The Shop

SHORT CIRCUIT SEARCH

There was more to Gabe's problem than met the eye; we thought the yellow was true blue.

By Jess Thomas

• We still have the CB200 Honda that was the subject of the road test in the February 1974 issue of *Cycle*. The bike has been such pleasant transportation for short-haul trips that its odometer now shows almost 3600 miles. That figure covers miles ridden by five staffers. Gabe Lukacs, our Production Editor, has decided to buy the CB200 for his 70-mile daily round trip between home and office.

Gabe is very enthusiastic, but, like many riders, he doesn't know very much about motorcycles or other mechanical things. He was blithely riding the CB200 back and forth for a while; then he began to complain about some strange and erratic behavior. Gabe is difficult to ignore.

The bike was ridden with the headlight on at all times so that we could tell whether or not it made any difference in the way car drivers reacted to the machine. An automatic switching device (Luminator) was fitted to the headlight circuit so that the low-beam automatically came on five seconds after the starter button was released.

Gabe first noticed that the engine wouldn't rev over 6000 rpm on the road and would die at idle. With the lights switched off, the engine would idle but still would not run well when asked to pull a high load. I was too busy to examine the bike, so I told Gabe to charge the battery and run the bike with the lights off. A hydrometer check of the battery after the recharge showed that only one of the cells was even marginal.

A hydrometer is a glass or plastic tube which has a rubber syringe bulb on one end, a specially weighted and marked float in the tube, and a suitable hose on the other end to fit into the battery filler holes. With the hose stuck into a battery's liquid, the bulb is pumped until the float buoys about half-way up the tube. Cheap hydrometers usually have their floats marked with equal-length bands of red, yellow, and green. With a fully-charged battery, the float will come to rest in the green band at the surface of the liquid. This tells you the specific gravity of the electrolyte. Electrolyte is a solution of distilled water, sulfuric acid and lead. The green band corresponds to a specific gravity of 1.27. That means the electrolyte is 1.27 times as heavy as pure water. If the float sinks to the yellow band, it indicates that the capacity of that cell is marginal; the battery may not be capable of operating the electric starter, although it might do an adequate job with the lights and ignition. When the ball drops into the red band, you know that the cell is effectively discharged beyond use.

If a battery shows yellow or red while in the bike, it means that a) the charging circuit is faulty, or b) there is a short, or c) the battery itself is deteriorating. If the battery fails to respond to a bench charger, with the charging rate set as specified in the owner's manual, then the battery is faulty and must be replaced.

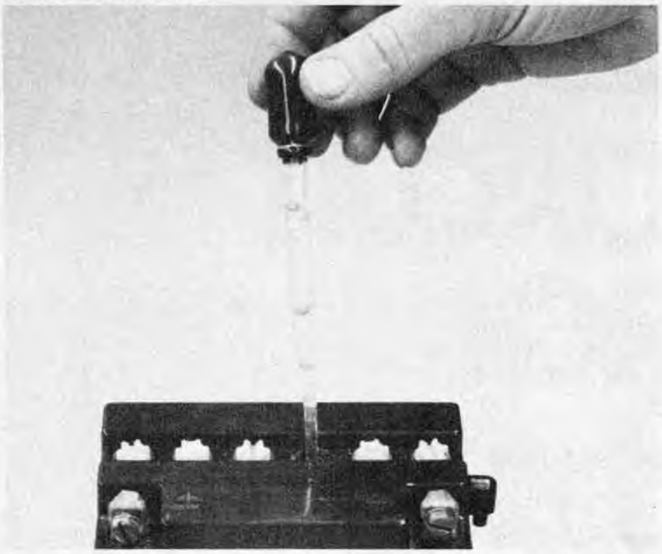
Gabe removed the battery again and then let it charge at a rate of 2 amps overnight. A hydrometer check showed that the battery recovered completely. Had one or more of the six cells in the twelve-volt battery not shown green on the hydrometer float, it would have demonstrated that the low cells were chemically and/or physically useless.

By the time I had an opportunity to check out the circuits on the CB200, Gabe had recharged the battery twice. Service personnel at a Honda shop told him both the battery and the rectifier were shot. I decided to start at one end of the charging circuit and work toward the battery before exploring the lighting, accessory, and ignition circuits for shorts. At the time, the CB200 was so new that Honda had neither shop manual nor owner's book available. Inspection showed that the wiring diagram for the CB175 was identical to what could be seen of the CB200's wiring, so the 175 schematic was used.

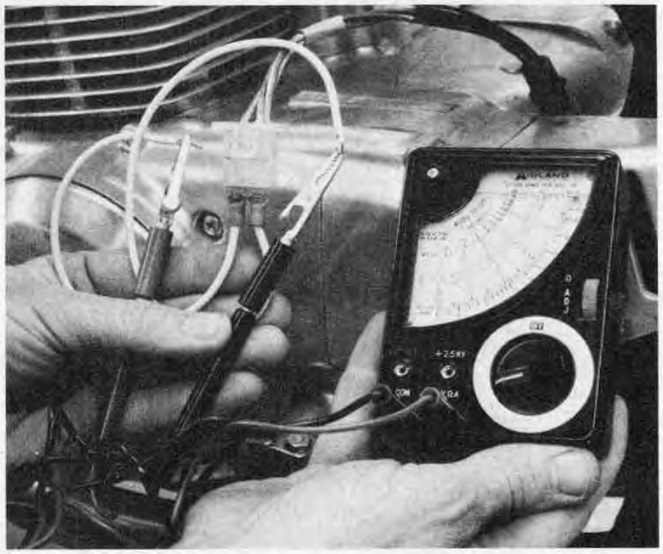
The first task was to determine which additional tools were needed to make the search. My choice was a small volt-ohm multimeter (Midland, model 23-101) and a direct current ammeter. Small multimeters can be bought for as little as six dollars, but I paid $17 (plus tax) for the one in this article. The smaller, cheaper meters had a range of 0-30 volts on their first alternating-current scale, the needle

A cheap multimeter and a direct current ammeter are the basic tools for bike electrical problems. The wiring diagram, crimping tool, extra wire, and ends will make the job easier and faster.

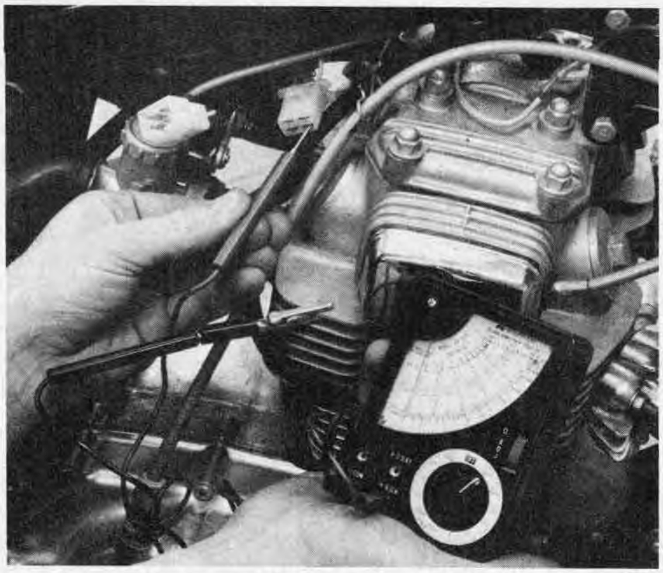
PHOTOGRAPHY: DALE BOLLER



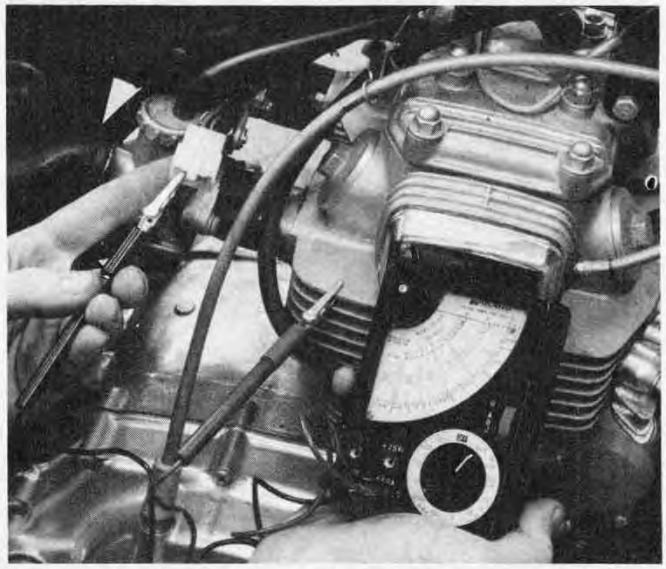
This small Sears hydrometer sells for less than $2.00 and will tell you the amount of useable electrical power in your bike's battery.



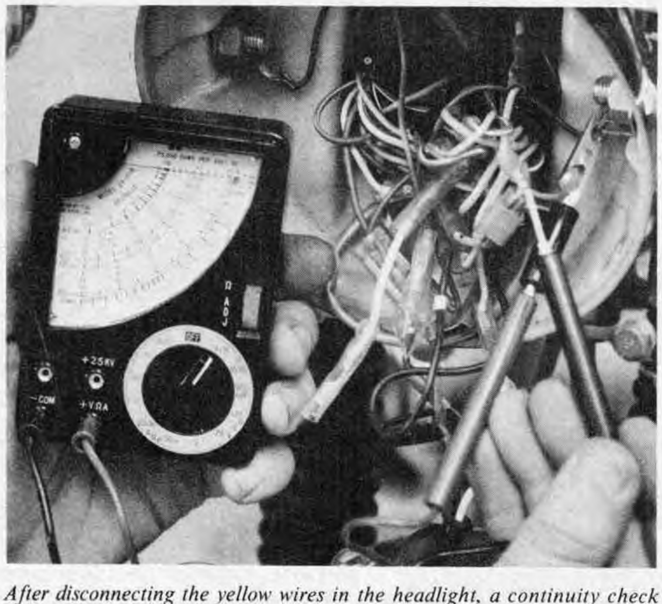
The first test is to measure the alternating current voltage at the engine. Measurement may be made with engine running or at kick-over.



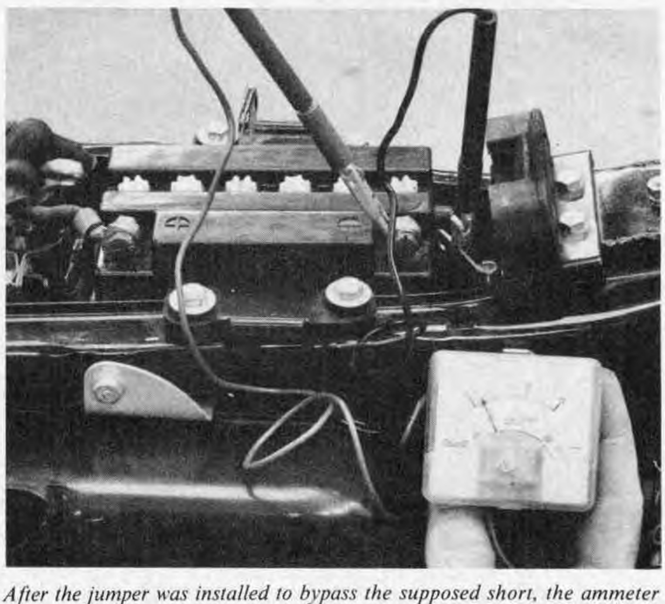
After "zeroing" the ohmmeter and grounding its negative lead, touching the yellow lead in the harness showed the short circuit to remain.



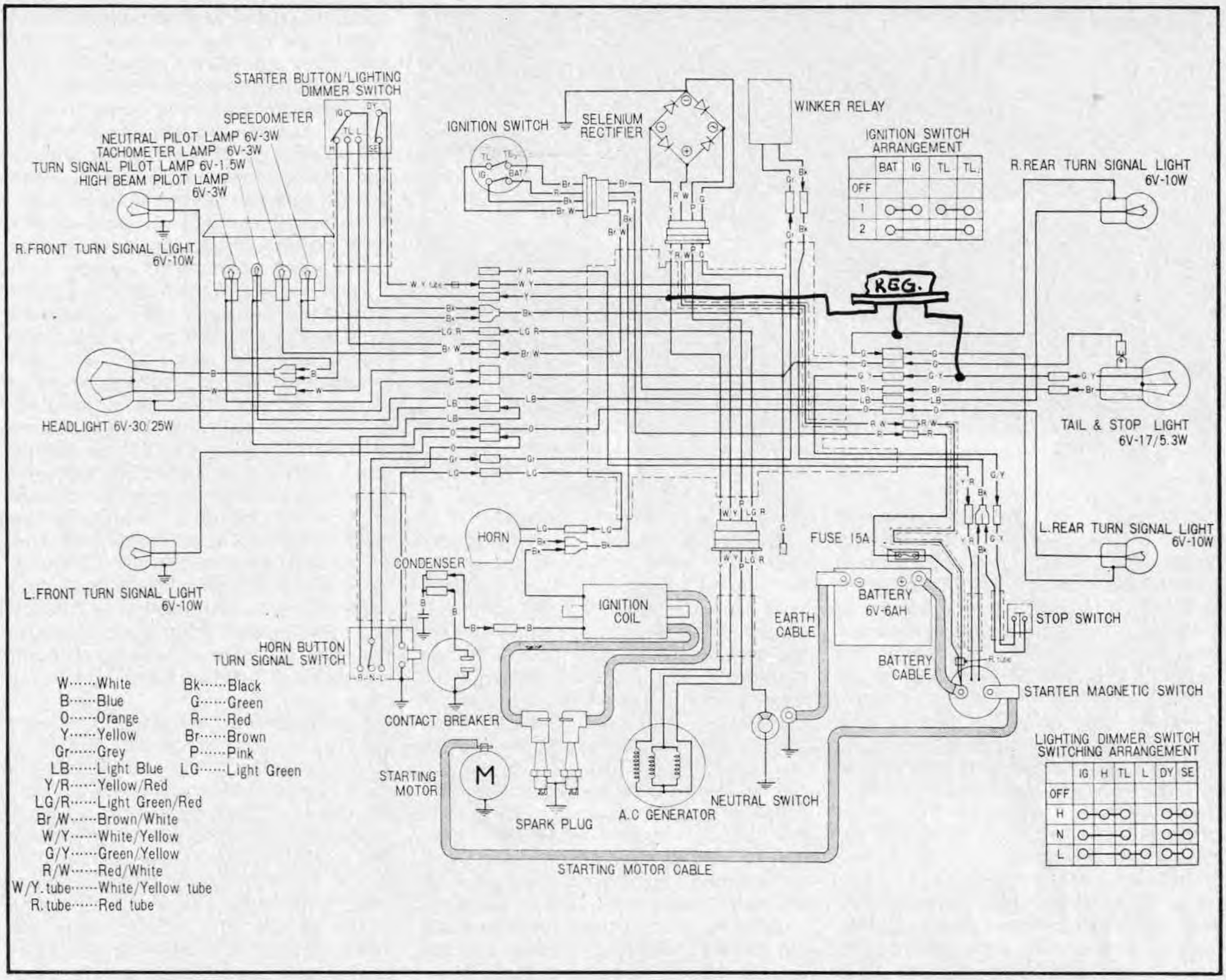
Direct current goes through the rectifier in one direction only. A continuity reading with both leads alternately grounded means a bad rectifier.



After disconnecting the yellow wires in the headlight, a continuity check shows the handlebar switch to be okay. A short in the harness!



After the jumper was installed to bypass the supposed short, the ammeter shows the battery to be charging at a normal two amp rate with lights off.



Honda's wiring diagram, with its understandable switch position graphs, is the easiest one in cycling to follow when one attempts to find electrical faults. The sketched addition shows the Zener diode voltage regulator which was the difference between the CB175 and CB200.

movement was only slightly damped, and there was very little protection in the meter against accidental damage in case the person using it attached it to a circuit wrong. With such a wide-range scale, there isn't very much space between each increment, and when the undamped needle reads the output of the alternator at kickstart speed, it's often difficult to tell whether voltage moved the needle—or whether the case was bumped slightly.

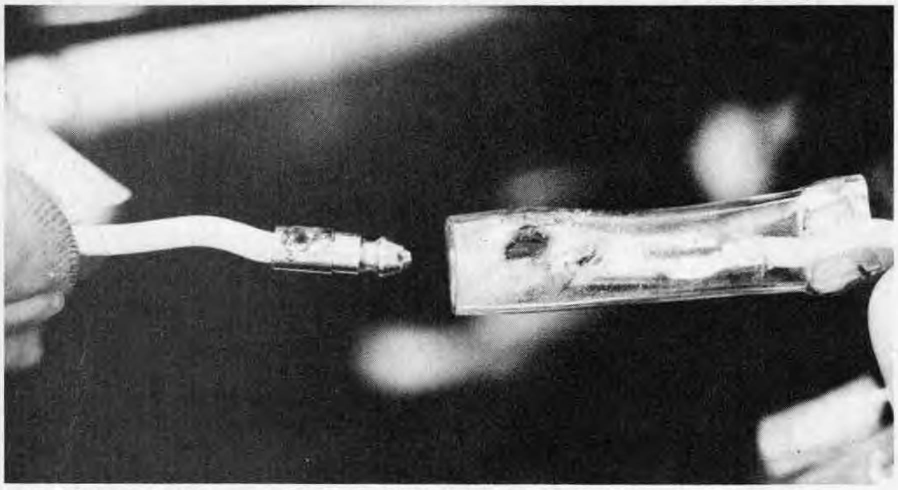
The electronics store dealer said that Midland also had a smaller and cheaper multimeter, with the scales I wanted, just as much meter damping, and a selector switch. But he was out of stock on that meter (#23-094), which sold for about $9.00, so I bought the more expensive one and went to work.

A small ammeter with a range of 0-15 amps will cost about $5.00. Most multimeters incorporate dc ammeters but they usually will measure a maximum of .1 amp or so. The type of meter used in multimeters does not lend itself to being an accurate ohmmeter as well as being an ammeter.

The first test performed on the CB200 was to measure the alternator-output voltage at kickstart speed. Honda makes this and other tests very easy to do by joining the various electrical components together with molded plastic connectors called Jones plugs. The one connecting the alternator to the rectifier is located about eight inches from where the alternator wire comes out of the engine case. A small plastic clip lock keeps the plug halves together; the connectors must be pushed in a little before the plug will separate. Of the four wires in the female half the plug coming from the engine, the pink, yellow, and yellow-on-white are ac power wires. Yellow and pink connect straight to the rectifier to be changed into dc to keep the battery charging when the engine is running. Yellow is one end of a charging coil in the alternator, and pink is the other end of that same coil. The yellow-on-white goes to the light switch on the handlebar where it joins with an extension of the yellow when the lights are switched on to provide extra current. The selector switch on the multimeter was turned to the 10-volt ac position, and the leads were slipped into the pink and yellow sockets of the alternator Jones plug. A swift kick on the pedal produced a 6-volt reading. Pink to white-on-yellow gave 4 volts and yellow to white-on-yellow gave 2 volts. All were good readings. None of the coils is grounded in the alternator, so there was no voltage reading between the wires and ground.

The next step was to check through the rectifier for a short or open circuit with the ohmmeter. Anytime the ohmmeter is used, the bike's battery positive terminal must be disconnected from the circuit; this prevents battery current from damaging the meter. Ohmmeters have their own dry-cell battery. Their readings tell how much resistance a circuit has to the flow of current through it. Zero-ohms readings mean no resistance and a short, or a complete circuit, depending on which is desired. No needle movement indicates infinite resistance and an open circuit. Any reading between zero and infinite shows resistance; the meter needle's movement indicates the level of resistance in the circuit being tested.

The CB200's rectifier has four individual silicon-controlled rectifiers wired together so that they change the alternating cur-



The culprit was a false assumption and a little hole worn through this connector.

rent into direct current. Batteries can only use direct current. One of the characteristics of the rectifier is that dc will only pass through them one way. A direct short in the rectifier will allow the electricity stored in the battery to discharge back into the alternator coils even when the bike is at rest with all the switches off. To perform a test for this kind of short, the ohmmeter must first be "zeroed." The multimeter's selector is turned to the RX1 scale and then the test leads are touched together while a dial is adjusted to cause the needle to register 0 ohms. This is done to compensate for battery aging and the effects of temperature.

Grounding the negative lead of the meter to the bike's battery ground wire and touching the positive meter lead to the pink wire terminal in the male half of the disconnected Jones plug showed a reading of 9.5 ohms, which is about right for that kind of rectifier. But switching the positive meter lead to the yellow wire showed 0 ohms, or a direct short. However, it was doubtful that the short was in the rectifier, for the resulting drain on the battery would have depleted it in short order. More likely, the fault was a short to the frame, or another wire somewhere along the run of the yellow. A check of the diagram showed the wire to run directly to the rectifier with a branch-off to the handlebar switch for the lights, joining with the third alternator wire previously mentioned.

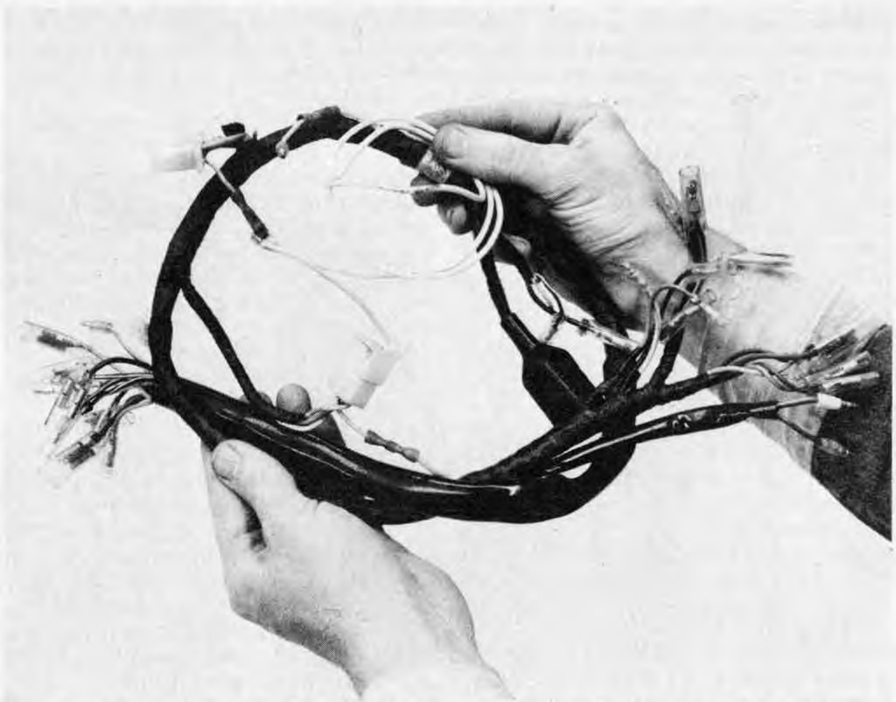
The next check was to disconnect the rectifier from the charging circuit by parting its Jones plug in the frame cavity above the carburetors. With the negative lead of the ohmmeter remaining grounded to the frame at the bike's battery negative pole, touching the yellow leading into the wiring harness showed that the direct short remained. Touching the yellow leading into the rectifier showed a normal 9.5 ohms. Reversing the polarity of the ohmmeter by grounding its positive lead, and alternately touching the rectifier pink and yellow leads, showed a normal infinite resistance reading with no needle movement. When rectifiers do fail in this type of grounded circuit, they usually show a direct short in both directions.

Next I disconnected the bullet plug from the yellow in the harness to the socket from the handlebar switch in the headlight shell. Checking again with the ohmmeter showed that the short was somewhere in the wiring loom. *Ah ha,* I thought. Honda messed up and made a faulty loom. It'll make great pictures. I'll pull the loom out and dissect it like a biology-class python and be sanctimonious as hell about the evils of mass production.

It was getting late. After cutting the yellow wire at both Jones plugs and in the headlight shell, I made an outside jumper wire as a replacement, putting it in the circuit with crimp connectors. With the wire in place and all the connections refastened, I placed the ammeter between the battery's negative terminal and the ground cable. The positive pole on the ammeter went to the negative pole of the battery, and the negative pole of the ammeter went to the ground cable. With the switch on, the needle nudged past zero, indicating a discharge to the ignition circuit. After the engine was kickstarted (the ammeter cables probably wouldn't pass enough current to operate the electric starter), the needle swung over to indicate 2 amps charge with the lights off and 6 amps with the lights on. Gabe happily rode the bike home with a promise from me to make a permanent repair.

Later, starting at the headlight, I pulled loose all 12 wires and worked backward, pulling plugs from the ignition and charging circuits. The rear end of the loom terminated under the battery, where its wires joined leads from the various components. Just as I was about to disconnect one of the last wires, my jaw dropped open, and my eyes bugged out: there was a yellow wire where none was supposed to be. And it went to a Zener diode-type voltage regulator that likewise isn't there on the CB175 wiring diagram. Of course, there was a hole worn in the blade connector cover on that yellow wire. The hole was made by the battery box as it rubbed near the air-cleaner housing with the connector in between. No python and no gloat.

I went into a lot of unnecessary work because I took for granted that the wiring diagrams for the CB175 and CB200 were identical. Next time you start having trouble with your bike's electrics, buy a small multimeter, an ammeter, a hydrometer, and a shop manual. It may be frustrating at first, but if you learn how to use these tools effectively, you won't be at the mercy of bad information. These test items will cost you less than the labor charge, and you will have them to keep. And don't take anything for granted. ◉



The removed wiring harness shows how the jumper wire was spliced in place of the yellow wire which contained the imagined short. Honda's matching diagrams and harnesses make searches easy.