(No Model.) 2 Sheets—Sheet 1.

R. H. SAYRE.

ARMOR PLATE.

No. 576,742. Patented Feb. 9, 1897.

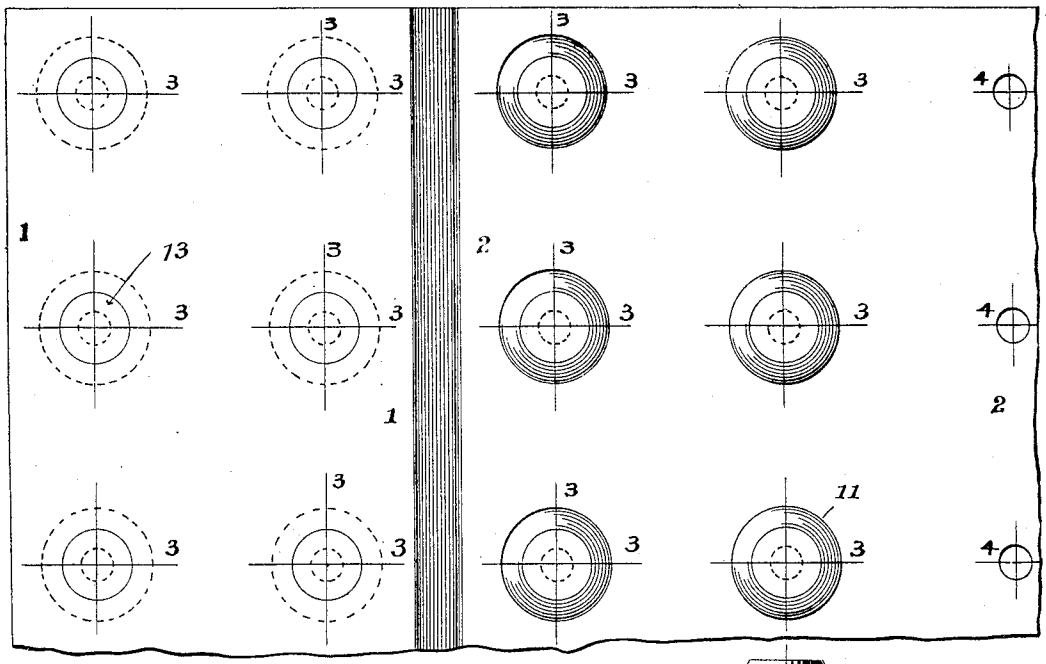

FIG. 1.

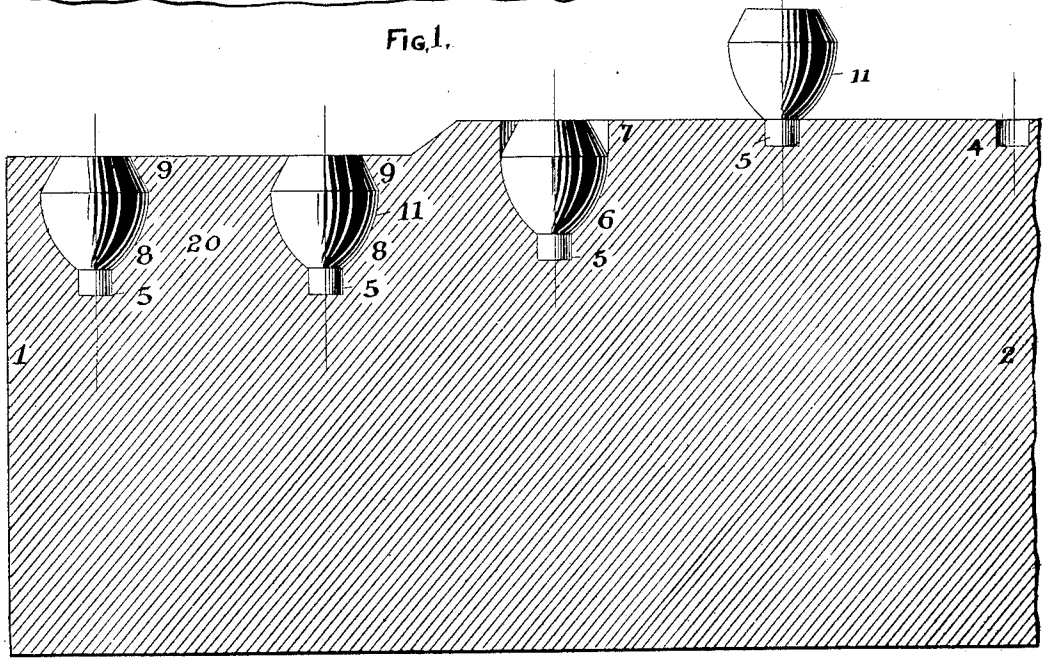

FIG. 2.

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ATTORNEY

(No Model.)

2 Sheets—Sheet 2.

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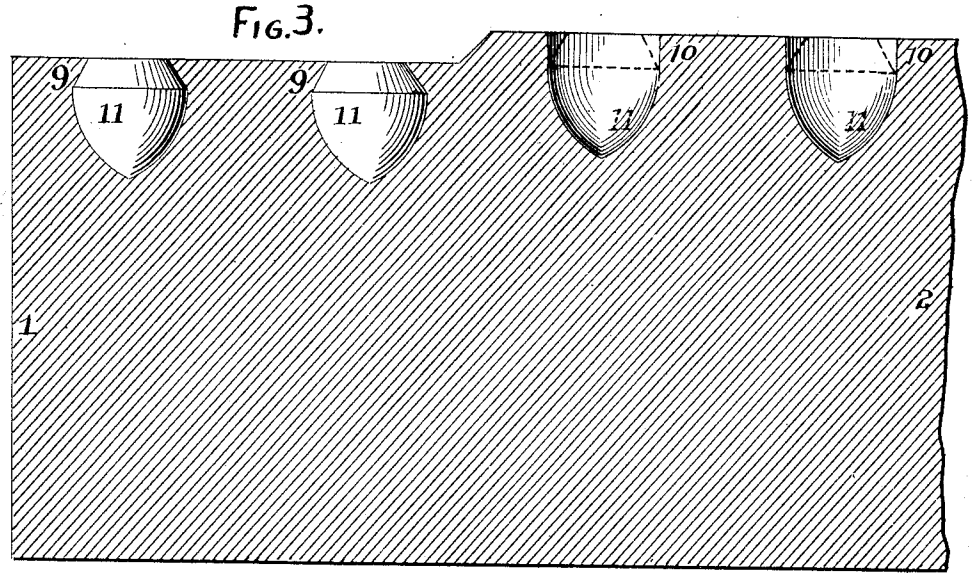
ARMOR PLATE.

No. 576,742. Patented Feb. 9, 1897.

FIG. 3.



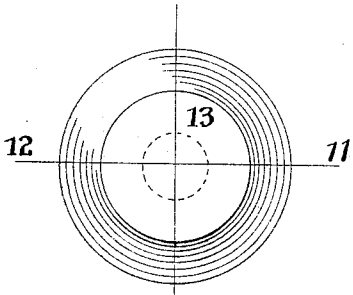


FIG. 4.

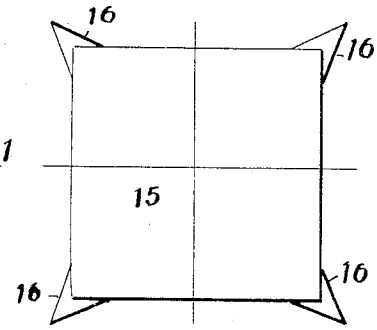


FIG. 5.

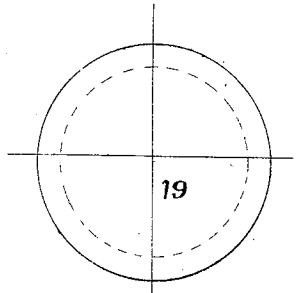
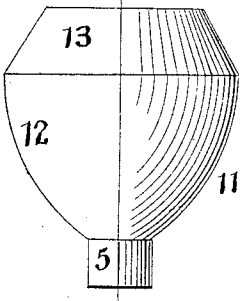
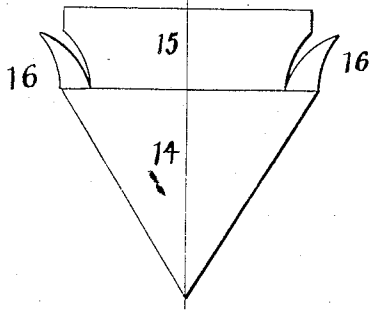


FIG. 6.





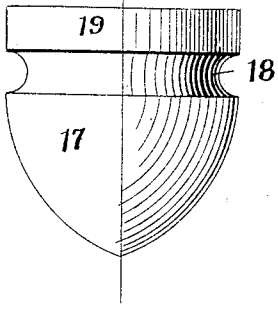
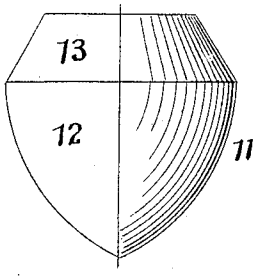


FIG. 7.



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ROBERT H. SAYRE, OF SOUTH BETHLEHEM, PENNSYLVANIA.

ARMOR-PLATE.

SPECIFICATION forming part of Letters Patent No. 576,742, dated February 9, 1897.

Application filed January 7, 1895. Serial No. 534,021. (No model.)

To all whom it may concern:

Be it known that I, ROBERT H. SAYRE, a citizen of the United States, residing at South Bethlehem, in the county of Northampton and State of Pennsylvania, have made certain new and useful Improvements in Armor-Plates and the Process of Making the Same, of which the following is a specification.

My improvements relate generally to that class of armor-plate which is provided upon the surface intended to receive the impact of a projectile with a hardened surface decreasing in hardness as the center of the plate is approached and having a backing or face opposite the hardened surface of tougher metal than that which is to receive the impact, such plates being produced by the process commonly known as the "Harvey" and analogous processes. Instead, however, of producing a surface by means of supercarbonizing, which is capable of being hardened, I produce not only a hardened surface, but one excessively hardened at intervals by the mechanical addition to the plate of plugs made of naturally hard steel or steel capable of being highly tempered so dispersed upon the surface of the plate as to effectually shatter or break a shell, besides accomplishing other results hereinafter set forth.

My invention therefore consists in an armor-plate having a surface constructed as hereinafter described, which is to be exposed to the impact of a projectile in which plugs or pieces have been inserted, preferably of naturally hard steel or steel capable of being highly tempered, disposed in and upon the impact-surface of the plate and at such a distance apart, preferably about six inches from center to center, as to resist the penetrating force of the projectile, and with a backing of softer metal less liable to fracture than the plugs.

My invention further consists in the shape or contour of the plugs and the means for securing them in the plate, the plugs when made component or inseparable parts of the plate itself being held in position by the metal of the plate being forced about the irregular conformation of the plugs during the rerolling or reforging of the plate, thereby holding them in place and enabling them to find a firm bed and resisting-seat in the body of the metal when impacted.

My invention also comprehends the process by which my new armor-plate is made.

My invention therefore consists in the article and in the process hereinafter described, and further pointed out in the claims.

In the drawings illustrating my process and an embodiment of the structural portion of my invention, Figure 1 is a plan view showing a portion of an armor-plate constructed in accordance with my invention and also indicating steps in the process of manufacturing the same; Fig. 2, a sectional elevation of a plate embodying my invention and also indicating steps in the process of manufacture; Fig. 3, a sectional elevation of a portion of an armor-plate, illustrating certain steps in the process of manufacturing the plate; and Figs. 4, 5, 6, and 7 respectively show various forms of plugs that may be used in carrying out my invention.

I shall describe the process of producing the plate contemporaneously with the description of the plate itself.

In the practice of my invention I take a plate of suitable thickness, say, for example, a plate which will finally produce a thickness of fourteen inches, as indicated at 1 on the drawings, (the drawings being to scale,) of any form of iron or steel or modifications thereof and which may be brought to the desired degree of malleability or hardness, if hardness is desired, by the processes usually employed for that purpose. This plate prior to the commencement of the operation of inserting the plugs (which latter are previously formed as hereinafter described) is preferably rolled or forged, after being heated to a forging temperature, to a little more than the final thickness, as indicated at 2 in the drawings, right hand of Fig 2. When reduced to the thickness suitable for the insertion of the plugs and the subsequent rerolling or forging, I preferably score the surface of the plate which is intended to receive the impact of the shell with lines 3 3 3, Fig. 1, the intersections of the lines fixing the positions of the center of plugs. I then preferably form at these

points of intersection depressions in the surface of the plate 4 4 4 4, Figs. 1 and 2. These depressions can be either formed by pressure when the plate is hot or by drilling when the plate is cold or by other suitable means. The object of these depressions is to hold the plugs in position prior to forcing them into the plate. These depressions being made the plate is heated to a forging temperature and plugs 11 of shape shown in Figs. 1, 2, and 4, or of some other suitable shape, having a projection 5 of proper size to enter the depressions 4 4 4 4, are stood up on the plate and are held in position by the projections entering the depressions, as in Fig. 2. The plugs are then forced down into the plate by forging or by the application of suitable pressure until the tops of the plugs are flush with the surface of plate, as shown at 7, Fig. 2, during which the wedge-like action of the plugs in entering compacts the adjacent metal. The forging of the plate to its final thickness (at 1, Fig. 2) can then proceed either with or without additional heating, by which forging the plugs are farther driven into the plate, as shown at 8 8, and the metal firmly compacted about them, as shown at 9 9, Fig. 2, the tops of the plugs being flush with the surface of the plate and firmly anchored therein, their irregular surface forming the anchoring portion thereof.

Another method of practicing my invention is as follows: I form in the surface of the plate which is intended to receive the impact of the shot a series of apertures or depressions 10 10, Fig. 3, of a shape wholly or partially conforming to a portion of the plug, the holes being formed of such dimensions or shape as to permit the plug to freely enter and leave a surplusage of metal above the same, so that when the plate is rerolled or reforged and the plate reduced to its final thickness, as at 1, Fig. 3, as before set forth, the top of the plugs will be flush with the impact-surface of the plate and the metal of the plate compacted about the plugs, which are irregular in shape, as shown at 9, Fig. 3, the plugs being then firmly held in position.

In either of these ways the plugs are caused to become component and inseparable parts of the body of the plate.

Several shapes of plugs are illustrated in Figs. 4, 5, 6, and 7, Fig. 4 illustrating the plug 11, having an entrant portion 12, formed in the shape of an inverted cone surmounted by a truncated conical portion 13, the apex of the cone being truncated and having the cylindrical or other shaped projection 5. That illustrated in Fig. 5 shows a plug formed with an entrant portion in the shape of an inverted pyramid 14, surmounted by a squared portion 15. From the corners and the inverted base of the part 14 are outwardly-diverging anchors 16. The plug illustrated in Fig. 6 comprises an inverted cone 17, surmounted by an annular depression or peripheral fluting 18 and a disk-like head 19. That shown in Fig. 7 is identical with that shown in Fig. 4 minus the projection 5.

It will be noticed by referring to the various illustrations of the plugs that all of them have an irregular contour or an anchoring portion about or in which the metal of the body of the plate can be compacted in order to hold the plug rigidly in position and a wedge-like portion which enables the plug to be forced into the metal of the plate and make its own seat therein, at the same time compacting the adjacent metal.

I have shown the plug 11 in connection with the above description of the process solely for the sake of clearness, and it is evident that the same process may be applied in a like manner to firmly embed either of the plugs illustrated or of any other desired shape in the metal of the plate, provided they can be driven or forced into the metal prior to or during the reduction thereof.

The plate completed as above can be further subjected to a supercarbonizing and hardening process, if desired, so as to produce upon the impact-surface a further decrementally-hardened stratum, (other than that formed by the plugs,) such as is produced upon a plate treated by the Harveyizing process; but should this be employed the temper or hardness of the surface of the plate adjacent the plugs need not be as great as that of the plugs themselves, in order that the plate can permit of the plugs being farther embedded in the metal of the body of the plate without fracture, that is to say, I prefer such a condition or relation as to the comparative hardness of the plugs and the metal of the body of the plate to exist that the plugs will be harder and offer a greater resistance to the penetration of the projectile than the adjacent portions of the impact-surface, so as to provide a suitable backing for the plugs, as before described.

Whether the plate be or be not supercarbonized (as in the Harvey process) after the insertion of the plugs, the face of the plate in which the plugs are inserted and the plugs themselves can be hardened by heating and sudden cooling with a cold-water spray or otherwise.

In planning out the location of the plugs in the plate I prefer that their centers should be so placed that they will not be in physical contact one with the other and that a section 20, of metal, will lie between each of the plugs, in order to provide for properly embedding the plug and compacting the metal of the plate about it, and I further prefer that the plugs should be so dispersed within and upon the impact-surface of the plate as not to permit of a projectile bodily passing between them; but should it be desired that the plugs have physical contact with each other I still consider such an arrangement within the scope of my invention, as it is possible to so

arrange or disperse the plugs or so conform them that they will have physical contact. The only essential feature which must necessarily be present in all constructions embodying my invention is that there should be sufficient metal adjacent to the plugs in order to permit of a reduction in the thickness of the plate by rerolling or reforging and to simultaneously firmly embed the plug in the plate and compact the metal thereof about the plug. It is apparent that this can be carried out in many ways, such, for instance, as embedding an irregularly-shaped or continuous or substantially continuous bar or some other appropriately-configured piece of metal having a suitable entrance portion, parts of which will have mechanical union, and which may be continuous for either the entire length of the plate or for a portion thereof or at least be continuous for the distance between two plug-centers, as illustrated in Fig. 1. Such a modification of the present embodiment of my invention could be adapted without departing from the spirit of the same.

The metal of the plugs (which are formed, prior to their incorporation into the plate, either by casting or forging) can be of any desired form of steel which will give a relatively extreme hardness, such, for example, as steel containing chromium, tungsten, &c.

By reason of the forcing in of the plugs during the act of rolling or forging to reduce the plate to its final thickness the metal of the plate adjacent to any entrant surface of the plugs is compressed in a direction at right angles to said surface, so that the fiber of the plate, which in forging or rolling is always laid at right angles to the direction of pressure, assumes a direction parallel with said adjacent surface of the plug and in general the fiber of the metal between any two adjacent plugs runs transversely of the direction between the plugs. The plate thus produced therefore presents an even or plain impact-surface wherein a series of impact portions are dispersed either uniformly or non-uniformly of hardened steel and an intervening backing of a softer metal, so that should the projectile strike full upon the face of one of the plugs its resistance to the penetration of the projectile will compress the metal adjacent the plug, (which, by the previous forcing in of the plug, has been in a degree compacted,) the plug being farther driven into the face of the plate, and lateral compression of the surface of the plate further resisted by the interception of the extremely-hardened plugs adjacent the one impacted.

Should the projectile strike the plate between the plugs, if wider than the space between, the projectile will be broken up by contact therewith and the penetration of the plate prevented by the before-stated resistance given to the entrance of the projectile, so that it can be stated that a plate so constructed is more advantageously formed than one treated under the Harvey or other analogous processes, as it may have not only a stratum of hardened steel, but it has in addition the harder masses entering a greater distance into the softer and tougher backing, thus offering resistance both to penetration and fracture and breaking up the impinging shot.

Having described my invention, I claim—

1. As a new article of manufacture, an armor-plate having an even or plain impact-surface, and having embedded therein, in proximity to said surface, plugs of a harder metal having a tapering lower or inner portion, the metal adjacent to the plugs being more compressed or compacted than the metal at a distance therefrom, substantially as described.

2. As a new article of manufacture, an armor-plate having an even or plain impact-surfact, and having embedded therein, flush with said surface, plugs of a harder metal having projections or anchoring portions below the surface of the plate, the metal adjacent to the plugs being more compressed or compacted than the metal at a distance therefrom, substantially as described.

3. As a new article of manufacture, an armor-plate having an even or plain impact-surface, and having embedded therein, flush with said surface, plugs of a harder metal having a tapering lower or inner portion, and having projections or anchoring portions below the surface of the plate, substantially as described.

4. The process of making armor-plates, which consists in, first, forming a plate of a suitable thickness with a series of depressions in the surface of the plate for the reception of plugs, next, locating the plugs in said depressions, and finally simultaneously rolling or forging the plate to the final thickness and forcing the plugs farther into the plate, substantially as described.

5. The process of making armor-plates which consists in, first, forming a plate of a suitable thickness with a series of depressions in the surface of the plate for the reception of plugs, next, locating the plugs in said depressions, and finally simultaneously forcing the plugs into the plate, rolling or forging the plate to the final thickness, and compacting the metal of the plate about the plugs, substantially as described.

6. The process of making armor-plates which consists in, first, forming a plate of a suitable thickness with a series of depressions in the surface of the plate for the reception of plugs, next, locating the plugs in said depression, then reheating the plate with the plugs, and finally simultaneously rolling or forging the plate to the final thickness and forcing the plugs farther into the plate, substantially as described.

7. The process of making armor-plates, which consists in rolling or forging a plate to a suitable thickness, forming depressions in the surface thereof for the reception of plugs,

the holes being smaller than the plugs, locating the plugs in said depressions, forcing the plugs into the plates and compacting the metal of the plate adjacent to the plugs, and then rerolling or forging the plate to its final thickness, farther progressing the plugs into the metal and compacting the metal about the plugs, substantially as described.

Signed at South Bethlehem, in the county of Northampton and State of Pennsylvania, this 27th day of December, 1894.

ROBERT H. SAYRE. [L. S.]

Witnesses:
EDWARD J. MALLOY,
RUSSELL W. DAVENPORT.