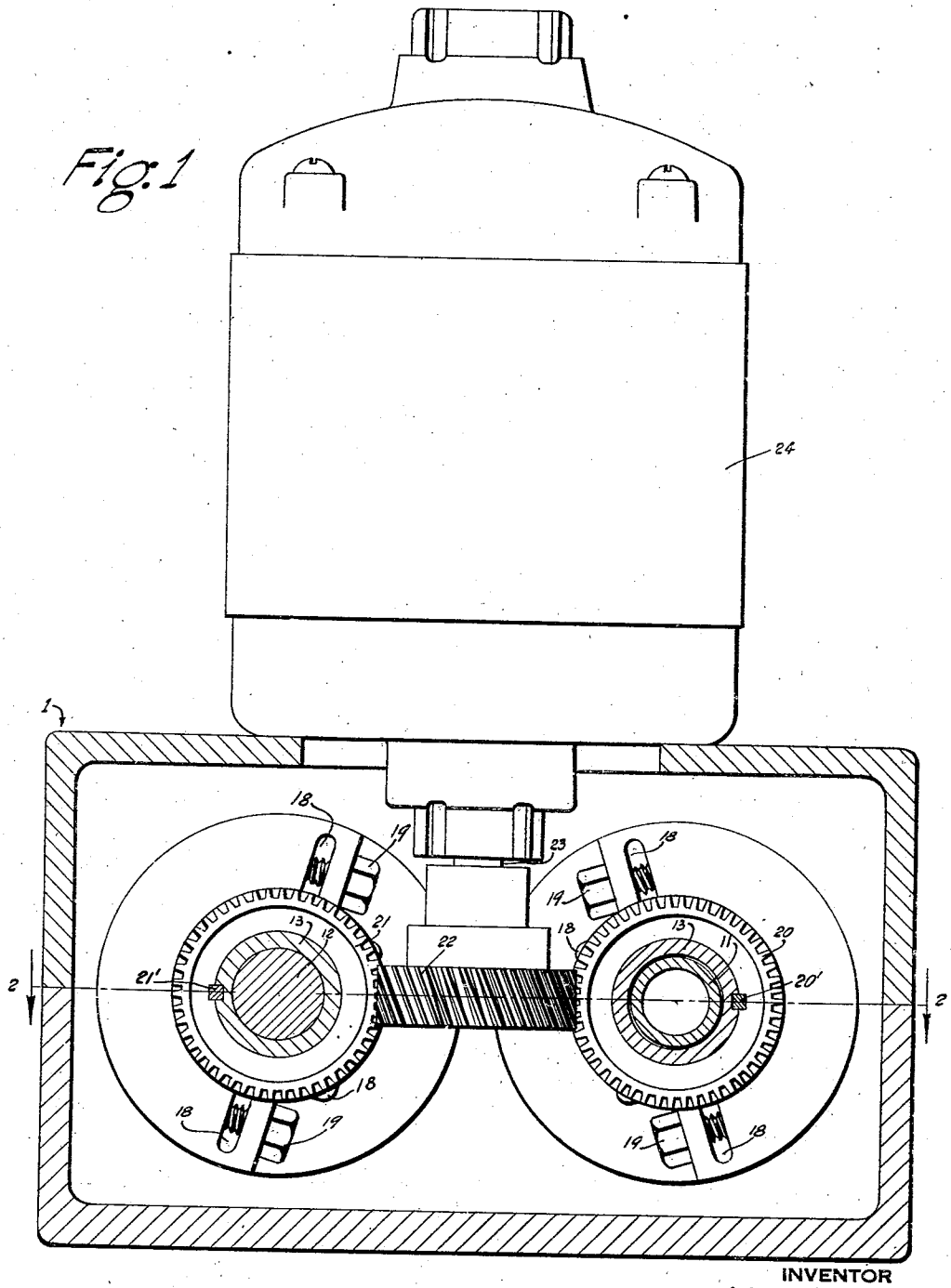
Oct. 29, 1946. B. J. LAZAN 2,410,170

OSCILLATOR

Filed Nov. 18, 1943 3 Sheets-Sheet 1

Fig. 1



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OSCILLATOR

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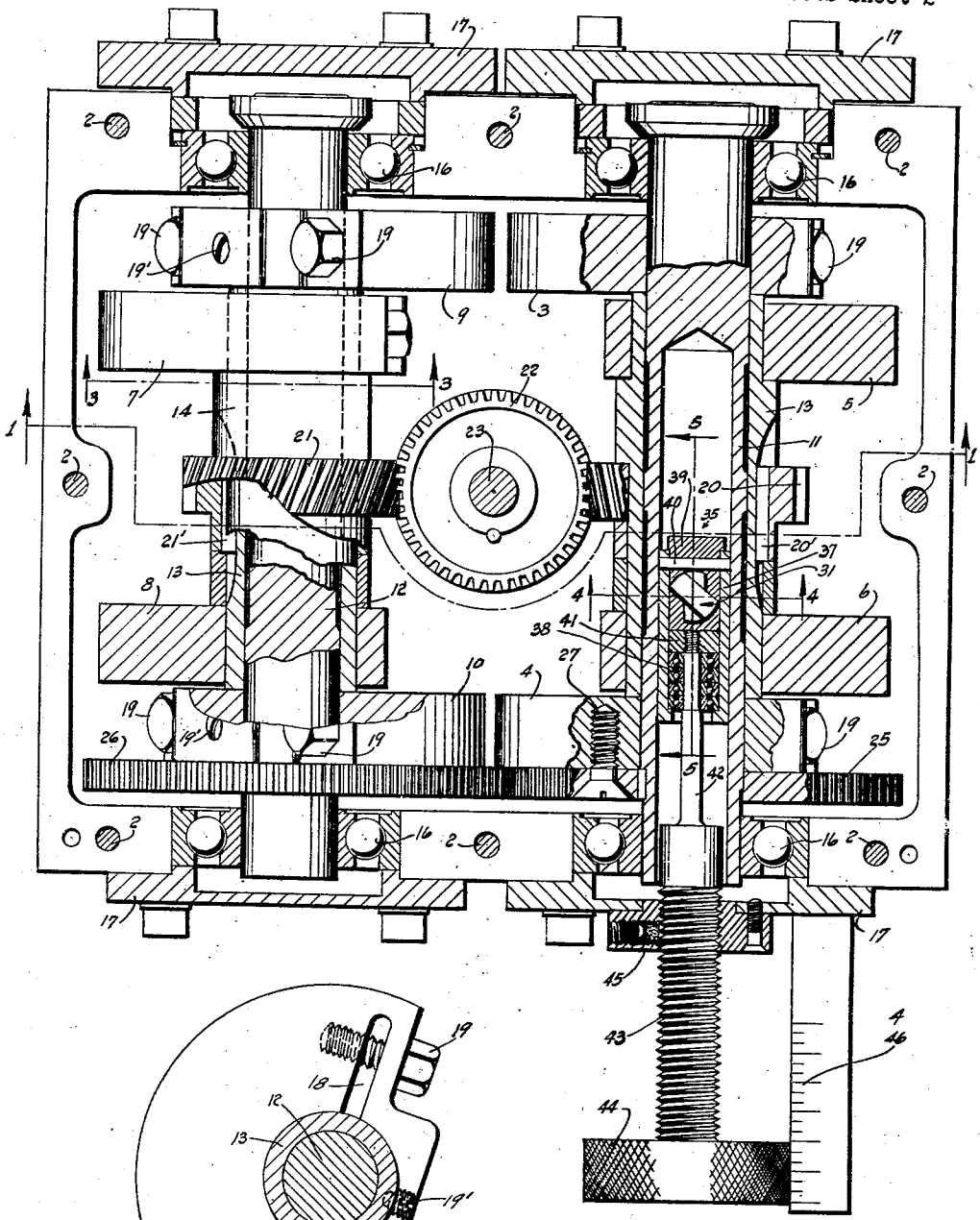


Fig. 2

Fig. 3

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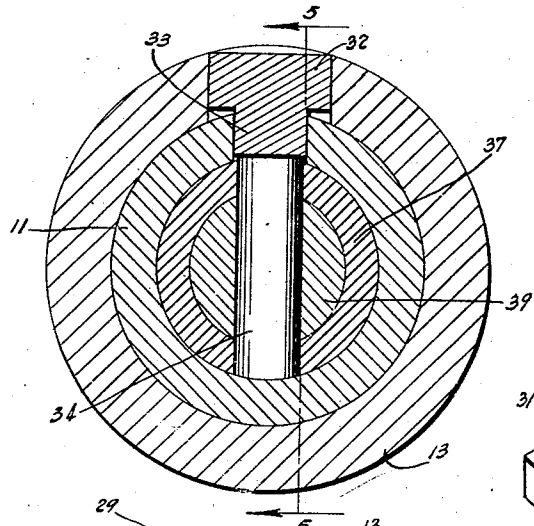


Fig. 4

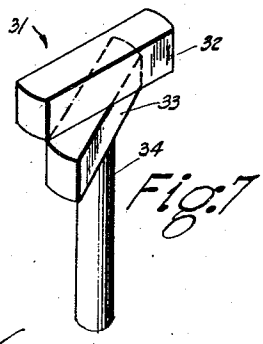


Fig. 7

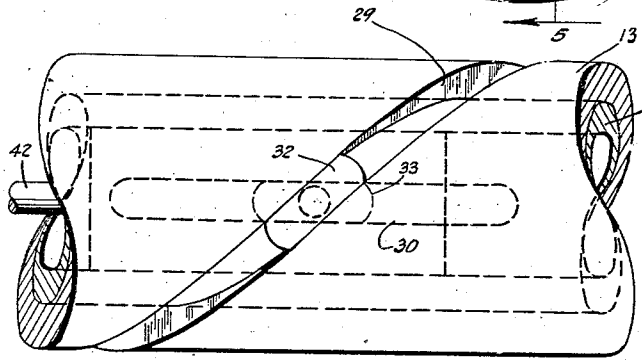


Fig. 6

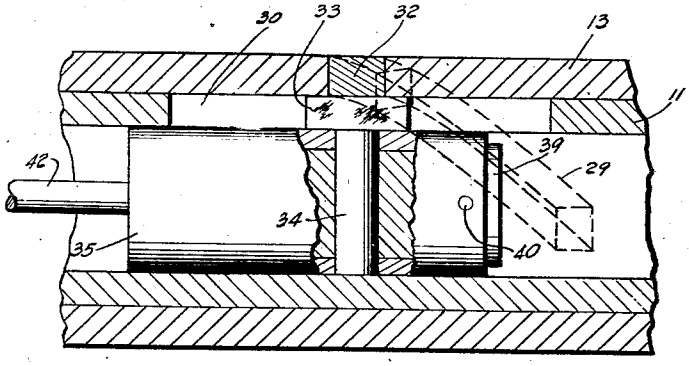


Fig. 5

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Patented Oct. 29, 1946

2,410,170

UNITED STATES PATENT OFFICE

2,410,170

OSCILLATOR

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Application November 18, 1943, Serial No. 510,828

9 Claims. (Cl. 74—61)

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This invention relates generally to oscillators for inducing vibrations in materials, specimens or structural units, for the purpose of studying their dynamic and mechanical properties, and it is an object of my invention to provide an improved oscillator that is self-contained, easy and flexible in its application, operation and control, and is compact and portable to facilitate both laboratory and field testing, together with having a high degree of ruggedness and durability.

A further object is to provide an improved arrangement for variably controlling the relative angularity of eccentrically supported rotating weights whereby during continuous operation of the oscillator any desired direction of vibratory force may be obtained with ease, dispatch and accuracy with minimum wear and tear on the adjusting mechanism. The minimizing of wear in the adjusting mechanism is a particularly difficult problem especially in a device such as an oscillator where vibration is deliberately generated and always present, this problem becoming most acute when the device is small and compact.

Other objects and advantages will be more apparent to those skilled in the art from the following description of the accompanying drawings in which—

Fig. 1 is a transverse sectional view taken substantially on the line 1—1 of Fig. 2, the driving motor being shown in elevation;

Fig. 2 is a horizontal section taken substantially on the line 2—2 of Fig. 1 with certain parts shown in plan view for purposes of clarity;

Fig. 3 is a side elevation of one of the eccentric weights taken substantially on the line 3—3 of Fig. 2;

Fig. 4 is a transverse section through the adjusting means for varying the relative angularity of the eccentric weights taken substantially on the line 4—4 of Fig. 2;

Fig. 5 is a longitudinal section through the adjusting means of Fig. 4 taken substantially on the line 5—5 of Figs. 2 and 4;

Fig. 6 is a fragmentary plan view of the adjusting mechanism; and

Fig. 7 is a perspective of a special key and pin device employed in my adjusting means.

In the particular embodiment of the invention disclosed herein for purposes of illustration I shown in Fig. 1 a casing generally indicated at 1 split along a plane containing the axes of the vibrating mechanism to be described, these split casing halves being suitably held together by studs or bolts 2, Fig. 2. The vibrating mechanism is specifically shown herein as having four pairs

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of rotating eccentric weights 3—10 although it will be seen from the principles of my invention that only two weights could be used if desired under certain circumstances or that more than four pairs could be employed. Considering specifically that four pairs are used, one pair such as 3 and 4 is mounted on a hollow shaft 11 while a cooperating pair such as 5 and 6 is mounted on a sleeve shaft 13. Another pair 9 and 10 is mounted upon a shaft 12 while the cooperating pair therefor 7 and 8 is mounted upon another sleeve shaft 14. The two sleeves 13 and 14 are coaxial with, specifically concentric, their respective shafts 11 and 12 and are journalled thereon to allow relative angular movement between the various pairs of weights. The shafts 11 and 12 are suitably journalled in four bearings 16 while cover plates 17 secured to the casing enclose and hold the bearings in position. The various weights are held in fixed angular relation to their respective shafts and sleeves by being clamped thereto, the weights having slots 18, Fig. 3, and studs 19 for this purpose. Set screws 19', Fig. 3, threaded in the weight are seated in the sleeve or shafts, as the case may be, to determine the initial angular position of the weights thereon.

The inner pairs of weights 5, 6 and 7, 8 are rotated in opposite directions by a pair of gears 20 and 21 keyed at 20' and 21' to the sleeve shafts 13 and 14 and commonly driven by a gear 22 mounted upon a vertical shaft 23 of an electric motor 24. The inner shafts 11 and 12 are connected together by a pair of meshing gears 25 and 26 keyed to their respective shafts and suitably secured to weights 4 and 10 as by screws such as 27, Fig. 2. To drive the outer pairs of weights in the same direction as their inner pairs, while at the same time allowing the inner and outer pairs of weights to be relatively angularly adjusted to vary their combined eccentric effect, I provide as shown in Fig. 6 a spiral groove 29 extending entirely through the wall of sleeve 13 and partially around the same for slightly greater than 180°. A straight slot 30 is then formed in the wall of the hollow shaft 11 axially thereof. A key 31 shown in Fig. 7 has two angularly displaced key portions 32 and 33 formed on the upper end of a pin 34 to constitute a single integral pin and key unit, the angle between the keys being the same as that between the spiral and straight grooves. The key 32 fits in the spiral groove 29 while the key 33 fits in the straight longitudinal groove 30. The pin portion 34 is supported in a shifting plunger 35 which is slidably disposed in the bore of shaft 11. This

plunger as shown in Fig. 2 consists of a sleeve 37 containing a series of ball bearings 38 at one end and a spaced plug 39 at the other end, the latter being held by a pin 40. Disposed between the bearings 38 and the inner end of the plug 39 is a disc 41 to which a rod 42 is secured as by threads or other suitable means. To axially shift plunger 35, the outer end of the rod 42 is provided with an enlarged threaded shank 43 having a suitably knurled hand knob 44. A nut 45 is suitably secured to the casing whereby rotation of knob 44 causes axial movement of plunger 35. A scale 4 may be suitably graduated to indicate the axial position of the plunger 35 and of the adjusting key 31 and accordingly determine the relative angularity of the eccentric weights. A removable friction plug 43' is pressed against the threads of shank 43 to hold the same at any given point of adjustment.

It will be noted that the second shaft unit consisting of 12 and its sleeve 4 do not have any adjusting mechanism, although adjustment of the weights thereon is accomplished in a novel manner from the single adjusting device on the first shaft unit 11, 13.

Operation.—The casing 1 is suitably secured to any desired specimen, structure or material to which a predetermined vibratory force is to be imparted, it being understood that any number of tapped holes may be formed in the casing for clamping purposes. Motor 24 is then rotated at any desired speed to drive vertical shaft 23 and gear 22 so as to rotate sleeves 13 and 14 in opposite directions through spiral gears 23 and 24, thereby directly rotating eccentric weights 5—8. Rotation is transmitted from sleeve 13 through spiral groove 29 to key 32 and 33 to the straight slot 30 Fig. 6 in shaft 11, thereby rotating weights 3 and 4 and transmitting rotation through gears 25 and 26 to shaft 12 and weights 9 and 10. Thus the two pairs of weights 3 and 4, together with 5 and 6 rotate as a unit in one direction while the other two pairs of weights 7—10 rotate as a unit in the opposite direction. If the pair of weights 3 and 4 are diametrically opposite weights 5 and 6, then the device is in balance and no vibratory force is created. However, if the two pairs of weights are adjusted so that they are both on the same side of the shaft, then a maximum unbalanced force is created. To obtain either one of these two extremes or any desired intermediate eccentricity it is only necessary to rotate hand knob 44 which axially moves shaft plunger 35, Figs. 2 and 5, whereupon spiral key 32 is caused to move laterally and accordingly similarly move straight key 33 to angularly rotate shaft 11 relative to sleeve 13, the weights following this adjustment. This relative movement between the shaft and sleeve is transmitted to the other two pairs of weights on the other shaft and sleeve through gears 25 and 26 while the common driving gear 22 holds the two sleeves in a constant relation to each other.

Thus it is seen that my improved arrangement not only provides an extremely compact oscillator in which the vibratory force may be varied during operation of the device but also the relatively large surface contact of the keys 32 and 33 with respect to their slots 29 and 30 insures minimum possibility of wear. This arrangement allows the sliding surfaces of the slots and keys to be as large as is necessary for maintaining proper lubrication and for tranmitting torque from the sleeve 13 to shaft 11 and thence on to the other pairs of weights 7—10. Notwithstanding that the key 31 transmits torque to two pairs of weights and maintains the weights in their predetermined angular relation, still I have found that it is possible to easily and accurately effect angular adjustment of the weights during operation of the oscillator. This is accomplished by a single adjusting mechanism in an oscillator that is not only compact but has a high degree of vibrating capacity together with flexibility and accuracy of control. Also, if desired, the oscillator may be used for inducing torsional vibrations about the axis of motor 24 by angularly shifting through 180° on the respective shafts and sleeves any four diagonally opposite eccentric weights while the remaining weights retain their present position. For example, in Fig. 2, if the position of weights 4, 6, 7, 9 are each angularly shifted 180° while the rest of the assembly is retained in its present angular position, the oscillator will then produce torsional vibrations and also be adjustable while running.

It will of course be understood that various changes in details of construction and arrangement of parts may be made by those skilled in the art without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. An oscillator comprising, in combination, inner and outer concentric shafts, means for rotatably supporting the same, eccentric weights mounted on said shafts, grooves formed in each of the respective shafts in angular relation to each other, a device having two keys angularly offset with respect to each other so as to respectively fit in said grooves, and means for moving said device so that said keys move lengthwise of said grooves thereby to cause relative angular adjustment between said shafts and the eccentric weights thereon.

2. The combination set forth in claim 1 further characterized in that said keys have relatively flat surfaces engaging the sides of said grooves.

3. The combination set forth in claim 2 further characterized in that the inner shaft has a hollow portion and said means for shifting said keys comprises a plunger disposed within the inner shaft and a pin transversely journalled in said plunger and secured to said keys to effect movement thereof when said plunger is moved.

4. The combination set forth in claim 1 further characterized in that the inner shaft has a hollow portion and said means for shifting said keys comprises a plunger disposed within the inner shaft and a pin transversely journalled in said plunger and secured to said keys to effect movement thereof when said plunger is moved, a normally stationary member extending within said inner shaft and connected to said plunger so that the latter may rotate with said shafts while said member remains stationary, and means for moving said member axially of said shaft to shift the plunger and accordingly effect relative angular adjustment of the eccentric weights.

5. An oscillator comprising, in combination, a plurality of shaft units each of which has a plurality of eccentric weights, means for rotatably driving said shaft units and the weights thereon in a predetermined relation to each other, means for positively angularly adjusting the weights on one of the shaft units, and means whereby said adjustment of the weights on said shaft unit

automatically and positively similarly adjusts the weights on the other shaft unit.

6. An oscillator comprising, in combination, a pair of shaft units, two pairs of eccentric weights, one pair being on one of said shaft units and the other pair being on the second shaft unit, means for driving one eccentric weight on one shaft unit in fixed angular relation at all times to the corresponding weight on the second shaft unit, means for angularly adjusting the second weight on the first shaft unit relative to the other weight thereon, and means for driving the second weight of the second shaft unit in accordance with the rotation of said adjustable weight, whereby the first weights of each shaft unit are held in their fixed angular relation to each other through their driving means while adjustment of the adjustable weight is transmitted to the second weight of the second shaft unit.

7. An oscillator comprising, in combination, a pair of shaft units each of which has a sleeve and an internal shaft, a pair of eccentric weights one of which is secured to one of the said sleeves and the other of which is secured to the shaft located internally of said sleeve, a similar pair of eccentric weights secured to the sleeve and inner shaft of the other shaft unit, gearing for connecting said sleeves so that they are maintained in a pre-determined angular relation to each other, gearing for connecting the inner shafts so that they are maintained in a pre-determined relation to each other, a source of power for rotatably driving said shaft units and weights thereon, and means for effecting relative angular movement between one of the said sleeves and its inner shaft so that the weights thereon are

similarly adjusted and said relative movement being transmitted to the other sleeve and its inner shaft so that the weights thereon are also similarly adjusted, thereby to vary the vibratory effect of the oscillator.

8. An oscillator comprising, in combination, a plurality of rotatable eccentric weights, means for driving certain of said weights in one direction and other of the weights in the opposite direction so as to produce a substantially sinusoidal oscillating force in one plane, said means including a hollow shaft coaxial with at least one of said weights, and means axially movable within said hollow shaft for relatively adjusting the weights so as to vary the effect of their eccentricity and thereby change and determine the magnitude of the oscillating force of the oppositely rotating weights.

9. An oscillator comprising, in combination, a plurality of eccentric weights, means for rotatably driving certain of said weights in one direction and other of said weights in the opposite direction so as to produce a substantially sinusoidal oscillating force in one plane, said driving means including a hollow shaft having a laterally cutout portion and at least certain of said weights being disposed coaxially of said shaft, means movable axially within the hollow portion of said shaft, and means operative through said cutout portion for connecting said axially movable means with at least certain of the weights for relatively adjusting the same to vary the effect of their eccentricity and thereby change and determine the magnitude of the oscillating force of the oppositely rotating weights.

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