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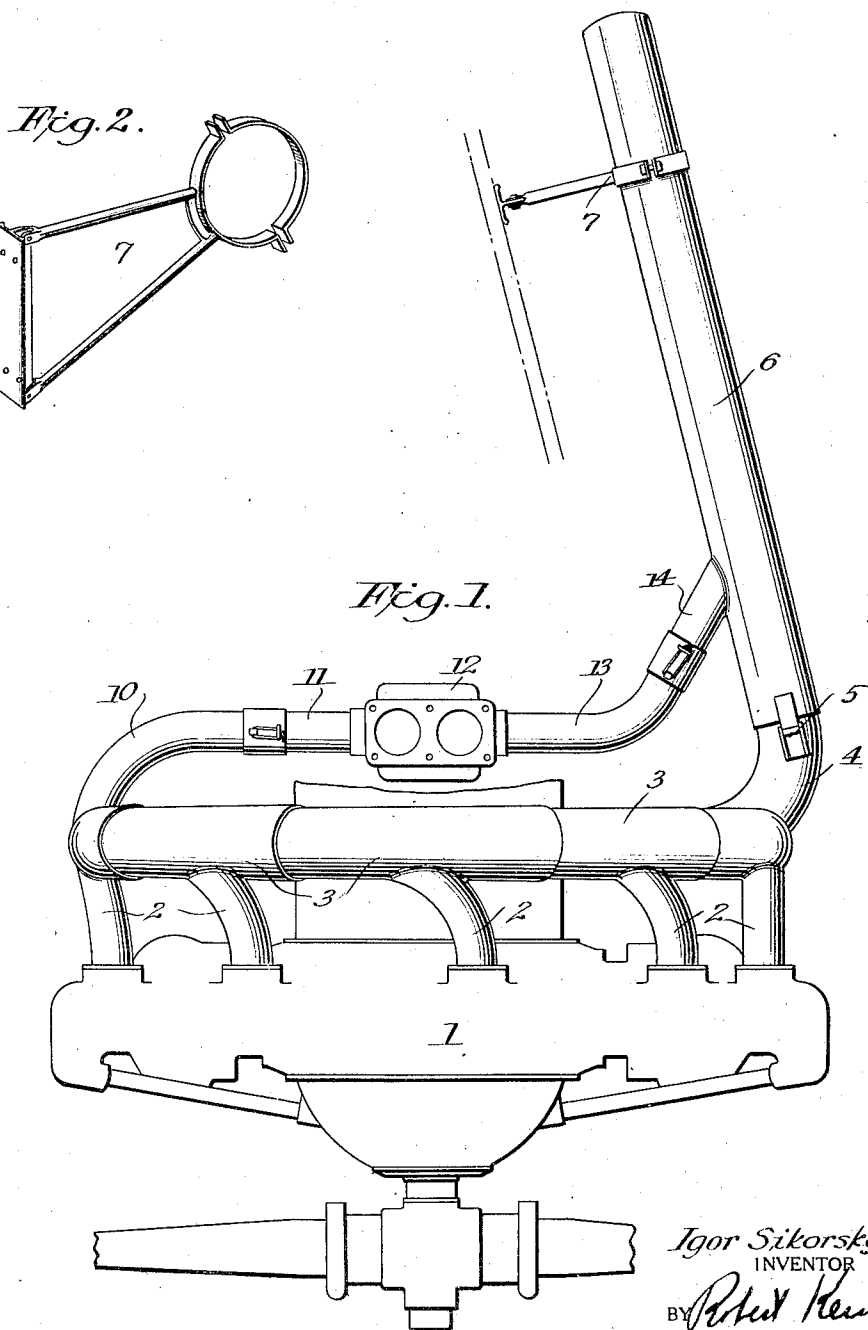
I. SIKORSKY

2,022,982

EXHAUST MANIFOLD

Filed Dec. 30, 1929

4 Sheets-Sheet 1



Igor Sikorsky
INVENTOR
BY *Robert Kemp*
ATTORNEY

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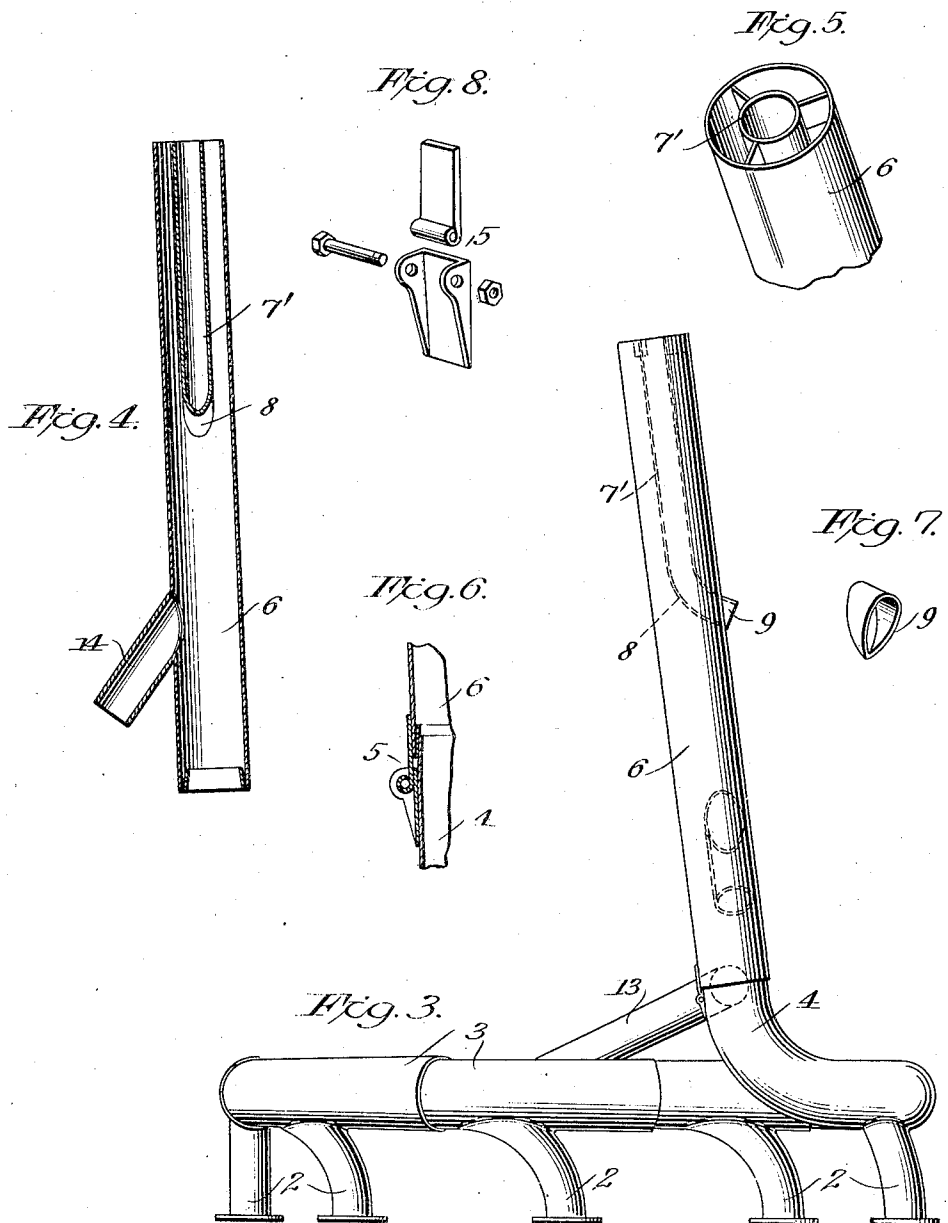
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EXHAUST MANIFOLD

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4 Sheets-Sheet 2



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INVENTOR
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ATTORNEY

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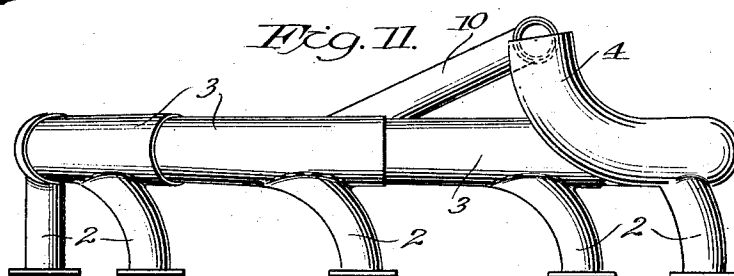
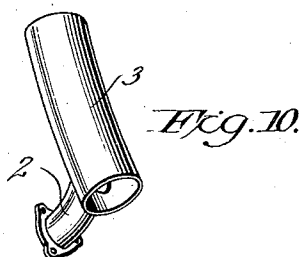
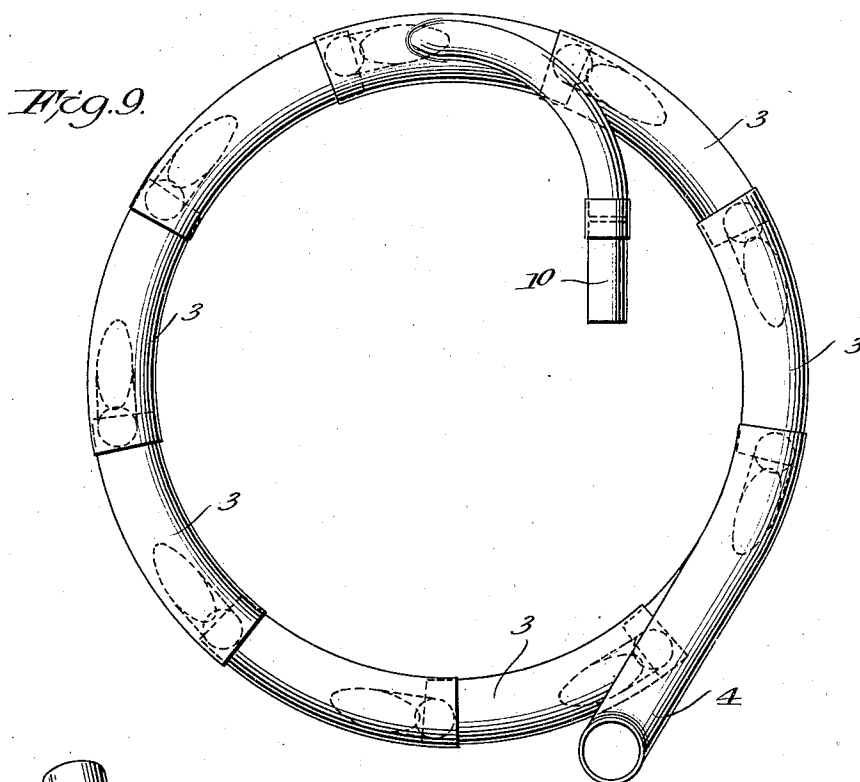
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INVENTOR
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ATTORNEY

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Fig. 12.

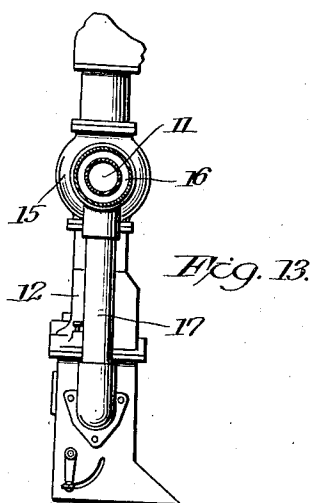
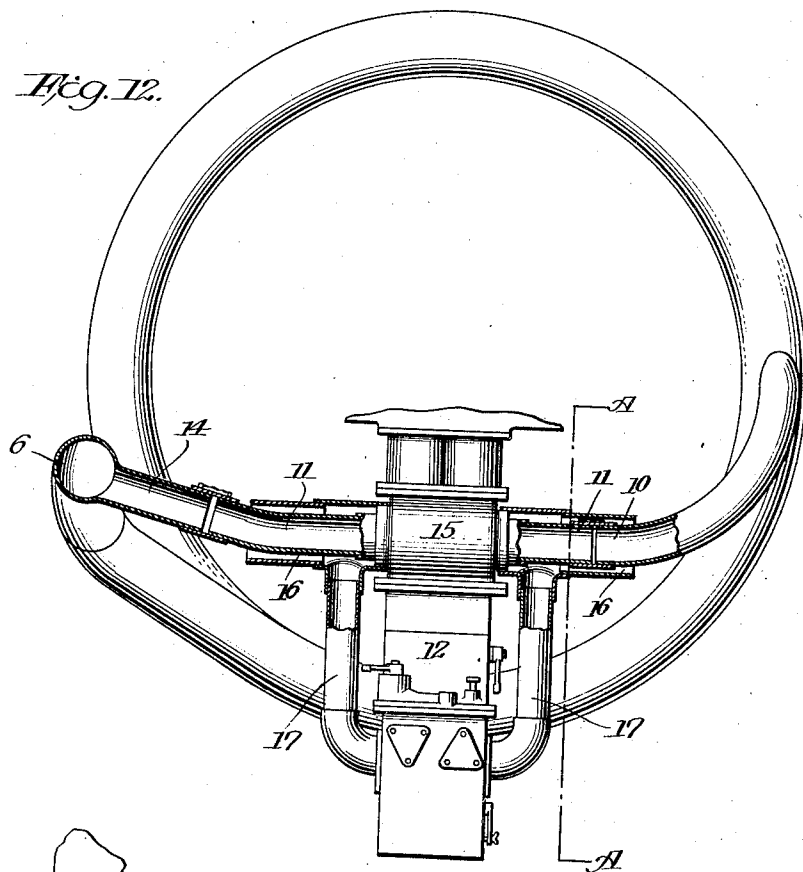


Fig. 13.

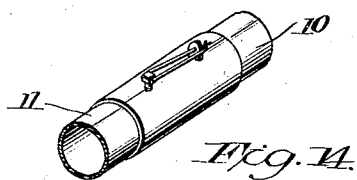


Fig. 14.

Igor Sikorsky,
INVENTOR
BY *Robert Mump*
ATTORNEY

UNITED STATES PATENT OFFICE

2,022,982

EXHAUST MANIFOLD

Igor Sikorsky, Stratford, Conn., assignor, by
mesne assignments, to United Aircraft Corpo-
ration, a corporation of Delaware

Application December 30, 1929, Serial No. 417,560

10 Claims. (Cl. 123—52)

The invention relates to an exhaust manifold for internal combustion engines, preferably of the radial type.

Unusual effort has been made in recent years to eliminate the back pressure created within the exhaust manifold, short exhaust stacks and even open exhausts of internal combustion engines. Such back pressure impairs the efficiency of the motor, and in some instances does considerable damage thereto.

It has been found heretofore that with the circular exhaust manifolds, there is a tendency for the exhaust gases, through evacuation, to cool as they approach the outlet port of the manifold, and because of the intermittent firing of the cylinders the cooling gases cause a back rush of air from the outside atmosphere into the manifold which in turn creates the back pressure within the said manifold, thereby reducing the efficiency of the motor both in power and fuel consumption.

With the exhaust manifolds heretofore used, it has also been impractical to use any medium for silencing the exhaust explosions due principally to the existence of and failure to expel the aforementioned back pressure created in the exhaust manifold and muffler attachment.

It is the object of my present invention to provide an exhaust manifold from which back pressure will be eliminated to the extent of creating a noticeable vacuum therein.

Another object of my invention is to provide an exhaust manifold which will muffle the exhaust explosions.

Another object of my invention is to provide an exhaust manifold which will have a cooling effect upon the exhaust gases as they leave the engine cylinders.

Still another object of my invention is to provide an exhaust manifold which will greatly increase the efficiency of internal combustion engines.

With these and other objects and advantages in mind, attention is called to the drawings in which:

Figure 1 is a top view of a radial airplane motor showing the exhaust manifold attached thereto.

Figure 2 is a bracket for supporting the exhaust outlet port of the manifold.

Figure 3 is a bottom view of the exhaust manifold.

Figure 4 is a sectional view of the exhaust outlet port of the manifold.

Figure 5 is a perspective end view of the exhaust outlet port of the manifold.

Figure 6 is a sectional side view of the bracket attaching means between the manifold and the exhaust outlet port of the manifold.

Figure 7 is a perspective view of the air inlet means for the exhaust outlet port of the manifold.

Figure 8 is a perspective view of the parts of the bracket attaching means between the manifold and the exhaust outlet port of the manifold.

Figure 9 is a plan view of the manifold.

Figure 10 is a perspective view of a section of the manifold.

Figure 11 is a bottom view of the sections of the manifold in assembled position.

Figure 12 is a back view of the manifold showing its relation and connection with the air heater and mixing heater of the carbureting system.

Figure 13 is a side view taken on the line A—A of Figure 12.

Figure 14 is a perspective view of the means for joining the pipes of the manifold and carbureting system.

Referring specifically to the drawings in which like numerals indicate like parts, 1 is a radial airplane motor of conventional design. Extending from the exhaust port of each cylinder and attached thereto by a suitable means such as a flange, is a slightly curved pipe 2 to which is integrally attached a section 3 of the exhaust manifold. In the particular embodiment of the invention here shown, there are nine sections to the manifold, the number of sections depending upon the number of cylinders in the motor. The sections 3 are provided with male and female ends and are telescoped loosely together to allow for expansion.

An outlet 4 for the manifold projects substantially midway between the outer periphery and the rear side of the manifold ring.

Attached to the manifold outlet 4 by any suitable means, such as a clamping bracket 5, as shown in Figs. 6 and 8, is an extension 6 which is held in place at a suitable distance from the fuselage by a bracket 7, as shown in Figs. 1 and 2. Concentrically arranged within member 6 and extending substantially half the length of said member is an aspirator pipe 7', which at its inner end diverges toward the underside of the member 6 and has an outlet 8 therein. Attached to said outlet 8 is an air inlet 9 which opens toward the front of the motor.

A pipe 10 projects from the exhaust manifold and is attached in any suitable manner, such as shown in Fig. 14 to the inlet 11 of the carburetor vaporizer 12. The outlet 13 of said carburetor

vaporizer is attached to an inlet pipe 14 which projects from the side of the exhaust manifold extension 6.

In Figures 12 and 13, it will be seen how heat is supplied to the carburetor vaporizer by means of the exhaust pipe branch above described, which extends through the mixture heater 15. Cool air is drawn in at 16, passes over the pipes 11 and 13 and down through pipes 17, whereupon it rises to the said mixture heater.

The theory upon which the exhaust manifold operates, and thereby reduces the back pressure and creates a muffling effect upon the exhaust explosions, is that not all of the exhaust gases are evacuated directly from the cylinder, but a certain part of them rotates around the inside of the tube. The continual rotation of the gases within the manifold ring is brought about by the individual exhaust explosions from each cylinder, and are given a rotating movement upon leaving the cylinder due to the curved construction of the connecting pipes between each cylinder and the manifold ring. As each cylinder fires, an impelling force is given to the circulating gases and there exists a continual stream of exhaust gases around the inside of the circular manifold. The continued rotation of the exhaust gases allows a certain cooling effect inside the tube and the excess of the exhaust gases, of course, will escape on the outside part of the ring through the exhaust outlet pipe.

Because of the continuous stream of exhaust gases circulating within the manifold ring, the back pressure which is usually present when intermittent exhaust explosions escape from the ordinary exhaust pipe is eliminated, there being a definite bar formed against said back pressure. Experiments have shown that by the use of this exhaust manifold, an actual vacuum is created adjacent the exhaust ports of each cylinder. This being the case, the exhaust explosions of each cylinder are given free passage without obstruction and the efficiency of the motor both as to power and fuel consumption is tremendously increased.

By means of the exhaust extension pipe and aspirator therein, a certain suction is created upon the exhaust gases to prevent any clogging or backing up of said exhaust gases.

At the same time, the manifold as constructed, together with the exhaust extension and aspirator, have a muffling effect upon the exhaust explosions of the motor. Heretofore, with the exhaust manifolds it has been very impractical to attach thereto any means for silencing the exhaust explosions, due to the tendency of such silencing means to create a back pressure against the cylinders of the motor. The continual rotation of the exhaust gases within the ring and their subsequent exclusion from the exhaust manifold extension silences the individual exhaust explosions from each cylinder, and it will be found that the motor is practically noiseless as compared with the exhaust explosions of the usual airplane motor having no muffling means.

The device, of course, can be used with an open tube exhaust where the maximum power is required, giving in this case much better results than even when short stacks or open exhausts are used. It is also possible to further silence the exhaust explosions of the motor by attaching to the exhaust outlet tube a conventional muffler such as is used with internal combustion engines.

It is understood, that the embodiment of the

invention herein shown is only one form which might be used, and that the invention is subject to variations and modifications without departing from the spirit of the appended claims.

I claim:

1. A radial motor manifold comprising a series of units telescoped within each other, and together forming a circular conduit, each unit having an integral flanged member for attachment to the exhaust port of a cylinder of an internal combustion engine of the radial type.

2. A radial motor manifold unit comprising a small curved conduit leading into and integral with a larger curved conduit, said larger conduit provided with male and female ends for connection with a similar unit at both its ends, and means for fastening the smaller conduit to an internal combustion engine cylinder.

3. A radial motor manifold unit comprising curved conduits formed integrally with a large curved conduit, the smaller curved conduit curved on an arc lying at right angles to the plane of the arc of the larger curved conduit, said larger conduit adapted for connection with a similar motor manifold unit.

4. A radial motor manifold comprising a series of manifold units telescoped within each other to form a complete circular conduit, each of said units including a small curved conduit integral with and leading into a larger curved conduit, said larger conduit provided with male and female ends for connection with similar units to form said complete circular conduit, and an exhaust take-off connected to said circular conduit.

5. A radial motor manifold comprising a series of curved telescopic conduit manifold units, each unit provided with a connection for attachment to a motor cylinder, all of said units forming together a circular conduit, a curved exhaust take-off pipe connected to a carburetor hot air stove, and an exhaust pipe leading exhaust gases away from said hot air stove.

6. A radial motor manifold comprising a series of loosely connected conduit manifold units, each unit provided with means for rigidly attaching said unit to a motor cylinder, all of said units forming together a circular conduit, a curved exhaust take-off connected to said circular conduit, and a muffler mounted on said curved exhaust take-off.

7. A radial motor manifold comprising a series of rigidly mounted but loosely connected curved manifold conduit units, each unit provided with means for rigidly attaching said unit to individual motor cylinders, all of said units forming together a loosely jointed but expansible circular conduit, a curved exhaust take-off connected at one end to said circular conduit and at its other end to a carburetor hot air stove, a carburetor hot air stove, a second exhaust gas take-off attached to and leading from said expansible circular conduit, a muffler mounted on said second take-off and an exhaust pipe connected at one end to said muffler and at the other end to said carburetor hot air stove.

8. A manifold unit comprising a relatively small conduit leading into a larger conduit, said larger conduit provided with male and female ends for connection with a similar unit at both its ends, said relatively small conduit directed at an angle to the larger conduit and toward the male end thereof.

9. A radial motor manifold comprising a hollow ring built up of a plurality of curved telescoping conduit units, each provided with a male

and a female end, conduits connecting each cylinder of a multi-cylinder engine with said ring and curved toward the male ends of said conduit units to discharge exhaust gases longitudinally of said ring and, thereby, cause rotation of the gas in said ring, an outlet for said ring facing opposite to the direction of rotation of said gases and adapted to conduct said rotating gases away from said ring.

10 10. A multi-cylinder radial engine manifold comprising in combination, a hollow ring built up

of a plurality of individual telescopically arranged curved manifold segments, one for each cylinder, means for conducting exhaust gases away from said hollow ring, a conduit connecting each cylinder of said radial engine with the respective manifold segment, said connecting conduits being fixed relative to said cylinders and said segments and adapted to direct exhaust gases discharged from said cylinders circumferentially of said circular manifold.

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IGOR SIKORSKY.

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