so that transistors Q3, Q4 are alternately fired and shut off in very rapid sequence. Thus current pulses flow in alternate sequence through primary coils **71, 73** at a very high frequency, this frequency being constant and independent of changes in input voltage to the circuit. The rapidly alternating pulses in primary coils **71** and **73**, which will continue for so long as ignition switch **48** remains closed, will generate higher voltage signals at the same frequency in the transformer secondary coil **67**.

A dump capacitor **C5** bridged by a resistor **R8** is connected by a line **86** to the line **66** from the secondary coil of transformer **TR1** and provides the output from that transformer which is fed via line **87** to a second stage transformer **TR2**.

When thyristor **T1** is triggered to become conductive the full charge of dump capacitor **C5** is released to second stage transformer **TR2**. At the same time the first stage of transformer **TR1** ceases to function because of this momentary short circuit placed across it and consequently thyristor **T1** releases, i.e. becomes non-conductive. This permits charge to be built up again in dump capacitor **C5** for release when the thyristor is next triggered by a signal from transistor **Q2**. Thus during each of the intervals when the thyristor is in its non-conducting state the rapidly alternating pulses in primary coils **71, 73** of transformer **TR1** produced by the continuously oscillating transistors **Q3, Q4** produce, via the transformer coupling, relatively high voltage output pulses which build up a high charge in capacitor **C5**, and this charge is released suddenly when the thyristor is triggered. In a typical apparatus using a 12 volt DC supply battery pulses of the order of 22 amps at 300 volts may be produced in line **87**.

As previously mentioned relay **58** is provided in the circuit to provide a delay in the connection of capacitor **C2** to the common negative line **54**. This delay, although very short, is sufficient to enable transistors **Q3, Q4** to start oscillating to cause transformer **TR1** to build up a charge in dumping capacitor **C5** before the first triggering signal is applied to thyristor **T1** to cause discharge of the capacitor.

Transformer **TR2** is a step-down transformer which produces pulses of very high current flow at low voltage. It is built into the anode of electrolytic cell **41** and comprises a primary coil **88** and a secondary coil **89** wound about a core **91**. Secondary coil **89** is formed of heavy wire in order to handle the large current induced in it and its ends are connected directly to the anode **42** and cathode **43** of the electrolytic cell **41** in a manner to be described below.

In a typical apparatus, the output from the first stage transformer **TR1** would be **300** volt pulses of the order of 22 amps at 10,000 pulses per minute and a duty cycle of slightly less than 0.006. This can be achieved from a uniform 12 volt and 40 amps DC supply using the following circuit components:

R1 2.7 K ohms ½ watt 2% resistor
R2 220 ohms ½ watt 2% resistor
R3 100 ohms ½ watt 2% resistor
R4 22 K ohms ½ watt 2% resistor
R5 100 ohms ½ watt 2% resistor
R6 220 ohms ½ watt 2% resistor
R7 1 K ohms ½ watt 2% resistor
R8 10 M ohms **1** watt 5% resistor
R9 100 ohms **5** watt 10% resistor
R10 5.6 ohms **1** watt 5% resistor
C1 2200 MF 16V electrolytic capacitor
C2 2.2 MF 100V 10% capacitor
C3 2.2 MF 100V 10% capacitor
C4 1 MF 100V 10% capacitor
C5 1 MF 1000V Ducon paper capacitor 5S10A
C6 0.002 MF 160V capacitor
Q1 2N 2647 PN unijunction transistor
Q2 2N 3055 NPN silicon power transistor
Q3 2N 3055 NPN silicon power transistor
Q4 2N 3055 NPN silicon power transistor
T1 BTW 30–800 RM fast turn-off thyristor
D1 A 14 P diode
D2 A 14 P diode
L1 Indicator lamp
SV1 continuously rated solenoid
RL1 PW5LS hermetically sealed relay
PS1 P658A-10051 pressure operated micro switch
TR1 Half cup transformer cores 36/22-341
Coil former 4322-021-30390 wound to provide a turns ratio between secondary and primary of 18:1
Secondary coil 67 = 380 turns
Primary coil 71 = 9 turns
Primary coil 73 = 9 turns
Primary coil 72 = 4 turns

The installation of the above circuit components is illustrated in FIGS. **3** to **13**. They are mounted within and on a housing which is denoted generally as **101** and which is fastened to a side wall of the automobile engine bay **32** via a mounting bracket **102**. Housing **101**, which may be formed as an aluminium casting, has a front wall **103**, top and bottom walls **104, 105** and side walls **106, 107**. All of these walls have external cooling fins. The back of housing **101** is closed by a printed circuit board **108** which is held clamped in position by a peripheral frame **109** formed of an insulated plastics material clamped between the circuit board and mounting bracket **102**. An insulating sheet **111** of cork is held between the frame **109** and mounting bracket **102**.

Printed circuit board **108** carries all of the above-listed circuit components except for capacitor **C5** and transistors **Q3** and **Q4**. FIG. **5** illustrates the position in which transistor **Q2** and the coil assembly **112** of transformer **TR1** are mounted on the printed circuit board. Transistor **Q2** must withstand considerable heat generation and it is therefore mounted on a specially designed heat sink **113** clamped to circuit board **108** by clamping screws **114** and nuts **115**. As most clearly illustrated in FIGS. **7** and **8**, heat sink **113** has a flat base plate portion **116** which is generally diamond shaped and a series of rod like cooling fins **117** project to one side of the base plate around its periphery. It has a pair of countersunk holes **118** of the clamping screws and a similar pair of holes **119** to receive the connector pins **121** which connect transistor **Q2** to the printed circuit board. Holes **118, 119** are lined with nylon bushes **122** and a formica sheet **123** is fitted between the transistor and the heat sink so that the sink is electrically insulated from the transistor.

The coil assembly **112** of transformer **TR1** (See FIG. **9**) is comprised of a casing **124** which contains transformer coils and the associated core and former and is closed by a plastic closing plate **125**. Plate **125** is held in position by a clamping stud **126** and is fitted with electrical connector pins **127** which are simply pushed through holes in circuit board **108** and are soldered to appropriate copper conductor strips **128** on the outer face of the board.