In contrast to the Genouilhac elements, made in the year 1527, let us look at the corresponding elements of the combat flyer’s armor. Three elements, Armor Vest M6, Armor Neck T59E1, and Helmet M5 (p. 7 and below), were designed to be worn together, to provide as nearly complete coverage of the upper torso, head, neck, and collarbone as is possible without limiting freedom of movement. The same factors are considered in designing modern armor as were considered in designing the ancient armor, namely, the thickness, the resistance, and the angle of impact. The aim is to combine lightness of weight with impenetrability. Weight remains as potent a factor as it was in the seventeenth century, when foot soldiers rebelled and threw away their armor, which had become much heavier as firearms improved. However, it should be borne in mind that metal need not be of great weight and thickness to be effective as a protection. Great weight isn’t necessarily good protection. Also, with curved surfaces, which ensure a glancing impact, thinner plate can be used than under normal impacts.

The definitive Air Force Helmet (M5), which weighs only two pounds, twelve ounces, is of skull-cap type with hinged ear plates and has a one-piece bowl with curved surfaces to deflect missiles; its sloping frontal lines were designed so as not to interfere with the sighting in the limited space around aircraft guns. It follows the general contour of an aviator’s cap. Consultation with the Aero-Medical Laboratory at Wright Field and a thorough study of cranial measurements from the Surgeon General’s Office preceded the development of this flyer’s streamlined helmet. One of its features is that the suspension is adjustable to fit any head size, and it is so designed that regardless of head size the forehead is held against the front of the helmet, thus preventing interference with upward vision. Split seconds count in air combat, and vision cannot be obstructed even momentar-
Waist gunner wearing helmet and flak suit in action on a heavy bomber

ily. Unlike their ancient counterparts, the helmet and neck armor are separate, to allow instantaneous and unrestricted movement of the head in following the movements of an enemy plane traveling at lightning speed. Also, the attachments of the neck armor and its accompanying armored vest permit instant and simultaneous release.

Both ancient and modern armor were influenced by the costume over which they were to be worn. Modern armor must also be of universal fit and readily adaptable to quantity production, it must occupy a very small space in the plane (see ill. above), and when discarded it must lie flat on the floor. In view of these restrictions in design it is evident that modern armor has to be different from ancient; on the other hand, it is obvious that
Armorer shaping an experimental helmet in the Armorer's Workshop at the Metropolitan Museum

ancient armor is indispensable as a model. The Air Force's neck armor was made to specifications, but its prototype already existed at least as early as 1517, as may be seen in the illustration on page 5.

The Ordnance Department is engaged largely in the technology and practice of metalwork. But before the presses can begin to produce, a design must be created and a master model must be made by hand. In the development of helmets and body armor the Museum's work, which is done under the direction of Colonel René R. Studler of the Office of the Chief of Ordnance, consists of making designs as well as models, the latter usually being a combination of metalwork and needlework. After a design has been approved, the next step is to make a pattern. Like the armorer of the past, the present-day armorer uses patterns, similar to those used by tailors, which enable him to see the shape of the various pieces in the flat and guide him during the making of the plates.

The smith always occupied an important place in our economy. He made the tools, and the tools made everything else. The artisan who used the tools took remarkable pride in his work, even to the point of ornamenting them until they were works of art in themselves. In a sense they were evidence of his skill. The armorer's tools in the Museum's workshop (above) belong to the pre-mecha-
nization period. The shape of hammers and anvils has been the same for hundreds of years—the same types are used in making the models of armor for modern warfare as were used to make the originals. Today, however, the bowl of a helmet is raised from a flat sheet of metal as in silversmith’s work, not forged from a lump of metal as were the elements of ancient armor. The fundamental tools are a ball-peen hammer and raising block. Hammering stretches and bulges the metal. The hammer marks are removed by the use of planishing stakes and hammers, which have a finely polished surface. The variety of hammers and stakes may be seen in the illustration of the Museum’s workshop. The handmade model anticipates the machine-made model, so that the authorities of the services which use the armor can appraise the result before the expensive and time-consuming die is made for quantity production.

The Museum armor gallery is not merely a repository for obsolete military equipment. The technical achievements of ancient armorers have proved to be extremely useful, and the Museum, in placing its exhibits at the disposal of the Army, is rendering a practical service to the nation. The suits of armor in the exhibition halls are constantly studied for suggestions, and no type which seems to hold the slightest promise of adaptation is overlooked. Heavy armor for the military sport of jousting, lighter battle armor, shirts of mail, scale armor, and the quilted jackets of renaissance days have all been carefully examined from a new viewpoint, and with profitable results. History has emphatically repeated itself on the subject of armor. The mediaeval knight was armed at all points; the modern soldier, because of the need of extreme mobility over long periods of time, must necessarily be satisfied with selective protection. In the Army’s experimental work the knowledge of ancient armor is being utilized, and we are advancing a step further in its historical development.