BOSCH dynastart service manual

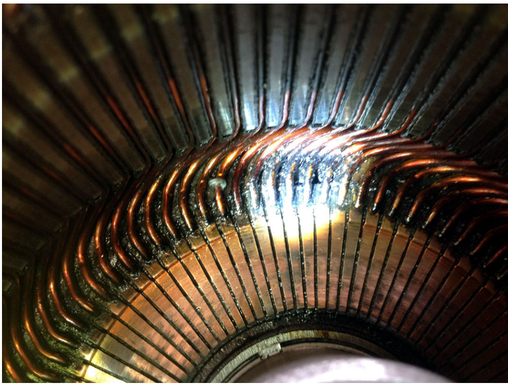
Compiled by David Garner – September 2018

How to avoid expensive Dynastart damage

by David Garner

Another example of extensive engine damage caused by inexperienced brush replacement is in my workshop this month. It seems that some years ago this engine was overhauled with a rebore and new piston and there was some attempt to repair the damage caused by the flywheel crankshaft nut not being tight enough. Keyway damage and the crankshaft was similarly affected with an elongated key slot. In almost every case, this results in out of balance operation as the flywheel does not sit true on the crankshaft causing vibration and limiting engine output.

Worse still was the electrical damage from careless fitting of the brushes and insulators resulting in a dead short to earth on one brush pair. Continued operation of the engine and starter with this fault caused significant damage to the commutator insulation and the windings are further damaged with a hole blown through the insulation. With rebuilt flywheels in short supply and with a high price of £400 or more, there are hard lessons to be learned to avoid costly repairs. Crankshaft damage cannot easily be repaired and an exchange unit was required in this case - a four figure sum just for parts could have been avoided with more care!



1. Do not attempt to replace the brushes without proper cleaning materials and electrical test equipment. A multimeter is essential to verify that the insulation is satisfactory.

2. Read the workshop manual and look at the pictures to ensure correct routing of the brush cables and terminals.

3. For SIBA dynastart make sure the cables cannot touch the flywheel (some cables are too long)

4. Make sure that you have a flywheel extractor and a locking tool.

5. Ensure the crankshaft keyway area is clean and smooth and that the key is properly in place before fitting the flywheel.

6. Use a torque wrench to ensure the flywheel nut is tight. Torque setting is 8,5-9,0 mkg.

Need advice on dynastarts? Contact David Garner on **karofahrer@yahoo.co.uk**

21. DYNASTART MAINTENANCE AND REPAIR

The brushes in the Dynastart will wear during normal operation and leave a "dust" of powdered graphite in the Dynastart. This graphite (carbon) will conduct electricity and possibly cause a short circuit in the Dynastart. The place where this will most likely occur is in the "brush-holders" and the brush springs. It could also occur at the armature segments and cause the same problem. Any short circuit could burn out the windings and destroy the Dynastart, Adjacent armature segments are shorted out by the brushes during normal operation so this is not a problem. If there is an excessive amount of carbon dust in the armature, the armature segments could become shorted to the frame which would cause the windings to burn up.

21.1. Test the insulation resistance of the Dynastart.

21.1.1. Disconnect the Dynastart wires from the black box.

21.1.2. Mark each wire as it is disconnected so you will know how to reconnect them. *(B1, B2, HE, A and DF).*

21.1.3. Check the resistance from each of the wires to ground *(earth)*.

If the resistance of any of the wires to ground is less than 10 Kilohms, the unit should be cleaned. Since the unit is out of the engine, you should clean it as well as you can. *(See para graph 21.5 for cleaning instructions).* There is no definite point where the resistance can be considered to be too low, but 10 Kilohms is as good a place to start as any.

21.2. Check the amount of wear on the brushes.

New brushes have about 4.7mm *(.187")* of material above the connecting wire. When this wears down to about 2mm *(.080"),* brushes should be replaced. Too short a brush will also decrease the pressure of the brushes against the armature segments. Brushes worn down to where the wire touches the armature segments can cause serious damage.
Regardless of how much wear there is on the brushes, it is wise to replace them with new brushes.

21.3. Stator inspection.

Perform a complete inspection of the stator windings. Check the solder connections to make sure they are good. Figure 28 shows the solder connections on the wide copper straps between the pole windings on the stator. The small wires have insulation broken and one of the wires is touching the frame. The only thing preventing a short circuit is the varnish on the wire. This will soon wear through with vibration and cause a short circuit. Reposition the wires away from the frame and try to add some insulation.

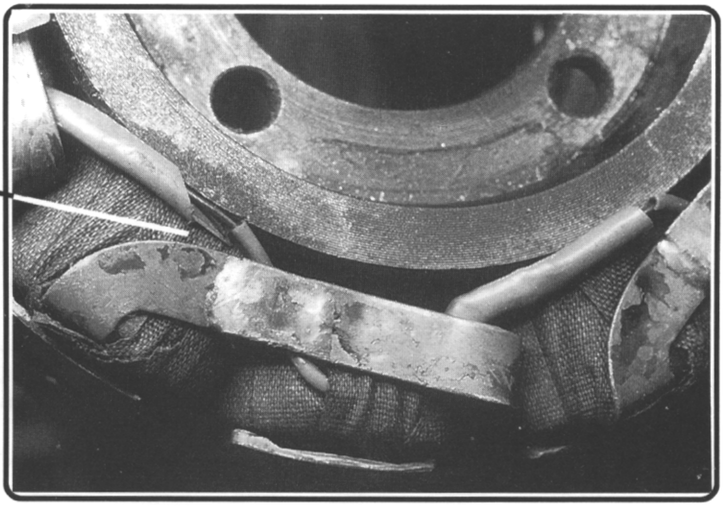


Figure 28. Defective wiring.

The wires on the coil of the pole piece are exposed in figure 29. These wires should be protected by painting the red insulating paint (glyptol) used by motor repair shops. It would be just as good to cover them with varnish to provide insulation and keep dirt out.

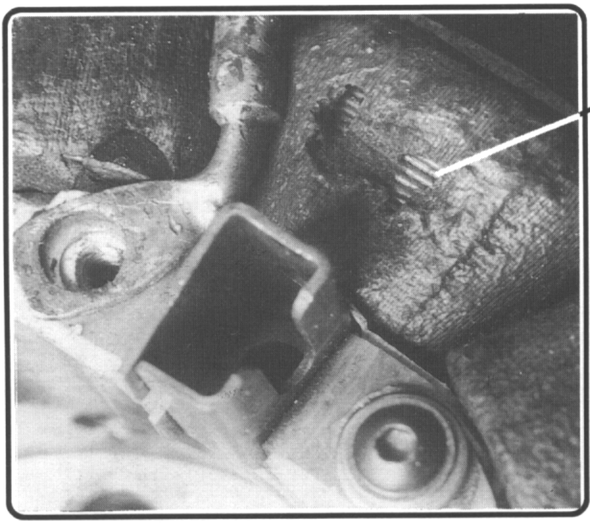


Figure 29. Defective stator coil insulation.

21.4. Check to see if any of the stator field coils are loose. If they are, tighten the screws shown in figure 30.

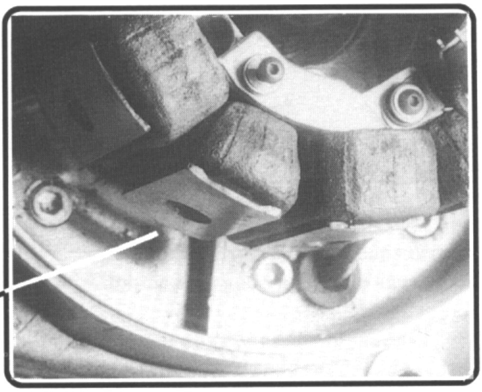


Figure 30. Stator field coils.

21.5 . Armature cleaning

Before doing any cleaning, use the ohmmeter and check the insulation resistance between one of the armature segments shown in figure 31 and the metal flywheel *(earth)*.

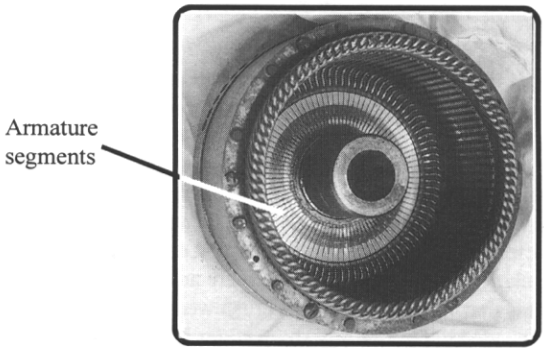


Figure 31. Armature segments.

Also check the resistance from each brush-holder to the stator frame *(earth)*. Record these readings so that after cleaning, you will know the amount of improvement.

Clean the armature in Mineral Spirits obtainable in any paint store. DO NOT use petrol *(gasoline)* as it will soften the varnish insulation on the wires. An old toothbrush and a household spray bottle can be used to wash out the carbon dust in places that are hard to get to with a brush.

Check the resistance after cleaning. It can be made to be as high as 100 Megohms. This is a case where if a little resistance is good, a lot is better. The higher you can get this resistance, the longer you can run the engine before cleaning again and the less chance there is for starter failure.

Check for wear of the armature segments. Figure 31 is a view of the inside of the armature and the copper segments can be seen surrounding the hub.

The smoothness of the armature segments can be seen by examining the top of the carbon brushes. If the armature segments are worn or grooved, they will cause excessive wear on the carbon brushes and more dust than necessary will collect in the armature.

If the segments are badly grooved, the segments should be "turned down" on a lathe in a machine shop. Do not attempt to do this yourself.

If the armature segments are turned on a lathe, some copper may be shorting adjacent segments and the insulation between the segments may be too high. High insulation between the segments will not allow the brushes to make good contact. If the insulation is too high, it must be "undercut" so that the insulation is lower than the copper. Use a sharp tool and scrape the insulation until it is below the copper. A tool can be made from an old hacksaw blade. Keep cleaning as you are working so that copper particles are not forced into the insulation. Check to make sure there are no sharp edges on the armature segments that would cause rapid brush wear. The armature segments can be lightly sanded to remove any sharp edges and then thoroughly cleaned.

After cleaning, recheck the resistance to see how much of an improvement you have made.

21.6. Stator cleaning.

Check the resistance from each brush-holder to earth and record the value. This should also be a high resistance *(greater than 10 Kilohms).* If the resistance is lower, disconnect the link between each pair of brush-holders and determine which holder is causing the low resistance. Wash the stator in Mineral Spirits and recheck the resistance until it is as high as you can get it. *(greater than 1 Megohm).* Completely rebuilding the stator can get this resistance to be infinite.

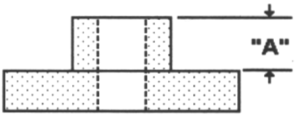
21.7. Rebuilding the stator.

Carbon will build up between the brush-holder and the frame of the stator. Remove the brush-holder and clean out all the dirt and graphite. The spring on the bottom of the brush rests on a round fibre disk. The spring is in a fibre cylinder which provides insulation on the sides. This bottom disk will sometimes wear through from continuous vibration. Make new parts to insulate the spring from the brush-holder and the frame.

The bottom disk can be glued to the fibre cylinder to prevent carbon dust from shorting the bottom of the spring. Us a non-conducting high temperature glue. Epoxy will soften if exposed to too much heat.

The hard part is mounting the brush-holder to the frame. The holder must be insulated from the frame and the mounting screws. The mounting holes in the brush-holder are oversized to accept a "shoulder washer". These washers will have to be made from "Bakelite" or some other insulating material that will withstand the heat of the engine.

The dimension "A" shown on the fibre washer should not be made greater than the thickness of the brush-holder material plus the thickness of the electrical connector going to the brush. If it is too high, the washer will crack when the screw is tightened. If it is too short, it may not insulate the electrical connection from the screw.



Shoulder washer

The mounting screw should not be insulated using "shrink tubing" or the insulation from electrical wire. These materials are too soft and vibration may cause them to wear and cause a short circuit.

A possible source of shoulder washers would be from old electrical relays. This type of washer was used to insulate relay contacts.

If you make your own shoulder washers, be sure that they are not too high *(thick)* so that when the mounting screws are tightened, the washer will not crack.

Another reason for not making the shoulder washers too high is that the mounting screw could be touching the washer and appear to be tight. The electrical connecting lug would be loose and you would have a poor connection.

If the shoulder washer is too short, the brush-holder or the electrical solder lug could touch the mounting screw and cause a short circuit.

Figure 32 is a view of a brush-holder with the brush removed. The left mounting screw would also have the "pigtail" of the brush connecting to the strap that goes off to the left. The shoulder washer should insulate the brush-holder, the connecting strap and the brush pigtail connection. Notice that the Allen head mounting screw has a flat metal washer and a Nylon insulating washer under it.The right side mounting screw is removed and you can see the parts that must be insulated.

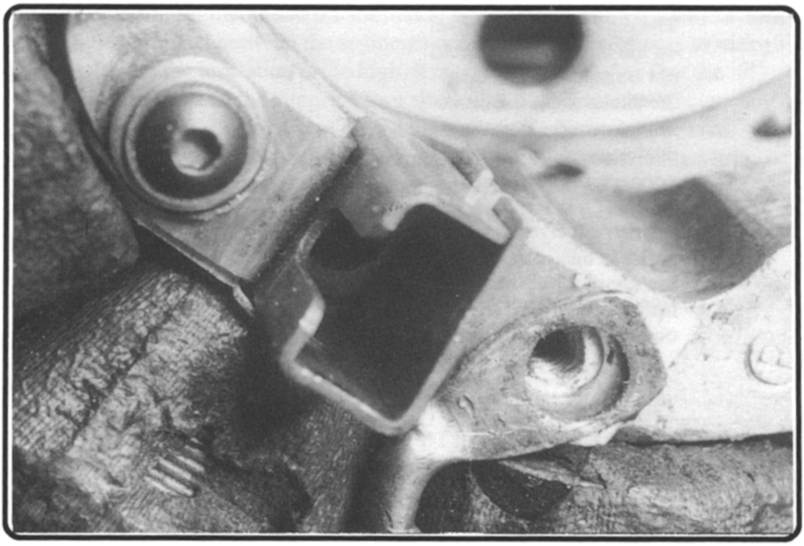
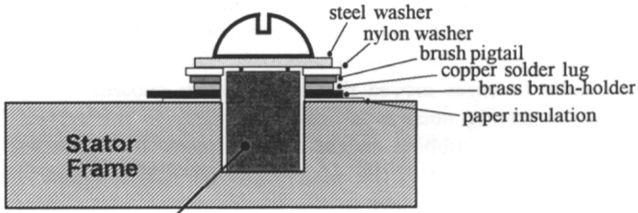


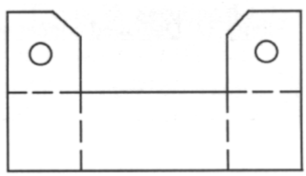
Figure 32. Brush-holder mounting screws and insulation.

The same results can be obtained by using an insulating cylinder.

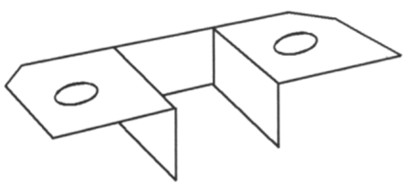


The metal parts, brush pigtail, solder lug and brush-holder are all squeezed between the nylon washer and the paper insulation. The insulating cylinder keeps the metal parts from touching the screw. Notice that the insulating cylinder is short enough so the steel washer does not crush it. The steel washer is needed for strength.

The brush-holder is insulated from the frame by paper. This is a special paper that can be obtained from any electrical motor repair shop. Do not use any other kind of paper because it can become oil soaked and impergnated with carbon. Use the old insulation as a template and cut new insulation from the paper in this shape.



Form it to this shape to insulate the brush-holder from the frame.



I have replaced the original brush-holder mounting screws with "button-head" Allen cap screws. This makes it possible to apply more torque for a tighter electrical connection and the screw heads are not as easily damaged.

Check the solder connections to the large copper straps that are between the pole pieces. Figure 33 shows the solder connection to the strap and also cracked insulation on the large wire. This copper strap was loose in-between the pole windings as well as one of the other straps. When the engine was assembled, the armature turned freely and smoothly. It was only after the engine was mounted in the car and the bundle of wires moved that this problem occured. As the car was moved while in gear, a grating noise was heard coming from the engine. The noise was caused by the armature rubbing on the copper straps. In Figure 33, you can see the copper worn off of the edge of the strap below the solder connection. Luckily, this was found before power was applied to the starter.

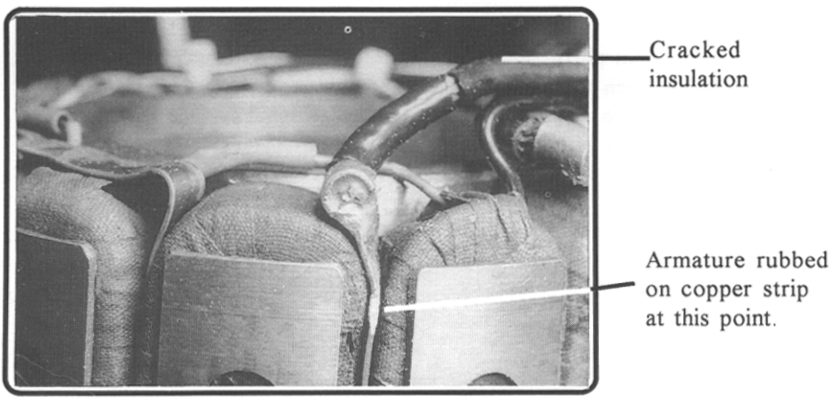


Figure 33. Damaged copper strip.

After cleaning the copper shavings out of the armature, a "fix" was made to hold the copper straps back in between the pole pieces where they belong. The fix is shown in figure 34 and merely consists of brass clips that pull the heavy wires back toward the center of the stator. The stator frame was drilled and tapped for the smallest screw available. *(American 0-80).*

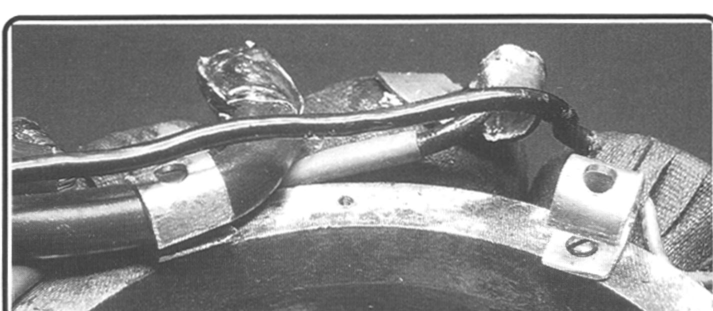


Figure 34. Fix for loose wiring.

I can't over-emphasize the importance of checking and double-checking everything. Look especially for insufficient insulation, loose wires or coils on the pole pieces and poor electrical connections. If you see anything that can be improved, do it. Then after you know that everything is perfect, check it again.

Securing the stator windings.

Figure 35 shows a rear view of the complete stator on the workbench. Notice the white plastic "cable ties" on the large bundle of wires and the two small wires at the bottom. The bottom wires go to the forward and reverse contact breakers *(points)*. The contact breaker wires are anchored to the copper straps between the pole pieces.

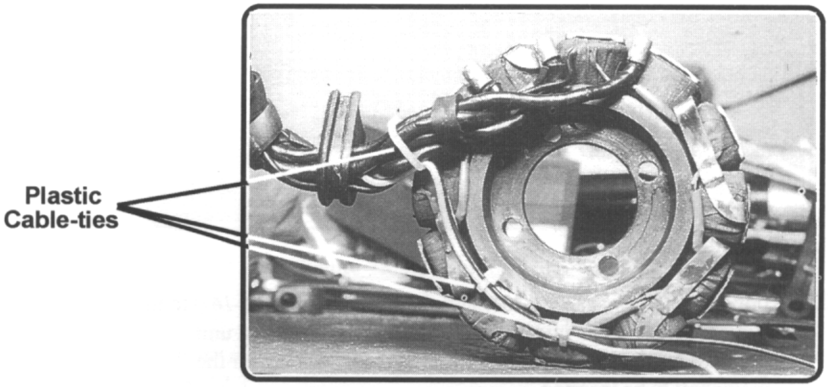


Figure 35. Securing the stator wires.

In Figure 36, the stator is mounted on the engine. Notice the Allen-head mounting bolts and the brush-holder mounting screws. One of the brushes has been removed. You can also see Allen screws bolting the crankcase halves together.

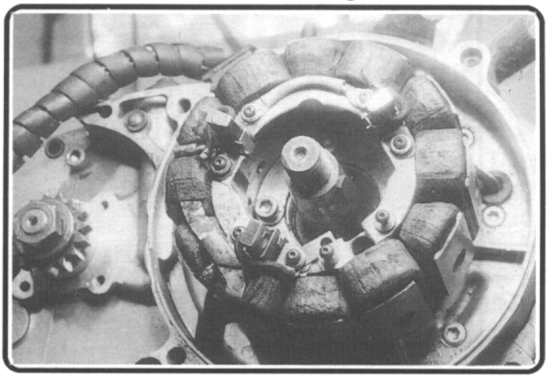
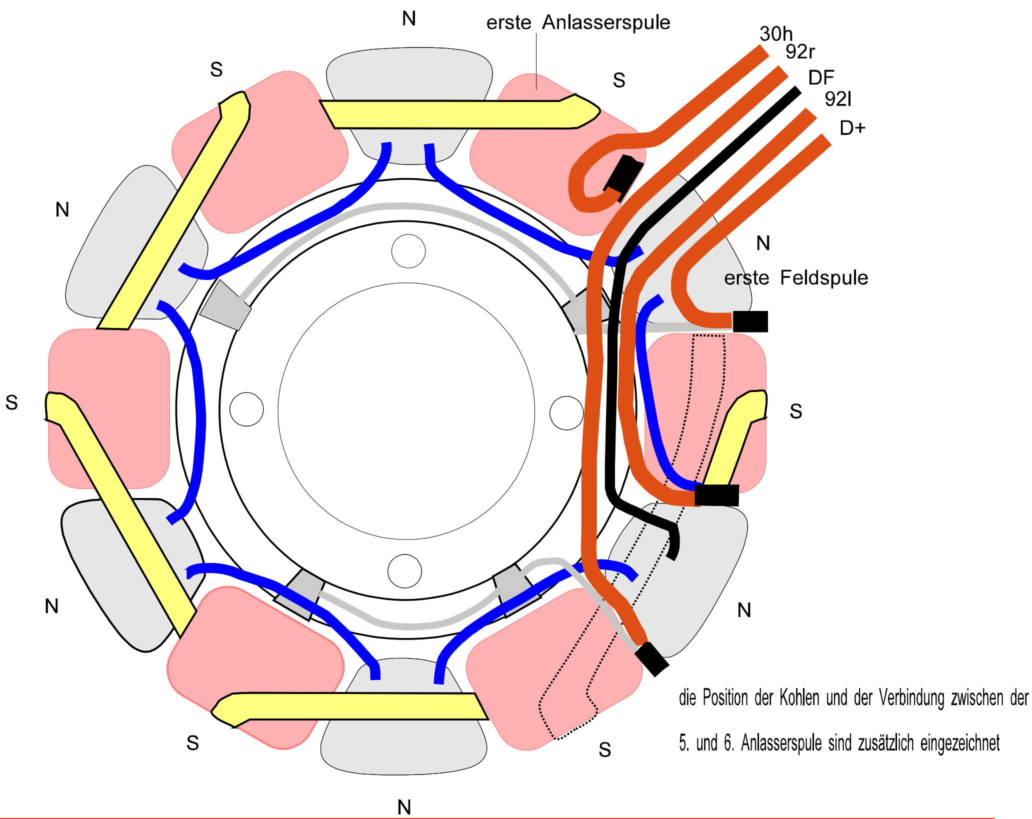
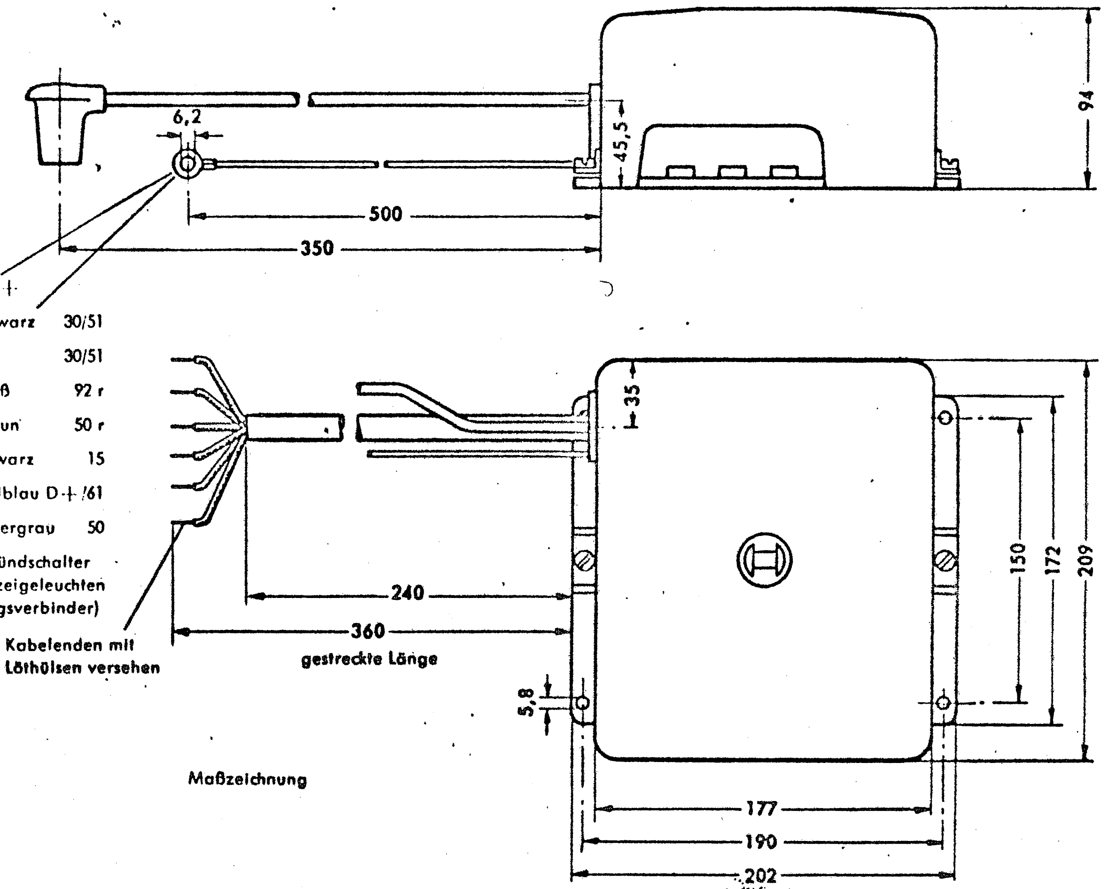


Figure 36. Stator mounted on the engine.

The cable going to the black box is held together with rubber "spiral-wrap". These are heavy wires and are not run "straight" but are twisted so that the cable can more easily be bent around corners.

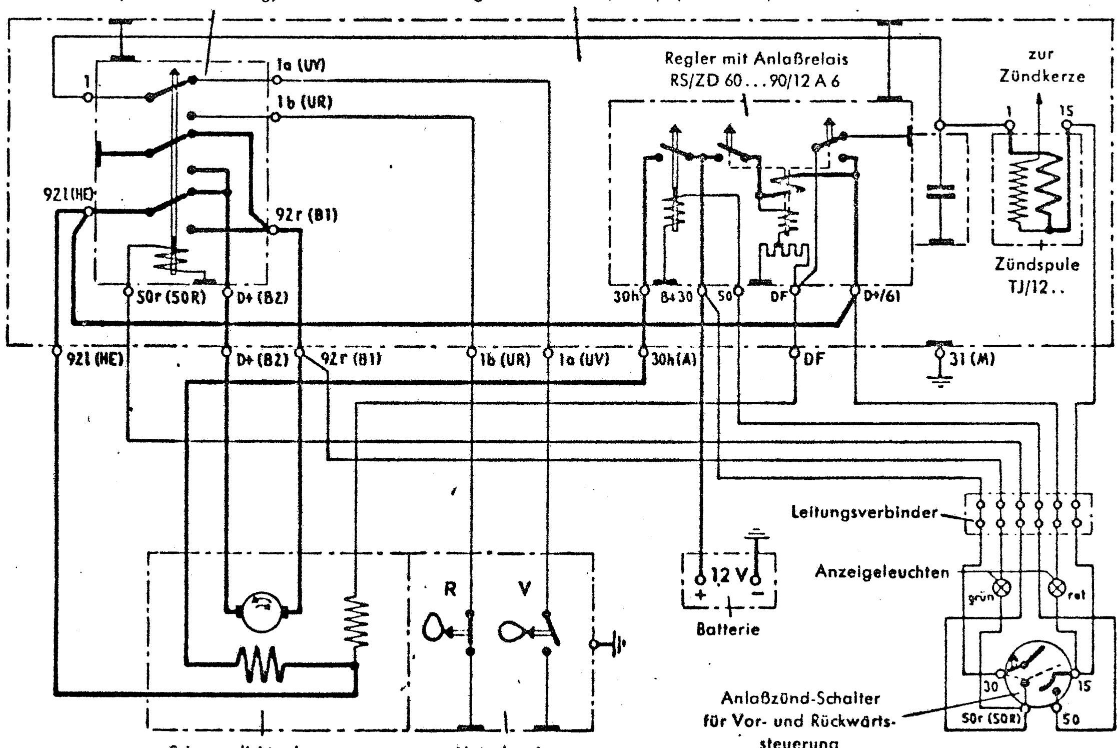


BOSCH view of field windings from rear. N=charging S=Starting



Maßzeichnung

Maße in Millimetern



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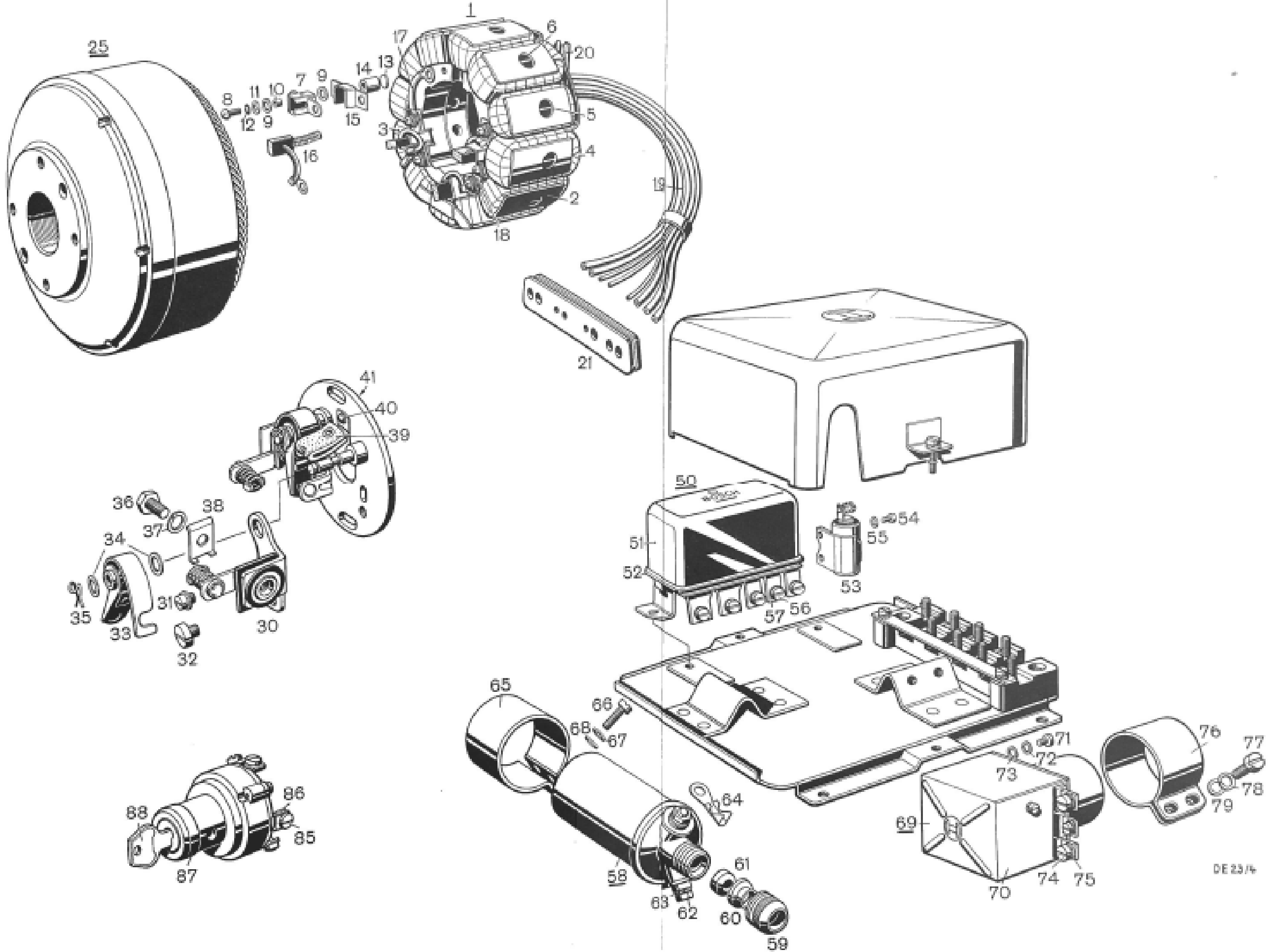
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