

1923

## Production of High Amperage in Low Voltage Coolidge Tube

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### Recommended Citation

Zumstein, R. V. (1923) "Production of High Amperage in Low Voltage Coolidge Tube," *Proceedings of the Iowa Academy of Science*, 30(1), 80-80.

Available at: <https://scholarworks.uni.edu/pias/vol30/iss1/23>

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## PRODUCTION OF HIGH AMPERAGE IN LOW VOLTAGE COOLIDGE TUBE

R. V. ZUMSTEIN

In a Coolidge tube, the electrons are focused upon the target by a metal tube surrounding the filament. As this tube projects more and more beyond the filament the electrons come to a smaller and smaller focal spot.

The magnitude of the electronic current from the filament increases slightly as the voltage is increased, but it increases very rapidly as the filament is made hotter. As the filament is heated still hotter the electronic current does not increase toward infinity but attains a maximum value. This saturation value may be as low as 40 mili-amperes.

In studying x-ray absorption spectra it is necessary to keep the voltage applied to the tube below a definite value, in these experiments about 3000 volts. The intensity of the soft x-rays is then very small unless the electronic current can be made large. This saturation current is primarily due to the space charge.

Some experimenters make a slight air leak into the tube. The positively charged atoms neutralize the space charge and so permit a greater current through the tube. My experience has been that such an increased current does not mean an increase in the intensity of the x-rays. Rather it may mean a decrease.

It was noticed that the value of the saturation current increased rapidly as the filament was brought towards the front of the focusing tube. This permitted an electronic current of about 100 m. a. When the filament was made hotter the current increased but the vacuum in the tube immediately was spoiled. It was thought that the electrons were missing the target and hitting the walls of the tube where they liberated gases.

The filament was then placed about 3 mm from the target and projecting  $\frac{1}{2}$  mm beyond the focusing tube. With this arrangement currents of 300 m. a. could be used.

The following explanation is suggested. If the electronic current is very large, the electrons repel each other and *spread the focal spot* out until it is larger than the target.

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