D. F. SULLIVAN.

SUCTION BOX AND COVER.

APPLICATION FILED JULY 27, 1916. RENEWED JAN. 28, 1918.

1,279,170.

Patented Sept. 17, 1918.

2 SHEETS—SHEET 1.

Fig. 1.

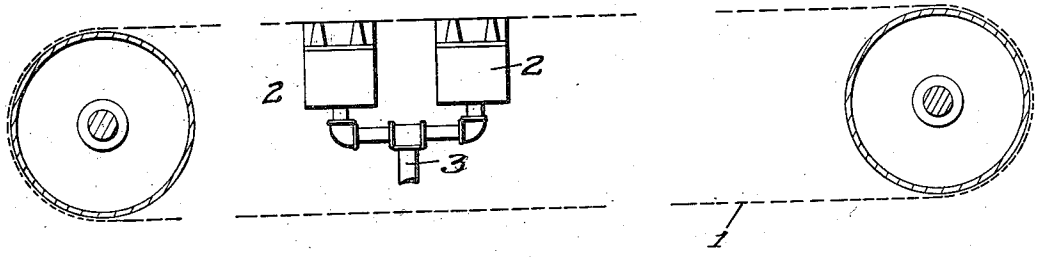


Fig. 2.

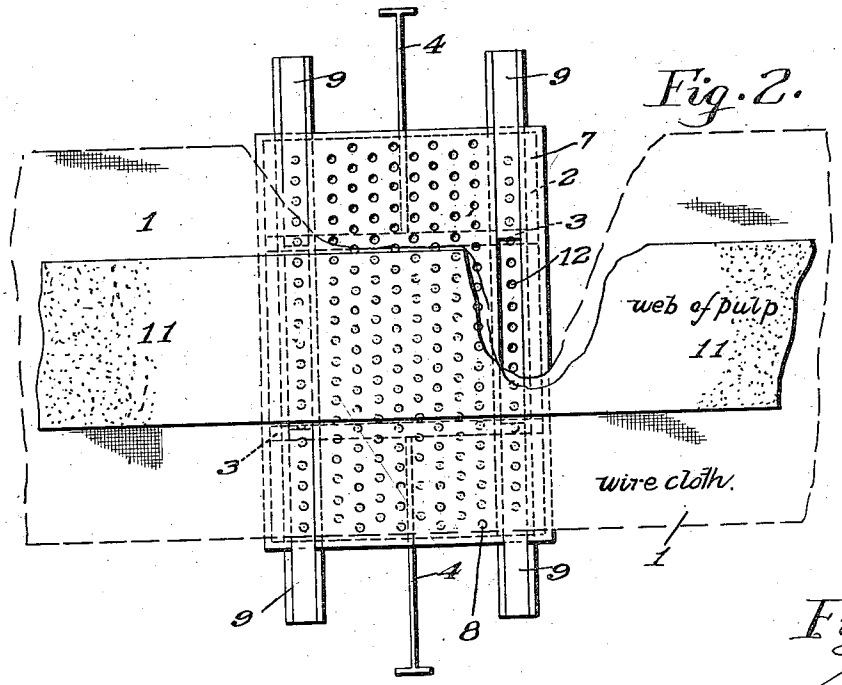


Fig. 4.

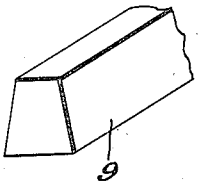
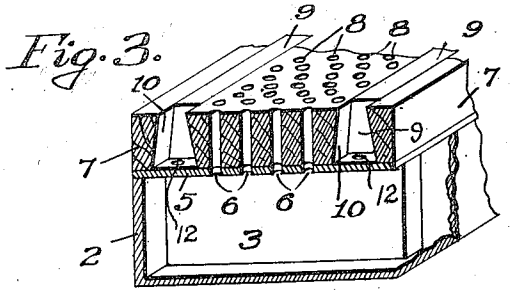


Fig. 3.



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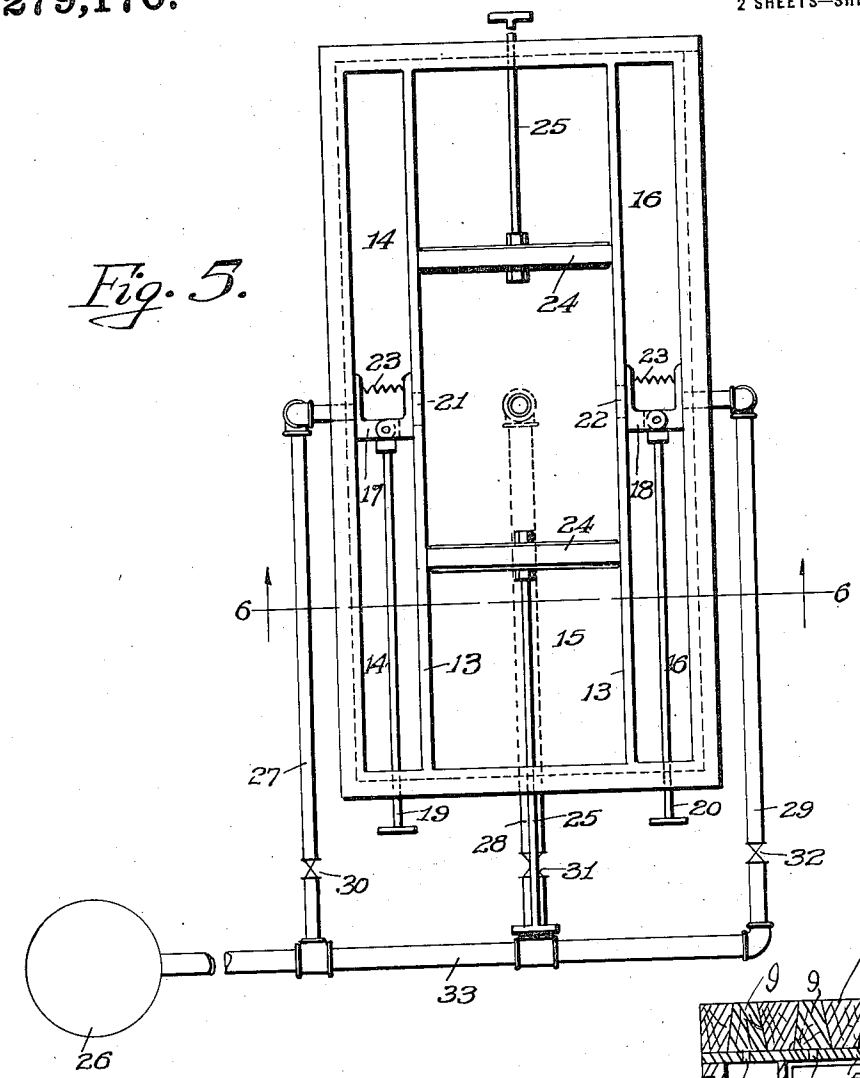
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2 SHEETS—SHEET 2.

Fig. 5.



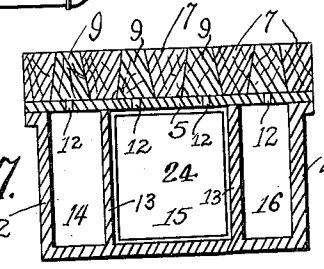


Fig. 7.

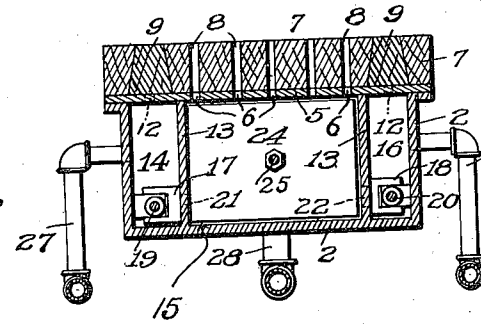


Fig. 6.

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UNITED STATES PATENT OFFICE.

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SUCTION-BOX AND COVER.

1,279,170. Specification of Letters Patent. Patented Sept. 17, 1918.

Application filed July 27, 1916, Serial No. 111,623. Renewed January 28, 1918. Serial No. 214,248.

To all whom it may concern:

Be it known that I, DAVID F. SULLIVAN, a citizen of the United States of America, residing in the city of Holyoke, county of Hampden, and State of Massachusetts, have invented certain new and useful Improvements in Suction-Boxes and Covers, of which the following is a specification.

This invention relates to improvements in paper making machines. It has for one of its objects an improvement relating to suction boxes and covers therefor which are used in this class of machines.

Heretofore, it has been the common practice to make the perforated cover of suction boxes of metal. This practice has been found to be objectionable on account of the excessive wear of the Fourdrinier wire which travels over and in contact with the metal cover of the box, causing the wire to be worn out very much sooner than if some other material than metal is employed for the cover, as wood or hard rubber. In my invention the cover is formed with two members, the upper member of the cover portion of the box with which the wire engages is made preferably of wood or other suitable material. This wooden member is secured at its lower side to the metal plate and both members are formed with perforations which are in alinement or registration with each other and which extend through the cover from its upper to its lower side.

A further object of my invention is to provide a cover in which parallel slots are formed in the upper member at the opposite sides of the box, that is to say, the side which is first engaged by the wire and the side or edge where the wire leaves the box. In these slots are located slides of suitable shape in cross section which can be moved inward and outward from the ends of the box for the purpose of varying the effective area of the suction in accordance with the width of the stream of pulp on the wire. It is the present practice to locate within the box a suction head which is adapted to be moved inward and outward to position the same so as to provide a space between the suction heads that corresponds with the width of the stream of pulp on the wire. In the present invention the usual suction heads are employed, but, in addition the slide or slides are used which can be readily positioned so as to cause the inner ends to register with the suction heads within the box.

A further and important object of my invention is to provide devices for preventing the uneven or streaked appearance which sometimes occurs in the finished sheet of paper, especially where the paper is colored. It is a well-known fact that in paper stock, which is known as "free" stock, the suction box fails to uniformly remove the water and coloring matter, since the usual perforations or openings in the cover of the suction box sometimes become filled rendering them inoperative and the suction action imperfect owing to the suction draft being so weak as to fail to keep the perforations clear. In my improvement the location and provision of transverse grooves at the near and far sides of the cover and having perforations in the bottom of these grooves provides an effective means for uniformly removing the water and coloring matter completely across the sheet or web of moving paper pulp. In paper stock that is "free" most of the water flows freely through the meshes of the wire before it reaches the suction box. In this case the amount of vacuum or suction which is required for removing the necessary remaining portion of water in the pulp would not be required to be so strong.

A further object of my invention is to provide a suction box having a plurality of compartments or chambers with suitable devices for connecting and disconnecting the various compartments with the vacuum pump. These compartments of the box are designed to coöperate with the especially constructed cover herein shown and described. Further objects and nature of the invention will occur in the body of the specication and be specifically pointed out in the claims.

Referring to the drawings:

Figure 1 is a diagrammatic view showing the Fourdrinier wire passing over supporting rolls and the usual suction boxes which are located below the upper strand or travel of the wire;

Fig. 2 shows a plan view of a portion of the wire and also the arrangement of the slides in the upper member of the cover which are located in grooves near the opposite sides of the same. This view also illustrates the usual perforations which are located in the cover. In this view the usual form of suction box is shown.

Fig. 3 is a perspective view partly in section showing the two members composing

the cover, also the peculiar form of the slides which are used to vary the effective suction area of the box; and

Fig. 4 is a perspective view of a portion of one of the slides;

Fig. 5 is a plan view of the box with the cover removed, showing the gates or slides for shutting off communication between the interior of the box and the two outer compartments, also the suction heads in the center portion of the box, the arrangement of the piping which is connected to the vacuum pump;

Fig. 6 is a transverse sectional view on the line 6—6 of Fig. 5 looking in the direction of the arrows and showing the gates or slides in the lower part of the side compartments, also illustrating the cover with the slides at the opposite sides, similar to the view shown in Fig. 3; and

Fig. 7 is a view of a cover in which the perforations are omitted and only slides are used.

Referring to the drawings in detail: The usual Fourdrinier wire is indicated at 1, 2 is the suction box which is suitably connected by means of the pipe 3, to a suction pump for producing the necessary vacuum within these boxes. Located within the boxes are the usual adjustable suction heads 3 which are adapted to be moved inward and outward from the ends of the box by means of the rods 4 in accordance with the width of the stream of paper pulp.

Referring now to the specific construction of the cover for the box, 5 indicates the rigid metal plate that is formed with the perforations 6. Secured to this plate by any suitable means, is a member 7 which is also formed with perforations 8 which register with the perforations 6. These perforations extend the entire length of the box as shown. This member is preferably made of wood, or other suitable material in order to reduce friction and wear on the wire. Besides wood, hard rubber, or other suitable material may be employed for the upper member of the cover. 9 designates slides which are formed wedge-shape in cross-section and are located in channels or grooves 10 in the upper member 7 of the cover and at the opposite sides of the box. These slides are adapted to be moved inward and outward for the purpose of positioning the same in order to make them agree in position with the suction heads 3 for locating their inner ends in the same vertical planes as the suction heads 3. The inner ends of the slides, as shown in Fig. 2, must register with the inner surface of the suction heads 3 in order to cause the vacuum pumps to effectively act on the stream of paper pulp which passes across the grooves 10 and at 11 on the wire 1. The width of this stream of pulp of course varies with the width of paper that is being produced. If a wide sheet is required the suction heads 3 and the slides 9 would necessarily be moved outward toward the end of the suction box, and, if a narrow web of paper is being made these heads and slides are moved inward in accordance with the width of the stream of pulp, which is clearly shown in Fig. 2, otherwise the suction in the box 2 would not properly operate to extract the water.

An important feature of the present invention is the location of these slides 9 at the opposite sides of the suction box and in wedge or other suitable-shaped grooves in the upper member of the cover of the box, the cross sectional area of the grooves and slide being, of course, equal in area, whereby when the suction pumps are operated a liquid tight joint is produced between the slides and the grooves, and effectively seals the perforations in the plate 5. It is to be understood that I do not limit myself to any particular shape of slides as triangular or hexagonal or other suitable shaped slides may be employed. It has been found in practice that slides which are formed with parallel sides and that lie in vertical planes do not produce a tight joint when the pump is operated. It will be noticed that the bottoms of the grooves 10 are formed with a plurality of perforations 12 which extend the entire length of the groove and box which communicate with the interior of the box and through which the water and coloring matter contained in the pulp is largely extracted when the layer of pulp passes over this first groove and more water is extracted as the pulp travels across the cover of the box. It should be stated that the purpose of the metal member 5 to which the wooden member 7 is secured is to cause the wooden member to retain its shape without being effected by the liquids whereby a smooth upper surface is always maintained, and form a base to keep the slides in true horizontal positions. In Fig. 7 is shown a cover in which all perforations in the upper member of the cover are omitted and in their place slides only, are used, four of which are shown. These slides may be simultaneously operated in any suitable manner, as by securing the same to a common cross-bar or operating handle. This form of cover is shown in this figure in connection with a suction box which is divided into a plurality of compartments, as shown in Figs. 5 and 6.

Referring now to the construction of the box proper which is shown in Figs. 5 and 6: 13 designates two partitions which extend the entire length of the interior of the box, forming the chambers 14, 15 and 16. The center chamber 15 lies directly under the main or center portion of the cover 7 in which the perforations 6 and 8 are located.

The side chambers 14 and 16 lie directly under the grooves 10 and slides 9 which serve to open and close the perforations 12 in the bottoms of the grooves 10. Located in the chambers 14 and 16 are the slide valves or gates 17 and 18 which are operated by means of the rods 19 and 20 to the outer ends of which a suitable handle is connected. These slides are designed for opening and closing the ports 21 and 22 in and at bottom portions of the partitions 13. These parts are designed to form communicating passageways between the central chamber 15 and the two side chambers 14 and 16. The slides or valves 17 and 18 are constructed in any suitable manner so as to properly close the ports 21 and 22. The form shown, illustrates two members which are suitably pivoted together and having an expansion spring 23 for holding the slides firmly against the partitions 13 of the box in order to impart a suitable pressure and prevent leakage. Slidably located within the middle or main compartment or chamber 15 are the suction heads 24 which are designed to correspond in position if desired with the position of the suction heads 3 shown in Fig. 2 and which are operated in the usual manner by means of the rods 25.

The usual vacuum pump is indicated at 26 and connected to this pump and with the three compartments or chambers of the suction box are the branch pipes 27 and 28 and 29 having the valves or shut-off devices 30, 31 and 32. Each of the branches 27, 28 and 29 are in turn connected to the main pipe 33 that leads directly to the vacuum pump 26. By means of the piping construction and slides or valves 17 and 18 shown in Figs. 5 and 6 it will be seen that a vacuum can be simultaneously produced in each of the compartments 14, 15 and 16, or, a vacuum can be produced in any one compartment independently of the others, or any two, independently of the third by properly operating the valves 30, 31 and 32 and the slides or valves 17 and 18.

In order to make the operation of the invention clear it may be assumed that the stock which is running on the wire 1 is "free." In this case only the compartments 14 and 16 under the grooves 10 and the two slides 9 would be used for the suction area to extract the water from the pulp. The valve 31 would be closed and the valve 30 and 32 would be open. The vacuum in the grooves 10 would then be sufficient to extract the necessary quantity of water remaining in the pulp. The transverse groove 10 would prevent any liability of the paper being formed with streaks or discolorations and have uneven appearance, particularly on tints or colors.

Assuming now that the pulp is "slow" in this instance it will be necessary to provide a greater suction area in the box. It will be necessary to open all three of the valves 30, 31 and 32, and also the ports 21 and 22 should be uncovered by operating the gates 17 and 18 to permit the water to flow from one compartment to another. A strong vacuum would then be simultaneously produced in all of the three compartments 14, 15 and 16.

From this construction of suction box and cover it will be seen that by suitably operating the valves 17, 18, 30, 31 and 32, the suction heads 24, and the slides 9 a correct vacuum or suction area can be produced in the box, whereby the correct quantity of water will be extracted from the pulp. Also, it will be observed that the transverse grooves 10 at the edges of the cover for the suction box will operate uniformly on the entire width of the stream of pulp and thus prevent any unevenness of color in the sheet. By locating the perforations 12 in the bottom of the grooves 10 there is less liability of these perforations becoming clogged or closed by means of the pulp being drawn through the mesh of the wire. Experience shows that where the cover is formed with perforations only, some of these perforations soon become clogged causing streaks to appear in the finished paper.

In the construction shown in Fig. 7 it will be seen that instead of the perforations 6 and 8 any one or all of the four slides 9 may be adjusted to provide the necessary vacuum area in the same manner as already described in connection with Fig. 6. The slides not in use, will serve to provide a supporting surface for the wire in the same manner as the cover with the perforations shown in Fig. 2.

It will be seen from my construction of suction box that when the wire on which the pulp is placed is traveling across the upper surface of the cover a uniform pressure will be exerted on the entire surface of the wire by reason of the large number of perforations which are in communication with the suction apparatus. It has been found from experience that unless the suction effect is uniform over the whole surface of the wire the same will not travel in a straight line but in a wavy or zig-zag manner resulting in damage to the side edges of the wire. It is to be understood in the operation of my suction box and cover that the operator may, if he desires, use either one or both of the slides 9. In case only one slide is used the suction effect would then be confined to a central portion and one of the side compartments of the box. The number of perforations to be used would depend upon the quality of the pulp from which the water is to be extracted.

What I claim is:

1. A cover for a suction box comprising

members having perforations which register with each other, extending to the upper surface of the box, the opposite side edges of the cover being formed with grooves extending downward to the lower member, slides mounted in said grooves and of the same shape in cross section as the grooves, the bottom of the grooves being formed with a plurality of perforations opening into the suction box and extending the full length of the box whereby when a stream of pulp passes across the cover of the suction-box the water contained in the pulp will be uniformly extracted over the entire surface, as described.

2. A suction box comprising an inclosing casing, a cover for the box having a plurality of rows of circular shaped perforations therethrough and extending the entire length of the box, the said cover being formed with grooves to receive slides for covering and uncovering those portions of the grooves not covered with the wire, said slides being adapted to register with the usual movable suction head within the box and independently of said head, whereby said box can be varied or controlled to extract water from a stream or layer of pulp of different widths, as the wire on which the pulp is conveyed passes across said cover.

3. A cover for a suction box for use in paper making machines and comprising members suitably secured together, each of the members being formed with a plurality of comparatively small perforations of the same diameter which register with each other and through which the water contained in the pulp is drawn, one member of the cover having a groove and a row of perforations in the other member extending the length of the groove, a slide located in the groove, the shape of the slide in cross section corresponding with the shape of the groove, whereby a tight joint will be effected between the slide and the groove when the suction pump is operated.

4. A cover for a suction box the opposite upper sides only of which are grooved the entire length of the box, slides located in said grooves, and the bottom part of the grooves having a plurality of perforations extending the entire length of the box, and a plurality of continuous perforations in the cover between the grooves.

5. A cover for a suction box comprising members formed with registering perforations which extend through said members, one of the members having grooves adjacent the opposite upper side edges of the same, slides located in said grooves, said grooves and slides having inclined sides which engage, whereby a liquid tight joint is formed between the slides and the grooves when the suction pump is operated to extract the liquids contained in the pulp.

6. A cover for a suction box formed of upper and lower members, the lower member being of metal and the upper one of wood, or other suitable material to reduce friction between the cover and wire, said members having registering perforations therethrough, the upper member having grooves with inclined sides extending from the top to the bottom, slides mounted in the grooves, the other member having perforations in the bottom of the grooves and extending the entire length of the grooves, whereby the effective area of the box can be varied by varying the position of the slides, as described and rows of perforations between the grooves and extending to the upper surface of the cover.

7. A suction box and cover for the same, said box having its interior portion divided into a plurality of compartments, the central compartment having communicating ports with the adjacent side compartments, means for closing said ports, means for producing a vacuum in the different compartments, devices for independently controlling the vacuum in each compartment, said cover being perforated and having grooves adjacent the opposite side edges, slides in the grooves for controlling some of the perforations which lead to said side compartments, the center portion of the cover having openings communicating with the central chamber of the box, whereby when the web of paper passes over the cover the suction effect exerted on the pulp can be varied in any one of the compartments depending upon the condition of the web when it reaches the suction box.

8. A suction box and cover therefor, said box having partitions within the box for dividing the interior space into a plurality of compartments, the partitions having passageways for forming communication between the different compartments, a cover formed with grooves adjacent its opposite sides, said cover having perforations leading from the top to the interior of the box, means for independently producing a vacuum in each of the compartments, and means for controlling said vacuum.

9. A suction box having its interior portion divided into a plurality of compartments, the central or main compartment being larger than the adjacent side compartments, means for forming communication between the central and the side compartments, means for producing a vacuum in each of the compartments, a perforated cover the opposite sides of which are formed with grooves which are arranged over the side compartments, a slide in each of the grooves for controlling the perforations in that portion of the cover, and for controlling the suction effect in its lower adjacent compartment, whereby when a stream of paper

pulp passes over the cover the suction effect produced on the pulp may be varied.

10. A vacuum box and cover for the same, for use in paper making machines, the box having a plurality of compartments, said cover having perforations extending therethrough, the lower portion of the cover being formed of rigid material, as metal, and the upper portion of the cover being formed of a substance, as wood, for reducing the friction between the cover and the Fourdrinier wire, the opposite side edges of the cover each having a groove that is arranged over a compartment of the box, an adjusting device located in each of said grooves for adjustment depending upon the width of the stream of paper pulp, means for forming a vacuum in each of the compartments and means for completely shutting off any one of the compartments from the others, as described.

11. A cover for a suction box having a plurality of grooves therein, slides in said grooves, a suction box having its interior space divided into compartments, means for producing a vacuum in any one or all of the compartments, the slides being located over the compartments, whereby the water contained in the pulp may be extracted by any one or all of the compartments.

12. A cover for a suction box across the upper surface of which the moving web of wire moves, said cover having a groove near the opposite sides, slides in the grooves, the bottoms of the grooves having perforations and the surface between the grooved sides also having perforations whereby a uniform suction effect is produced over the entire surface of the web of moving wire on which the pulp is placed and a uniform pressure will be exerted over the entire upper surface of the cover.

13. A cover for a suction box having a groove therein, a slide with inclined sides in said groove, a suction box having its interior space divided into compartments, means for producing a vacuum in any one or all of the compartments, the slide being located over a compartment, whereby the water contained in the pulp may be extracted by any one or all of the compartments.

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