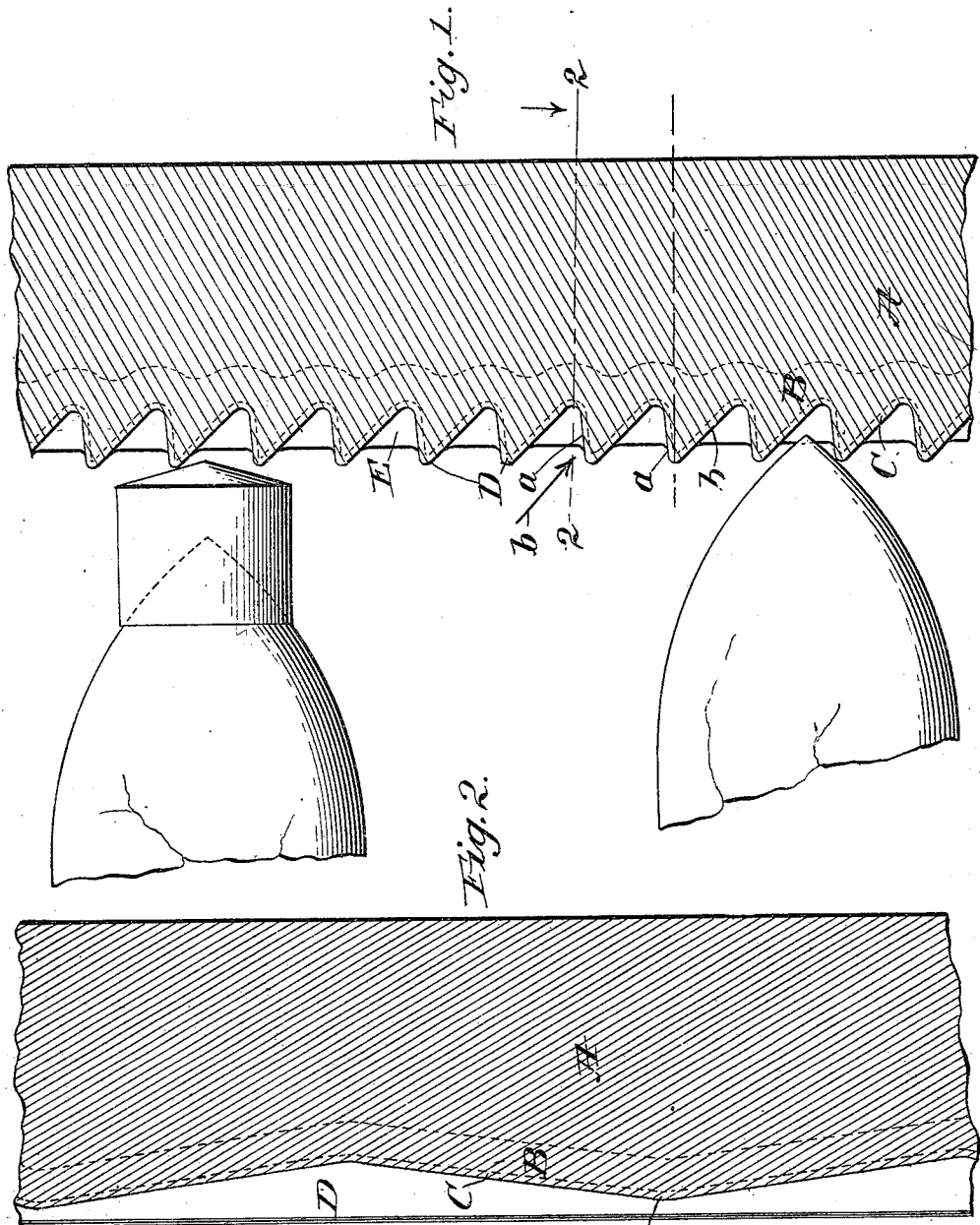


E. GATHMANN.
ARMOR PLATE.
APPLICATION FILED NOV. 9, 1906.



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PATENTED MAR. 26, 1907.

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3 SHEETS—SHEET 2.

Fig. 3.

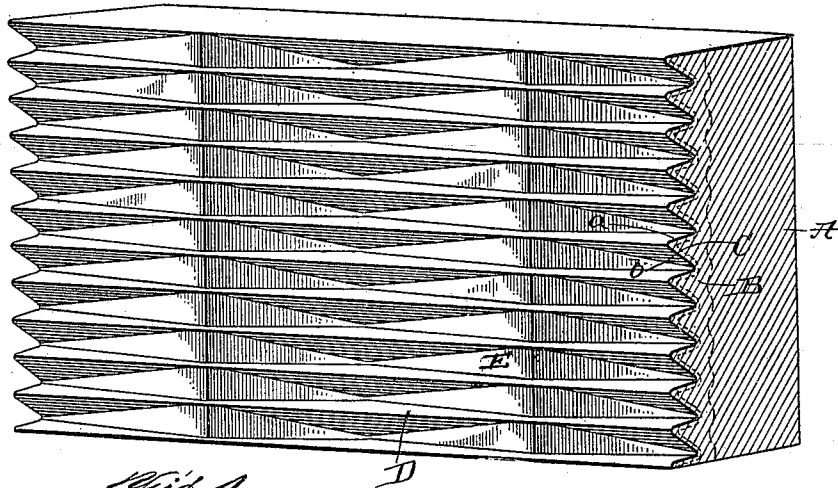


Fig. 4.

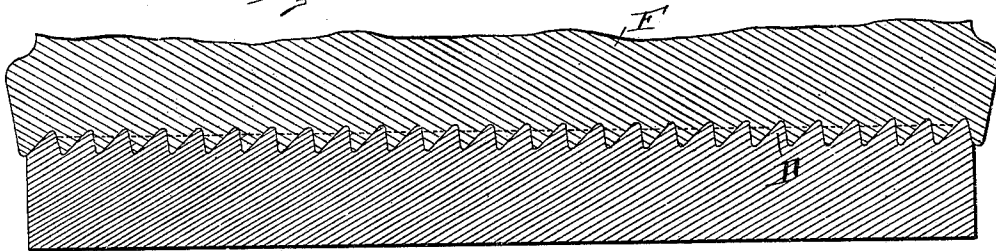
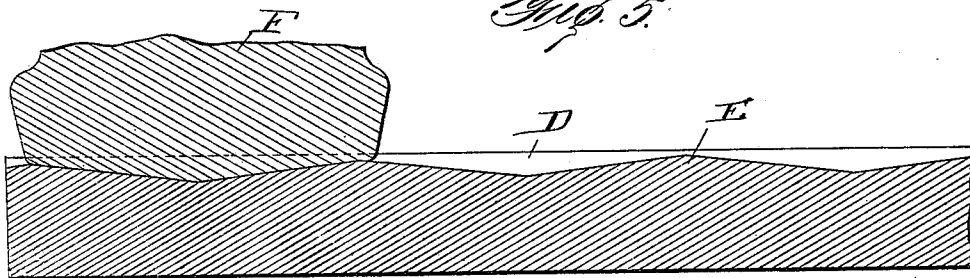


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 6.

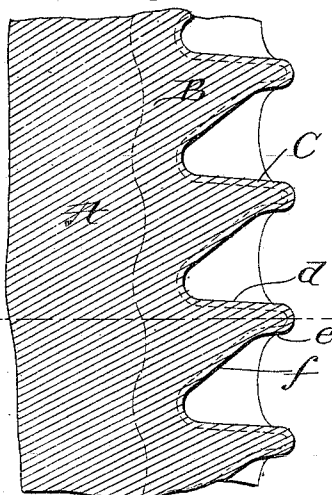


Fig. 7.

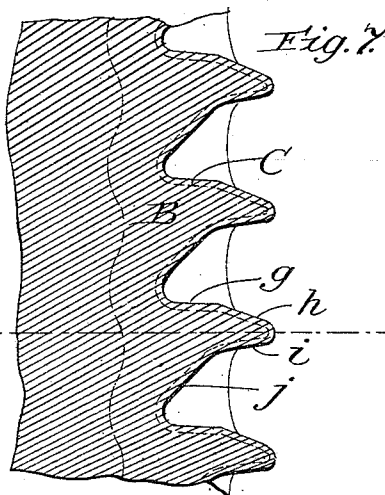


Fig. 8.

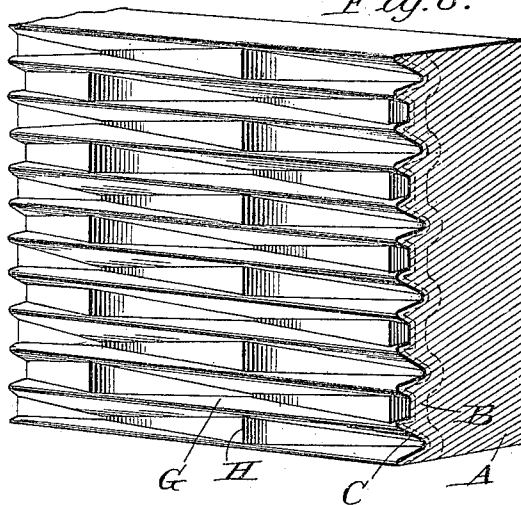
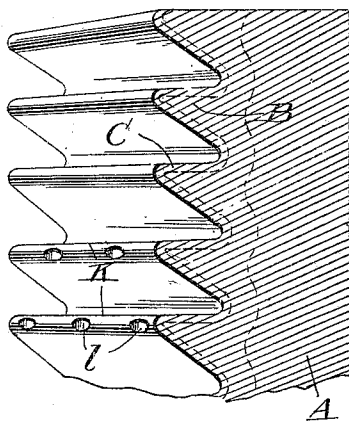


Fig. 9.



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UNITED STATES PATENT OFFICE.

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ARMOR-PLATE.

No. 848,024.

Specification of Letters Patent.

Patented March 26, 1907.

Application filed November 9, 1906. Serial No. 342,691.

To all whom it may concern:

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

My present invention pertains to improvements in armor-plate, the construction and advantages of which will be hereinafter set forth, reference being had to the annexed drawings, wherein—

Figure 1 is a transverse sectional view of one form of the plate; Fig. 2, a similar view taken on the line 2 2 of Fig. 1; Fig. 3, a perspective view of the plate illustrated in the foregoing figures; Figs. 4 and 5, sectional views illustrative of one manner in which the plate may be formed; Fig. 6, a sectional view of a modified form of plate; Fig. 7, a similar view showing a still further modification; Fig. 8, a perspective view of a plate illustrative of a modification wherein the cross-ribs are not continuous and are placed in a staggered relation; and Fig. 9, a perspective view of a still further modification wherein the cross-ribs are omitted, but the angular relation of the faces of the ribs, as hereinafter set forth more in detail, is still maintained.

The main object of the invention is to provide a superior armor-plate, the construction being such that for the same body or weight of metal the plate will have a much higher degree of efficiency against penetration by both capped and uncapped projectiles than has the armor-plate now employed.

A further object of the invention is to so form and proportion the ribs that they will afford the maximum resistance to the penetration of the shell.

A still further object of the invention is to arrange or dispose the various faces of the ribs or to form them in such angular relation to each other and to the main body of the plate that any uncapped projectile striking the plate to one side of the apices of the ribs will be deflected and as a consequence its penetrating power thereby greatly reduced.

Another object of the invention is to provide a plate having cross-ribs, the formation of the ribs being such as to afford a minimum resistance to the passage of the plate through the water. This construction, which will be

more fully set forth, also renders the plate simpler of manufacture. The ribbed construction likewise enables me to secure better face-hardening of the plate and by reason of the construction shown and described to secure a line of junction between the hardened and unhardened portions thereof which will be more extended than obtains under the present method, whereby "spalling" of the plate, due to the impact of a projectile, will be minimized.

With these and other objects in view a detailed description of the invention will be given.

At the outset it may be well to state that preferably the plates from which the armor is formed are, as is usual, first subjected to pressure and then carbonized by any approved process. The ribs are then formed by direct-acting dies or by rolling, after which the plate is face-hardened, whereby three strata are formed in the plate—the main body A, the carbonized and hardened stratum B, and the outer relatively thin "glass-hardened" face C. While this is the preferred method, it is of course immaterial, in so far as the broad invention is concerned, how the plate is treated and the metal de-formed to produce the ribs.

Referring to the construction shown in Figs. 1 to 5, inclusive, it will be seen that the face of the plate is formed with a series of longitudinal ribs D and a series of cross-ribs E, the longitudinal ribs being higher or projecting out beyond the ribs E. It will also be seen that the ribs D are somewhat closer together than the cross-ribs E, and as a consequence they are narrower in cross-section. (Compare Figs. 4 and 5.) In practice it is designed that the ribs D shall be placed or disposed longitudinally of the hull, for the reason that the lower cross-ribs E, whose sides are at angles much less acute than those of ribs D, will afford much less resistance to the passage of the ship through the water. It is likewise to be noted that in the manufacture of the plate by a press-die, such as F, Figs. 4 and 5, the de-formation of the carbonized plate may be more readily accomplished.

The ribs, as in the construction shown in my former patent, No. 826,562, dated July 24, 1906, are wedge-shaped or triangular in cross-section, the apex of each rib being somewhat rounded or curved in order to

avoid sharp lines in the plate. So, too, the lines of the bases of the ribs merge into each other upon curved lines, or, in other words, in the formation of the plate it is advisable that all sharp angles be avoided, as otherwise lines upon which fracture might take place would be presented. Fracture not only takes place upon the impact of the projectile if a sharp angle is present in the plate, but in hardening the plate it is also necessary that the curves as just noted be present to prevent the cracking of the plate as it chills or contracts.

As will be seen upon reference to Figs. 1, 2, 3, and 4, the faces of the ribs D are formed upon different angles, the upper face *a* standing at, say, five degrees to a line extending vertically from the longitudinal axis of the plate, while the lower face *b* is formed at approximately forty-five degrees to said line. With this construction or angular relation of the faces, with the face *a* lying almost horizontally, the nose of an uncapped projectile traveling in the direction of the arrow *b*, Fig. 1, will strike the face *a* a glancing blow, whereas if the face *a* were given a greater slope or downward inclination the point of such uncapped projectile would strike the face of the rib squarely, or approximately so. The ribs D are designed to be spaced so as to prevent the entrance of the cap of a capped projectile between them, the distance being regulated or proportioned according to the thickness of the plate and the size of the projectile which it is primarily designed to resist. When this is followed out, the ribs will be so spaced that the cap of a projectile which under ordinary conditions would penetrate the plate will be broken up and disrupted by the ribs. This being so, the cap is thereby precluded from placing the plate under such local stress as would permit the projectile to pass through the same.

With the present construction one or more of the ribs will receive the initial impact of the cap, and as the ribs are pointed the relatively soft cap will be split and destroyed without transmitting any considerable pressure or blow to the body of the plate. Therefore "dishing," so called, will be prevented. The point of the projectile impacting upon the glass-hardened angular surface of the plate will be deflected or broken, and consequently the penetrative efficiency of the projectile very much reduced.

As above noted, the spacing between the ribs will be determined by the size of the projectile the plate is primarily designed to resist, the plate being increased in thickness as the ribs are spaced wider apart, the increase in thickness, however, being materially less than would obtain with the ordinary plate.

In Fig. 6 a modification is shown wherein

the main or longitudinal ribs have one face *d* formed at a slight angle—say five degrees—while the opposite side presents two sections *e* and *f* arranged at different angles.

In Fig. 7 is illustrated a construction in which both sides of the longitudinal ribs are formed with two faces or facets, the side which is designed to be uppermost having the faces *g* and *h* at relatively slight angles, while the lower side has two faces *i* and *j* arranged at different angles, the innermost face *j* being at approximately forty-five degrees to the horizontal.

Instead of having the cross or low ribs continuous or in alinement, as in the constructions heretofore shown and described, they may be staggered, as illustrated in Fig. 8. In said figure, G denotes the longitudinal continuous ribs, and H the cross-ribs, the latter being preferably lower than the others and spaced wider apart. As under the former constructions, a series of inverted pyramidal spaces will be formed between each pair of adjacent longitudinal and cross ribs, or, stated otherwise, the face of the plate will be provided with a series of pyramidal pockets formed by wedge-shaped ribs.

In Fig. 9 I have illustrated a plate provided with longitudinal ribs alone, the faces of the ribs, however, being given an angular relation, so that the upper face K lies in a substantially horizontal plane, as in the constructions heretofore described. While this arrangement will have the effect of destroying the caps of capped projectiles and deflecting uncapped projectiles, it is not as advantageous as those which employ cross-ribs, as the latter materially strengthen the plate and likewise assist in destroying the caps of capped projectiles. The construction, however, falls within that portion of my invention which relates to the angular formation or the angular relation of the faces of the longitudinally-disposed ribs. It will also be seen upon reference to the lower portion of Fig. 9 that I have provided the ribs with a series of relatively shallow notches *l*, which will have the effect of preventing cracks from extending throughout the length of the rib should one be started by a projectile or otherwise. Said notches will also permit the metal to contract without cracking when cooling during the hardening process.

The constructions herein shown, particularly those employing the cross-ribs, permit of better face-hardening than the ordinary plate, as the projecting portions allow slight yielding to compensate for the stresses set up and likewise present a greater superficial area upon which the cooling medium may act in the hardening process, thereby insuring the hardening of the plate to a greater depth.

The line or plane of junction between the

hardened and unhardened sections will assume a wavy form, (see the dotted lines, Figs. 1 and 2,) whereby a greater surface area of contact or junction is obtained between such hardened and unhardened portions, and spalling of the plate is thereby prevented to a greater or less extent. This is a point of considerable advantage, as it materially adds to the strength and life of the plate.

While the two series of ribs are shown as disposed at right angles to each other, it is to be understood that the invention is not limited to such arrangement, as any disposition thereof may be made so long as they are so spaced as to intercept any projectiles which would pierce an ordinary plate of the same thickness or weight.

Having thus described my invention, what I claim is—

1. Armor-plate provided with integrally-formed ribs, the opposite faces thereof as compared to each other being inclined in different angular relations to the body of the plate, said ribs being wedge-like in shape and formed upon curved lines at their bases and apices, whereby fracture or cracking of the plate, either in the process of hardening or by the impact of a projectile, is prevented.

2. Armor-plate provided with a series of integrally-formed ribs, one face of each rib lying in an approximately horizontal plane, whereby the nose of a projectile is prevented from striking the plate a fair blow and coming into contact with the plate at the bottom of the depression formed between adjacent ribs, substantially as described.

3. Armor-plate provided with a series of integrally-formed ribs, each of said ribs having its uppermost face lying in a plane approximately at right angles to the longitudinal axis of the plate, while the under face thereof stands at approximately forty-five degrees thereto, whereby the nose of a projectile is prevented from striking the plate a fair blow and coming into contact with the plate at the bottom of the depression formed between adjacent ribs, substantially as described.

4. Armor-plate provided with a series of pyramidal pockets or recesses in its face, the angle of inclination of the uppermost face of each pocket being greater than that of the opposite side, whereby the nose of a projectile is prevented from striking the plate a fair blow, substantially as described.

5. Armor-plate provided with a series of pyramidal pockets or recesses in its face, said pockets being defined by a series of wedge-shaped ribs formed integrally with the plate, the angle of inclination of the uppermost face of each of the longitudinally-disposed ribs being approximately at right angles to the longitudinal axis of the plate.

6. Armor-plate provided upon its face with intersecting wedge-shaped ribs, the ribs running in one direction being higher than the others.

7. Armor-plate provided upon its face with intersecting wedge-shaped ribs, the longitudinally-disposed ribs being higher than the others.

8. Armor-plate provided with intersecting wedge-shaped ribs, the ribs running in one direction being higher than the others, and the ribs and adjacent portions of the body of the plate being hardened.

9. Armor-plate provided with a plurality of depressions encompassed by a series of ribs having a wedge-shaped cross-section, the ribs running in one general direction being higher than those running in the opposite direction.

10. Armor-plate provided with a plurality of depressions encompassed by a series of ribs having a wedge-shaped cross-section, the ribs running in one direction being wider at their bases than those running in the opposite direction.

11. Armor-plate provided with a plurality of depressions encompassed by a series of ribs having a wedge-shaped cross-section, the ribs running in one direction being lower and wider at their bases than those running in the opposite direction.

12. Armor-plate provided with a series of intersecting ribs formed integrally with the body of the plate, the distance between the ribs being proportioned to the thickness of the plate and the size of the projectile which it is primarily designed to resist.

13. Armor-plate provided with a series of integrally-formed, wedge-shaped ribs, said ribs being so disposed as to produce a series of pyramidal pockets in the face of the plate, the distance between said ribs being proportioned to the thickness of the plate and the size of the projectile which it is primarily designed to resist.

14. Armor-plate provided with a series of integrally-formed, longitudinally-disposed, wedge-shaped ribs, the face of the body between each pair of such ribs having an undulating surface of a height less than that of the ribs.

15. Armor-plate provided with a series of integrally-formed ribs, said ribs being substantially wedge-shaped in cross-section with curved lines at their bases, one face of each rib lying in a plane at approximately right angles to the longitudinal axis of the plate, substantially as and for the purpose specified.

16. Armor-plate provided with a series of integrally-formed, wedge-shaped ribs, curved at their apices and bases, each of said ribs having one of its faces lying in a plane approximately at right angles to the longitu-

dinal axis of the plate, while the opposite face thereof stands at an angle of less than forty-five degrees thereto, substantially as and for the purpose specified.

5 17. Armor-plate provided with a series of pyramidal pockets or recesses in its face, the sides or walls of the pockets being curved at their bottoms and apices, the angle of inclination of one of the faces of each pocket being
10 greater than that of the opposite side.

18. Armor-plate provided with a series of pyramidal pockets or recesses in its face, said recesses being defined by a series of wedge-shaped ribs curved at their bases and formed
15 integral with the plate, one face of each of the aforesaid ribs being inclined at approximately right angles to the longitudinal axis of the plate.

19. Armor-plate provided with a plurality
20 of depressions encompassed by a series of ribs integrally formed with the plate, the angle made by the general contour of one of the faces of each rib being greater than that formed by the general contour of its opposite
25 face as measured from a plane passing through the longitudinal axis of the plate, said ribs being curved at their bases and apices, substantially as and for the purpose specified.

20. Armor-plate provided with a plurality
30 of integrally-formed ribs having major and minor sides or surfaces, the minor side of each rib being inclined at a greater angle, as measured from a plane passing through the longitudinal axis of the plate, than the major
35 side, said sides being curved at their apices and bases.

21. Armor-plate provided with a plurality of integrally-formed ribs and depressions having major and minor sides or surfaces,
40 the minor side of each rib being inclined at a greater angle, as measured from a plane pass-

ing through the longitudinal axis of the plate, than the major side, said sides being curved at their bases.

22. Armor-plate provided with a plurality
45 of integrally-formed ribs and depressions having major and minor sides or surfaces, the minor side of each rib being inclined at a greater angle, as measured from a plane passing through the longitudinal axis of the plate,
50 than the major side, said sides being curved at their apices, substantially as and for the purpose specified.

23. Armor-plate provided with wedge-shaped ribs integrally formed therewith, the
55 angles made by opposite faces of said ribs, with reference to a plane passing through the longitudinal axis of the plate, being unequal, and the apices and bases of said ribs being curved, substantially as and for the purpose
60 specified.

24. Armor-plate provided with two series of intersecting ribs, the ribs of one series being higher than those of the other, one face
65 of each of said higher ribs standing at approximately right angles to the longitudinal axis of the plate.

25. Armor-plate provided with two series of intersecting wedge-shaped ribs, the ribs being formed upon curved lines at their
70 apices and bases, and one series being higher than the other, the uppermost face of each of said higher ribs lying in a plane approximately at right angles to the longitudinal axis of the plate.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EMIL GATHMANN.

Witnesses:

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FANNIE WISE.