# United States Patent [19]

**Mauthe**

[11] **3,786,215**

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[54] **ELECTRICAL COMPRESSION SWITCH**


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[30] **Foreign Application Priority Data**

Dec. 1, 1970 Switzerland ..... 17815/70

[52] **U.S. Cl.** ..... **200/148 A,** 200/150 G

[51] **Int. Cl.** ..... **H01h 33/70**

[58] **Field of Search** ..... 200/148 A, 150 G



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*Attorney*—Ralph E. Parker et al.



[57] **ABSTRACT**

An electrical switch of the compression type wherein for quenching the arc drawn in a gap formed between the contacts as they disengage, a pressurized gaseous quenching medium is caused to flow into the gap. The quenching medium is compressed during a so-called pre-compression phase of the switch contact movement, and prior to disengagement of the contacts, by a piston and cylinder arrangement surrounding the movable contact, there being an energy-storing device in association with the piston which latter is actuated in one direction within its cylinder by the movable contact during a contact-closing movement to bring the gaseous quenching medium through a one-way valve into the cylinder and also store energy. During the first phase of a contact-opening movement the stored energy acts upon the piston causing it to move in the opposite direction thus compressing the gas within the cylinder and subsequently freed to flow into the gap between the contacts as soon as they disengage.


**8 Claims, 4 Drawing Figures**

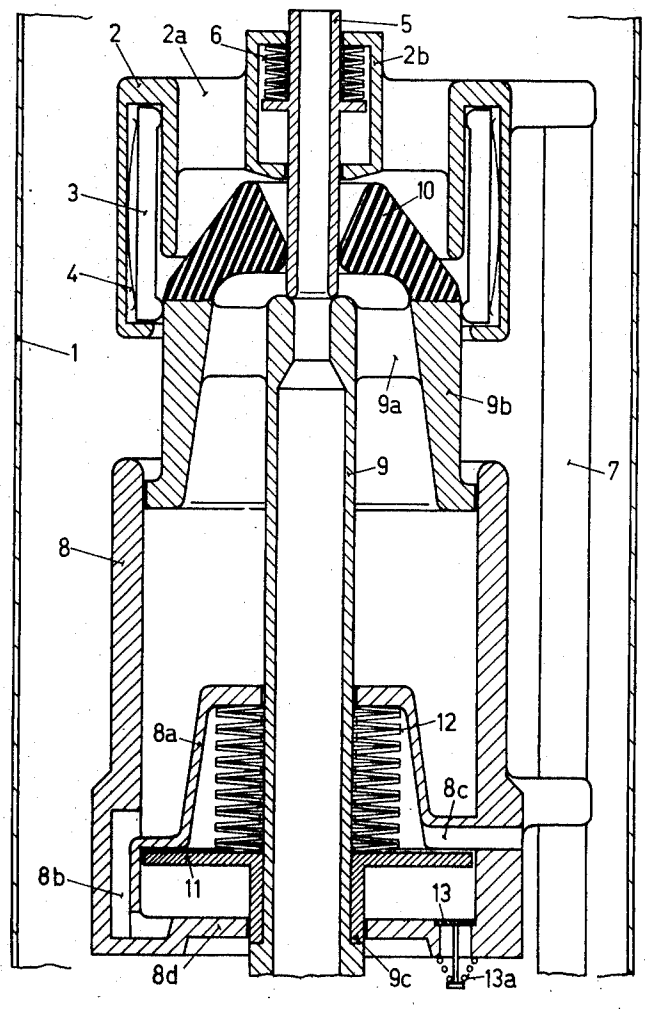
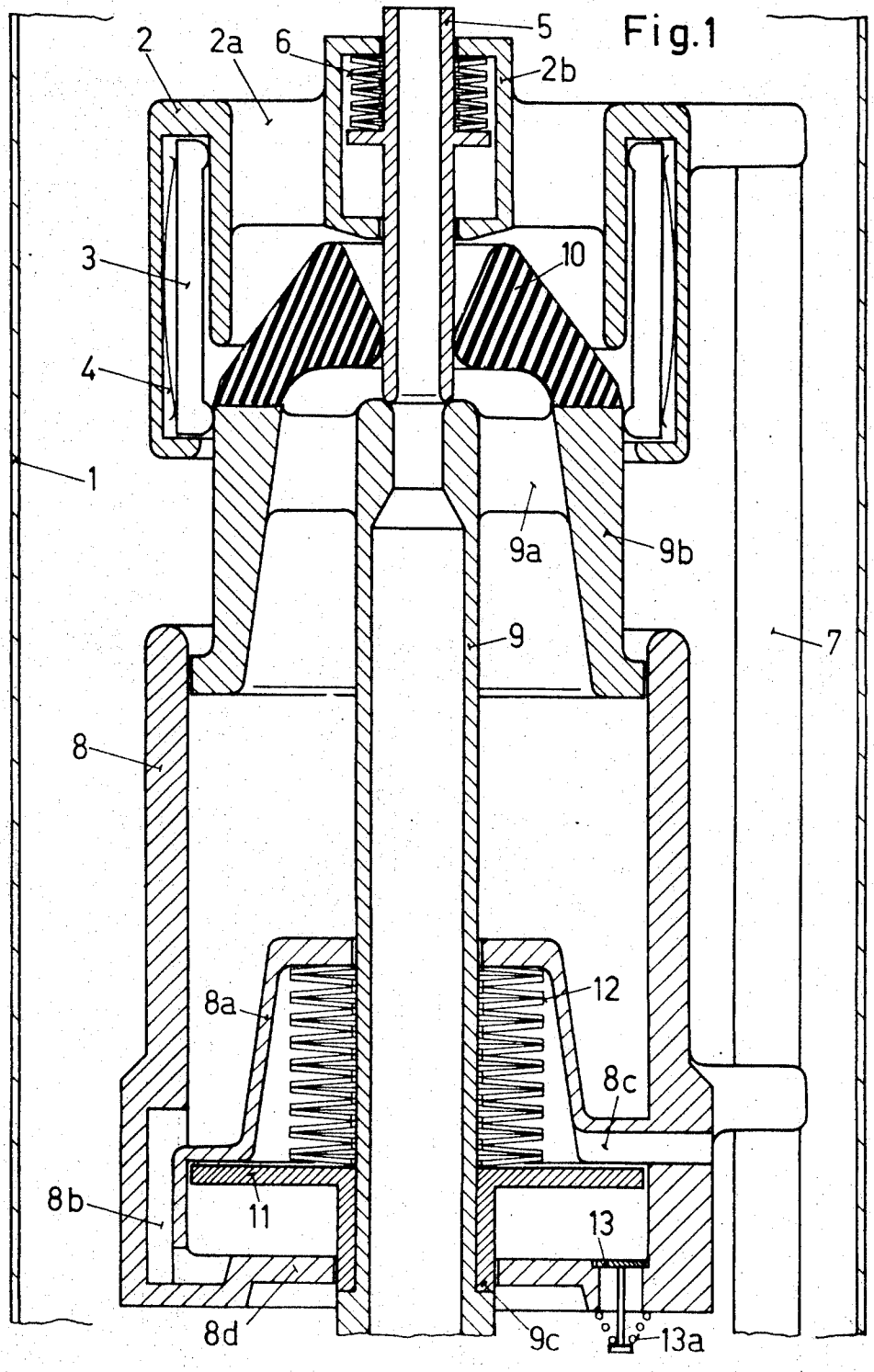


Fig.1



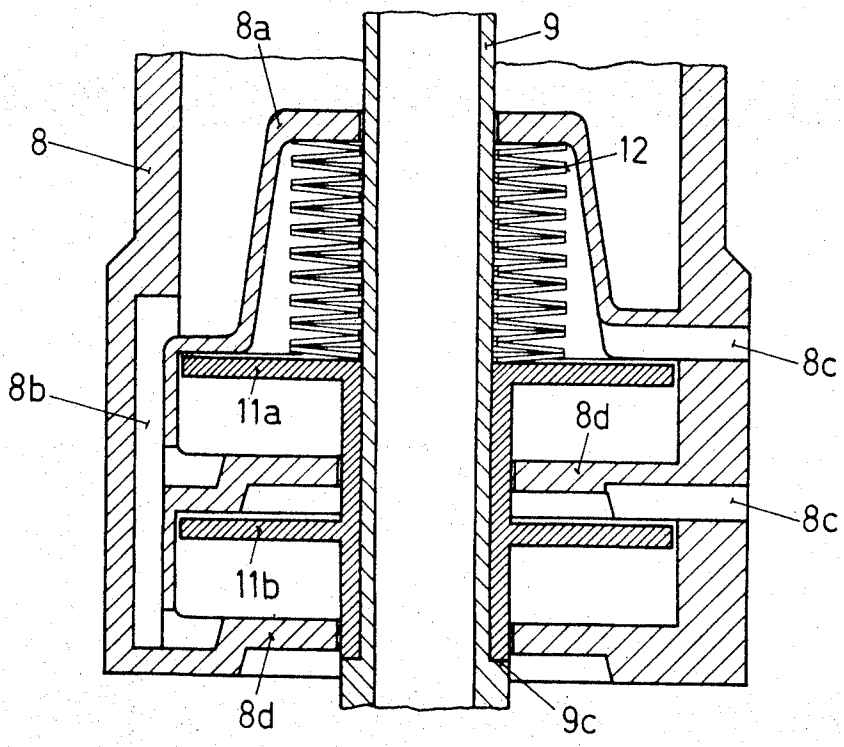

8a
9
8
12
8c
8b
11a
8d
8c
11b
8d
9c

Fig. 2

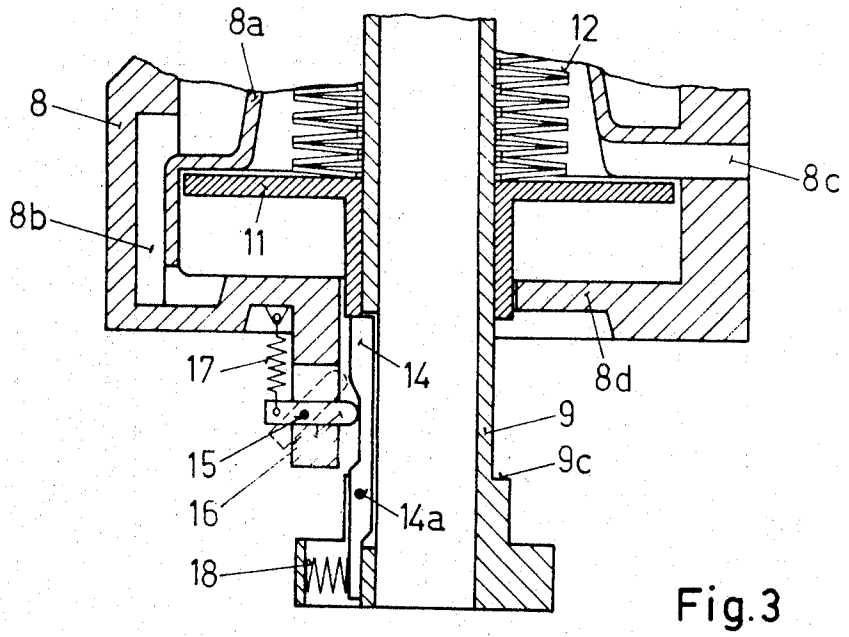

8a
12
8
8c
8b
11
17
14
8d
9
15
9c
16
14a
18

Fig. 3

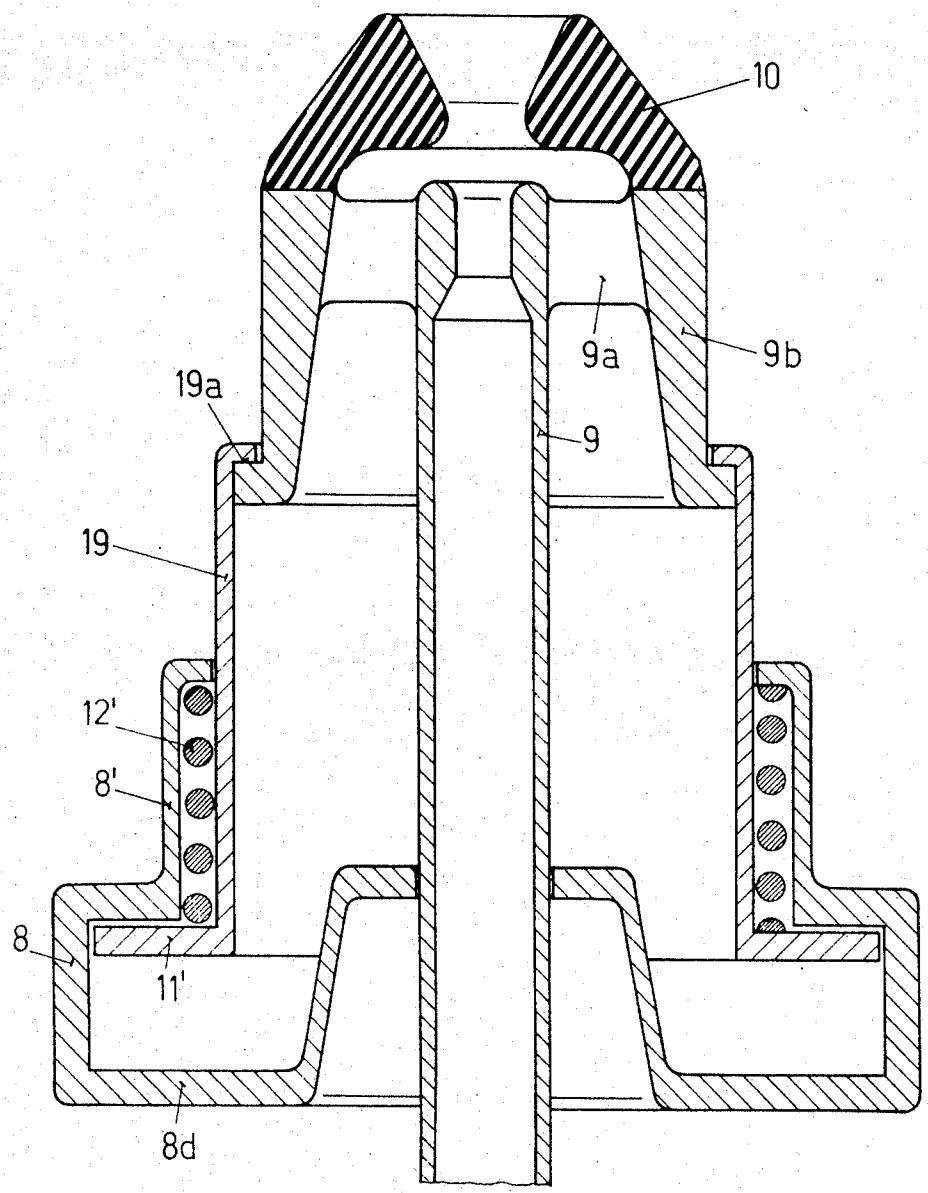



Fig.4

# ELECTRICAL COMPRESSION SWITCH

The invention is concerned with an electric compression switch whereby for the quenching of the electric arc there is utilized a flow of the quenching medium, the flow being generated by a compression apparatus which comprises cylinders and pistons, its movable part, or parts, being connected with the movable switching part, and whereby an insulating nozzle is arranged in front of, and at a distance from the movable switching part in direction toward the counter-switching part.

A switch of this type is known, for example shown by Swiss Pat. No. 494,467. In case of the known arrangement a stationary switching part interacts with a hollow tripping pin which is rigidly connected to a blow-out cylinder. At circuit-breaking time the blow-out cylinder is pulled over a stationary piston, the blow-out cylinder carrying an insulating nozzle at its front side facing the stationary switching part. The hollow tripping pin and the stationary switching part will form a sliding contact which remains closed during one half of the tripping pin travel, for the purpose of creating a pre-compression of the quenching medium at cut-off time; the switching part will then separate and thus release the flow of gas. However, in order to keep the switching time at the opening of the switch to a minimum, it is desirable to make the contact separation as rapidly as possible, and the necessary pre-compression should therefore not be dependent on such extensive tripping pin travel prior to the contact separation.

In order to attain this aim, it is proposed by the invention that the movable switching part be surrounded by a circular auxiliary piston, and that this piston be provided with an energy-storing device in such manner that during the cut-off movement, the auxiliary piston will perform, under the influence of energy-storing device, a pre-compression stroke, while the loading of the energy-storing device during the switch-closing movement takes place through coupling by shape to the movable switching part. In this manner it becomes possible to reduce significantly the travel up to contact separation, while keeping the pressure ratios for the pre-compression at identical levels, thus attaining a significant saving of time for the cut-off operation of the switch.

The drawings depict practical examples of the invention.

FIG. 1 gives a sectional view of a switching chamber with a single auxiliary piston, while

FIG. 2 shows a modification of the arrangement depicted by FIG. 1, whereby the auxiliary piston is designed in the form of a twin-piston.

FIG. 3 shows an auxiliary piston which, in further modification of FIG. 1, has a decoupling device, and

FIG. 4 shows a species whereby the auxiliary piston takes over simultaneously the function of a guide.

Within the casing 1, which can be metallic, there is fastened the support 2 for the stationary, but resiliently mounted switching part 5; the support being insulated from the metallic casing 1 by means not shown in the drawings. The switching part 5 is acted upon by the cup spring unit 6 which is placed in a housing-like part 2*b* of the support. This part 2*b* is connected by several webs 2*a* with the support 2 within which there are placed finger-shaped laminated contacts 3 with their proper springs 4. These laminated contacts 3 form a



tulip-shaped counter-contact piece to part 9*b*. This part 9*b* forms, together with the laminated contacts 3, a shunt contact device for the continuous current conduit to the switching parts 5, 9 between which the arc is forming during the cut-off operation. Part 9*b* is fixedly connected with switching part 9 by means of webs 9*a*, and forms together with the insulating nozzle 10, fixedly connected with it, a blow-out piston which is slidingly guided within cylinder 8. Parts 2 and 8 are stationary relative to each other, as indicated by insulating rod 7. Cylinder 8 is closed off at its lower end by the base 8*d*, and is divided by the partition 8*a* in such manner that a chamber is formed for the auxiliary piston 11 and the cup spring unit 12. While the upper end of the auxiliary piston 11 is in constant communication with the interior of the switching chamber by way of the aperture 8*c*, the area below the auxiliary piston 11 is connected with the interior of cylinder 8 by way of one or more ducts 8*b*. Base 8*d* contains at least one one-way valve 13*a* which opens toward the inside. In switch-on position (FIG. 1) the cup spring unit 12, which represents the energy-storing device, is loaded because piston 11 rests with its cylindrical part at neck 9*c* of the switching part 9 because the latter is held in place by its drive (not shown in detail).

The method of operation is as follows: When the switching part 9 is moved downward for the purpose of cut-off by means of a conventional drive, the auxiliary piston 11 can follow accordingly under the influence of the cup spring unit, and thus cause a pre-compression of the quenching gas, so that a blowing flow will be created as soon as the nozzle opening of the insulating nozzle 10 lifts off the switching part 5 which briefly runs along its path, since switching parts 5, 9 will separate practically simultaneously, whereby the cut-off arc will be subjected at the moment of its formation to a blow-on under favorable pressure ratio. The auxiliary piston 11 is restricted in its travel by the base 8*d*, while the switching part 9 will continue to move until it reaches its final position as determined by the drive. For switching-on, the switching part 9 is then moved upward again to the switched-in position, as depicted by FIG. 1, whereby the auxiliary piston 11 is lifted up by neck 9*c*, thus putting the spring unit 12 under compression again.

FIG. 2 shows how the area ratio of auxiliary piston 11 to main piston 9*b* can be brought up to a desired value without diameter increase. The arrangement shown by this figure provides for a doubling of the auxiliary piston by the presence of two piston surfaces 11*a*, 11*b* which are located within the areas of cylinder 8, further subdivided by an additional base 8*d*.

FIG. 3 shows another, very useful, modification where movement of the auxiliary piston 11 to pre-compress the gas can be released during the initial movement of the switching part 9 in the cut-off operation. This is accomplished in that manner that within the switching part 9 there is pivotally-mounted at point 14*a* a pawl 14 which uncouples, very shortly after the beginning of the cut-off movement, the auxiliary piston 11, as soon as the support lever 16, due to the bevel at pawl 14, pushes the pawl inward against the return spring 18. The auxiliary piston 11 can thus move freely downward under the influence of springs 12. In this manner it becomes feasible to adjust the travel of the auxiliary piston 11 and the spring characteristics of the spring-loaded device 12 to the specific requirements of

the pre-compression and to the energy conditions arising during the cut-in operation. In order to enable the support lever **16** to avoid initially the pawl **14** during cut-in operation (position shown by dashes in FIG. **3**) and then to return to the desired position, there is provided the spring **17** to pivot the pawl about its stationary pivot pin **15.**

In FIG. **4** there is shown the auxiliary piston **11'** being provided with a cylindrical projecting part **19** within which the main blow piston **9***b* is being guided. As soon as the switching part **9** moves downward in cut-off direction, the auxiliary piston **11'** can follow under the influence of the compressed spring **12'**. This spring unit **12'** is located within an annular space, formed by parts **8'** and **19,** which is in communication with the switching chamber area (in a manner not shown in detail) to avoid the creation of any interfering pressure conditions within the annular space. The one-way valve **13,** shown in FIG. **1,** is also present in the bases **8***d* of the arrangements shown by FIGS. **2** to **4** but is not shown there by drawing.

I claim:

**1.** In an electrical switch of the type wherein for quenching the arc drawn in a gap formed between the switch contacts as they disengage a gaseous quenching medium is caused to flow into the gap, the combination comprising a switch casing, a pair of switch contact members supported within said casing, at least one of said contact members including driving means for effecting engagement and disengagement with the other contact member, a piston and cylinder unit for precompression of the gaseous quenching medium, means forming a passage for delivering the gaseous medium compressed by said piston in said cylinder to the gap formed between said contact members as they disengage, an energy storing device correlated to said piston, and means for coupling said driven contact member to said piston and to said energy storing device only when said driven contact member moves in the contact-engaging direction thereby to store energy and simultaneously move said piston in one direction to a position within said cylinder in which the gaseous medium enters said cylinder through valve means, said piston being freed for movement in the opposite direction by the stored energy upon movement of said driven contact member in the contact-disengaging direction thereby to effect compression of the gaseous medium and discharge the same from said cylinder through said passage to the gap formed between said contact members.

**2.** An electrical switch as defined in claim **1** wherein said piston and cylinder unit surrounds said driven contact member and said energy-storing device is constituted by a compression spring.

**3.** An electrical switch as defined in claim **1** and which includes two piston and cylinder units surrounding said driven contact member and which are located in succession along the direction of travel of said driven contact member.

**4.** An electrical switch as defined in claim **1** wherein said means for coupling said driven contact member and piston is constituted by a shouldered portion of said driven contact member engageable with a longitudinally extending part of said piston.

**5.** An electrical switch as defined in claim **1** wherein said means for coupling said driven contact member and piston includes a shouldered portion of said driven contact member engageable with a longitudinally extending part of said piston and which further includes a latching device for said piston carried by said driven contact member and which unlatches from said piston after a predetermined travel of said driven contact member in the contact-disengaging direction thereby releasing said piston for movement to effect the precompression of the gaseous quenching medium.

**6.** An electrical switch as defined in claim **1** and which further includes means controlled by and actuated upon a predetermined movement of said driven contact member in the contact-disengaging direction for releasing said piston thereby to effect the precompression of the gaseous medium.

**7.** An electrical switch as defined in claim **1** wherein said piston and cylinder unit is located within an outer cylinder, and said driven contact member includes a tubular portion terminating in a guide piston therefor which is slidable within said outer cylinder.

**8.** An electrical switch as defined in claim **1** wherein said piston includes a cylindrically projecting part and said driven contact member includes a tubular portion terminating in a guide piston therefor which is slidable within the cylindrically projecting part of said piston.

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