Ringing a Bell at its Fundamental Mode

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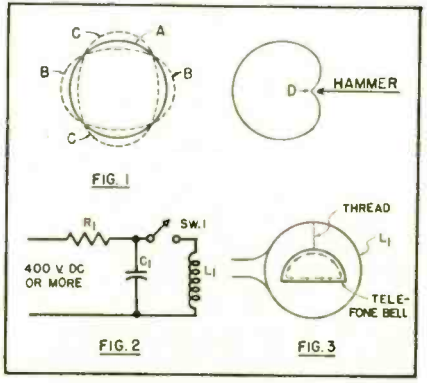
IT IS NOT GENERALLY REALIZED that there is no way to ring a bell at its fundamental mode of oscillation. This can be better realized when we look at *Fig. 1.* The view of the bell from the bottom, which is always a perfect circle, is shown in *Fig. 1A.* If we could squeeze the bell into the perfect oval of *Fig. 1B* and instantly release it, it would oscillate between the oval of *Fig. 1C* and back to *Fig. 1B,* and so on until the energy died out. Since this is very difficult to do, we actually hit the bell with a hammer and form a local dimple, as in *Fig. 1D,* and from there on anything can happen in the way of extremely complex coupled oscillations.

Since many of us have some condensers around that are capable of high discharge rates we can set up the circuit of *Fig. 2,* where the big filter condenser C_1 is 20 to 100 microfarads, charged from a source of 400 volts or more through a limiting resistor R_1 of 10,000 ohms or so. The inductance L_1 is 50 or 100 turns of number 24 wire on a three-inch form, or just wound in a bunch and taped together. Nothing is critical. The switch Sw_1 had better be a mercury switch, otherwise it will weld together. If you want, you can just touch two wires together to close the discharge path.

Now we take a telephone bell, or a dime store bell of any kind, and place it in the field of the coil as shown in *Fig. 3.* On closing the circuit the bell will ring, and by careful attention you will probably think you are listening to



Figures 1, 2, and 3.

at least a fifteen-pound bell, with a very deep, pure tone.

The surge of current through the coil induces a tremendous current in the side of the bell facing us, as shown by the arrows. There is an equal current with a similar path on the opposite side of the bell. These two current loops mechanically repel each other, and the bell is forced into the oval form of *Fig. 1C.* The current then disappears, and the bell oscillates at its fundamental.

If you want to make a set of chimes this way, you must use thyratrons or at least mercury switches to control the high current, as any ordinary switch contacts will simply weld together.

If the bell sounds weak, try about 5 or 10 ohms in series with the discharge path, as the circuit might be oscillating. The series resistance insures that the circuit is at least critically damped so you can get a single surge instead of oscillations.

All sorts of metal shapes will "ring" when placed in the coil, but the real fun is to take a very tinkly telephone bell and have it sound like a monster.