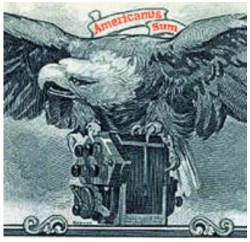
MagDyno

The “D-Zünder” series from Robert Bosch (1861-1942, left) and his workshops in Stuttgart-Feuerbach ran from the early 1930s until probably the end of the Second World War. The company changed its legal form several times, which is noted accordingly in the model name of the devices. Although Bosch set up public welfare foundations with the profits from his successful company and was one of the first to reduce working hours to eight hours in five working days with the highest wages in the region, he was subjected to strikes by socialist unions between the world wars.

It was one of the first to reduce working hours to eight hours in five working days with the highest wages in the region. Between the world wars, it was covered with strikes by socialist unions.

The first gasoline engine producer, Magirus Deutz (Otto&Cie./Cologne, since 1864), also built the first dynamo magnet in the early 1880s to drive stationary engines. In 1898, Bosch constructed an improved model for the first motor vehicles. Gottlob Honold (1876-1923, right), who joined the Bosch company in 1901, developed the spark plug into a magneto and improved its performance through higher speeds with smaller dimensions. By 1906, Bosch had sold 100,000 such devices. Since 1925, production has been carried out on the assembly line principle. Bosch engine ignition was the first choice at that time and by 1910 the company already had branches with production in France and the USA. Of the total turnover, 88% was foreign trade, mainly with magnetos.

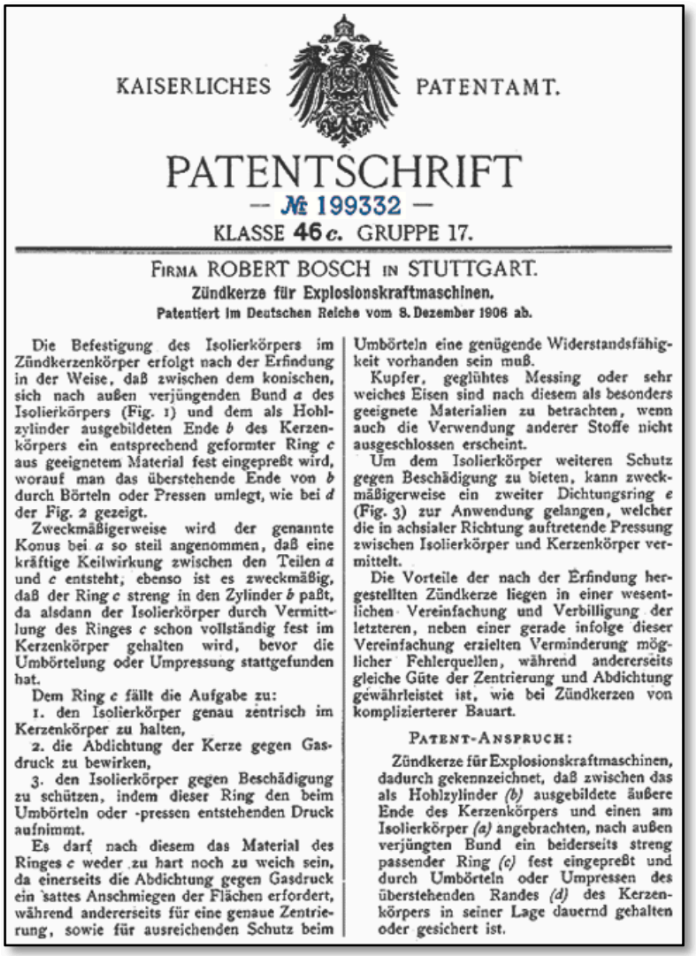


All of these foreign branches were confiscated by the winners of the First World War - a loss of 50% of the company's assets. The USA even stole the brand name "Bosch" in May 1918, so that for a time between the world wars there was pirated production of lower manufacturing quality.

Designation "ABMC - American Bosch Magneto Corporation" in Springfield, Massachusetts (right). When Bosch took legal action against the abuse, in 1929 a US court under judge Thomas Grain banned Bosch from using its own name there, since this name was ultimately only available to the US company. Honold responded to this in 1921 by introducing the now familiar trademark (left). Thanks to high quality standards, Bosch was able to quickly win back foreign markets. It took until 1983 before Bosch was granted the right to its own name again in the USA (HRES 943 IH)

During World War II, Bosch electrics were used in most army vehicles, even war aircraft. After the end of the war, the company's foreign branches were confiscated a second time by the victorious powers, including the production sites in the Soviet-occupied zone in central Germany. In 1948, the Western victorious powers also tried to completely destroy the company. This attempt could only be prevented by waiving all patent rights to one's own inventions.

(Source: Bosch - History / Index / Archives / ABMC - p.8f.).



KAISERLICHES PATENTAMT.

PATENTSCHRIFT

— № 199332 —

KLASSE 46 c. GRUPPE 17.

FIRMA ROBERT BOSCH IN STUTTGART.

Zündkerze für Explosionskraftmaschinen.

Patentiert im Deutschen Reiche vom 8. Dezember 1906 ab.

Die Befestigung des Isolierkörpers im Zündkerzenkörper erfolgt nach der Erfindung in der Weise, daß zwischen dem konischen, sich nach außen verjüngenden Bund *a* des Isolierkörpers (Fig. 1) und dem als Hohlzylinder ausgebildeten Ende *b* des Kerzenkörpers ein entsprechend geformter Ring *c* aus geeignetem Material fest eingepreßt wird, worauf man das überstehende Ende von *b* durch Börteln oder Pressen umlegt, wie bei *d* der Fig. 2 gezeigt.

Zweckmäßigerweise wird der genannte Konus bei *a* so steil angenommen, daß eine kräftige Keilwirkung zwischen den Teilen *a* und *c* entsteht, ebenso ist es zweckmäßig, daß der Ring *c* streng in den Zylinder *b* paßt, da alsdann der Isolierkörper durch Vermittlung des Ringes *c* schon vollständig fest im Kerzenkörper gehalten wird, bevor die Umbörtelung oder Umpressung stattgefunden hat.

Dem Ring *c* fällt die Aufgabe zu:

1. den Isolierkörper genau zentrisch im Kerzenkörper zu halten,
2. die Abdichtung der Kerze gegen Gasdruck zu bewirken,
3. den Isolierkörper gegen Beschädigung zu schützen, indem dieser Ring den beim Umbörteln oder -pressen entstehenden Druck aufnimmt.

Es darf nach diesem das Material des Ringes *c* weder zu hart noch zu weich sein, da einerseits die Abdichtung gegen Gasdruck ein sattes Anschmiegen der Flächen erfordert, während andererseits für eine genaue Zentrierung, sowie für ausreichenden Schutz beim Umbörteln eine genügende Widerstandsfähigkeit vorhanden sein muß.

Kupfer, geglühtes Messing oder sehr weiches Eisen sind nach diesem als besonders geeignete Materialien zu betrachten, wenn auch die Verwendung anderer Stoffe nicht ausgeschlossen erscheint.

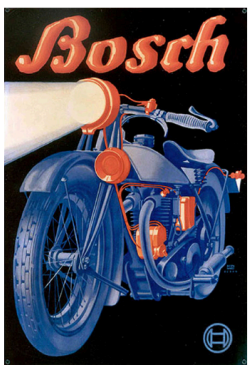
Um dem Isolierkörper weiteren Schutz gegen Beschädigung zu bieten, kann zweckmäßigerweise ein zweiter Dichtungsring *e* (Fig. 3) zur Anwendung gelangen, welcher die in achsialer Richtung auftretende Pressung zwischen Isolierkörper und Kerzenkörper vermittelt.

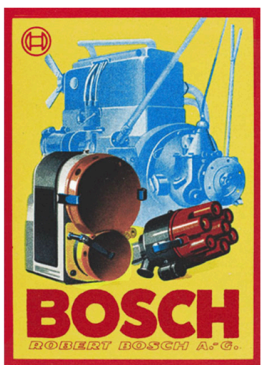
Die Vorteile der nach der Erfindung hergestellten Zündkerze liegen in einer wesentlichen Vereinfachung und Verbilligung der letzteren, neben einer gerade infolge dieser Vereinfachung erzielten Verminderung möglicher Fehlerquellen, während andererseits gleiche Güte der Zentrierung und Abdichtung gewährleistet ist, wie bei Zündkerzen von komplizierterer Bauart.

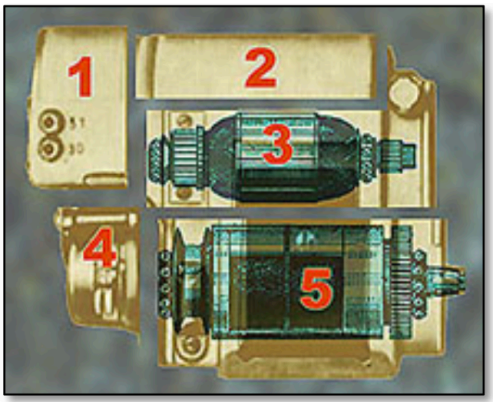
PATENT-ANSPRUCH:

Zündkerze für Explosionskraftmaschinen, dadurch gekennzeichnet, daß zwischen das als Hohlzylinder *(b)* ausgebildete äußere Ende des Kerzenkörpers und einen am Isolierkörper *(a)* angebrachten, nach außen verjüngten Bund ein beiderseits streng passender Ring *(c)* fest eingepreßt und durch Umbörteln oder Umpressen des überstehenden Randes *(d)* des Kerzenkörpers in seiner Lage dauernd gehalten oder gesichert ist.

In the early 1920s, Bosch was able to win over the Munich professor of graphic design, Lucian Bernhard (1883-1972), to design his product advertising. He left behind many works that uniquely expressed the characteristics of companies and products. The following selection in the automotive electrical sector:

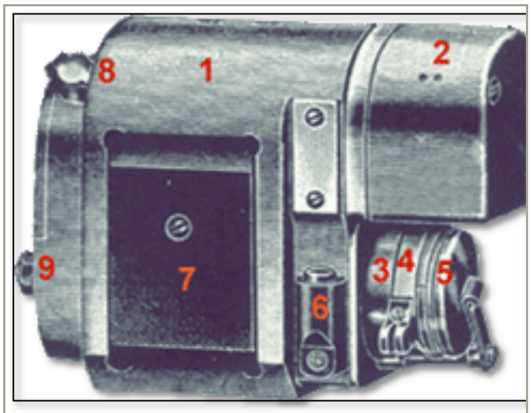






Honold's "light magneto" consists of the following functional elements:
1) Regulator / control of the dynamo
2) Field coil / amplification of the dynamo
3) Dynamo / luminous flux production
4) Breaker / Engine Control Ignition Timing 5) Ignition / Engine Ignition

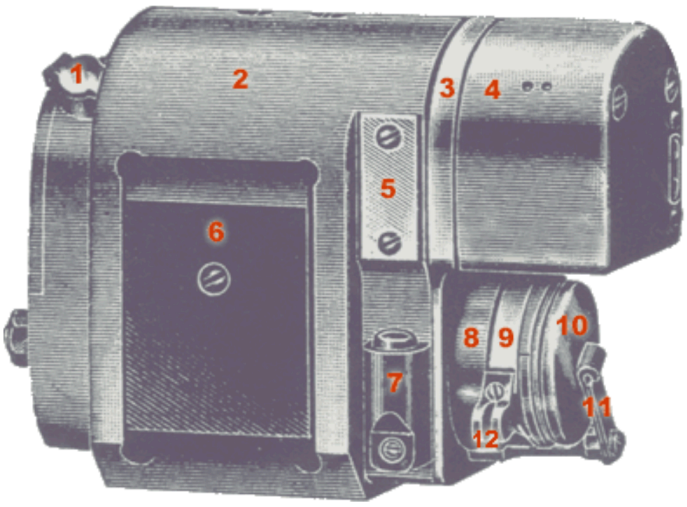
Dynamo (3) and ignition (5) are separate units. They are only connected by transmitting the drive from the engine via the ignition armature to the dynamo. Part of the dynamo electricity is directed to the field coil (2) via the controller (1), which increases its magnetic strength and at the same time increases the generator power that feeds the battery. The ignition feeds the spark plugs, time-controlled by the breaker (4), which usually also causes the short circuit to switch off the engine.



1 Hauptgehäuse
2 Reglergehäuse
3 Kontaktgebergehäuse
4 Zündverstellring
5 Verschlußdeckel
6 Zündkerzenanschluß
7 Erreger-Magneten
8 Ölklappe für Getriebe
9 Antriebswelle

02 Color Scheme

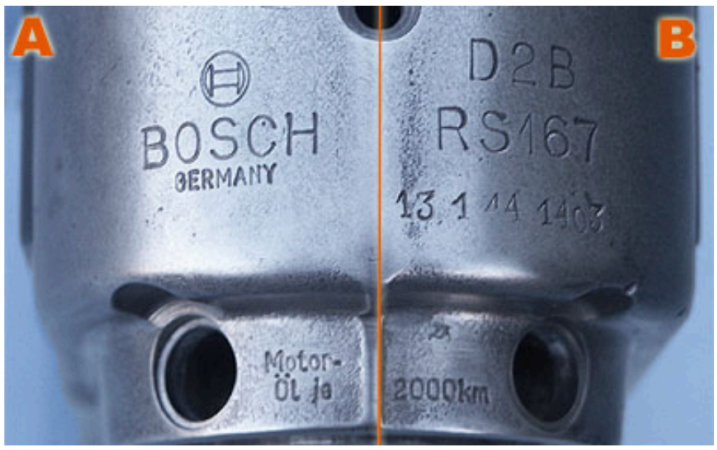
The series was subject to a number of changes. The regulator cover (4) was nickel plated brass, painted steel and polished aluminum. The short circuit cover (10) was available in plastic and steel versions, the latter painted or galvanized. Many model changes such as paraffin capacitors (DxB) are not externally visible. So the following color scheme just shows a typical and common design. Current reproductions of parts do not always respect the historical color scheme, but in the case of bluing at (11), replaced by chrome, this is more of an improvement.



	1) Nickel		4b) Lack: mausgrau		6) Lack: mausgrau		10a) Plastik: braun
	2) Aluminium		4c) Aluminium		7) Plastik: black		10b) Stahl: schwarz
	3) Nickel		5a) Nickel		8) Nickel, Lackfarbe silber		11) Stahlblau / keine Lackfarbe
	4a) Nickel		5b) Chrom		9) Stahlblau / keine Lackfarbe		12) Nickel

03 Model information

Each Bosch D igniter has a label indicating the manufacturer and model. Either as a riveted oval plaque or as a stamping on the top of the housing near the flap oilers with alignment from the drive axle to the regulator cover. There appears to have been no systematic approach to the positioning of the punching.



The manufacturer is usually indicated on the left of the central axis (A), and the model is indicated on the right (B). But this system has been changed several times. The different names for the manufacturer in particular allow an initial assessment of the production time of a unit.

A) Manufacturer

A1 (1918-1937)

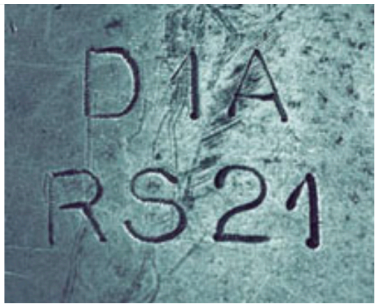
A2 (bis 1937)

A3 (1937-1945)

B) Model

B1 (zu A3)

B2 (zu A2)



B3 (zu A1)

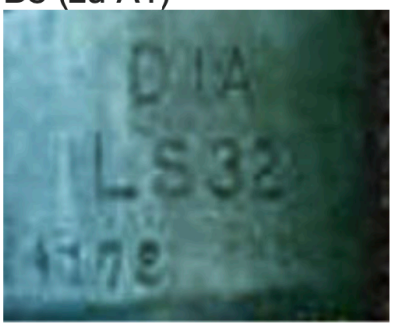
B4 (zu A3)

B5 (zu A1)

B6 (zu A1)

B7 (zu A1)

B8 (zu A1)



B9 (zu A2)

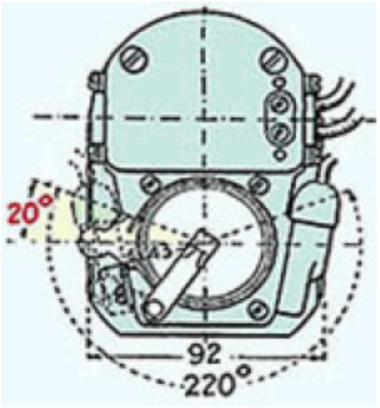
B10 (zu A3)

B11 (zu A1)

C) Historical Changes

04 Bosch Model Types

Bosch aggregates differ from each other
a) Power transmission from the engine (drive pinion, control by crank or camshaft) b) Direction of rotation (right/left)
c) Number of cylinders (1/2)
d) Ignition interval (angle degrees)
e) Current consumption at the dynamo (polarization)
The components of the pinion, interrupter, slip ring and cam ring are correspondingly different. Many parts of the D series are identical and can be subsequently exchanged between the models for different vehicles. That's why the model name on the case no longer necessarily corresponds to the production condition. Over time, many of these magnetos have been converted for a different vehicle than the one for which they were designed.



Grundfläche mit Stiftlöchern
Konische Antriebsachse
Nockenring mit Feder
Zündverstellung 20° - auf Achse
Rotation: R = rechts / L = links
Alle Drehrichtungsangaben verstehen sich von der Antriebsseite

D1

Zylinder: 1 / Typ: 4-Takt / Nockenwelle

D1A R 900	ohne Kurzschlußdeckel	rechtsdreh	Anschluß 61
D1A L 900	Kohlebürstenhalter	linksdreh	
D1A R 904	ohne Kurzschlußdeckel	rechtsdreh	Anschluß 61
D1A L 904	Kohlebürstenhalter	rechtsdreh	
D1A R 906	ohne Kurzschlußdeckel	rechtsdreh	Anschluß 61
D1A L 906	Kohlebürstenhalter	linksdreh	
D1A R 912	mit Kurzschlußdeckel	rechtsdreh	Anschluß 61
D1A L 912	Kohlebürstenhalter	linksdreh	

D1B LS 2	D1B LS 27	D1B LS 46	D1B RS 126
D1B LS 5	D1B LS 29	D1B LS 13	D1B LS 127
D1B LS 6	D1B LS 31	D1B RS 48	D1B RS 132
D1B RL 8	D1B RS 46	D1B LS 102	D1B RS 133
D1B RS 8	D1B LS 46	D1B LS 104	D1B LS 134
D1B LS 8	D1B RS 32	D1B LS 106	D1B RS 138
D1B LS13	D1B LS 32	D1B LS 109	D1B RS 139
D1B RS 9	D1B LS 34	D1B LS 110	D1B RS 141
D1B RL 9	D1B LS 35	D1B LS 111	D1B RS 144
D1B RS 12	D1B LS 36	D1B LS 112	D1B LS 145
D1B RLS 12	D1B LS 39	D1B LS 115	D1B LS 146
D1B RS 16	D1B LS 40	D1B RS 116	D1B LS 149
D1B LS 16	D1B LS 42	D1B LS 120	D1B RS 152
D1B LS 8	D1B LS 44	D1B LS 123	D1B LS 163
D1B RS 21	D1B LS 45	D1B RS 124	D1B LS 166

D2

Zylinder:2 / Typ:4-Takt / Nockenwelle / Zündsteuerung:360°

D2A R 900	ohne Kurzschlußdeckel	rechtsdreh	Anschluß 61
D2A L 900	Kohlebürstenhalter	linksdreh	
D2A R 906	ohne Kurzschlußdeckel	rechtsdreh	Anschluß 61
D2A L 906	Kohlebürstenhalter	linksdreh	
D2A R 912	mit Kurzschlußdeckel	rechtsdreh	Anschluß 61
D2A L 912	Kohlebürstenhalter	linksdreh	

D2B R 900	D2B L 912	D2B RS 12	D2B LS 155
D2B L 900	D2B R 9141	D2B LS 12	D2B LS 165
D2B R 906	D2B L 9141	D2B LS 22	D2B RS 167
D2B L 906	D2B LS 2	D2B LS 25	D2B RS 170
D2B R 912	D2B LS 5	D2B LS 153	D2B RS 172

DK2

Zylinder: 2 Typ: 2-Takt Nockenwelle Zündsteuerung: 180°

Zylinder: 2 Typ: 4-Takt Nockenwelle Zündstrg: 180° 540°

DK2A R 900	ohne Kurzschlußdeckel	rechtsdreh	Anschluß 61
DK2A L 900	Kohlebürstenhalter	linksdreh	
DK2A R 906	ohne Kurzschlußdeckel	rechtsdreh	Anschluß 61
DK2A L 906	Kohlebürstenhalter	linksdreh	
DK2A R 912	mit Kurzschlußdeckel	rechtsdreh	Anschluß 61
DK2A L 912	Kohlebürstenhalter	linksdreh	

DK2B R 900	DK2B R 912	DK2B RS 143	DK2B LS 169
DK2B L 900	DK2B L 912	DK2B RS 159	
DK2B R 906	DK2B RS 105	DK2B RS 161	
DK2B L 906	DK2B RS 121	DK2B LS 161	

DV

Zylinder: 2 / Typ: 4-Takt-V / Nockenwelle

DVA R 900	ohne Kurzschlußdeckel	rechtsdreh	Anschl. 61
DVA L 900	Kohlebürstenhalter	linksdreh	
DVA R 906	ohne Kurzschlußdeckel	rechtsdreh	Anschl. 61
DVA L 906	Kohlebürstenhalter	linksdreh	
DVA R 912	mit Kurzschlußdeckel	rechtsdreh	Anschl. 61
DVA L 912	Kohlebürstenhalter	linksdreh	

DVB R 900	DVB RS 24	DVB RS 101	DVB RS 131
DVB L 900	DVB LS 24	DVB RS 101/2	DVB RS 136
DVB R 906	DVB RS 35	DVB LS 101/2	DVB RS 137/3
DVB L 906	DVB LS 35	DVB LS 103	DVB LS 146
DVB R 912	DVB RS 36	DVB LS 106	DVB RS 154
DVB L 912	DVB LS 39	DVB RS 108	DVB LS 154
DVB RS 4	DVB LS 40	DVB LS 113	DVB RS 157
DVB RS 4/2	DVB RS 41	DVB LS 114	DVB RS 162
DVB LS 4/2	DVB LS 41	DVB LS 117	DVB LS 164
DVB RS 5	DVB LS 46	DVB LS 119	DVB RS 168
DVB LS 5	DVB RS 49	DVB LS 129	DVB LS 171
DVB RS 12	DVB RS 49/2	DVB RS 129/2	
DVB LS 12	DVB LS 49/2	DVB RS 129/15	

DK1

Zylinder: 1 / Typ: 2-Takt / Nockenwelle

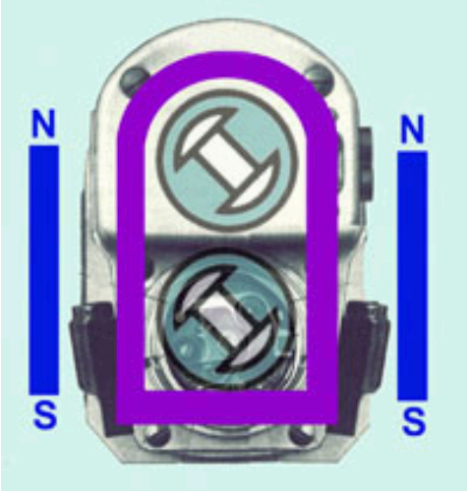
DK1A R 900	ohne Kurzschlußdeckel	rechtsdreh	Anschluß 61
DK1A L 900	Kohlebürstenhalter	linksdreh	
DK1A R 904	ohne Kurzschlußdeckel	rechtsdreh	Anschluß 61
DK1A L 904	Kohlebürstenhalter	rechtsdreh	
DK1A R 906	ohne Kurzschlußdeckel	rechtsdreh	Anschluß 61
DK1A L 906	Kohlebürstenhalter	linksdreh	
DK1A R 912	mit Kurzschlußdeckel	rechtsdreh	Anschluß 61
DK1A L 912	Kohlebürstenhalter	linksdreh	

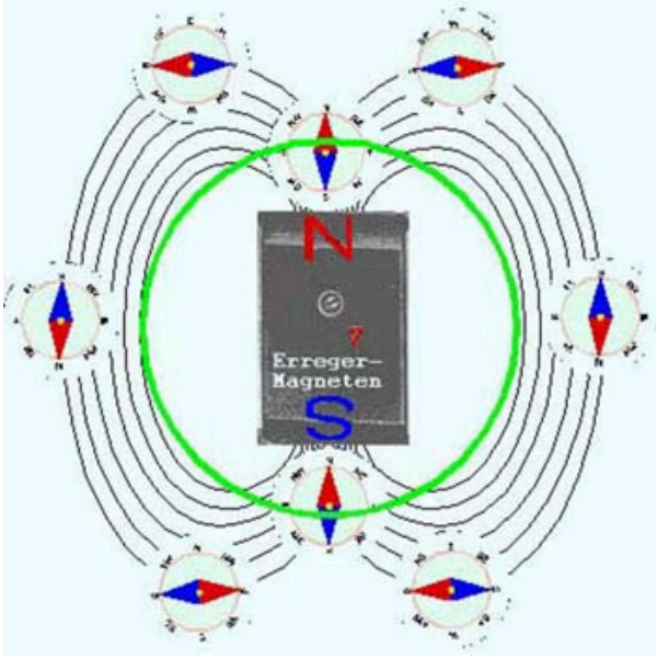
DK1B R 200	DK1B RS 12	DK1B LS 128
DK1B L 200	DK1B LS 12	DK1B LS 140
DK1B R 900	DK1B RS 14	DK1B LS 147
DK1B L 900	DK1B LS 14	DK1B LS 148
DK1B R 906	DK1B RS 20	DK1B LS 150
DK1B L 906	DK1B RS 21	DK1B LS 151
DK1B R 912	DK1B RS 35	DK1B RS 156
DK1B L 912	DK1B LS 109	DK1B RS 173
DK1B RS 1	DK1B RS 122	

Functional mechanics

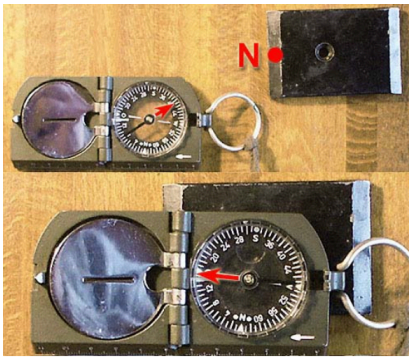
01) Magnet Effect

The coils are surrounded by a horseshoe magnet (right/purple), which is closed into a circle. Cast into the aluminum casing, it consists of a package of thin iron plates that are insulated from the casing. At times a solid core was also used. This magnet creates the field needed to generate electricity through coil rotation. Its field is weak and is strengthened by two magnetic plates on the outside (right/blue), as well as by temporary electromagnetism as described below.





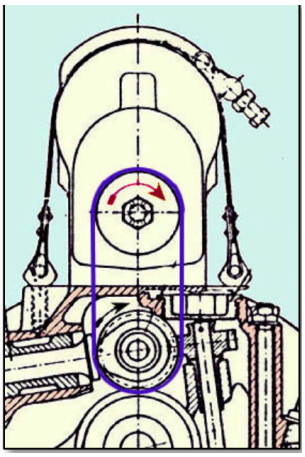
Magnetic plates ensure full ignition performance even with a slight rotational movement at the start. Storing D-detonators without these plates causes a reduction in field force over time. The magnetism of the side plates is stamped into the sides as a Gaussian value (left). Like all magnetism, this one is polarized, with the correct alignment being ensured by off-center screw mounting. The upper half of a plate is north, the lower half is south.



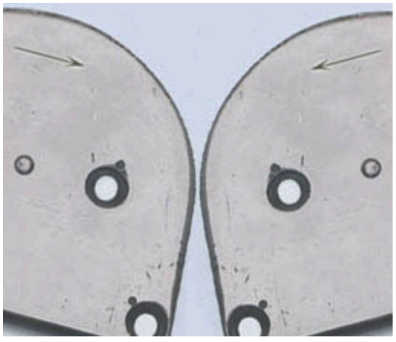
Temporary magnetism is generated by a field coil mounted on the top inside. Their magnetic force is determined by the electricity controlled by the regulator. The electromagnetism of this coil also renews the magnetization of the iron core in the housing.

The magnetic plates in contact with the iron core in the housing should be free of coatings and corrosion to enable maximum mutual magnetization. This also applies to the carrier of the field coil and its contact surface with the housing core. The metal fastening band for the magneto on the engine should also be made of non-ferrous metals (bronze, brass). Shocks such as those caused by falls or hammer blows can reduce permamagnetism in ferrous metals. When driving, magnetos can reach temperatures of around 60°C on the engine. At hot temperatures, influences on the permamagnetism of metals have a stronger effect than at cold temperatures.

02) Direction of Rotation

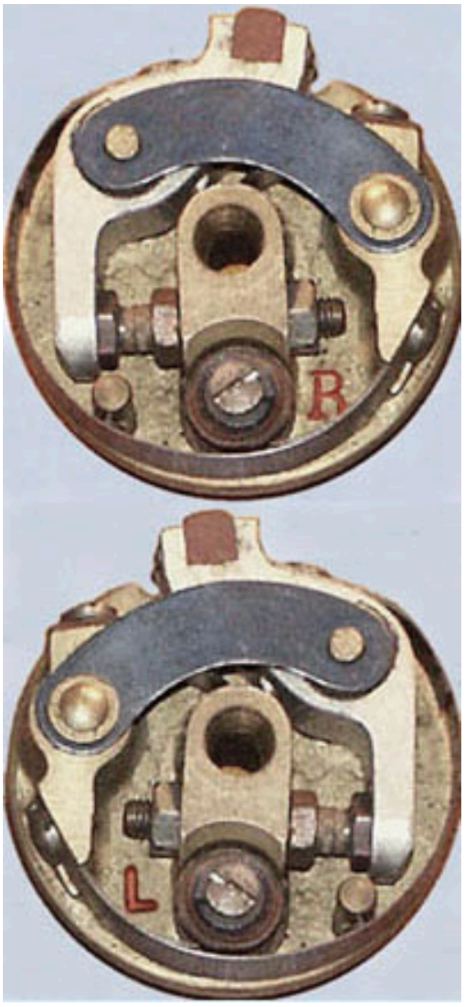


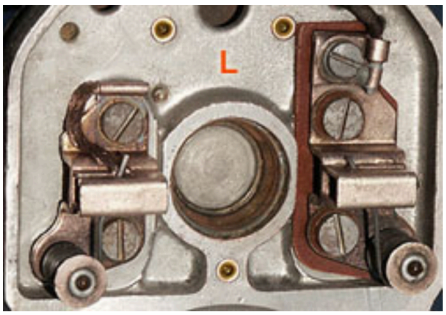
The direction of rotation is always defined as the view of the magneto from the drive axle. The external declaration of the direction of rotation is the model name and a directional arrow on the gearbox cover (right). In the picture on the left is the assembly of a model D2B-RS170 on a BMW R12 with a clockwise drive from the camshaft of the motorcycle engine.



For the ignition armature with its alternating current, the polarity and thus the direction of rotation is irrelevant. But the dynamo generates depending on the direction of rotation.

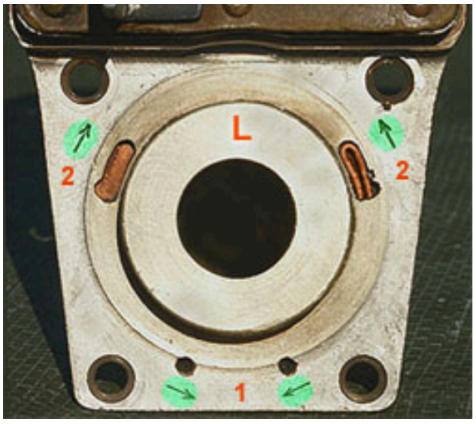
Direct current with a specific polarity. The field coil is polarized accordingly, although this can be changed by changing its connecting cable. Therefore there are no different field coils based on the direction of rotation.





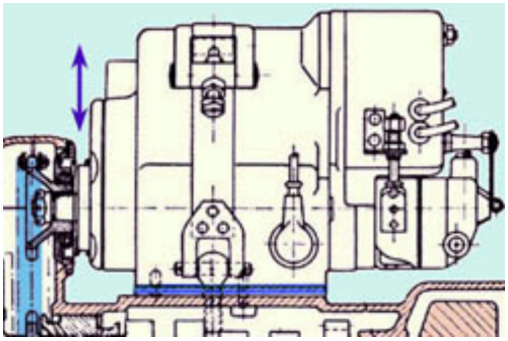
Carbon contacts for collecting the luminous flux from the dynamo are either isolated or in contact with the housing ground depending on the direction of rotation. When changing the direction of rotation, these components must also be mounted in reverse. Due to their design, this is possible without the need for special construction variants for a specific direction of rotation.

Breakers are factory marked with the direction of rotation ("R" or "L", picture on the right). The switching point varies depending on the direction of rotation because the cam ring is built asymmetrically.

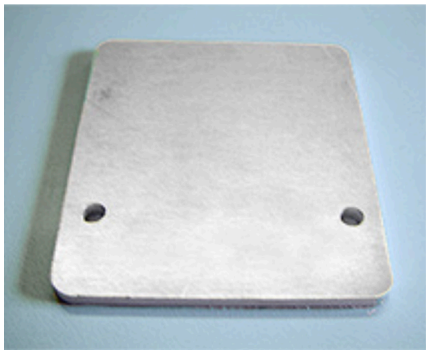


Because the ignition timing is controlled, the cam ring has a different position on the cover depending on the direction of rotation. Mounted in its housing, the position of the ring is defined by the spring in the housing (hole 1) and by a pin in the base of the ring (hole track 2). If a multi-purpose cover is installed that is suitable for both directions of rotation, as in the picture on the left, one of the two hole tracks is blocked (here: counterclockwise).

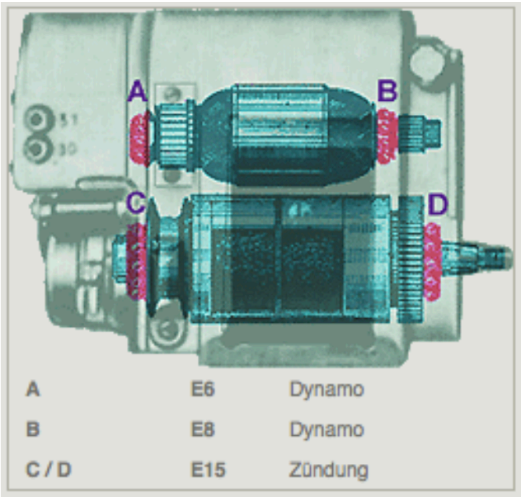
03) Chain Tension



The chain drive from the engine has its chain tension adjusted by metal plates between the bottom of the magneto and its base on the top of the engine housing. The number of plates and their total thickness determine the distance between the drive gears and the chain tension. It is important that there is always good electrical contact between the two housings. So only metallic plates without a surface coating can be used.



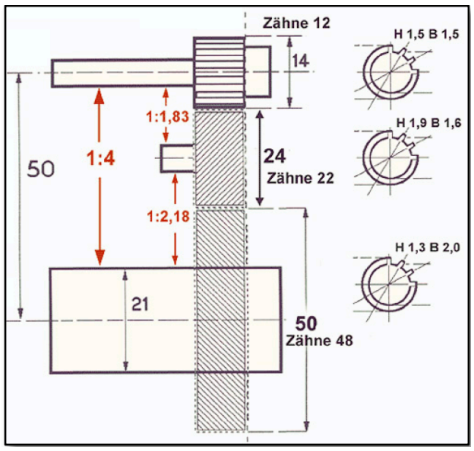
04) Running Bearings



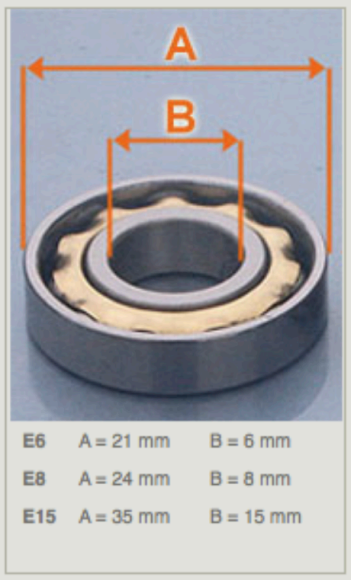
The bearings in the magneto serve to ensure that the two armatures for generating electricity are precisely and firmly seated so that they can run as close as possible to their magnetic fields. The smaller the running gap, the better the efficiency. The rotation of the armatures should run with as little friction as possible in order to reduce wear and keep the load resistance to the motor as low as possible.

Übersetzung Motor / X	
Motor	1
Nockenwelle	0,5
Zündung	0,5
Dynamo	1,7

Since the ratio between the ignition armature and dynamo is up to 1:3.4, the component can reach over 6,000 rpm at full throttle. can be achieved. Bearings in the magneto must be manufactured with the highest precision. D-igniters use shoulder bearings from an industry standard that is still in use today (E6/E8/E15).

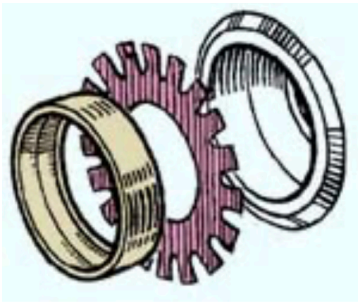


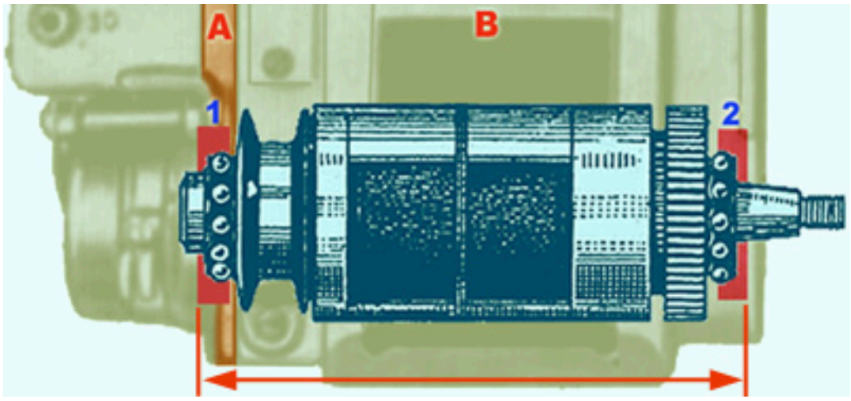
Test: New bearings of the type mentioned have no play in the final assembly of the magneto. The original old bearings will usually be worn out or corroded so that they no longer have the required quality. Their replacement is usually necessary.



Insulation: The armature core in dynamos becomes electrically charged. Depending on the voltage generated, spark bridges can occur between the armature and the ground on the housing. Such spark bridges not only weaken electricity generation but can also erode metals.

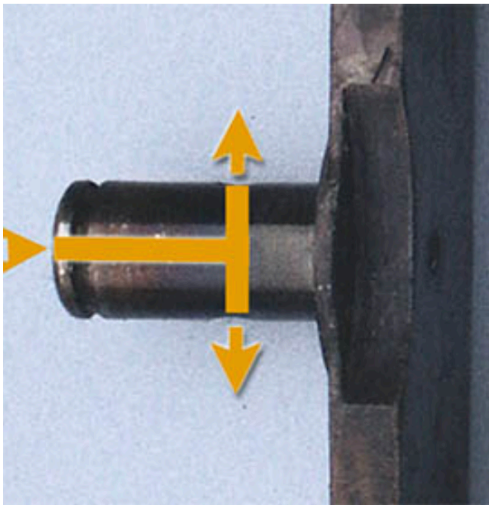
In order to avoid this effect on the ignition armature with its high voltage, the bearings of this component are insulated from the mass on the housing using paper inserts. The Bosch insulation was usually a ring and a strip. Not every type of paper is suitable; compressed and paraffinized papers were mostly used.



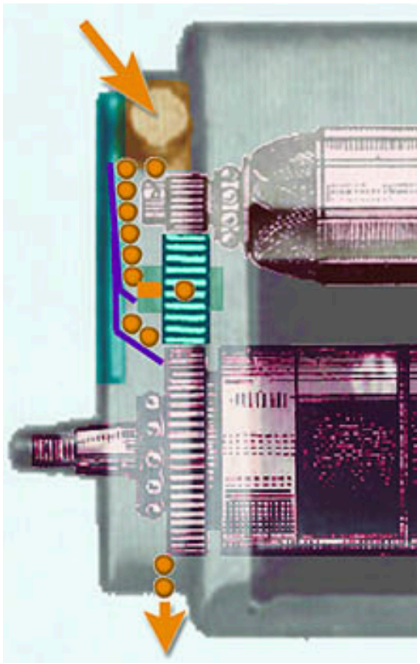


Adjustment:
Depending on the thickness of the insulation used, the adjustment of an anchor in the housing (B) also changes. After the main cover (A) has been closed, it must not sit too tightly or too loosely in the bearings (1) and (2). If this cover is used with sealing material, the fit of the anchors will increase. D-igniters therefore had shims on the bearing seats of the armatures in order to be able to precisely adjust the bearing fit.

05) Oil Lubrication

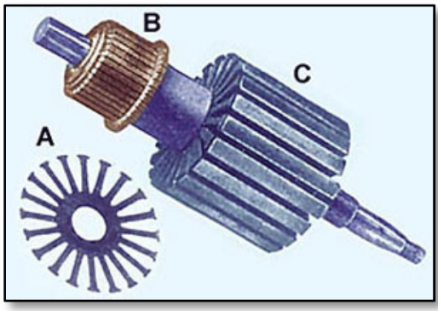


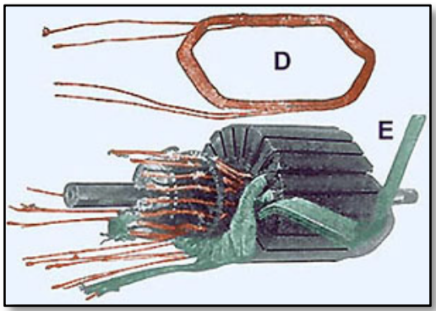
Every 2,000 km, D igniters are provided with new lubricant (engine oil) via the flap oilers. The filling point leads into a chamber on the top of the gearbox, filled with cotton wicks or a felt block. From here the oil lubricates the transmission with three gears. The middle transmission wheel (right/green) sits loosely on a hollow axle (left). Filled with felt, it draws lubricating oil via the distributor spring in the gearbox cover to its drill holes and onto the friction points of the gear. Dripping oil eventually reaches the bottom of the gear unit from where it can run out through a hole. Just a few drops of oil per maintenance interval are sufficient. However, these are important because a lack of lubrication has already destroyed the gearbox of many historical units.



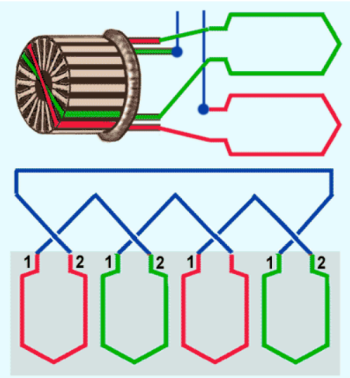
Structure and function of the power generator

01) Dynamo Principle



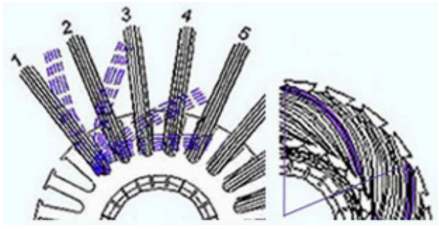


Dynamo armatures produce alternating current when their coil rotates in a magnetic field between its north and south poles. The polarity of the electricity generated also changes accordingly. But direct current is required to charge a battery. An approximately direct current can be generated if many coils in an armature are slightly offset from one another and are electrically connected to a collector (=commutator). The polarities of the individual coils then complement each other to form a direct current that only oscillates slightly.

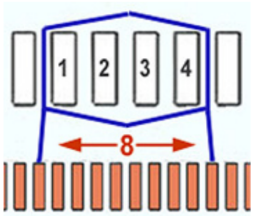


Armature structure: The armature core (C) of the D-igniter consists of many thin iron disks (A) to avoid eddy currents. There are 10 different coil windings (D) embedded in it made of insulated copper wire. The total of 20 line ends of the coil loops are soldered to a collector (B), from where the direct current is picked up by carbon brushes.

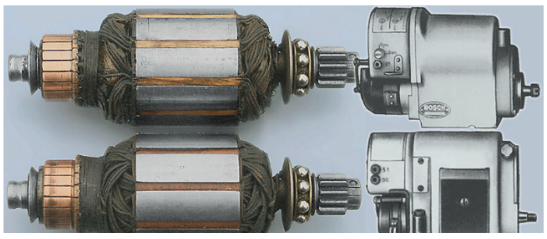
Connection diagram: The collector consists of copper segments that are connected from their respective pole to the corresponding opposite pole on the other side. However, a coil loop does not connect the pole and opposite pole of a segment, but rather one segment in front of it. Each coil loop is continuously connected to the next one, with the last one in the series connecting to the first, creating a ring circuit. When assembling the winding, four segments of the armature core are placed between a coil loop and eight collector segments lie between each line end of a coil.



Power: How much electrical energy is generated with a commutator depends primarily on the number of turns per coil. The wire thickness has no influence on this, but is a dependent variable, based on the expected current flow in amperes and limited by the available space. At 30 W to 6 V, a D commutator has a current of 5 A and a correspondingly 0.5 mm thick winding wire. These components can usually continue to be used safely during restoration, even if they are old.

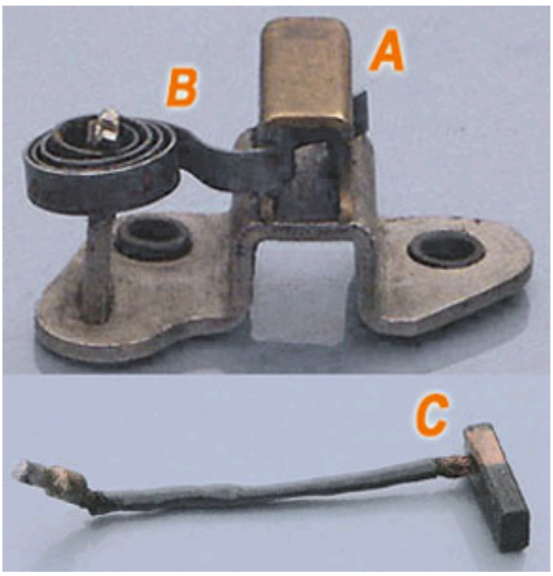


The Bosch D-series dynamo armatures and the B-series battery igniter are identical in construction and similar in appearance. However, if such an armature on the same motor produces a nominal power difference of 15 watts (30/45 W) and therefore half more power, there must be something different about the component. In fact, the D-anchor is constructed with fewer cable turns and weighs



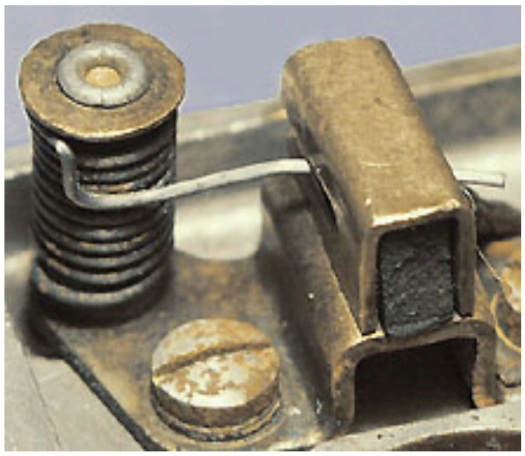
25g less copper cable (390/410 g).

02) Carbon Brushes

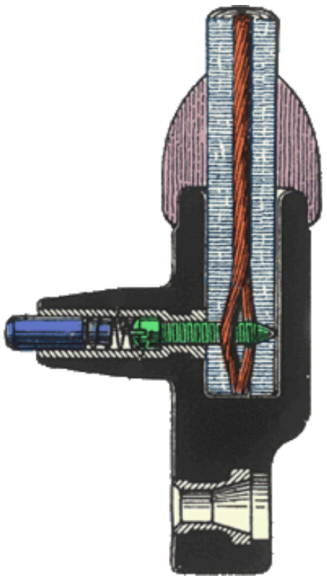


Carbon contacts connect moving parts to circuits via electrically conductive carbon. In the D igniter the brush holders are either insulated (plus) or not (minus). In the picture on the right is the isolated version. A contact module consists of:
(A)Housing that adjusts the sliding movement of the carbon brush,
(B)Spring that gives the carbon brush contact with the moving component
(C)Carbon brush with connection cable.

A) Housing: they are designed for common sizes of existing carbon brushes and are intended to allow the carbons to move freely without friction. However, not all of today's components fit exactly into the brush holders of historical D-igniters, which means that the coals wear out more quickly.



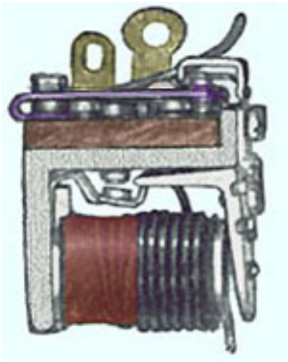
B) Spring: The compression spring determines how reliably the electrical contact is achieved. The stronger their force, the more stable the contact, but the greater the wear and vice versa. The early civilian versions of the D-igniters had a spiral spring (bottom left), the later military versions had a flat spring like in watches (right).



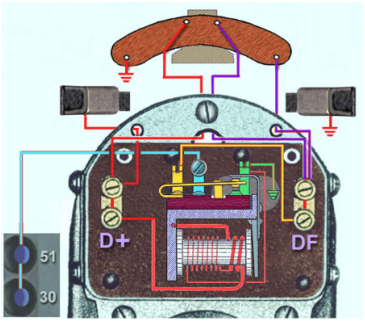
C) Carbon brushes: During production, the hardness of the material is designed for their intended purpose. They should be hard enough so as not to wear out too quickly, but also not too hard so as not to put unnecessary strain on the dynamo's copper collector, which is not as easy and convenient to replace as the carbon brushes. Some modern reproductions of carbon brushes for Bosch D igniters have proven to be too soft and caused short circuits due to lubricated carbon tracks on the sliding surfaces. By scratching each other with a sharp corner on the old and new carbon brushes, you can provisionally check whether their material hardnesses are the same.

Carbon brushes should be replaced after 50% wear of their length. From then on, depending on the design, the spring force drops noticeably and the electrical contact can become unsafe.

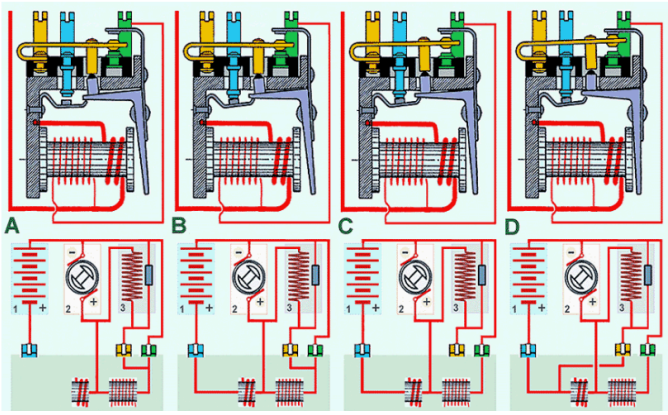
03) Regulator



The regulator's mechanical voltage-regulating relay has four switching states and is the brain of power generation in the D-igniter. When negatively controlled, it controls the charge of the battery as a buffer for the consumers and acts as a fuse against overloading of the electrical components. This function is achieved by controlling the field coil, whose electromagnetism influences the dynamo performance.

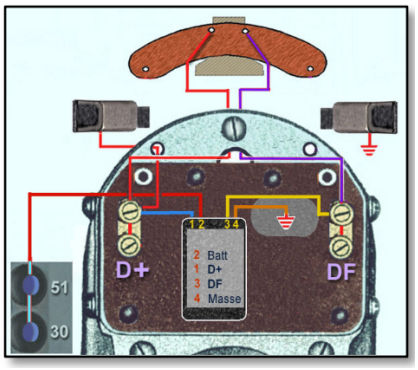


A) Idle state: When the engine is off, the controller finds no dynamo electricity, so no force will lift the switch (yellow). The battery (1) is now switched off from the circuit.
B) Operating state: When the engine is running and the dynamo (2) is active, magnetic force pulls the switch (yellow) up and closes the connection to the battery (1). The lower their voltage, the more current flows through the circuit of the field coil (3) that is now switched on, which increases electricity generation.



C) Utilization: When the battery (1) has reached its charging capacity, the current flow decreases and the voltage in the circuit increases. Then the switch (yellow) is pulled to the middle position between the contacts and reduces the field coil (3). The performance of the dynamo (2) decreases accordingly. As soon as the battery needs electricity again due to consumption, its current flow increases as the voltage drops and the regulator switches back to state B).
D) Overload: Due to a short circuit or failure of a consumer, voltage peaks can pull the switch (yellow) into the highest position. This causes the field coil (3) to have the same voltage with both connections and is switched off. The dynamo (2) then only works with perma-magnetism and minimal power, so that no damage can occur to the unit or the consumer circuit.

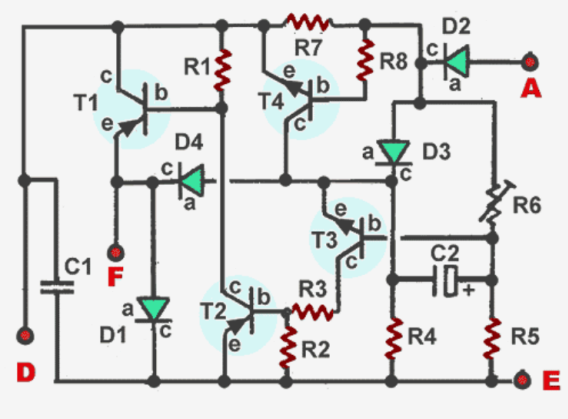
04) Regulator (E-Controller)



The electronic regulator is now most common in restored units, especially since the mechanical regulator is no longer in production. The E-controller consists of an SMD semiconductor circuit with transistors, diodes, resistors and capacitors. Switching changes no longer occur through mechanical movements but through control of current flows. This regulator no longer requires a resistance wire in the field coil. Its task of a bypass circuit is now achieved differently. The corresponding connections of old field coils are no longer used and are no longer present in new production.

Advantages: Lower power consumption during switching operation, less sensitive to climatic influences and corrosion, hardly any wear during operation, easily available on the market.

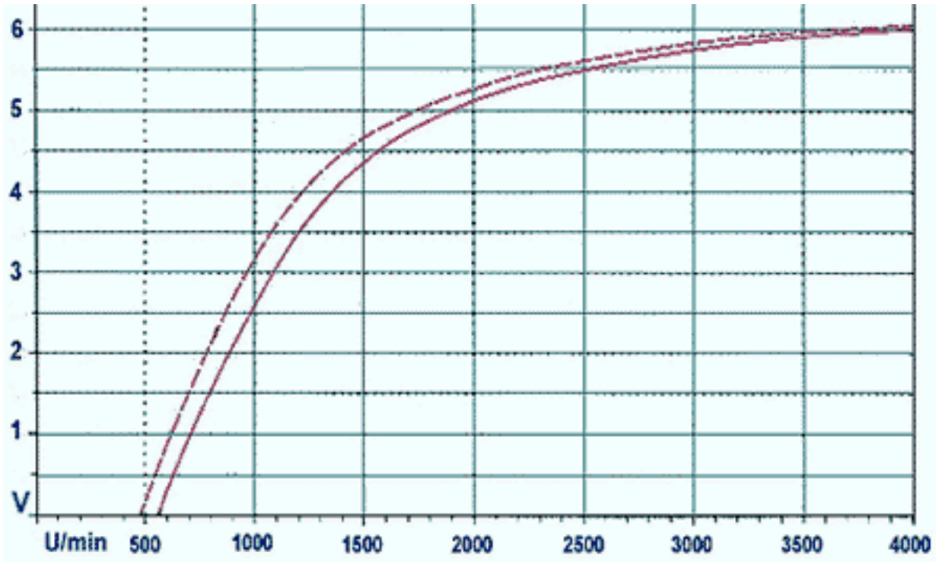
Disadvantages: Only works when a working battery is connected, cheaper models do not offer manual fine adjustment of the switching limits, incorrect connection of the device destroys it immediately and the lack of control of the resistance wire in the field coil misses an opportunity to increase the performance of the dynamo.



Own construction: If you already have experience in building semiconductor circuits, you can build an electronic controller yourself. Due to the very low price of the individual components, a device can be assembled 1:10 cheaper than standard market offerings. The disadvantage is that semiconductor components have larger dimensions than professional SMD (surface mounted devices). Processing them requires experience and special equipment, which is not worth purchasing for a one-time use. Dealing with SMDs, which can be destroyed by static discharges or soldering heat, is difficult and requires testing equipment to check functionality. Structures with normal, cheap semiconductors, on the other hand, can become clunky constructions.

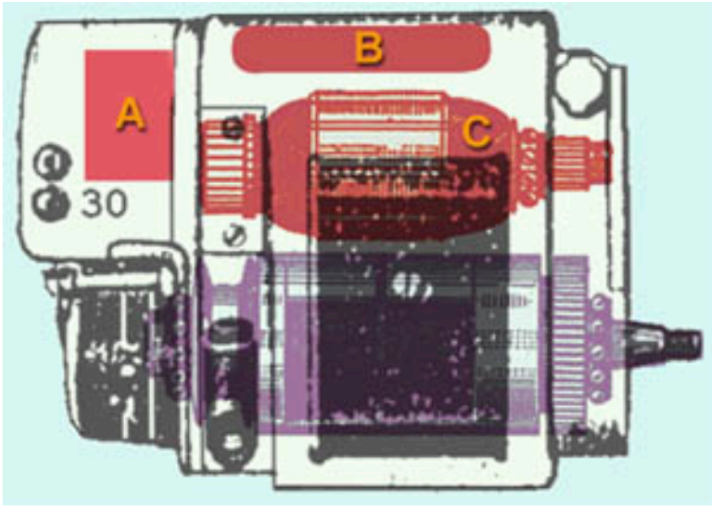
Bauteile & Kenndaten			
T1	MJE 2955	**R4**	1kΩ; ½W
T2	BC 461	**R5**	1kΩ; ½W
T3	BC 107	**R6**	1kΩ; ½W (preset)
T4	BC 107	**R7**	50mΩ; 3W
C1	0,1µF 300V	**R8**	470Ω; ½W
C2	22µF 4V	**D1**	50V 1A
R1	150Ω; 1W	**D2**	50V 10A
R2	10kΩ; ½W	**D3**	5V1 Zener 0,4W
R3	1kΩ; ½W	**D4**	50V 50mA
A	51/30 Ausgang	**E**	Masse
D	D+	**F**	DF

05) Performance Curve



The dynamo's electrical output depends on the rotation of the armature in the magnetic field. The nominal power of 6V, 30W is only available from 3,000 rpm. of the engine. The dynamo armature then rotates at around 8,000 rpm. A second influencing factor is the field coil. Controlled by the controller, it also generates electromagnetism to the magnetic plates. This additional field strength increases the generation output. But the number of revolutions is the main factor. As long as the output voltage remains below 5V, the battery will not be charged. The generator reaches the limits of its performance when all consumers on the vehicle are working at the same time. When driving at night with a sidecar on a motorcycle, 30W of luminous flux consumption can easily be achieved. When using high beams and a signal horn, as well as driving at low speeds (e.g. city driving), the generator power consumption can be exceeded, which will discharge the battery. Converting to 12V is therefore often discussed as a correction option.

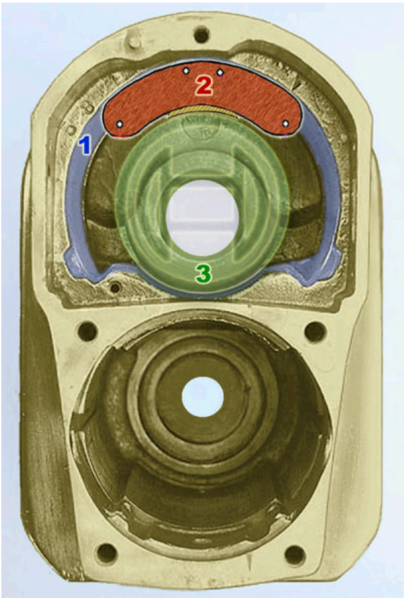
06) Conversion 12 volts



This change assumes that more wattage can be achieved from the generator. When driving at night with a sidecar and high beam, the dynamo usually works at the limit of its capacity. An operating voltage of 12 V is also today's car standard and allows the use of common accessories, with higher voltage bulbs in particular producing brighter light. With the magneto, all components of the dynamo unit must be changed: controller (A), field coil (B) and dynamo (C). The latter two have twice the number of turns, although the wire thickness has to be halved for space reasons. The field coil could also be retained, but must then be secured with a series resistor, which reduces the power output of electricity generation. Rewinding the coils is the biggest expense of the conversion. The dynamo anchor could usually continue to be used without a change in tension, even without restoration.

If the conversion is carried out while the vehicle is in operation, all consumers must also be replaced. The battery and horn are expensive. It is said that the original 6V horn

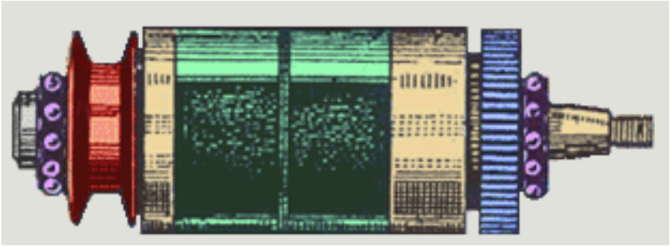
Readjustment can continue to be used, but then your already high power consumption increases at twice the tone frequency. Depending on the equipment of a motorcycle (sidecar, accessories), at least 3 additional lamps must be replaced.



The basic problem with such a change, however, lies in the construction (left): The field coil (2) sits on a steel core (1), which is magnetized by the electric field, but is not uniformly strong across the entire area. The position of the single field coil at the top and thus a tensile force on the steel core of the anchor (3) below acts against the weight of the anchor and reduces one-sided load on the bearings. However, if the field coil is operated with 12 V, the magnetic pulling force increases and the bearings run hot. The problem could be reduced by not using the full double number of turns and going below the base value of 12V. However, charging power was only achieved at maximum engine speed and the battery was discharged too often.

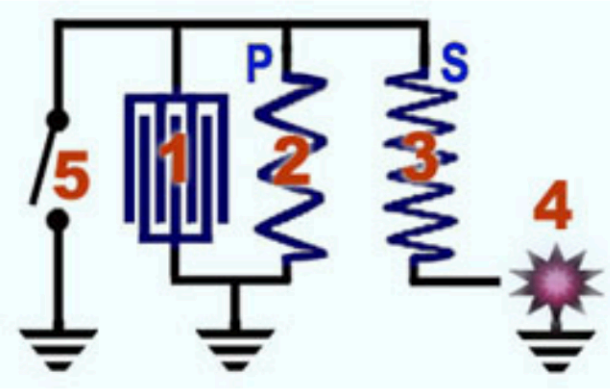
Structure and function of the ignition circuit

01) Ignition Anchor



Assembly: The ignition armature is a unit of coil with armature (green), the front cover, which is also the drive axle, in which the capacitor is mounted, (yellow/right), the rear cover (yellow/left), the slip ring (red), of which the ignition voltage is removed, and a gear (blue) that passes the rotary drive to the dynamo via a gearbox. Because of their high speed, both components require high-quality bearings (purple).

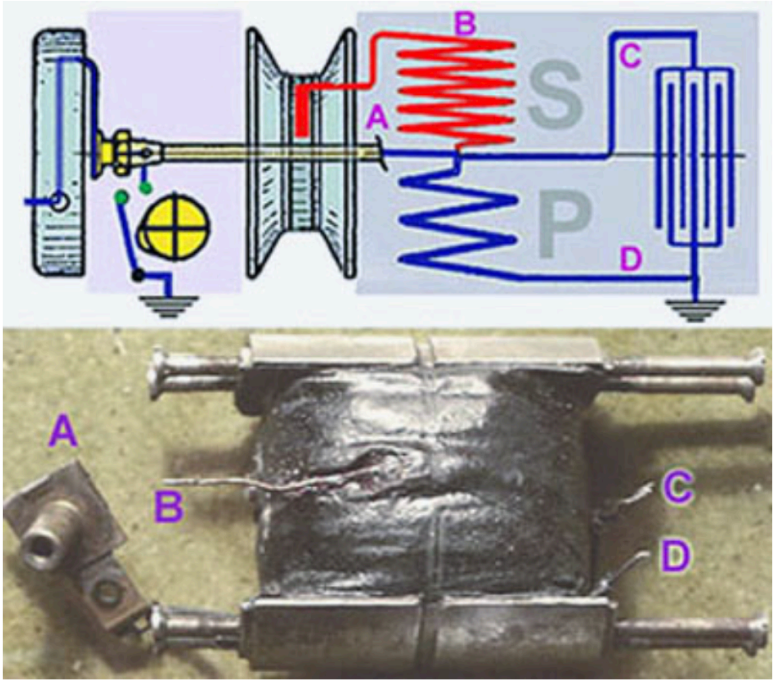
Transformer: The coil in the armature generates alternating current through a primary coil (2) made of typically 16 m of copper wire in 180 turns with a wire thickness of 0.7 mm. The secondary coil (3) is wound into this coil pack and consists of 1,500 m in 10,000 windings with 0.09 mm wire thickness. The field energy of the primary coil generates an ignition voltage of approximately 16,000 volts in the secondary winding via the spark plugs (4).

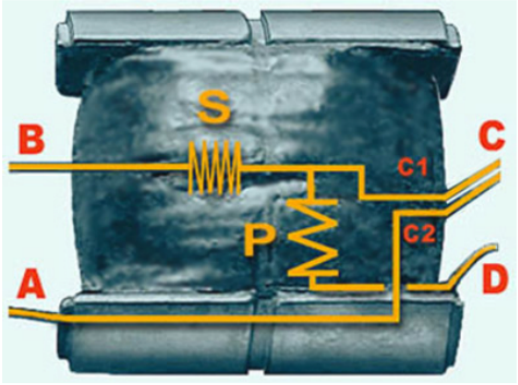


Breaker circuit: When the breaker contact (5) is closed, the primary coil (2) develops a strong electromagnetic field that is neutralized via ground. As soon as the contact opens and a ground connection is cut, generator current flows into the secondary winding (3), where high voltage is generated through transformation. This flows via the slip ring and current collector to the spark plug (4).

Slip ring/collector: It connects to the high-voltage output of the ignition coil and delivers the energy to a metal track made of thick brass, embedded in the insulation material (Pertinax / Repros: plastic) of which the component is made. The cable connection in the slip ring is a pin with a hole that leads to the metal track. The ignition voltage is passed from the metal track via brush carbons directly to the current collectors to the spark plug. In two-cylinder engines that work in alternating cycles, both spark plugs should not fire at the same time. This is why such slip rings have a shorter sliding path.

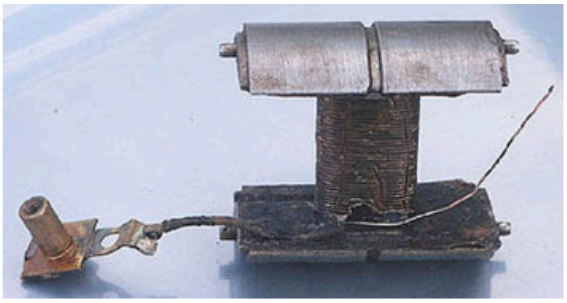
Circuit design: Due to the compact design, the wiring diagram of the ignition armature is difficult to see from the outside. The circuit diagram below left shows the block structure of the ignition coil.

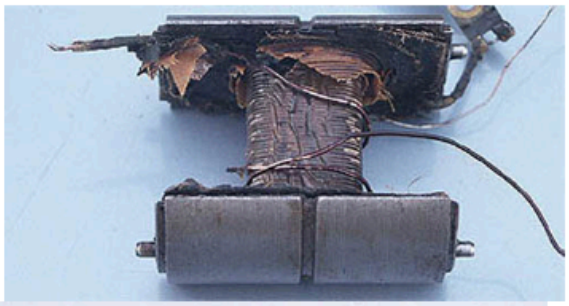


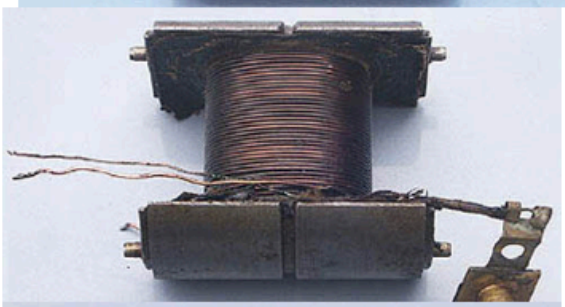


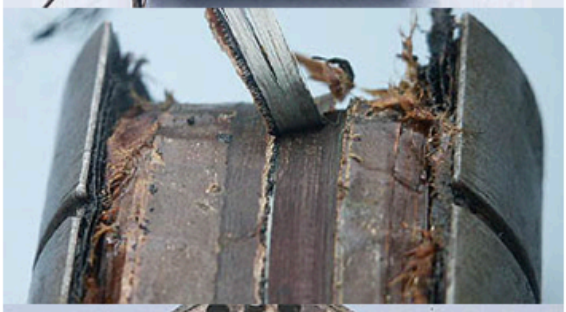
The electrical connection between the breaker cover and the generator coils, for example, is realized via the mass of the ignition armature (right). The line (A) is the short-circuit connection via the breaker holder, which stops the energy generation and switches off the engine. This cable runs invisibly inside the anchor core.

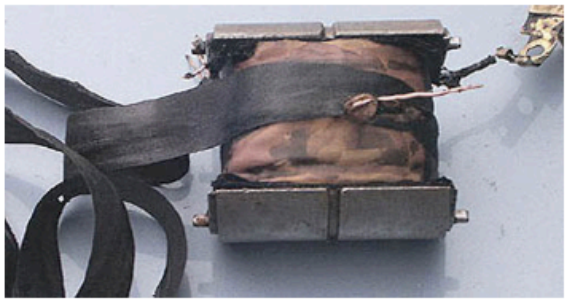
This is how the ignition coil was wound:

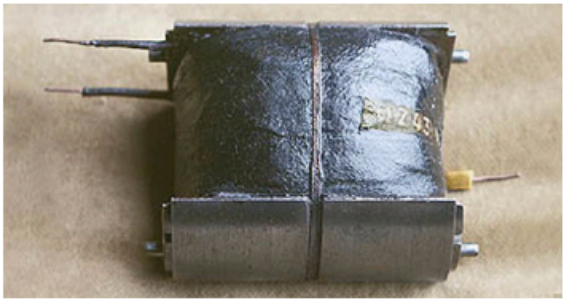




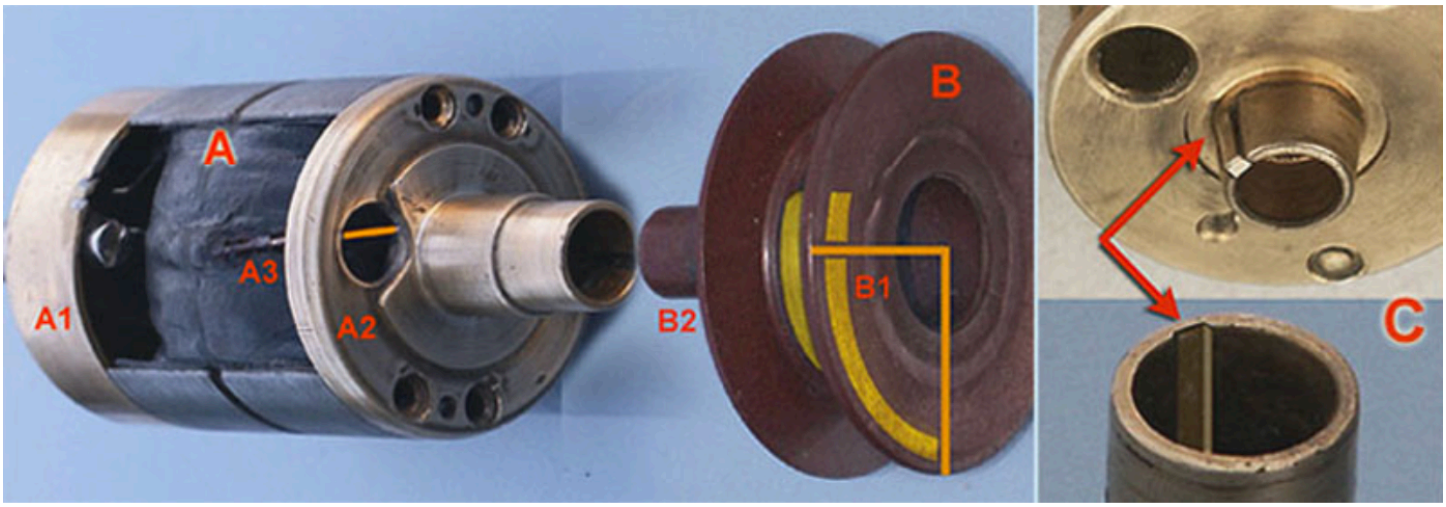


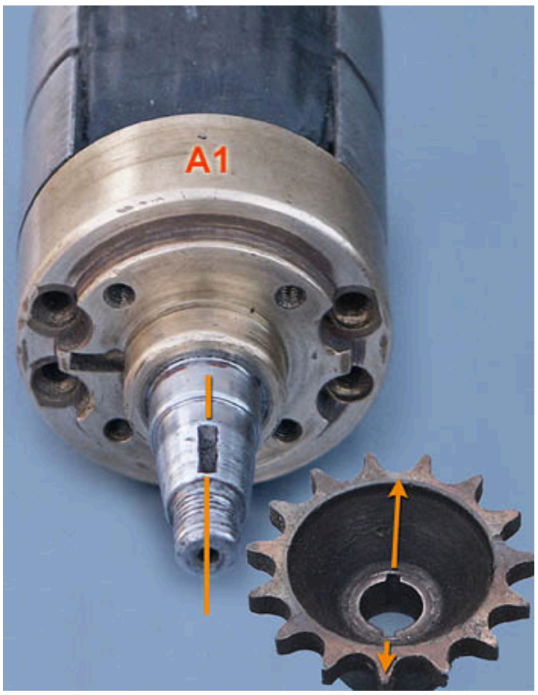






02) Ignition Point Control



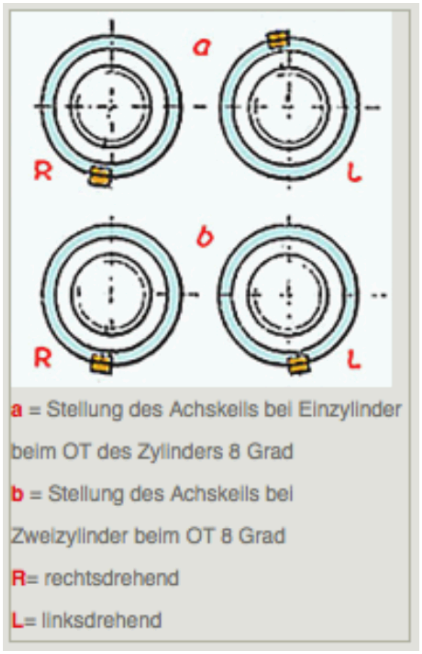


Function: The ignition control ensures that the spark is delivered at the right time, just before the cylinder has reached top dead center. The following are involved in this control:
A) >Ignition armature, special
B)Slip ring
C) breaker in
Cam ring, whereby its adjustment and that of the ignition timing can be adjusted while driving using an adjusting lever.
Component location: When the breaker contact opens, the metal track B1 in the slip ring must have already reached the current collector. The position of this metal track depends on the assembly of the components in the ignition armature. Its rear cover A2, which aligns the slip ring, has a hole for its connecting pin B2 so that no confusion is possible. But the front cover A1 can be mounted in two different directions. For orientation purposes, the cut in the drive axle for the gear wedge must be on the opposite side where the cable to the slip ring is.

Gear wedge: With its help, the drive gear is oriented on the axis and so the ignition control of a magneto is maintained even during maintenance work. However, the wedge, a relic from the early designs of the 1920s, is not used to secure the gear, only for orientation. The tight fit is only achieved by pressing in the cone. There are also a total of 11 locations in the engine that are involved in controlling the ignition timing. If inaccuracies and deviations add up here, even if the magnet is correctly adjusted during maintenance work, differences of up to six degrees of angle can result.

Ignition Adjustment

1) Cleanliness: The contact surfaces of the axle and drive wheel on the cone must be absolutely free of dirt and oil, otherwise the seat will slip.
2) Pre-assembly: The magneto is mounted on the engine, the drive wheel is placed loosely so that the axle runs freely and the adjustment on the breaker is possible.
3) Presetting: The cylinders are set to the intended top dead center. For BMW R12 about 10-20 degrees before TDC. The cam ring on the igniter is set to maximum advance ignition.
4) Breaker: The ignition armature is turned until the breaker opens, i.e. a cigarette paper can be moved freely between the contacts.
5) Attach: In this position, the crankshaft and ignition armature are blocked in a suitable manner and the drive wheel on the magneto axle is screwed tightly into the cone.
6) Readjustment: The motor is moved several revolutions and then the breaker contacts are adjusted exactly.



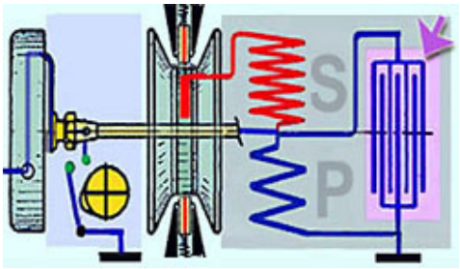
Please note: It is possible for the end of the shoulder of the shaft to protrude above level with the side of the sprocket wheel, so that when the nut is tight against the washer, the washer is against the end if the shaft instead of against the side of the sprocket wheel, so that the wheel is still loose on the shaft. Remedy is to have a special washer made with a recess on one side to allow it to overhang the shaft and press the wheel tight against the taper of the shaft but still to center on the threads.

03) Cam Ring

The D-igniter housing is suitable for two- and single-cylinder models. On single-cylinder engines, a spark plug is only connected to one side. The internal structure then has additional deviations. The cam ring (left) controls the switching states of the breaker. The two-cylinder version has two recessed areas, while the single-cylinder version only has one. When the breaker slide reaches a depression, it opens the contact and triggers the ignition. Another difference, related to the number of cylinders, is the slip ring (below). The single-cylinder version (B) has a grinding path over the full circular angle, the two-cylinder version (A) only over around 50 degrees. Further details on the ignition control.

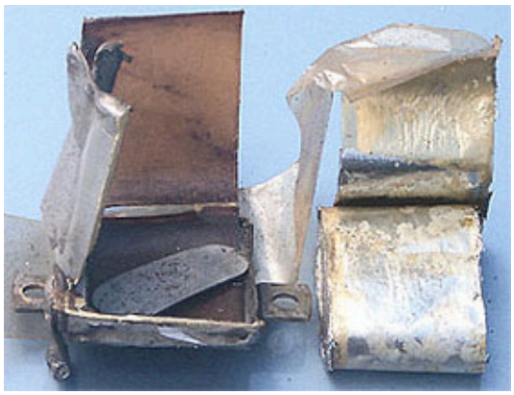
04) Capacitor

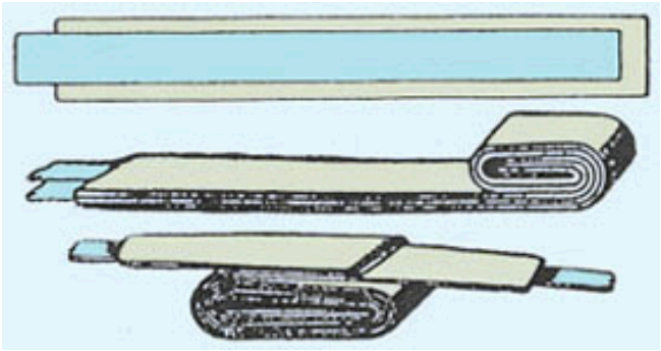
Design: The capacitor consists of wound layers of aluminum foil and paper insulation (wound capacitor). In the "B series" of magnetos, paraffin capacitors were used, unlike before. In contrast to the earlier versions with stearin coating of the paper, better component properties result.



Spare parts: The exact capacitance value of the capacitor in the ignition circuit does not seem to be important for functionality. The common ignition capacitors in vehicle electrics have values between 0.25 µF and 0.33 µF (microfarads). They also work well in the historic Bosch units. Current replacement parts should have a metal housing to protect against vibrations caused by armature rotation and temperature fluctuations. The lowest quality capacitor components from the broadcasting sector cannot be used.

Task: Capacitors in the ignition circuit dampen voltage peaks. Since the breaker supplies high voltage for sparks to the spark plug in the same circuit and at the same time, when the breaker contact is opened, sparks are released and burn the ignition contact surfaces. Capacitors dampen voltage peaks and reduce sparks.

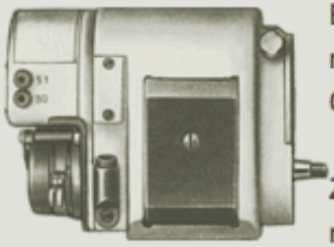




Malfunctions: A defective capacitor either leads to a short circuit or an open circuit in the circuit. In the latter case, the defect manifests itself in difficult engine starting and weak and irregular spark plug spark. If there is a short circuit, the ignition circuit breaks down and the engine no longer runs. In this case, as a temporary remedy, a replacement capacitor can be temporarily connected to ground from short-circuit contact No. 2 on the breaker cover while driving.

General construction data

01 Datenblatt



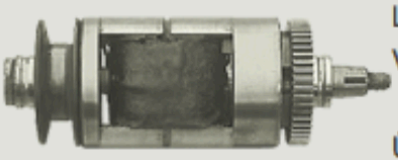
Lichtmagnetzünder D-Serie: D1, D2, DK, DV
Baumaße: H-135, B-191, T-101 mm
Gewicht: 5,4 kg
Zündverstellung: 20°
Übersetzung Antrieb/Dynamo: 1:3,4

Zünderkerze: Bosch W175 T1
neu: W7AC / 0,4-0,6 mm
Kerzenstecker: 1 kΩ;

Dynamo DAN503/3Z
Leistung: 6 V, 30 W
Anker: 10 Seg. Kollector: 20 Seg.
Übersetzung/Motor: 1,7

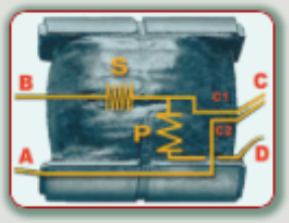
Standard 6 V:
Wicklung: Wd. / 0,6 Ω; / Ø 0,5 mm
Werte: 0,5 H / 6 V DC

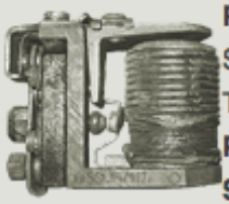
Umbau 12 V:
Wicklung: Wd.? / 0,6 Ω; / Ø 0,2 mm
Werte: 0,5 H / 12 V DC



Zündung ZAN13/13Z (D2-re), ZAN13/12Z (D2-li), ZAN13/11Z (D1)
Leistung: 15-18.000 V
Übersetzung/Motor: 0,5

Pri (B-C1): 15 m / Wd.120 / Ø 0,9 mm / 0,9Ω; / 0,007 V DC @1A =2T
Sek(C1-D): 1.500 m / Wd. 10.000 / Ø 0,07 mm / 11KΩ; / 6 V DC / 0,5 A / 30 nT



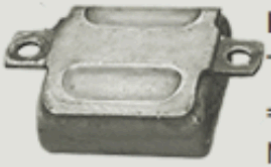


Regler SSM5/11Z, SSM5/12Z, SSM6/14Z
Typ: minusregulierend, 6 V
Pr: Wd.8 / Ø 1,6 mm / 0,2 Ω; / 0,2 H
Se: Wd.? / Ø 0,5 mm / 33 Ω; / 0,7 H

Unterbrecher ZUB10/3Z (re), ZUB9/3Z (li)
Einstellung: 0,4-0,5 mm Abstand

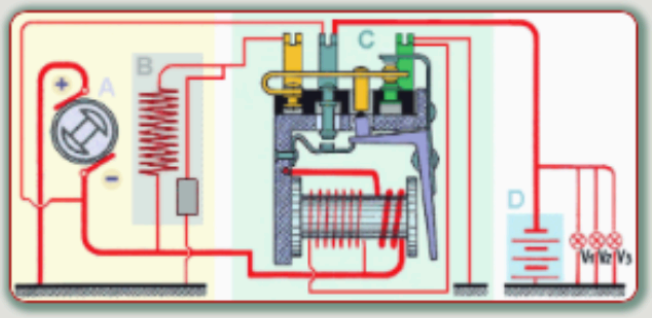
Erreger/Feld DWC501/1Z
Widerstand 0,6 H / 6,4 Ω; / 6 V DC 0,6 A / 40 nT / Draht: Wd.18 Ø 0,51 mm

Feld 5,3 H / 2,9 Ω; / 6 V DC 1,2A / 1,9 T / Draht: Wd.300 Ø 0,51 mm

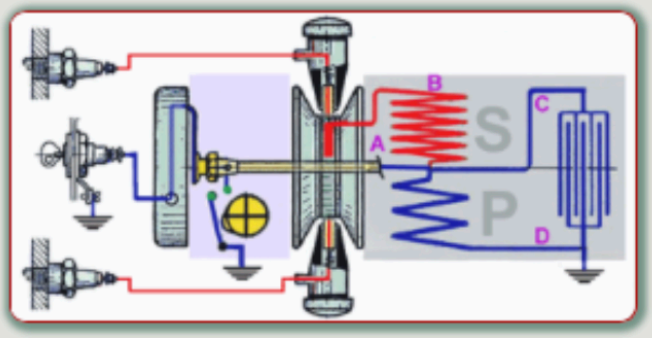


KondensatorZKO18/23Z
Typ: Folio, Wert: 0,22 µ F = 220 nF
Neu: 0,33 µF fol./ceram. 300 V
Baumaße: H-15, B-31 T-33 mm

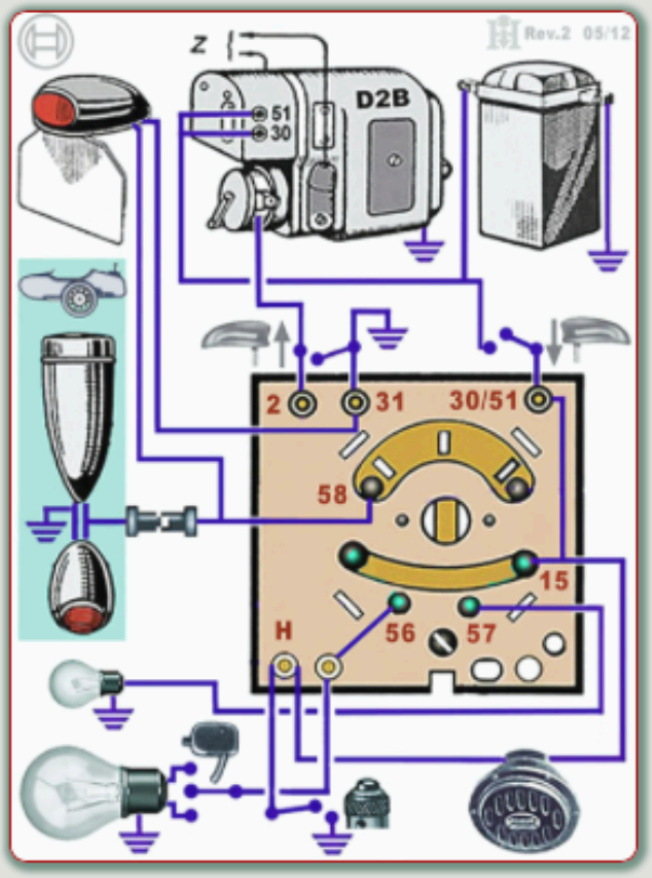
Dynamo



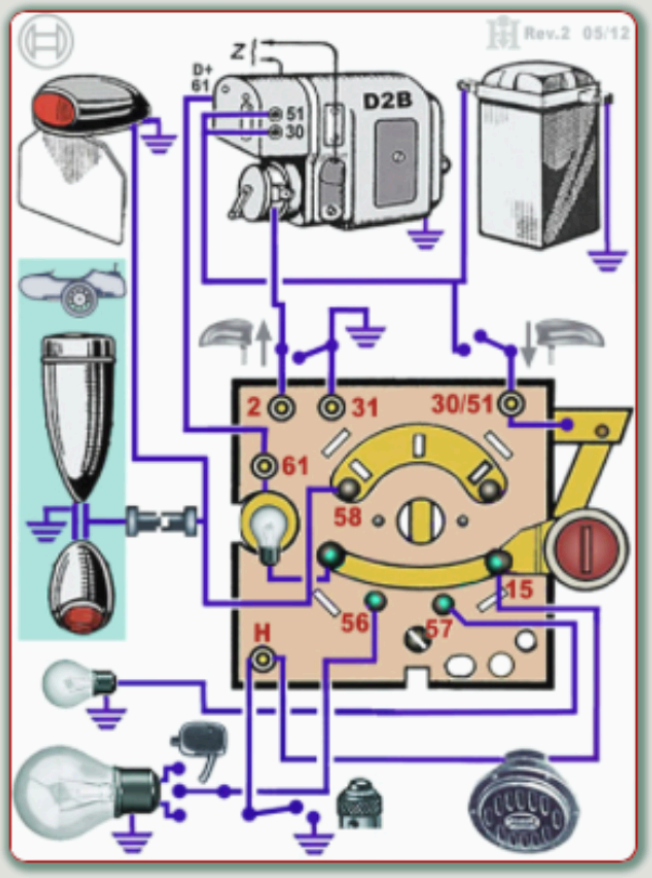
Zündung



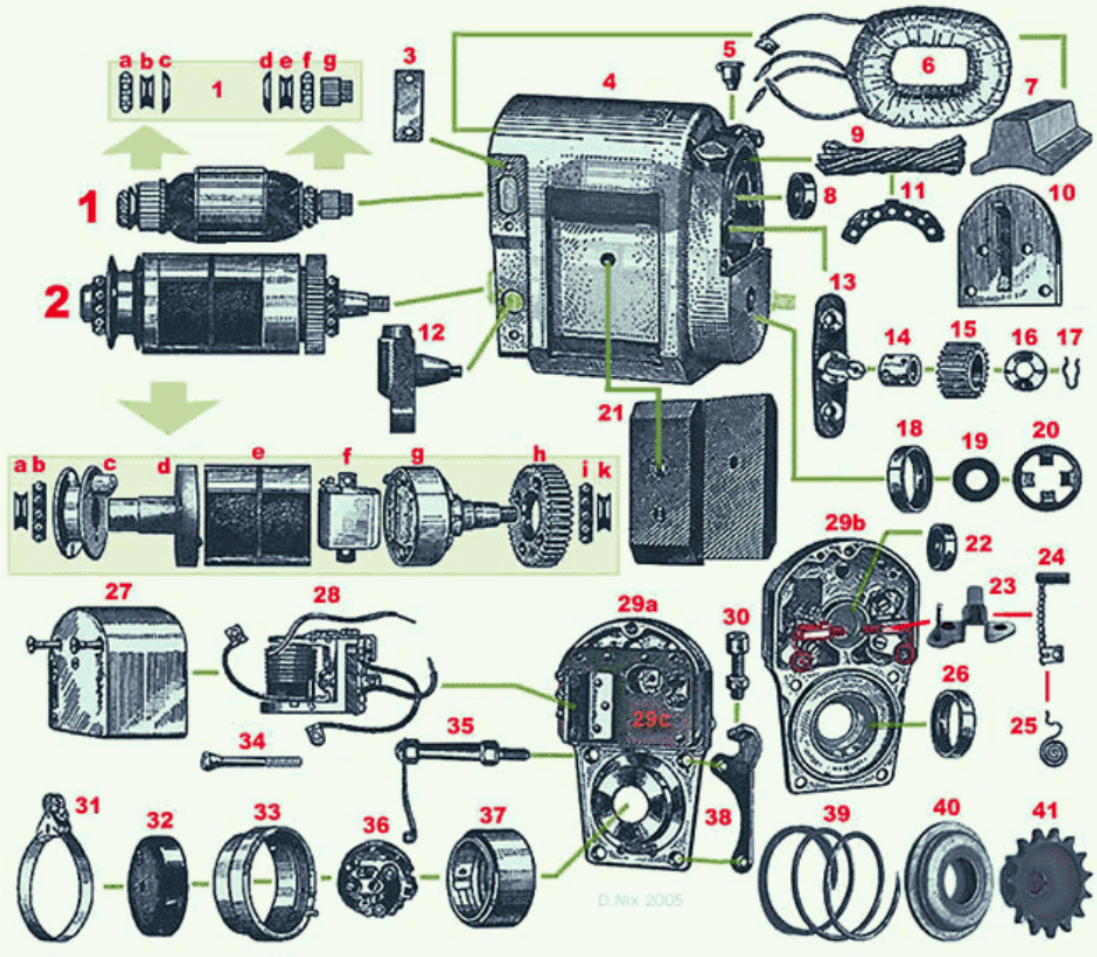
Zündschloßplatte/Magnetzünder



Zündschloßplatte/Batteriezünder



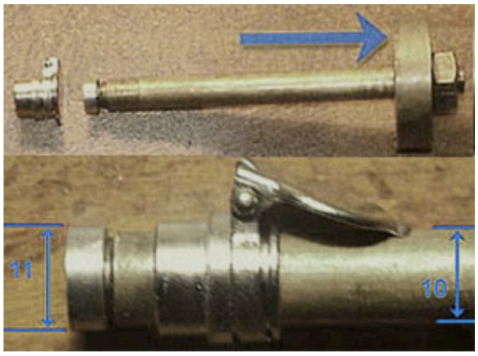
Components of the Bosch magneto igniter D2B

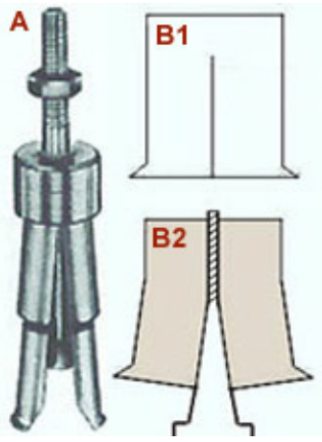


01) Dynamo	04) Gehäuse	18) Zündung/Lagerschale	30) Bowdenzug Stellschraube
1abef) Dynamo/Kugellager	05) Klappenöler	19) Dichtscheibe	31) Nockenring/Stellhebel
1cd) Dynamo/Ölscheibe	06) Feldspule	20) Dichtscheibenhalter	32) Unterbrecherdeckel
1g) Dynamo/Antriebsrad	07) Feldspule/Halter	21) Magneten	33) Nockenring/Gehäuse
02) Zündanker	08) Dynamo Lagerschale	22) Dynamo/Lagerschale	34) Unterbrecher/Halter
2ak) Zündung/Lagerschulter	09) Öldocht	23) Kohlebürsten/Halter	35) Unterbrecherdeckel/Halter
2bl) Zündung/Lagerring	10) Getriebedeckel	24) Kohlebürsten	36) Unterbrecher
2c) Zündung/Schleifring	11) Öldocht/Halter	25) Kohlebürsten/Feder	37) Nockenring
2d) Zündung/Deckel hinten	12) Stromabnehmer	26) Zündung/Lager	38) Bowdenzug/Halter
2e) Zündung/Anker	13) Getriebe/Lagerflansch	27) Reglerdeckel	39) Antrieb/Druckfeder
2f) Zündung/Kondensator	14) Getriebe/Buchse	28) Regler	40) Antrieb/Deckel
2g) Zündung/Deckel vorne	15) Getriebe/Zahnrad	29a) Hauptdeckel außen	41) Antriebsrad
2h) Zündung/Antriebsrad	16) Getriebe/Scheibe	29b) Hauptdeckel innen	
03) Dynamo Kohlendeckel	17) Getriebe/Sicherung	29c) Reglerbasisplatte	

Work instructions for maintenance and repairs

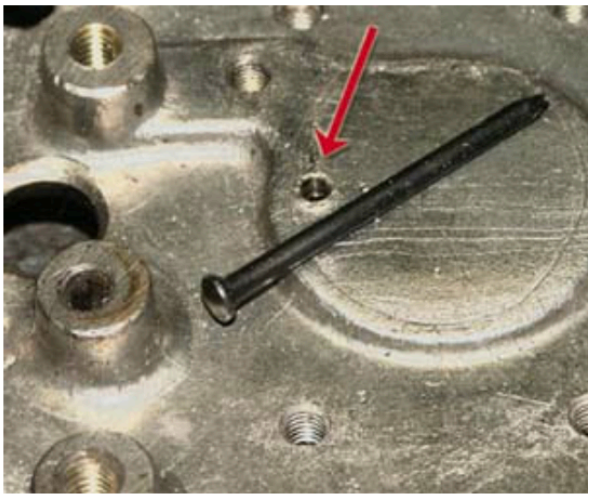
01) Bearing Puller



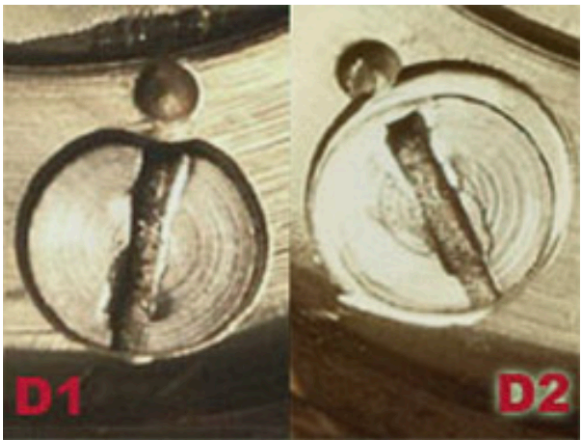


Some special tools are required during disassembly. If you find another use for it in your own workshop, you can get the usual extraction tools (A) from retailers. If you only need a solution for the Bosch magnet, you can turn metal cylinders with an edge collar (B1). They are drilled axially and sawn through in the middle until just before the end. By screwing in a cone pin (B2), the halves are spread apart and press a bearing shell out of the seat. The flap oilers can only be removed with a rod that has a ring at the end with exactly 11mm diameter and is removable (left). In the solution shown, the oiler is removed by hitting the window with a hammer. It is not worth making a special puller for your own one-off restoration.

Depending on the circumstances of age and corrosion, bearing shells in particular can become stuck in the seat. With the large E15 bearings on the ignition armature, they can often be loosened by heating because they are clamped with insulating paper, which decomposes in high heat. With the un-insulated small bearing shells on the dynamo, a hole on the opposite side must help in an emergency. It is drilled precisely positioned against the edge of the bearing shell. Then a steel nail of smaller diameter, preferably with a blunt end, is driven into the hole. This loosens the bearing shell and raises it at least enough so that a normal extraction tool can then be used.



Hallmark screws



Many screws on the magnet are secured by hallmarks and can no longer be removed. This affects the gearbox cover, the intermediate wheel axle and the ignition armature. There, a pin was used to make a depression in the soft metal of the housing directly at the slot end of the countersunk screw head. When you press it in, a bead of material pushes into the end of the slot and the screw can no longer be turned.

Here the inner edge of the recessed head seat must be cut free with a small cutter like the one on the right at the bulge. If the screw is still tight, it may need to be loosened by hitting it with a hammer and using a blunt cylinder on the screw head.

03) Screw Breakage

Especially when combining steel screws in aluminum, a threaded piece in the hole can break off (left/1) if a tight connection is loosened. The problem can only be solved using extractors (right) as a special tool.

The fracture surface of the threaded piece is scored in the middle with a center punch (2) and then drilled through the length. To ensure that the hole remains axial, a bench drill stand is required (3). Even if the boring tool only requires a small drilling depth, you should drill as deep as possible (4) in order to loosen the broken piece in the thread, also through the friction heat. The left-handed extractors can then easily pull out right-handed thread fragments (5).

04) Coil Aging

Aging effects on electrical components are caused by:
a) strong temperature changes that create hairline cracks in cables or their insulation
b) Moisture combined with heat can corrode metal surfaces and reduce or interrupt the flow of current on contact surfaces
c) High voltage ignition is said to cause molecular erosion over time, affecting insulation and wiring.

Coils are made of wound wire that has been varnished and insulated with shellac (gum resin from the varnish scale insect). Although this coating is insoluble in water, it swells when exposed to moisture and its material properties are further impaired by high voltage. Therefore, the field coil and dynamo armature can usually continue to be used even after long use, while the ignition armature, in which around 16,000 V is generated, is usually no longer reliable. Under the influence of heat up to 60 degrees C. while driving and due to moisture, short circuits occur in its windings, which greatly reduce the ignition performance. This typically shows up on the motorcycle in the form of loss of power and misfiring only after the otherwise problem-free start while driving.