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REBOUNDING IGNITION AND SPACER DEVICE FOR EXPLOSIVE ENGINES.

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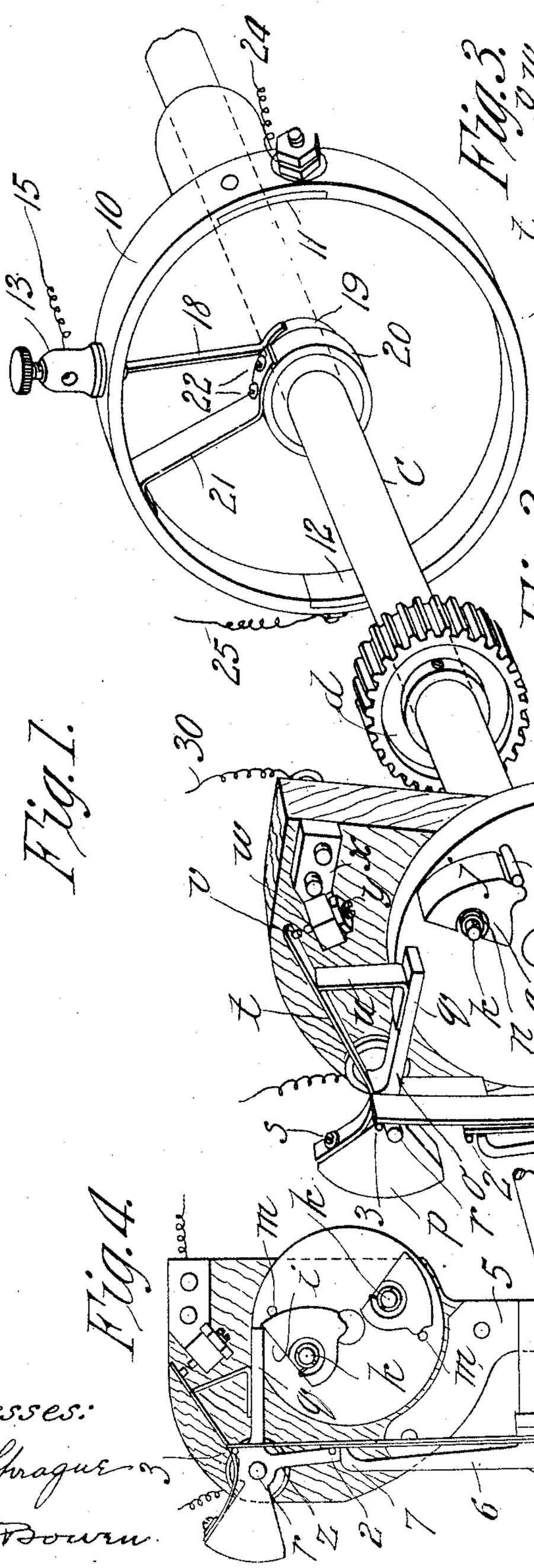

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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REBOUNDING IGNITION AND SPACER DEVICE FOR EXPLOSIVE-ENGINES.

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To all whom it may concern:

Be it known that I, STEPHEN DUDLEY FIELD, a citizen of the United States of America, residing at Stockbridge, in the county of Berkshire and State of Massachusetts, have invented new and useful Improvements in Rebounding Ignition and Spacer Devices for Explosive-Engines, of which the following is a specification.

This invention relates to improvements in electric ignition devices for internal combustion engines, as gasolene or other vapor engines.

One of the objects of my present invention is to simplify and cheapen the construction of such devices; a further object is to effect a saving in battery consumption either when in or out of use; a further object is to provide a device that can readily be adapted to engines of one or more cylinders.

Primarily, the invention consists in means whereby but one set or pair of electrical contact points is employed to effect the ignition; further, in combining or arranging with the pair of contact points a suitable resilient device for determining the location of the spark delivery; further, in means for effecting the separation of the contact points at all times, except at the exact moment when a spark is required to ignite the vaporous charge in the cylinder of the engine; further, in providing means for balancing all moving parts in order that the same may be unaffected by all shocks or jars incident to a moving vehicle during its passage over or along the roadway; further, in providing means whereby the device is locked at all times when not in use; further, in means for rendering the device inoperative during a reverse operation or motion of the engine-shaft, and, further, in means for effecting the timing of the spark.

The following detailed description will be confined to the above points, wherein it is assumed new and valuable features of the assembled mechanisms are secured. It is also assumed that the mechanism is to be operated in connection with a two cylinder four cycle internal combustion engine.

In the drawings forming part of this application,—Figure 1 is a perspective view showing the parts assembled in connection with the cam or secondary shaft of the engine; the contact points being shown in their normal or open position. Fig. 2 is a detail end elevation of the make and break device in its operative position at the instant that the contact points are about to come together when the balance lever is actuated by the cams; also showing the operating springs in a state of stress before their release to operate the balance lever. Fig. 3 is a detail end view showing the contact points at the instant of contact; the momentum of the balanced lever carrying the same into contact with the extension end of the leaf spring for returning or rebounding said lever to its normal state of rest. Fig. 4 is a detailed view showing the contact points open during a reverse motion of the cam-shaft. Fig. 5 is a detail view of a modification showing means associated with the contact lever for permitting its elevation and also permitting reverse movement of the shaft without operating the contact lever.

Referring to the drawings in detail, *c* designates the usual cam-shaft; *d* the gear thereon which meshes with the gear on the crank-shaft of the vapor engine (not shown), the ratio of rotation of the two shafts being two to one, as usual.

e designates a plate or block of insulation which is journaled or arranged to rotate on or about the cam-shaft *c*.

f designates a face-plate or disk carried by the cam-shaft *c* on which are located the two cams *g* which are provided with a straight face portion *i* and a curved portion *j*. These cams are pivotally secured to the face-plate *f* by means of a pin *k* and are normally rotated against limiting stops *m* that are secured to the face-plate *f* by means of the coil springs *n*,—one end of the springs being secured to the pin *k* and the other to the cams *g*. My present invention, however, is not limited to the use of two cams, as I may use any convenient number that may be necessary, the speed of rotation of the cam shaft determining in a large measure the number required. It will be seen from this construction that the cams can rotate independently of the face-plate *f* on the pin *k* and away from the stop *m* when the cam-shaft *c* is rotated reversely or left-handed, as shown in Fig. 4. Obviously the cams may be fixed and a pivotally mounted pawl q^1 carried on a contact lever q^2. The pawl q^1 is pivotally mounted in the end of the contact lever q^2. The pawl q^1 is normally held against a shoulder q^3 by means of a spring q^4, as

shown. The cam g^1 is, in this case, fixed to the face-plate f. This construction will cause the contact lever q^2 to rise when the cam g^1 strikes the pawl q^1 and close the contacts. During a reverse rotary movement of the cam g^1 the pivotal pawl q^1 will simply turn under without disturbing the contact lever q^2. Fig. 5 does not show the contact points nor spring elements associated therewith but simply the alternative construction of having the pawls movable and the lugs fixed.

o designates a weighted balance lever, the weighted portion being at one end, as clearly shown at p in the drawings the free end of the lever, designated by q, being arranged in the path of the curved surface j of the operating cams g. The lever o is accurately balanced on the pivot-pin r and is balanced for the purpose that when traveling over obstructions in the road-way, the contact points will not accidentally close and result in an unnecessary waste or expenditure of electrical energy by short circuiting the battery.

Attached to the lever o on the overweighted portion p by means of a screw s is a spring t that is placed under tension by means of the angular piece u which is secured to the arm portion q of the weighted balanced contact lever o. The end of the spring t is provided with a platinum contact-point v which is arranged to engage or strike another platinum contact point w that is adjustably secured in the block x on the insulating base-piece or plate e by means of the lock-nut y. The weighted balance contact lever o is provided with an integral arm z which extends in a direction nearly at right angles to the arm q.

Located on opposite sides of the pivotal pin r are two pins 2 and 3 which are secured to the weighted balance contact lever o. The pin 2 is located in the outer end of the arm z and the pin 3 near the pivot r in the hub portion of the balance lever.

A post 4 is secured to the base-piece e by means of the bracket 5. Secured to the post 4 is an arm 6 that is provided with a right-angled end portion 7. This arm is for the purpose of clamping the blade or leaf springs 8 and 9 to the post 4 and at the same time the inturned end portion 7 normally places the springs 8 and 9 under stress by slightly bending or curving the same. The free end of the spring 9 extends under the pin 2, while the extension end of the spring 8 extends under the pin 3. The spring 8 is lighter than the shorter spring 9. The springs 8 and 9 in their normal position, as shown in Fig. 4, do not exert any tension on the pins 2 and 3, but the lever o is free to slightly oscillate on the pivot r, but not enough to close the contacts v and w.

In order to vary the time that the spark takes place, I provide a rod e^1, see Fig. 1, which extends to within easy reach of the driver. This rod permits the plate e to be rotated about the cam-shaft c whereby the position of the cams g may be advanced or retarded relative to the end of the lever-arm q, whereby the time at which the spark occurs in the engine cylinder may be varied, as readily understood. This construction enables me to do away with the usual "timing" mechanism ordinarily found in this class of devices, thus simplifying the system in this respect.

Referring now to the operation of the device: Fig. 1 shows the cams g out of contact with the extension or free end q of the weighted balance contact lever o, and as the face-plate f is rotated to the right it carries the cams g around with the same until the curved surface j will be brought into contact with the end q of the lever o. This operation brings the contact-points v and w farther apart (as shown in Fig. 2) by rotating the lever o on its pivot-pin r and carries the pin 3 away from the end of the leaf spring 8, while at the same time the pin 2 is pressed against the spring 9 causing this spring to be subjected to still greater stress than is normally placed thereon by means of the arm 6, as indicated in Fig. 2, where the free end of the spring 9 is moved away from the curved end 7 of the arm 6.

After the cam g leaves the arm q of the cams g, as shown in Fig. 3, the springs 8 and 9 (which have been placed under stress, as noted above by the elevation of the arm q,) are now exerted on the pin 2 to violently throw the weighted balance lever o in the opposite direction or toward the right. This action of the springs, or the weighted end p of the lever o, causes the contacts v and w to instantly come together, and, by reason of the momentum or kinetic energy inherent in the moving mass of metal, the contact point v will slide, as shown in Fig. 3, on the contact point w with the result that these points are always kept in a bright condition, thus insuring a good electrical connection from the battery 26 through the wires 29 and 30 and effectually prevent any chance of these points becoming corroded. The pin 3 at this instant is now brought into contact with the free end of the spring 8, and bent, as shown in Fig. 3; this spring then reacts on the pin 3 to cause a rebounding or returning of the balance lever o and again separate the contact points v and w, as shown in Fig. 1, which is their normal position.

Referring now to Fig. 4, it will be seen that should the cam shaft c be rotated backward or to the left, carrying therewith the cams g, the flat face portion i of the cams will be brought into contact with the end q of the balance-lever o. This operation does not actuate the balance lever but results sim-

ply in rotating the cams g on their own pivotal pins k against the tension of the coiled spring n without effecting a closure of the contact points.

The direction of force exerted by the cams g on the lever o being radial and substantially in the direction of the arms q, does not rotate the lever o from its position of rest but simply results in rotating the cams g as described. This provision of always maintaining contact-points v and w open during the reverse rotation of the cam-shaft prevents the accidental firing of the vaporous charge in the cylinder.

It is understood that the contact points v and w are closed at the instant when the circuit is to be closed in the primary of an induction coil in order to deliver the spark or induced current from the secondary winding of the induction coil to the spark-plugs.

My construction fully compensates for all speeds of the engine since the opening between the contacts v and w is proportional to the speed of the shaft c, that is to say the cams g will, at a rapid rate of rotation, open the contacts farther than at a slow speed; therefore the circuit closing device compensates for all speeds.

What I claim, is:—

1. In combination with a cam-shaft of an internal combustion engine, a base-plate pivotally mounted with relation to said shaft a contact on the base-plate, a lever having a weighted end portion for normally retaining the same in a balanced condition and carried by the base-plate, and means rotating with the cam-shaft for disturbing the equilibrium of said lever.

2. In combination, a shaft, a base-plate carried thereby, a fixed contact thereon, a pivotally mounted lever carried by the base-plate, means, including a weighted end portion and forming a part of said lever for balancing the same about its pivot, and means mounted on said plate for operating the lever.

3. In combination, a shaft, a face-plate mounted thereon, a fixed contact, a freely balanced contact lever having one arm arranged in operative relation with the face of the plate and an independently rotatable cam mounted on said plate for operating said lever.

4. In combination, a shaft, a base-plate mounted on the shaft, a normally and freely balanced contact-lever, a pair of contact points, elastic means for normally maintaining the equilibrium of said lever and the contact points open, and an independently rotatable cam carried by said plate for periodically disturbing the equilibrium of the lever.

5. A make and break mechanism having in combination with the cam-shaft of an internal combustion engine, a base-plate, a normally balanced lever having a weighted end mounted thereon and provided with a contact terminal on one of its arms, means for maintaining the contact terminal of the lever open, a second terminal, and means on the cam-shaft for disturbing the balanced effect of the lever and permitting the contacts to periodically close.

6. In combination, a shaft, a base-plate, a contact mounted thereon, a balanced contact-lever having a weighted end, a contact thereon, said lever being operatively located with relation to said contact, means carried by the shaft for permitting said contacts to close, and means for effecting their separation.

7. In combination, a weighted balanced contact lever, a contact thereon, a base-plate, a contact mounted thereon, elastic means for normally maintaining the lever in equilibrium and said contacts open.

8. In combination, a fixed contact, a contact-lever having a weighted arm, a spring normally under stress, and means on the lever engaged by the spring for maintaining the lever in equilibrium and the contact lever in open circuit.

9. In combination a fixed contact, a contact lever having a weighted arm, a spring normally under stress, and means on the lever engaged by the spring for maintaining the lever in equilibrium and the contact lever in open circuit, a rotating element, and means carried thereby for engaging the said contact lever.

10. In combination, a contact lever balanced about its pivotal point a contact thereon, a spring normally under stress, means located on opposite sides of the fulcrum of the contact lever engaged by the spring for maintaining the contact lever in equilibrium, and the contact open, a rotating element, and means carried thereby for engaging said contact lever, said means including a cam for actuating the contact lever and increasing the state of stress of the spring, whereby when the additional stress on the spring is removed the contact lever will be operated and the contact closed.

11. A pivoted balanced contact-lever having pins or projections thereon, and located on opposite sides of the pivotal point of the lever, elastic means normally under stress and engaging said pins or projections, whereby the lever is maintained in equilibrium.

12. An electric contact device having in combination, a shaft, a pivotally mounted cam carried thereby, an abutment adjacent the cam for permitting the same to rotate in one direction only, a contact lever balanced about its pivotal point having an arm extending into the path of the cam, a contact thereon whereby when the cam engages the arm the equilibrium of the lever will be dis-

turbed and the contact closed, and elastic means coöperating with the contact lever for maintaining the same in open circuit.

13. An electric contact device having in combination, a shaft, a pivotally mounted cam carried thereby, an abutment adjacent the cam for permitting the same to rotate in one direction only, a contact lever balanced about its pivotal point and having an arm extending into the path of the cam, a contact thereon whereby when the cam engages the arm the equilibrium of the lever will be disturbed and the contact closed, and whereby when the shaft is reversely rotated the cam will engage said arm and be rotated on its own axis, as described, without disturbing the contact lever, and means for maintaining the contact lever in open circuit.

14. An electric contact device having in combination a rotatable base-plate, a contact lever, pins secured to the lever and on opposite sides of its pivot, and an elastic element engaging the pins for maintaining the lever in equilibrium.

15. An electric contact device having in combination, a rotatable base-plate, a contact carried thereby, a contact lever having abutments thereon, a contact thereon, an elastic element engaging the abutments for maintaining the lever in equilibrium, the contact lever being balanced by an overweighted end portion whereby when the lever is rotated in one direction the elastic element will be placed under stress and upon the discontinuance of the rotation of the lever the elastic means or the weighted end will violently throw the lever in the opposite direction and cause the contact lever to close the contacts.

16. An electric contact device having in combination, a shaft, a base-plate rotatable relative thereto, a weighted balanced contact lever, an elastic element normally maintained in a state of stress and having its free end engaging a plurality of abutments on the contact lever, whereby said lever is normally maintained in equilibrium.

17. An electric contact device having in combination, a shaft, a base-plate rotatable relative thereto, a contact carried thereby, a weighted balanced contact lever, a contact thereon, an elastic element normally maintained in a state of stress and having its free end engaging a plurality of abutments on the lever whereby said lever is normally maintained in a position of equilibrium, a cam carried by the shaft and engaging an end of the lever to disturb the condition of equilibrium and permit either the elastic means or the weighted end of the contact lever to effect the closure of the contacts.

18. In combination, a plate, an arm secured thereto having a bent end portion, two springs engaged by the arm for maintaining the said springs in a state of stress, a contact lever, pins secured to the lever and located on opposite sides of the pivot, one of the springs being extended and having its free end engaging one of the pins, the other spring having its free end engaging the other pin, whereby said lever is normally maintained in equilibrium.

19. In combination, a plate, a fixed contact thereon, an arm secured to said plate and having a bent end portion, two springs engaged by the arm to be maintained in a state of stress, a contact lever, a contact thereon, pins secured to the lever and located on opposite sides of the pivot, one of the springs being extended and having its free end engaging one of the pins, the other spring having its free end engaging the other pin, whereby said lever is normally maintained in equilibrium, a rotatable cam for engaging an arm of the lever, whereby upon such engagement the lever will be rotated and one of the pins moved away from one spring while the other pin is pressed against the other spring, and upon release of the lever by the cam the contact lever will be violently rotated to close the contacts and rebounded by the extended spring, as described.

20. In a circuit closing device, a fixed contact, a contact lever having a weighted end for balancing the same about its pivotal point, a spring to maintain the lever in equilibrium, means for momentarily engaging an arm of the lever to rotate the same in one direction against the tension of said spring, and move the contact lever away from said fixed contact point, whereby when the lever is released the weighted end or spring will cause the contacts to close, and means coöperating with the spring for returning said lever to equilibrium.

21. In a circuit closing device for ignition systems, a contact lever having a weighted end, and an arm for balancing the weighted end portion, a spring having one end secured to the weighted portion, means for placing the spring under tension, a contact mounted on the other end, a second contact, means for normally maintaining the contacts open, means for momentarily separating the contacts to a greater distance whereby when the separating means ceases to act the contacts will be closed with a sliding effect, and whereby the contact lever will be rebounded or returned and restored to normal condition.

22. In an electric ignition system having in combination, a shaft, a base-piece supported thereby, a contact on the base-piece, a freely balanced contact lever having a weighted end, a contact yieldingly supported thereby, means carried by the shaft for operating the lever, yielding means for rebounding or returning the contact lever to its normal or open position, after each contact, said

yieldingly supported contact permitting an overthrow or sliding of said contacts on each other.

23. In an electric ignition system having in combination, a shaft, a yielding balanced contact lever, a fixed contact to be engaged by said lever, means for operating the lever when rotated in one direction, said means rendering the lever inoperative when rotated reversely, the means including a pivotal pawl located in the path of the operating means.

24. A circuit-closing device comprising a freely balanced contact lever, a contact thereon, pins or projections thereon and located on opposite sides of the pivotal point of the lever, a fixed contact, yielding means engaging said pins for normally retaining the lever in open circuit and for permitting an overthrow of said lever when the contacts are closed and the yielding means is placed under stress, and means for operating said lever to effect the closing of the contact points, substantially as described.

25. A circuit-closing device, comprising a fixed contact, a contact lever, a contact thereon, said lever being provided with a weighted end for balancing the same, a yielding contact member carried thereby, yielding means for retaining the lever in a state of equilibrium about its pivotal point, means for actuating the lever, whereby the amount of separation of the contact points is proportional to the speed of operation of the lever-operating means, and whereby the weighted end will effect an overthrow or sliding of the contacts on each other.

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