No. 826,562. PATENTED JULY 24, 1906.

E. GATHMANN.

ARMOR PLATE.

APPLICATION FILED JULY 2, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

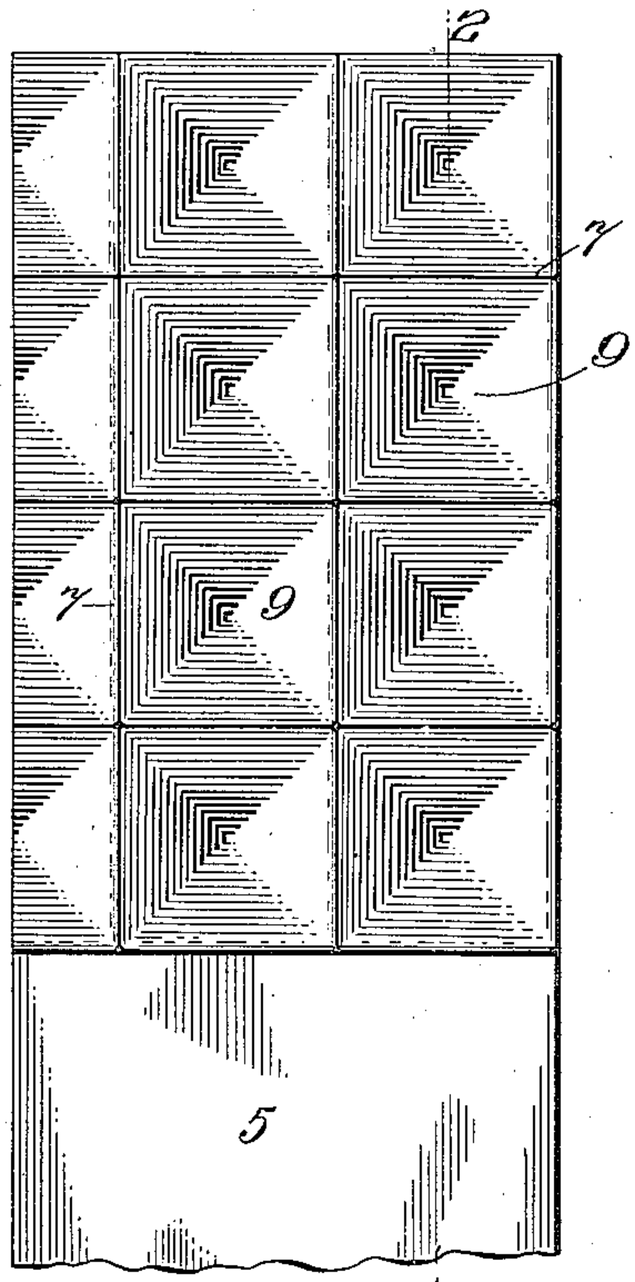

Fig. 2.

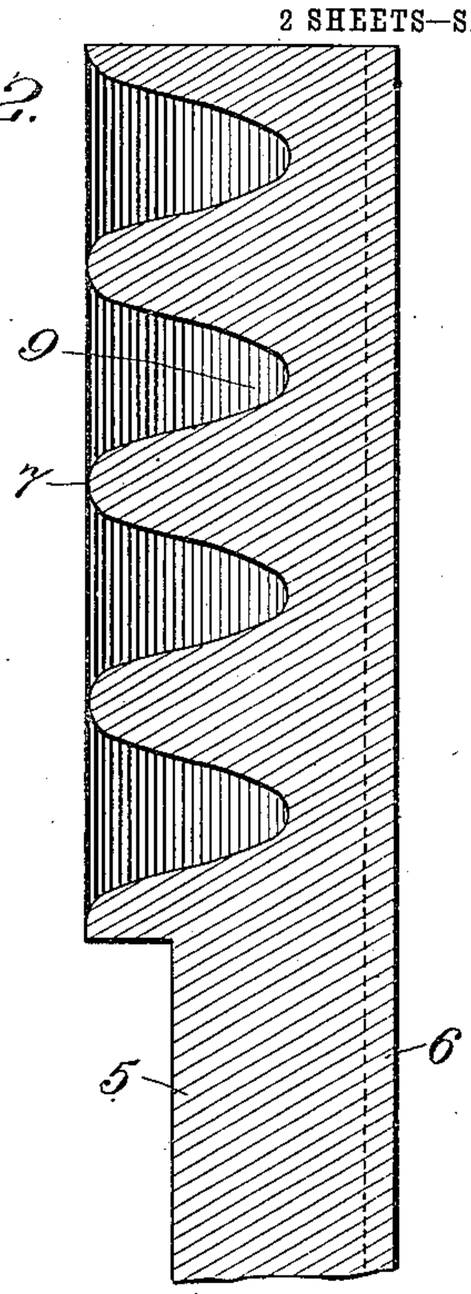

Fig. 1.a

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Fig. 3.

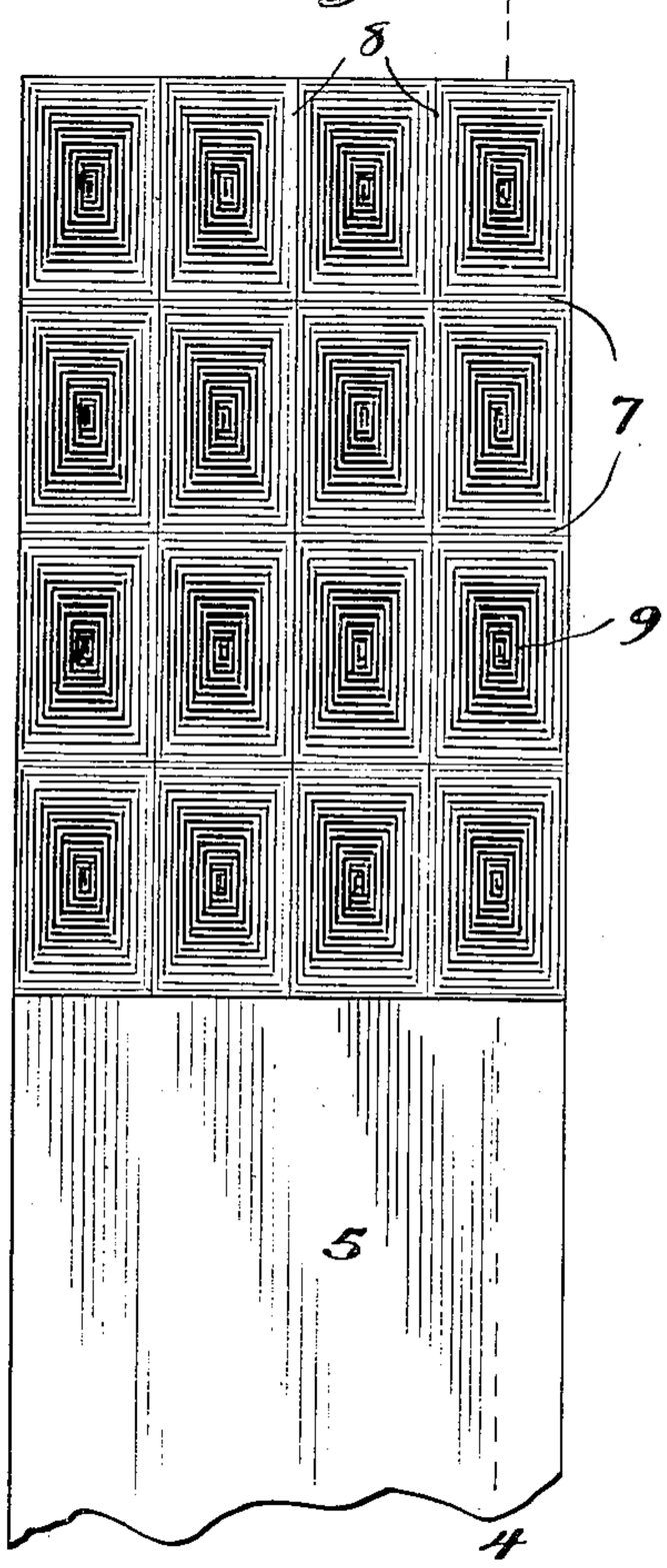
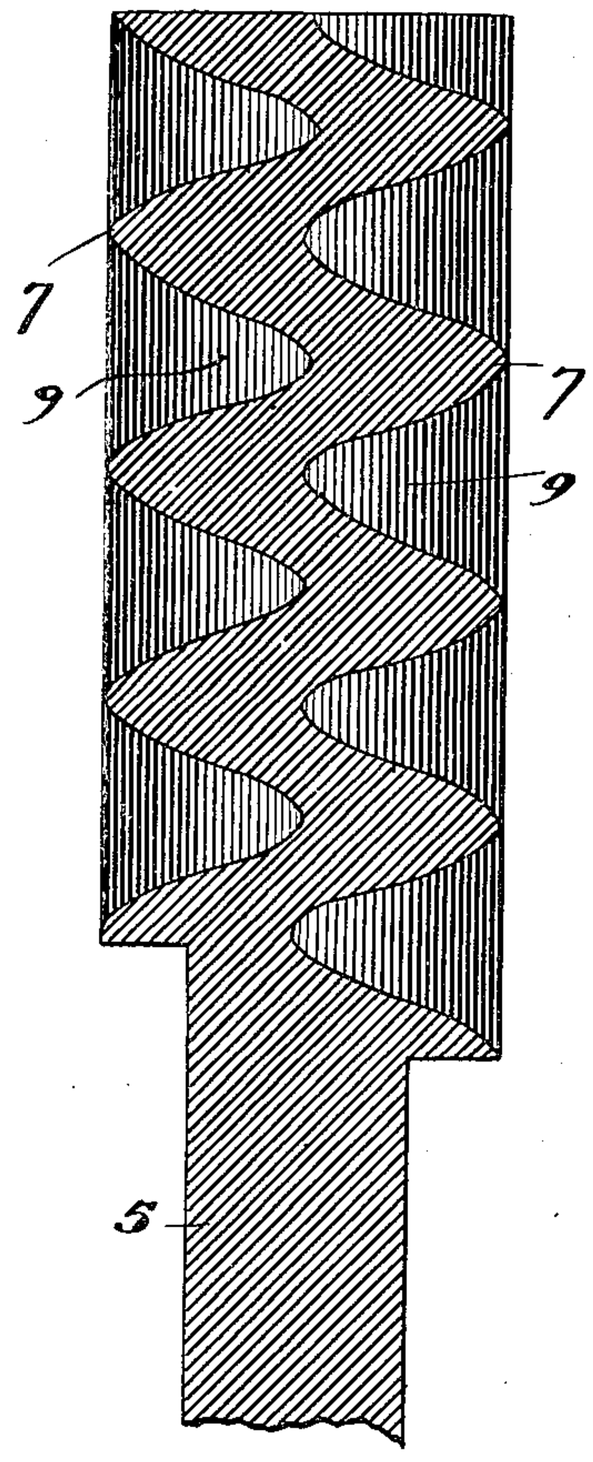


Fig. 4.



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UNITED STATES PATENT OFFICE.

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ARMOR-PLATE.

No. 826,562. Specification of Letters Patent. Patented July 24, 1906.

Application filed July 2, 1904. Serial No. 215,156.

To all whom it may concern:

Be it known that I, EMIL GATHMANN, a citizen of the United States, residing at Bethlehem, Pennsylvania, have invented certain new and useful Improvements in Armor-Plates, of which the following is a specification.

My invention has for its object the production of an armor-plate designed to afford the maximum strength with minimum weight.

Armor-plates are usually face-hardened, and their resistance to penetration is proportioned to the thickness of the plate and the hardness of its face. A homogeneous steel plate—*i. e.*, one which is not face-hardened—is easily penetrated by a hard projectile, and the penetration is effected by the compression of the molecules of the metal on lines approximately at right angles to the line of penetration. In a face-hardened plate, on the contrary, the metal does not yield by the compression of its molecules; but penetration is effected by a punching action of the projectile. The nose of the projectile, acting as a punch, breaks through the hardened surface, carrying a portion of the metal with it in the form of a "button," which is punched or sheared out of the hardened face of the plate and is driven into the soft portion of the plate or through it, resulting usually in the breaking of the plate after the penetration has proceeded beyond the hardened portion, and the splitting action thus permits the button to escape. The power of the plate to resist penetration by a projectile can be increased indefinitely by adding to the thickness of the plate, and of course the weight of the plate increases as its thickness is increased. The power of the plate to resist displacement of its particles by punching with a theoretically-unyielding projectile of a given caliber can be established in terms of the projectile's circumference, and the thickness of the plate can likewise be estimated on approximately the same circumferential line. It follows, therefore, that the plate should be thickest at lines corresponding to the cross-section of a projectile of the smallest caliber capable of penetrating armor upon normal impact. It follows, further, that within this cross-sectional area the plate may be thinner. Proceeding in accordance with these propositions I have devised an armor-plate calculated to afford a higher percentage of resistance in proportion to the weight than has been heretofore attained. I accomplish this result by deforming the body of the plate, so as to increase its effective thickness and consequent resistance to penetration without increasing the weight of the plate. I accomplish this object by deforming the surface of the plate on one or both sides, but preferably on its face side only. These deformations have preferably a series of depressions of uniform depth and cross-section bounded by ribs of uniform height and cross-section, the ribs intersecting each other, so as to define the depressions and the ribs being produced in any convenient way, as by drawing, punching, or rolling.

By means of my invention I am able to increase the efficiency in the resisting power of the plate at least twenty-five per cent. without any addition to its weight.

In the accompanying drawings I have represented for purposes of illustration only two forms of plate, which will serve to indicate how my invention may be practically carried out.

In said drawings, Figure 1 is a face or plan view of a plate, one portion of which has been deformed so as to produce the alternate ribs and depressions; Fig. 1ª, a perspective view of a portion of a plate. Fig. 2 is a longitudinal sectional elevation of the plate on the line 2 2 of Fig. 1. Figs. 3 and 4 are similar views of a plate having depressions on both faces.

In the drawings, let 5 represent an armor-plate, say, of the normal thickness of four inches and with its face 6 hardened to the depth indicated by the dotted line in Figs. 1ª and 2. For purposes of comparison I have shown one end of such plate as of normal thickness and the other end deformed so as to produce therein a series of ribs 7 8, intersecting each other and bounding intervening pyramidal depressions 9, the walls of the ribs being slightly curved from apex to base and the thickness of the metal through these ribs being five and one-half inches, as indicated in the drawings, while the plate has a thickness in its depressed plane of two inches. Now assuming that the smallest-sized projectile capable of penetrating a four-inch plate is of five-inch caliber, it is obvious that the depression should fall within the cross-sectional area of such a projectile and,

conversely, that the ribs should be so disposed that the projectile could at no point penetrate the plate without cutting through the same on one of its lines of greatest thickness, or, in other words, through one of the ribs. The strength of the plate is due to the thickness of the metal on any line through which the projectile must pass, and therefore if the metal is so disposed as to afford this increased thickness at some point within the cross-sectional area of the impact spot the measure of efficiency of the plate is thereby determined. I prefer to provide these ribs and corresponding depressions upon one of the surfaces only; but it is feasible, of course, to form such ribs and depressions in both sides of the plates, and this construction is illustrated in Figs. 3 and 4. In this case each rib 7 is opposite a corresponding depression on the reverse side of the plate. While this construction increases the comparative thickness of the plate from four to seven inches, yet it is not so desirable, as difficulties would be presented in the way of hardening the face and also in the increased resistance to movement through the water if such ribbed surface were below the waterline. This latter objection, however, might readily be overcome by covering such ribbed plate with a skin of thin metal sheets. The ribs at their outer or face plane of plate have a curved and pointed contour similar to a pointed or rounded wedge, thereby presenting a cutting and deflecting surface to impacting projectiles.

While I have shown and described two forms of ribbing, it will be understood that my invention is not limited to any particular form of rib or depression nor to any particular means or apparatus for forming the same. It will be observed that the ribs are so arranged as to intersect each other, and in both the illustrations shown the intersecting ribs are arranged at right angles to each other; but it is obvious that the ribs might be so arranged as to intersect each other at different angles, thereby producing depressions of different forms, and it will be understood that my invention is not limited to any particular arrangement of the ribs and depressions so long as they are so arranged that the depressions are not greater in cross-section than that of a projectile which upon normal impact will be capable of penetrating a plate of the normal thickness. It is readily seen that if it require a five-inch projectile to penetrate an ordinary face-hardened armor-plate of four inches in thickness the ribbing of said plate, whereby an additional thickness of one and one-half inches is provided, will increase the resistant effect of the plate so as to avoid penetration. This object is attained by my invention by a redisposition of the material without increasing the weight of the plate.

I claim—

1. Armor-plate provided with arch-shaped or tapering depressions on its rear face, said plate having a hardened or chilled front face.

2. Armor-plate provided with intersecting ribs on its rear face.

3. Armor-plate provided upon one or both of its faces with dome-shaped or arched depressions encompassed by intersecting wedge-shaped ribs, said ribs at their outer or face plane having a curved or pointed contour similar to a pointed or rounded wedge.

4. Armor-plate having one or both of its faces indented with taperwise depressions encompassed by intersecting triangular-shaped ribs curved at their apex.

5. Armor-plate having one or both faces provided with intersecting ribs of a curved triangular-shaped cross-section.

6. Armor-plate provided upon one or both of its faces with intersecting cuniform ribs having a rounded or pointed apex.

7. Armor-plate provided with surface ribs intersecting each other and bounding depressions, said ribs having a curved or pointed contour and presenting a cutting and deflecting surface at outer plane of plate.

8. Armor-plate having one of its faces provided with cuniform ribs bounding curved depressions, said ribs being arranged in parallel series and the series of ribs intersecting each other, and having a pointed curved contour at their outer face plane.

9. Armor-plate provided with a plurality of depressions encompassed by a series of ribs having a triangular cross-section, the apex of said ribs being shaped similar to a pointed or rounded wedge.

10. Armor-plate provided with a plurality of depressions on its hardened face, said depressions being surrounded by intersecting ribs, and said ribs vanishing in a curved or pointed apex.

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