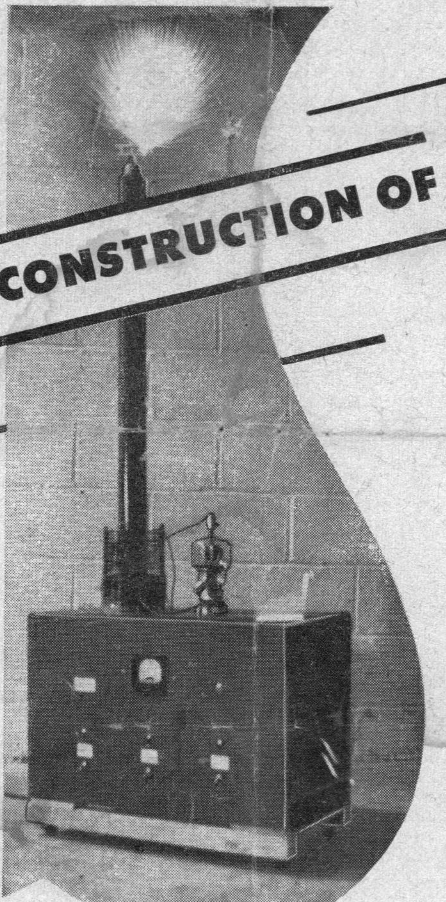
The 1000 watt Tesla unit. The use of vacuum tubes is safer, quieter, and more TVI-proof than the older spark gap apparatus. A test was made with a recent-model G-E receiver located about 20 miles from the three local TV transmitters. This apparatus was operated within 20 feet of the set with no interference except for slight snow on Channel 4. A 14" corona was obtained with the 1000 watt unit. The authors also built 150 and 500 watt units, described herein.



THE DESIGN AND CONSTRUCTION OF VACUUM-TUBE TESLA COILS

By

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and

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An interesting project for the experimenter. Mystify your friends by lighting unconnected bulbs and igniting candles.

THE experimenter who has tired of reading about color TV, transistor pocket radios, and ultra-fidelity amplifiers may find a Tesla coil giving 100 kilovolt corona discharges and flame arcs that melt steel wire more to his liking.

The circuit of the Tesla coil is simple and almost foolproof, consisting of an r.f. oscillator driving a large air-core step-up transformer; high voltage is built up across the secondary because of its high turns ratio and resonance effects, since the primary of the transformer is tuned to the natural resonant frequency of the secondary coil.

First, decide on the power of the coil, and then obtain a transformer to suit. For small outfits, a power transformer having a high-voltage winding of at least 800 volts at 150 to 250 ma. is suitable; for larger coils, a transmitting-type transformer, which need not have a center tap, is necessary. The secondary should be rated at about 1500 volts at 350 ma. Two smaller transformers, with the secondaries in series and the primaries in parallel, can also be used.

The next thing to consider is the oscillation transformer. The most convenient form to use for the high voltage secondary coil (L_3) is a 2- to 3-foot long cardboard mailing tube 2- to 2½-inches in diameter, the lower end of which fits over a wooden plug mounted on top of the chassis. Before winding, the form must be thoroughly impregnated with melted paraffin; it is then dried and closewound with a single layer of #30 B. & S. gauge d.c.c. or formex insulated magnet wire, leaving three inches of tubing unwound at each end. The coil is then given a half dozen coats of shellac, with a few days drying time between applications. The discharge terminal is a porcelain insulator mounted on a round block of dry, shellacked wood glued into one end of the form, with the lead from the coil attached to the terminal; the other end of the winding is brought to a binding post at the lower end of the coil for a ground connection.

The plate tank (L_1), #14 wire, and the grid coil (L_2), both concentric with the secondary, are arranged on a shellacked cardboard form for outfits less than 150 watts, but for larger units the plate coil should be air wound with heavy wire (#9 to #12), threaded through insulating support strips, the turns being spaced the wire diameter. The grid coil is wound on a cardboard form and mounted over the supporting strips about an inch below the plate coil.

For small coils, a pair of surplus triode tubes like the 801A or 10Y are suitable; for larger coils, types 826, 211, and 805 have been successfully used. Because the push-pull connection complicates the circuitry, the tubes are run in parallel.

Construction is most conveniently done on a plywood or Masonite chassis, using adequate insulation where needed, heavy wire for filament and r.f. leads, and following good constructional technique. The filament voltage should be held within 5% of the rated value while the coil is in operation.

The value of the grid resistor is not critical; it can range from 1000 ohms for parallel high mu tubes to 4000 ohms for low mu tubes; it is helpful to use an adjustable resistor to find the best operating conditions.

The plate tank condenser consists of transmitting-type mica condensers having a voltage rating double the applied a.c. and a current rating of at least 3 r.f. amps.; or, lacking these, use heavily shellacked glass plates coated with metal foil for high power coils. If the oscillator does not function, as

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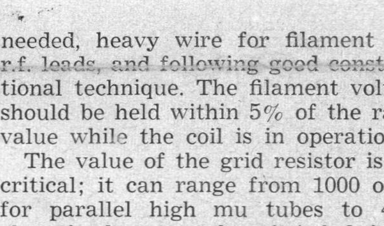
Schematic of the Tesla unit. The use of an external ground is strongly recommended.



R_1—See text. 20 watt rating for small coils and up to 150 watts for large coils
C_1—.005 µfd., high-voltage ceramic cond.
C_2—.002 to .01 µfd. (See text. For small coils, Sangamo Type A or equivalent; for large coils Sangamo Type E or equivalent)
C_3—500 µµfd., 1000 v. mica or ceramic cond.
C_4, C_5, C_6, C_7—.01 µfd., 600 v. cond.
S_1, S_2—S.p.s.t. heavy-duty toggle switch
T_1—See text
T_2—Fil. trans., c.t., to match tubes used
PL_1, PL_2—117 v. pilot light
F_1—Fuse of suitable size
L_1—15 t. #14 en. closewound on 4" to 5" cardboard tube (for small coils) 15 t. #9 to #12 bare or en. spaced dia. of wire, 5" to 6" dia. (for large coils)
L_2—25 t. #18 en. closewound on cardboard form mounted to fit below L_1, same dia.
L_3—See text
Note: Coils are wound in same direction, connections are made in order from top to bottom as numbered.
V_1—Paralleled 801A's, 10Y's, 826's, 805's, etc. or single 304TL