

Dec. 22, 1959

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2,917,801

APPARATUS FOR MAKING TILE PANELS

Filed Nov. 29, 1954

3 Sheets-Sheet 1

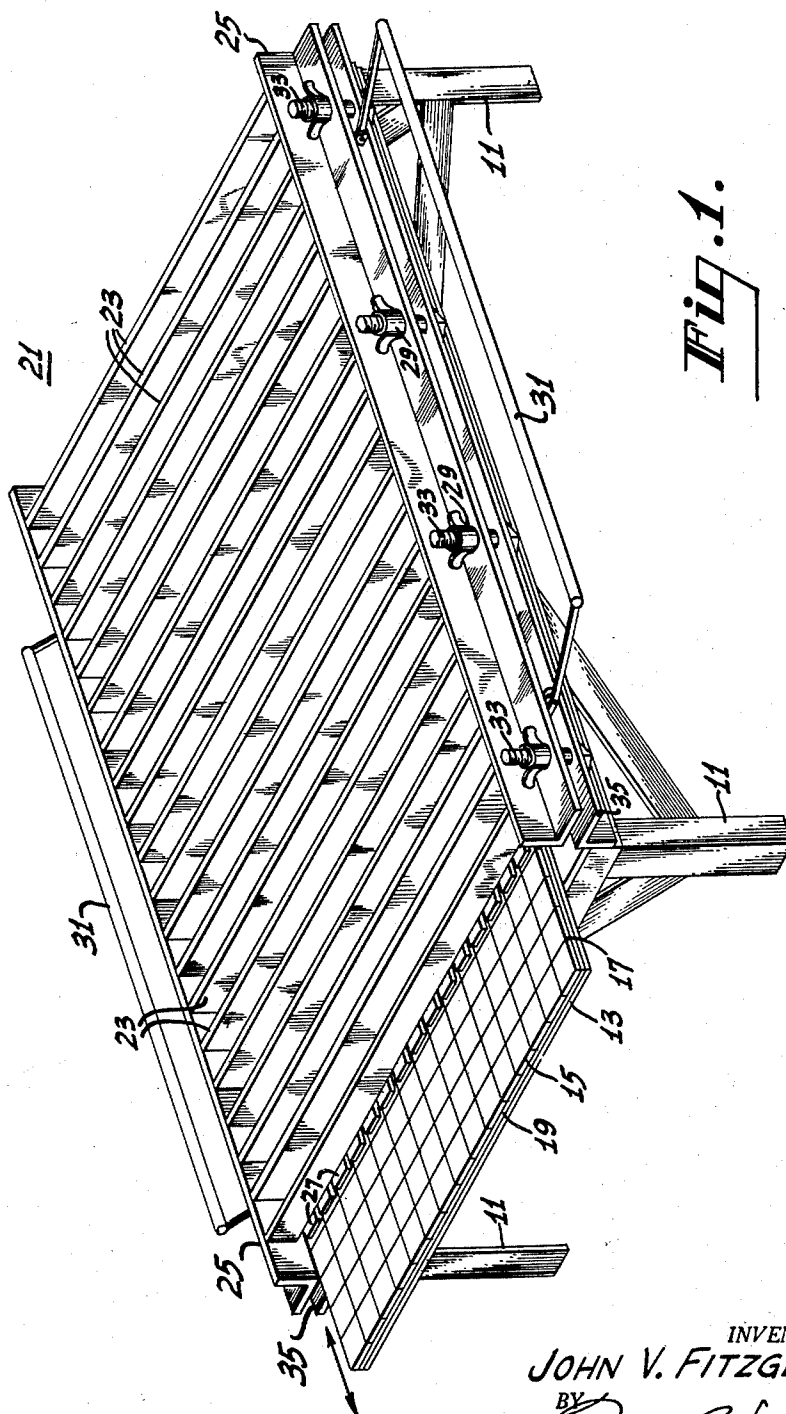


Fig. 1.

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3 Sheets-Sheet 2

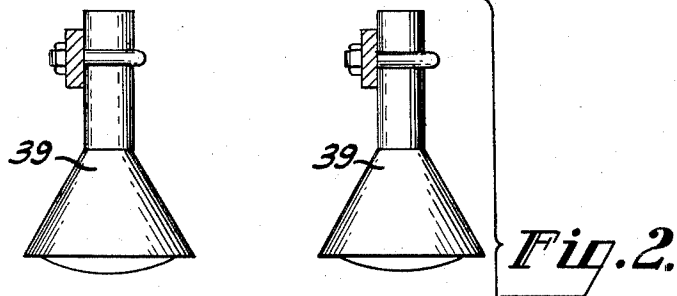
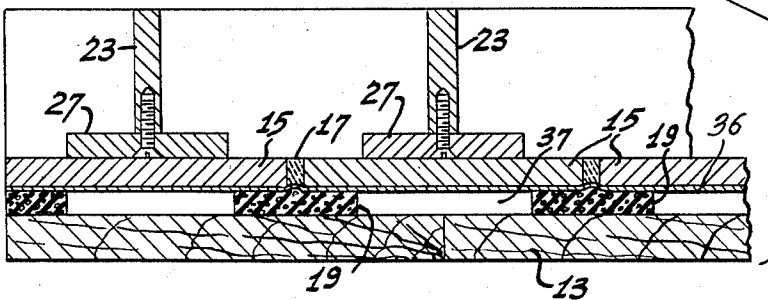
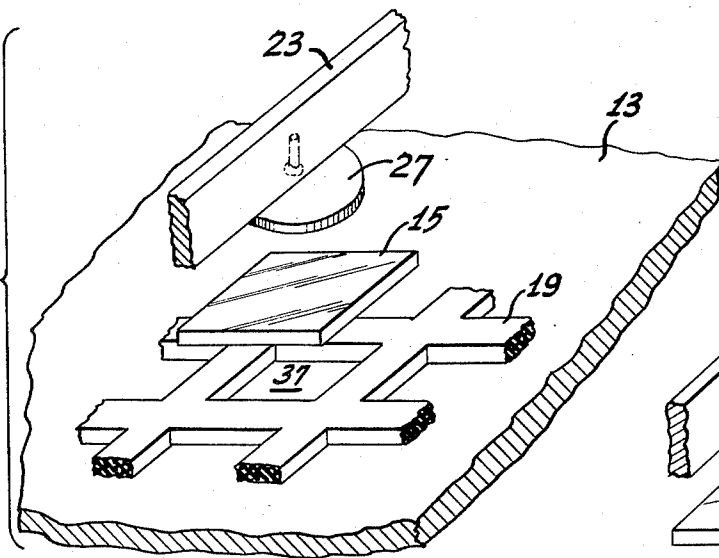
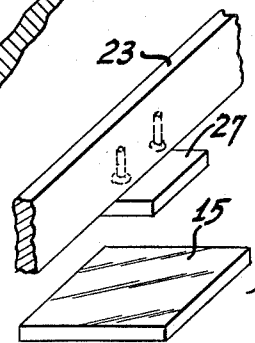


Fig. 3.

Fig. 4.

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3 Sheets-Sheet 3

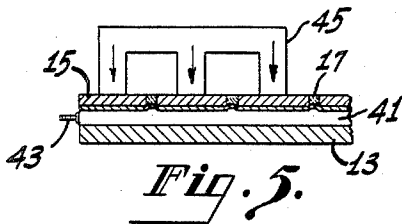


Fig. 5.

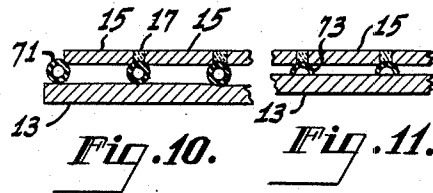


Fig. 10.

Fig. 11.

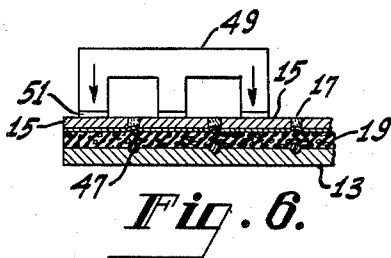


Fig. 6.

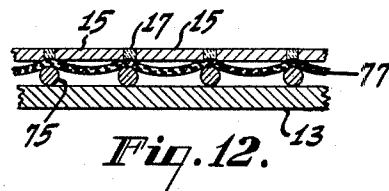


Fig. 12.

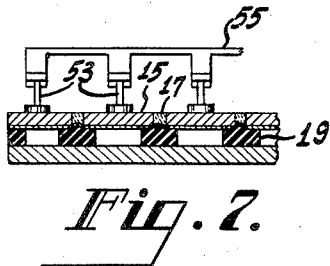


Fig. 7.

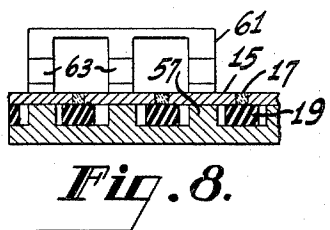


Fig. 8.

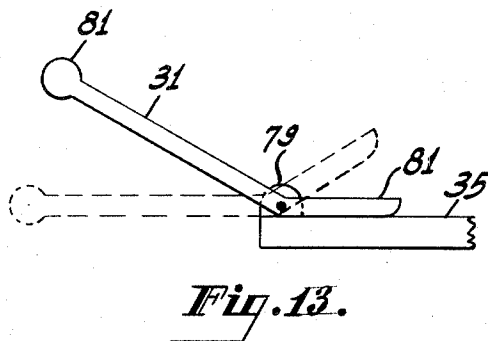


Fig. 13.

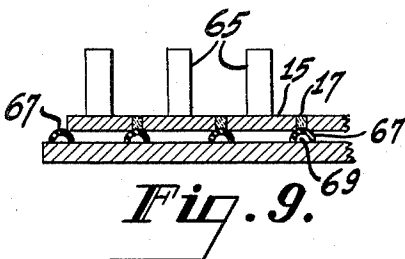


Fig. 9.

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APPARATUS FOR MAKING TILE PANELS

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Application November 29, 1954, Serial No. 471,749

3 Claims. (Cl. 25—1)

The present invention relates to panels constructed of a plurality of tiles and more particularly to apparatus suitable for mass production of multiple tile panels.

The employment of prefabricated multiple tile panels may offer a number of advantages which are not to be obtained by the construction of tile walls or panels at their permanent installation. The panels constructed with maximum tolerances and in accordance with mass production techniques may be made more uniform and thus provide a more pleasing appearance. Panels cut to predetermined sizes may be more quickly installed in a wide variety of installations. Prefabricated panels may be made more impervious to water or vapor.

A primary object of this invention is to provide an improved apparatus for making tile panels.

It is another object of this invention to provide apparatus for manufacturing panels consisting of a plurality of tiles wherein the panels are more uniform than can normally be done at a permanent installation of the tile panel.

It is still another object of this invention to provide increased use of tile by reducing cost of installation of tile.

According to this invention there is provided apparatus for the construction of multiple tile panels consisting of a rigid support member adapted to support a plurality of tiles on its upper surface in such a manner that the tiles are positioned edge to edge finished surface downward and spaced from each other to form grooves between the tiles. A flexible element distributed on the rigid support member under the grooves formed between the tiles is employed to seal the bottom of the grooves to enable the use of a fluid bonding agent. Means are provided for pressing the tiles and the flexible element together so as to cause the flexible element to provide a convex surface in the bottom of each of the grooves between the tiles.

Other and incidental objects of the invention will become apparent after a reading of the following specifications and an inspection of the accompanying drawings wherein:

Figure 1 illustrates the invention in one of its forms.

Figure 2 illustrates in more detail a portion of the machine shown in Figure 1. There is also shown in Figure 2 a series of heat lamps which may be employed to hasten the setting of the bonding agent.

Figure 3 shows detail in perspective of one form of this invention.

Figure 4 shows detail concerning another form of this invention.

Figure 5 shows still another form of this invention wherein there is employed a pneumatic flexible element for both sealing the bottom of the grooves between the tiles and for applying pressure to the tile.

Figure 6 shows still another form of this invention

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wherein rigid rods are employed under the flexible element to provide for a convex surface in the bottom of the grooves between the tile.

Figure 7 shows still another form of this invention wherein separate hydraulic pistons are employed for each of the tiles in a multiple tile panel.

Figure 8 shows still another form of this invention wherein there is employed limiting devices to insure still greater accuracy in the manufacture of tile panels.

Figures 9, 10 and 11 show additional forms which the flexible element between the tiles and the rigid support member may take.

Figure 12 shows still another form of this invention wherein there is employed a thin layer of flexible material over a series of rods.

Figure 13 illustrates details concerning a lever which is employed to raise the upper grillwork shown in Figure 1 to permit the insertion of the plurality of tiles.

Throughout the various figures of the drawing the same number will be employed to designate the same element.

Turning now in more detail to Figure 1, there is shown one form of this invention wherein a table or other rigid support member 11 is adapted to receive a rigid support member 13 upon which there has been placed a plurality of tiles 15. The tiles 15 are placed edge to edge and spaced sufficiently to provide a uniform groove 17 between each of the tiles 15. The tiles are placed with their finished surface downward on a flexible element 19, such as rubber or foam rubber.

The assembly of tiles 15 is placed under the grillwork 21 such that one of the edgewise positioned metal bars 23 is located over each row of the tiles 15. The edgewise positioned metal bars 23 are supported at their ends by angle iron 25. A plurality of dish shaped elements 27 are fastened to the bottom of each of the edgewise positioned bars 23 in such a manner that one of the dish shaped members 27 is centered on each of the tiles 15 when grill member 21 is lowered to apply pressure to the tiles 15.

The grill shaped member 21 is clamped down to apply pressure to the tiles by wing nuts 29 which are located on both sides of the grill 21. Handles 31 also located on both sides of the grill 21 are employed to raise the grill 21 off from the tiles 15 when the wing nuts 21 are loosened. It will be understood that the grill 21 must be raised at the time the tiles 15 are inserted or removed from the machine.

The bolts 33 upon which the wing nuts 29 are adapted to be placed extend from angle iron 35 on each side of the machine and are made fast to the angle iron 35 in order that they will extend upward and act as a guide when the grill 21 is being raised or lowered.

Table 11 may be extended to the left to provide a platform to support the member 13 upon which the tiles 15 may be put in their proper position and design before the assembly of the base 13 and tiles 15 is pushed under the grill 21.

Apparatus suitable for the manufacture of panels of standard $4\frac{5}{16}$ " by $4\frac{5}{16}$ " by $\frac{5}{16}$ " ceramic tile and constructed in accordance with the teachings of this invention in the form shown in Figure 1 may have the following dimensions. Table 11 measures 5'7" wide by 8' long. Edgewise positioned bars 23 measure 2" by $\frac{3}{4}$ " by 5'6 $\frac{3}{4}$ ". Angle irons 25 measure 4" by 4" by $\frac{3}{8}$ " by 8'. The dimensions referred to above are for illustrative purposes only and are not intended to limit the invention. With a machine having such dimensions a panel consisting of 300 ceramic tiles with an overall dimension of 5'6" by 8'2 $\frac{7}{32}$ " allowing for a $\frac{3}{32}$ " space between tiles for the tile bonding agent can be made.

Turning now to Figure 2 there is shown details concerning the rigid base member 13, flexible member 19, tiles 15 and the dish shaped members 27 as shown in Figure 1.

The rigid base member 13 may, for example, be a sheet of plywood upon which is mounted a flexible element 19 with a suitable adhesive to prevent the flexible element 19 from shifting its position on the rigid base member 13.

The flexible element 19 is distributed over the surface of the rigid base member 13 in such a manner that it will lie under the grooves 17 between the tiles 15.

A cleavage or release membrane 36 is located between the tiles 15 and the flexible element 19. The cleavage membrane 36 is employed to prevent the liquid bonding agent which is poured into grooves 17 from sticking to the flexible element 19. The cleavage membrane 36 may be made of polyethylene .0025" thick.

In the form of the invention shown in Figures 2 and 3 the flexible element 19 takes a grill-like form whose openings 37 are positioned under each of the tiles 15.

In the form of the invention shown in Figures 2 and 3 the flexible element 19 is cut out under the center of each tile in order to cause the flexible element 19 to bulge upward into the groove 17 when pressure is applied to the tiles 15. It will be seen that as the flexible element 19 bulges upward into the groove 17 there will be formed a convex surface in the bottom of the groove 17. The flexible element 19 may, however, extend with uniform thickness across the entire surface of the rigid base member 13. In such a form of the invention more pressure will be required on the tile 15 in order to cause a suitable bulge in the flexible element 19 up into the groove 17.

The convex surface at the bottom of the groove 17 caused by the upward bulging of the flexible element 19 into the groove when the flexible element 19 is subjected to pressure by the tile 15 provides for an attractive concave surface to the bonding agent on the finished surface of the panel. It will be remembered that the finished surface of the tiles 15 is downward in Figures 2 and 3.

In Figure 2 there is shown heat lamps 39 which are distributed over the whole surface of the machine to accelerate the setting of the bonding agent poured into grooves 17.

In Figure 3 there is illustrated a circular dish shaped element 27 centered over each tile 15 to apply pressure uniformly to the tile 15.

In Figure 4 there is shown a square dish shaped member 27 attached to bar 23 for the purpose of distributing the pressure evenly on the tile 15.

A practical embodiment of the form of the invention shown in Figure 2 employs 3" washers welded to the bottom of edgewise positioned bars 23 at the location of each of the tiles 15. The invention in the form shown in Figure 2 has operated successfully by the employment of 1/2" sponge rubber, softness grade, as the flexible element 19. A suitable size for the cut outs 37 has been found to be 3" square when ceramic measuring 4 1/16" by 4 1/16" by 5/16" was employed.

Figure 5 shows another form of this invention wherein there is provided a flexible element in the form of a pneumatic tube 41. The pneumatic tube 41 may be expanded by use of air or liquid inserted into the pneumatic tube 41 through a valve stem 43. It will be understood that in the form of the invention shown in Figure 5 the upper grillwork 45 may be positioned in a fixed relation with the supporting table beneath the rigid base member 13. A cleavage membrane 36 is employed to prevent the bonding agent in grooves 17 from sticking to the pneumatic flexible element 41.

In the form of the invention shown in Figure 5 the assembly of the rigid base member 13, the flexible element 41, the cleavage membrane 36, and the tiles 15 may all be assembled out from under the grill work 45 and slid

into position in the machine and under the grill work 45 before inflation of the pneumatic flexible element 41. When in position the pneumatic flexible element 41 is inflated in order to force the tiles 15 up against the grill work 45. The bonding agent is then poured into the grooves 17 and allowed to set. The pneumatic flexible element 41 is deflated when the bonding agent in grooves 17 has set and the assembly is pulled out of the machine. The finished tile panel may then be easily removed from the assembly which is then ready to receive another group of tiles 15 for the fabrication of another tile panel.

Figure 6 shows another form of this invention wherein there is employed a series of rigid rods 47 under the flexible element 19 which in this form of the invention may consist of a solid layer of flexible material such as sponge rubber. The rigid rods 47 are positioned under all of the grooves 17 between the tiles 15. It will be understood that the rods 47 extend crosswise to form a grill or screen-like pattern. The purpose of the rods 47 is to cause a bulge of the flexible element 19 into the bottom part of all of the grooves 17.

In the form of the invention shown in Figure 6 the upper grill work 49 includes flexible members 51 on the contact points of the grill work 49 with the tiles 15. Elements 51 may, for example, take the form of 1/8" hard rubber cushions. Rods 47 may, for example, be 3/16" diameter metal half-rounds to force the 1/2" foam rubber 19 tightly against the edges of the tiles 15.

Figure 7 shows still another form of this invention wherein there is employed individual hydraulic pistons 53 for applying pressure to the top of each of the tiles 15. In this manner equal pressure may be conveniently applied to each of the tiles 15. The hydraulic pistons 53 may be energized by forcing liquid into the common supply chamber 55.

Figure 8 illustrates still another form of this invention wherein there is provided stops 57 in the form of extensions of the rigid base member 59 to provide a uniform limit to the downward movement of the tiles 15 when subjected to pressure by the grill work 61. In order to provide for the necessary resilience in the members clamping the tiles 15 flexible elements 63 have been inserted in the grill 61.

It will be understood that with the employment of the stops 57 a tile panel may be fabricated which has an extremely accurate finished surface.

Figure 9 illustrates still another form of this invention wherein individual weights 55 are employed to acquire uniform pressure against each of the tiles 15. In the form of the invention shown in Figure 9 there is illustrated a split rubber tubing 67 covering a half-round 69. The combination of the split rubber tubing 67 and the half-round 69 extend under all of the grooves 17 in order to provide a convex surface in the bottom of the grooves 17.

Figure 10 illustrates a form of the invention employing soft rubber rods or tubes 71 as flexible elements. When soft rubber tubes 71 are employed little or no pressure on the top of the tiles 15 is required to provide for a convex surface in the bottom of grooves 17.

Figure 11 shows the use of split flexible tubing 73 as the required flexible element.

Figure 12 illustrates a form of the invention wherein there is provided a series of rods 75 covered by a thin sheet of flexible material 77. The material 77 may, for example, consist of a thin sheet of 1/8" foam rubber.

In the forms of the invention shown in Figures 8, 9, 10, 11, and 12 it will be seen that no cleavage membrane such as illustrated in the other forms of the invention is employed. In order to prevent the bonding agent from adhering to the flexible elements the flexible elements may be coated with silicone to provide for the release of the bonding agent.

In order to provide for the release of the bonding agent from the cleavage member or flexible element and in

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order to prevent a feather edge of the bonding agent on the surface of the tile adjacent to the edges of the tile by capillary action of the bonding agent a silicon oil or a silicon emulsion may be employed to coat the surface of the tile near the edges of the tile in contact with the cleavage membrane or flexible element. Other agents than silicone may be used providing they are incompatible with the bonding agent in order that they will prevent capillary action of the bonding agent.

Figure 13 illustrates an end view of the levers 31 more clearly shown in Figure 1. The fulcrum 79 of the lever 31 may be fixed to the angle iron 35 of Figure 1. By pressing downward on the handle 81 the point 83 will be pushed upward to lift the grill 21.

Apparatus constructed in accordance with the teachings of this invention is suitable for the fabrication of ceramic tile panels as shown and described in my co-pending application entitled Ceramic Tile Panels and Structural Members, Serial No. 471,748, concurrently filed.

Although any suitable bonding agent may be employed in the grooves 17 an improved bonding agent is described in my co-pending application entitled Dry Mortar Mix Comprising Portland Cement and Polyvinyl Acetate, Serial No. 471,910, concurrently filed. The application referred to immediately above teaches the use of Portland cement and polyvinyl acetate in the ratio of about one hundred parts by weight of the cement and up to fifty parts by weight of the polyvinyl acetate. A stearate and powdered aluminum as well as a fungicide may be added to the mortar mix suggested immediately above.

Having thus described the invention what is claimed is:

1. Apparatus for making tile panels comprising the combination of a rigid support member, said rigid support member adapted to receive a plurality of tiles positioned edge to edge and spaced from each other forming grooves between tiles, a flexible member having a grill-like form, said flexible member distributed on said rigid support member under the grooves between said tiles and forming a convex surface at the bottom of the grooves be-

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tween the tiles, means for pressing said tiles and said flexible member together, means for filling the grooves between the tiles with a tile bonding agent, and wherein said pressure applying means consists of means for expanding said flexible member and there is provided a rigid member clamping said tile and said rigid support member.

2. Apparatus for assembling glazed tile panels comprising the combination of a support member having a flexible surface element, a plurality of tiles positioned edge to edge, glazed side downward on the flexible surface element of said support member, said flexible surface element having greatest uncompressed thickness under the space between the edges of said tile and with a space between said tiles, means for compressing said flexible surface element with said tiles, means for filling the space between the edges of said tile with a bonding agent while said flexible surface element is in a compressed condition, and wherein there is provided a compression limiting member under each tile, said compression limiting member consisting of rigid members extending from said support member by an amount less than the thickness of said flexible surface element when said flexible surface element is not compressed.

3. The invention as set forth in claim 2 and wherein said compressing means includes a flexible member.

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