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THYRATRON USED AS COMBINATION GATE, STORAGE, AND DRIVER FOR PUNCHED PAPER-TAPE OUTPUT

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THYRATRON USED AS COMBINATION GATE, STORAGE, AND DRIVER FOR PUNCHED PAPER-TAPE OUTPUT*

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In order to accelerate the nuclear research program at this laboratory, a system was designed to punch binary data from an RCL pulse-height analyzer (PHA) on paper tape concurrent with the printing of decimal information.

In the PHA a 20-bit word is stored in a magnetic core memory. There are 256 (2^8) such words stored. When the PHA is in the print mode, the 20-bit word is read out of storage into a flip-flop register. The 8-bit address is available in a similar register. Approximately 8 μsec after being read into the word register, a binary-to-decimal conversion routine begins which destroys the binary data.

A total of 300 milliseconds is required to punch the 28 bits of data and address on paper tape, so that storage external to the PHA is necessary. In addition, 60 ma at 50 v are required to operate the punch coils.

The usual method to achieve the required results is shown in Fig. 1. Information is gated to storage flip-flops on store command. Storage flip-flops are gated to punch drivers, which drive paper-tape punch coils. For this system 56 gates, 28 flip-flops, and 6 punch drivers are required.

*This work was performed under the auspices of the U.S. Atomic Energy Commission.

Our solution calls for a minimum number of components, resulting in greater reliability and economy.

The basic element of our system is the tetrode thyratron, which has the following desirable characteristics:

1. Conduction may be inhibited by either grid (gating).
2. Once the thyratron conducts, grids lose control (storage).
3. Thyratrons may safely pass large amount of current (driver).

The final circuit is shown in Fig. 2. Twenty-eight thyratrons and a stepping switch are required. The output of a PHA flip-flop is connected to grid 2 of the thyratron; it is slightly positive for a "1" and at minus 40 v for a "0." When the 20-bit word is set up in the PHA register, a 4-μsec store pulse is applied to grid 1. The thyratrons connected to flip-flops in the "1" position will now fire. Since grid 1 is normally biased negative, changes in the PHA flip-flops before or after the store pulse will not affect the thyratrons. Thyratrons conduct through a 50K plate resistor until selected by a stepping switch connected to the punch coils, punching five bits per punch cycle. In six punch cycles the binary word and address are punched, then the thyratron memory is cleared, and the unit is ready for another channel. The channel is advanced when both paper-tape punch and PHA printer have completed the cycle.

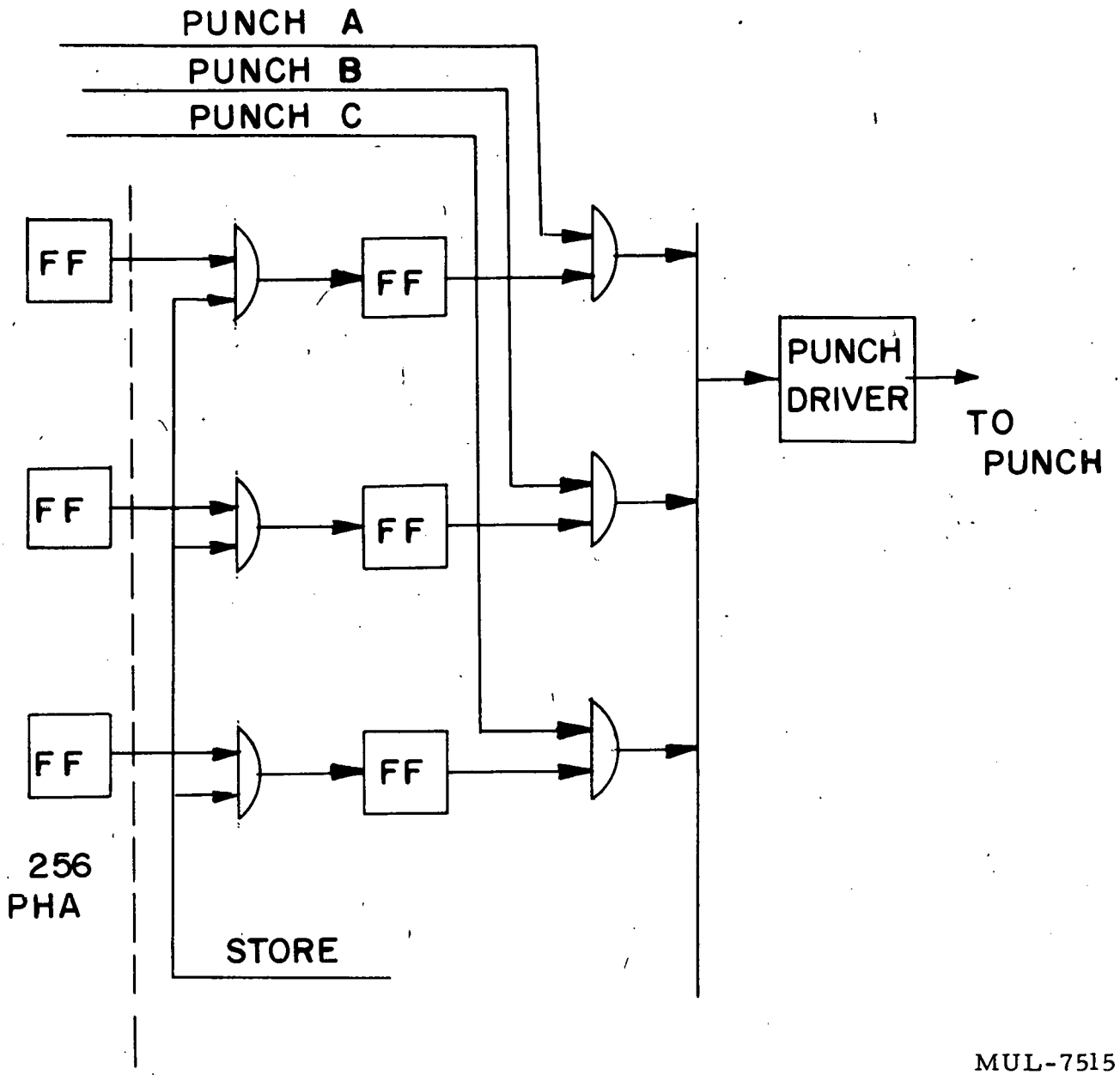

Fig. 1. Conventional storage.

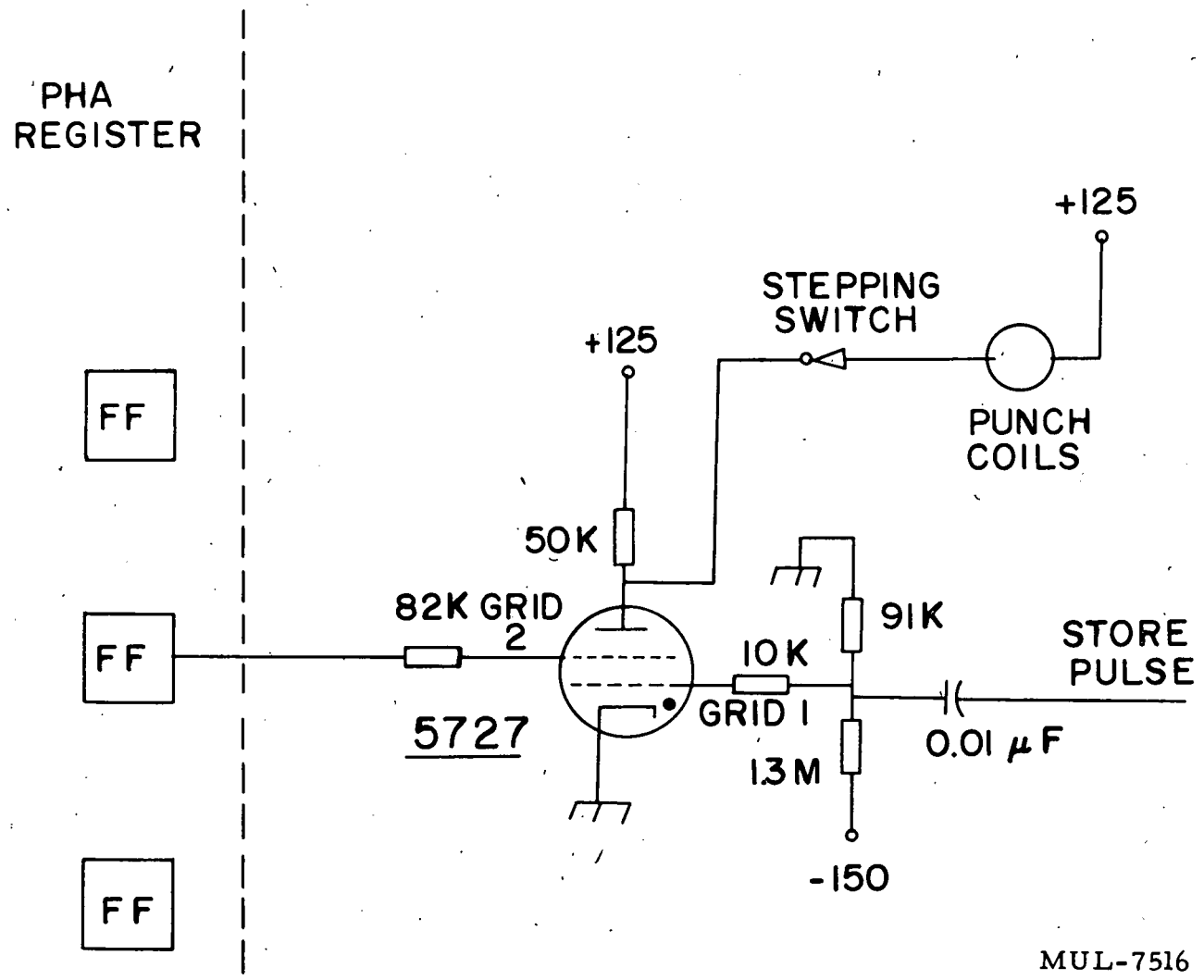

Fig. 2. Thyratron storage.