

Cunningham RADIO TUBES

BULLETIN

HIGH VOLTAGE OUTPUT WITH THE TYPE CX-381 TUBE



Type CX-381 is a half-wave rectifier tube with a rating of 700 volts A.C. input and 85 m.a. D.C. output permitting D.C. voltages on the order of 600 volts to be obtained from a single wave rectifier, and of 700 volts with a full wave connection. When higher voltages are required it is possible to use a single or full wave voltage doubling arrangement by which voltages of 1000 to 1500 volts may be obtained (using low transformer voltages), two to four CX-381 tubes being required.

NORMAL SERVICE

Typical connections and output voltage secured from the CX-381 in a half wave rectifier circuit are shown in Fig. 1, while Fig. 2 shows similar data for two CX-381 tubes used in a full wave circuit. When an output voltage under 500 volts is required the first filter condenser should be omitted. The effect of this connection is to greatly reduce the peak current supplied by the CX-381 tubes, which will run cooler and give much better life service under such conditions. The regulation is also much improved, as may be seen by comparing the output voltage curves.

This latter system of filtering was tried at station 2AQO, in place of a single section filter, with improved results when supplying a Hartley oscillator and especially for phone modulation. The filtering action was better than necessary for crystal controlled operation, some A.C. modulation being found preferable. The input choke in these tests was a 7 Henry inductor, the self-inductance being measured with full load current of 85 m.a. flowing.

HIGHER VOLTAGES

A familiar type of voltage doubling connection was tested (Fig. 3). The voltage regulation was rather poor, as indicated, but for low currents the small amount of apparatus required makes it convenient. The regulation can be improved by using two CX-381 tubes in parallel on each side as indicated by the

dotted lines. The voltage increases rather rapidly below a load of 20 m.a., and to prevent it from rising a fixed load (r) is indicated in the diagram. This may be a 100,000 ohm resistor capable of carrying 20 m.a. A milliammeter in series with this resistor is indicated (M.A.), and will give an indication of the output voltage. The scale reading with the resistor specified becomes 100 volts per milliampere; thus a full scale reading of 200 milliamperes indicates an output voltage of 2000 volts.

Much improved results were obtained with the full wave voltage doubling circuit shown in Fig. 4. The adjacent curves show the very high output voltage obtainable with this circuit, and the excellent regulation secured. The high voltage transformer may be a 1400 volt winding center tapped, or two similar 700 volt transformers connected in series. Regulation curves are shown for transformer voltages of 1000 and 1400 volts. The current output should not exceed 170 m.a. Three separate filament transformers insulated for the full output voltage are required.

When tested at Station 2ABQ this latter arrangement, with a 10 Henry choke, gave slightly better results than the equipment formerly used, a 3000 volt transformer center tapped two 1500 volt rectifiers and a 50 Henry choke. The transformer used was a 1200 volt unit, center tapped. The CX-381 tubes, supplying 100 m.a. ran quite cool, the output being well below rated maximum.

The filter condensers, C_1 , must be capable of withstanding one-half the load voltage as the normal working voltage. A condenser larger than 4 m.f. should not be used unless it is possible to close the filament circuit of the rectifier tubes before the high voltage is applied. The initial charging surge may overheat the tubes and cause an arc if the filament is allowed to come up to temperature with the high voltage turned on.

FILAMENT

The filament used in type CX-381 is of the rugged coated type. With this filament the difficulties in handling the shipping are overcome, as severe mechanical shocks cannot break the filament. The filament should be operated at, or slightly below, the rated voltage of 7.5 volts, and the voltage across the filament should never exceed 7.9 (rated voltage $\pm 5\%$).

The main precaution to be observed in operating the CX-381 tubes is that of avoiding an overload with respect to plate current. The shorting of the rectifier output, such as may occasionally occur due to the failure of some part of the apparatus (as by the breakdown of a filter condenser) will overload the filament and result in filament failure, unless the current is turned off promptly. An indicating lamp may be placed in the circuit in series with each plate lead adjacent to the plate; if a .15 ampere 6 volt dial lamp is used in this position it will glow at normal brilliancy when the full rated current of 85 m.a. is flowing through each tube (170 m.a. from a full wave rectifier). Excessive brilliancy of this lamp will immediately indicate an overload on the tube, which can be corrected before damage results.

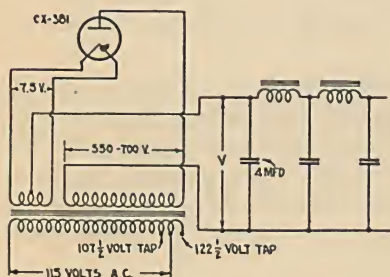


FIG. 1

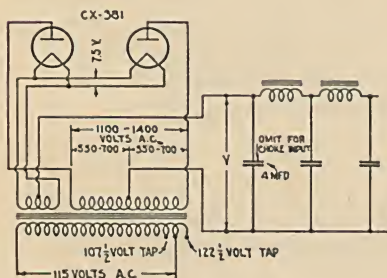
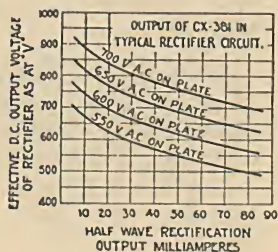
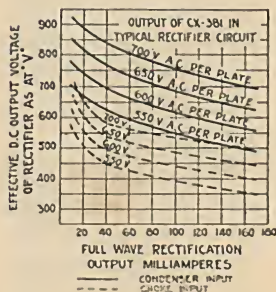


FIG. 2



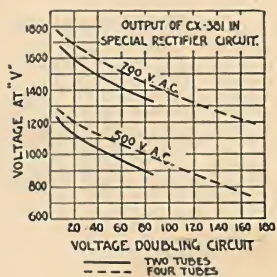
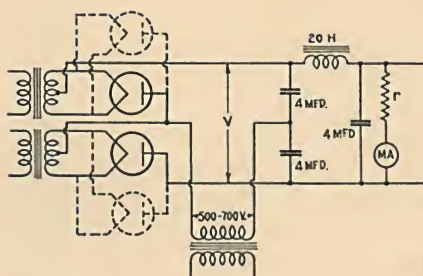


FIG. 3

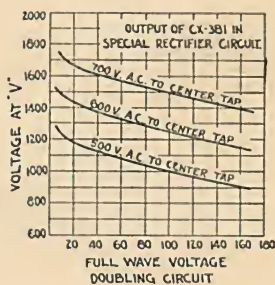
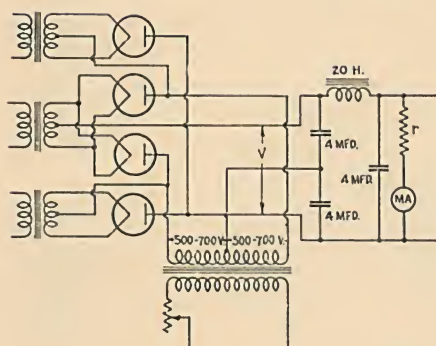


FIG. 4

