Texas Instruments Electronics Online Challenge

Black & Decker Drill Model #: BDCDD12C

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We disassembled a Black + Decker Drill, model number BDCDD12C (Figure 1). We decided to do this because we were interested in how the assembly worked and how all the components performed together. We also had many drills to disassemble which influenced our decision. We started by disconnecting the battery from the bottom of the drill (Figure 2). Then, we removed the outer shell of the drill by removing the eight screws around it. Inside, we found out that the system had three main components: the screwdriver, the speed controlling system, and the battery connector (Figure 3). We connected the exposed battery connector to the disconnected battery to see if the motor could spin the screwdriver. The motor did spin on its own when we pressed the trigger, so we could actually see it at work.

The first system we disassembled was the screwdriver (Figure 4). We did this by undoing the three screws around its motor. We had a bit of trouble because some pieces were not attached to anything, including a steel washer that separated the motor from a plastic cap. We took the plastic cap off and then saw a cylindrical ring inside a plastic chamber (Figure 5). After, we took the ring and examined it to find out that it had a circular gear rack along the inside. Along the gear rack teeth were three axles holding three metal gears and on the opposite side there were three plastic gears surrounding a smaller gear (Figure 6). The ring and the gears inside were very greasy. After examining it, we found out how the system worked. The gear on the motor would be inserted into the middle of the three metal gears which would spin around it when the motor is powered. The three metal gears are spinning the part that has a smaller gear connected to it on the opposite side (Figure 7). Because of this, the three plastic gears also rotate, causing the drill bit to spin.

The second system we focused on was the speed controlling system (Figure 8). We began by undoing a screw from the trigger and one from a metal chip, allowing us to remove a supporter that prevents the chip from bending. Once we took that off, we could see the chip that was embedded in the plastic. The system for switching the direction of the rotation is also on the speed controlling system. To change the rotation, we flipped the switch above the trigger and it ran the other way. To lock the position of the drill, we put the position of switch inline with the trigger so it stops the trigger from being pushed back. So essentially, when the trigger is pushed it sends information to the chip which sends it through the wires, all the way to the motor causing the screwdriver system to rotate.

The last system was the battery connector (Figure 9). The connector had no pieces to take apart. It functioned by using metal sheets that would slide into the battery sockets. The battery sockets would clasp onto the metal sheets. Since metal is a conductor, the sockets would transfer power through the metal sheets, into the wires, and to the motor powering the screwdriver.

We did not find any Texas Instrument components while disassembling, but we really enjoyed disassembling the drill. It was amazing how each little piece played a crucial role in making the drill function. This was an incredible experience and we hope to keep learning and exploring more about electronics and mechanics.

Figure 1

On the left is the drill fully assembled with no pieces missing (Black & Decker model BDCDD12C).

Figure 2

This is the battery that connects to the bottom of the drill and powers it. It is rechargeable, so when it dies you can still charge and reuse it.

Figure 3

The interior of the drill is comprised of three main components: the screwdriver, the trigger system, and the battery connector.

Figure 4

This is the screwdriver part of the drill. The numbers on the side let you adjust the torque and the silver cylinder at the end is the motor.

Figure 5

The inside of the screwdriver case, holding three axles that will spin the drill bit.

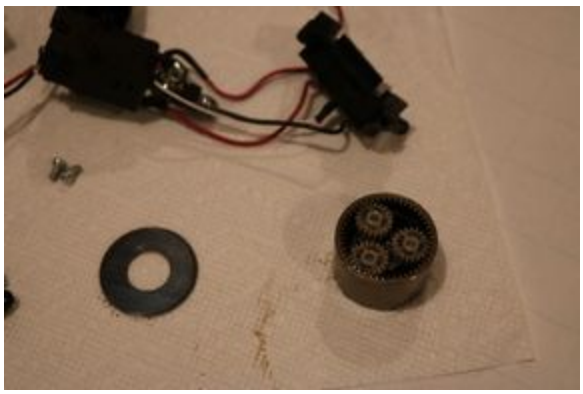

Figure 6
The cylindrical ring outside of its casing with the and metal washer.

Figure 7
The piece that spins the three gears on one side and connects with three gears on the other.

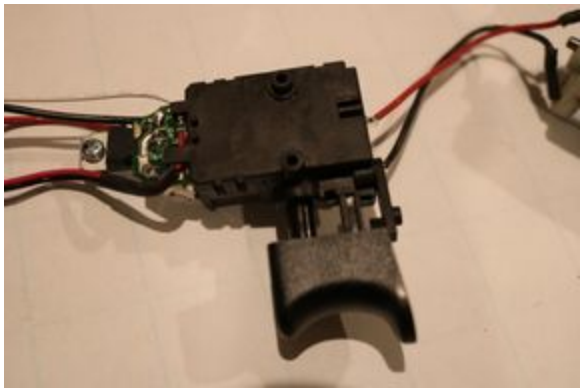

Figure 8
This is the trigger system. The information is sent by the chip on its left side when you pull the trigger back. You can lock the trigger by flipping the switch, on the top, inline with the trigger.

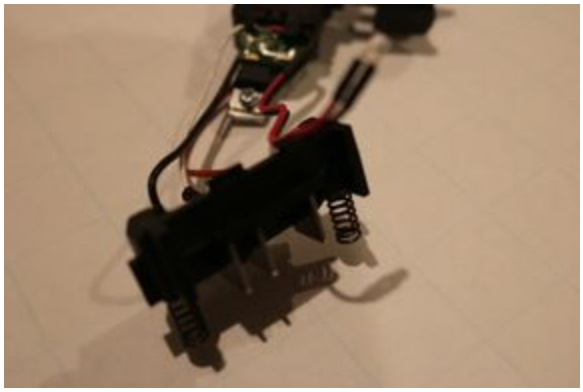

Figure 9

The battery connector connects to the battery we removed and using the metal plates, it powers the rest of the drill.

Figure 10

This is the outer casing of the drill which we took apart by undoing all of the screws on the outside.

Figure 11

This pictures includes the outer shell, the interior, the direction changing bar, and the screws

Figure 12

The screwdriver disassembled has the motor, the screwdriver casing, a metal washer, plastic cover, a cylindrical ring with the gears, six metal balls, and two screws. The metal balls are to help the screwdriver spin smoothly.

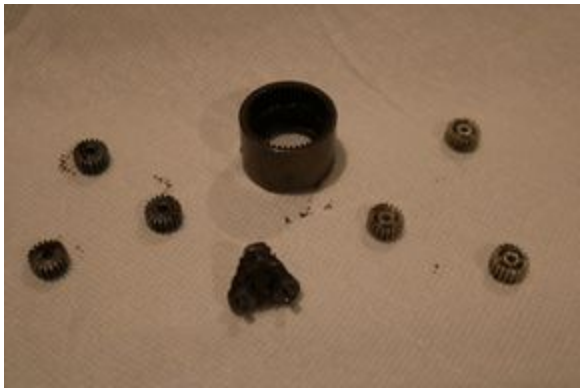

Figure 13

The disassembled cylindrical ring contains the ring, the three plastic gears, the three metal gears, and the part with a small gear and three axles on the other side.