FUTURE DEVELOPMENT OF THE TARGET CONTROL SYSTEM

INTRODUCTION.

With the growth of target utilization, it has been found necessary to develop a more versatile control system. This note outlines a new system and also discusses its future extension. It is hoped that this note will also act as an introduction to the new system, so making it possible for the operating staff to become familiar with its main features at the same time as the equipment is being installed in the control room. With reference to the future operation and extension of this equipment, comments, suggestions and criticisms will be welcomed.

SYSTEM LAY-OUT.

Fig. 1 gives a simplified layout of the target timing control. The main feature of this system is the use of an interconnecting matrix (patch panel). This matrix consists of 40 horizontal and 40 vertical bus-bars. With the use of shorting pins, any number of horizontal and vertical bars may be interconnected. Timing pulses are supplied to a number of horizontal bars from "M" and B_{10}" coincidence circuits and connected to the vertical bars are the inputs of the units to be controlled e.g. target drive units, perturbation generator, R.F. programme, etc., For simple operation, i.e. (without programme) timing pulses are fed to the appropriate units by means of a simple interconnection with a shorting pin.

PROGRAMMING.

Programming of the target operation is achieved by using a programme generator. This unit produces 6 independent control lines which are fed to the matrix. These control lines can have one of two possible states i.e. "ON" or "OFF" and the determination of a given state can be manual or automatic. To

obtain a gating action, a simple "and" gate is formed with the required timing pulse and a control line, see Fig. 2. The gate is patched directly onto the matrix using pins which contain diodes. When used for manual operation, the control lines are normally at zero volts i.e. (OFF), so shorting any pulse to earth. By pressing the button of the appropriate line, + 50 volts are applied, so opening the gate and allowing the pulse to pass and operate the unit to which it is connected. The 6 control lines may be used independently or in any combination.

For automatic operation there is only one line in service at a given time. The number of machine pulses for which this line stays in operation is determined by a preset counter which can be set to any number in the range 1 - 99. After the prescribed number of operations, the next control line will be switched on and will remain for a period determined by the associated counter. Operation is always in the sequence 1 through to 6. For examples of simple programmes, see Fig. 3a, 3b and 3c.

DESCRIPTION OF INDIVIDUAL UNITS.

Matrix. Manufactured by Sealectro corporation to our specification.

"M" and "B_{10}" coincidence circuits. Developed by the R.F. section and built in the electronic workshop.

Target drive units. These new units have been built for a much higher power rating i.e. (capable of delivering a full current pulse for a period in excess of 1.5 sec.) and at the same time a much smaller model has been produced. The new unit has been built as a "plug in" form to ease maintenance and repair. Other features in which it differs from the present unit are :

a) No counter. This was considered unnecessary.

b) A variable control of the current pulse duration has been added. This allows any valve between 20 - 1,500 mSec. to be used.

Perturbation generator. This generator has 4 channels, the outputs of which can be added to form a single steering voltage for the beam radial control. The form of this steering voltage may have 4 independent perturbations or in the limit 1 perturbation with a complex form. The first two channels are similar to the prototype unit which has been in use for some time. These two channels have the following controls : 1. Rise-time; 2. Plateau time; 3. Fall time; 4. Amplitude; 5. Polarity. Channels 3 and 4 have fixed rise and fall times (approx. 20 μsec.) all other features being the same. Included in each channel there is the possibility to control the plateau time by means of an external pulse. To obtain this mode of operation the "plateau stop trigger mode" switch has to be placed in the external position (see back panel) and a pulse supplied to the "stop" socket.

Programme unit. As mentioned above, this unit has 6 control lines which apply "on" or "off" voltages to the gates which have been patched on the matrix. This unit consists of a 6 position stepping switch (each position representing one control line), and a preset counter. Associated with each position of the stepping switch there are a pair of coincidence switches which are connected to the counter. This counter is fed with X_1 pulses and therefore it counts the number of machine cycles. After a prescribed number i.e. (the number set on the pair of coincidence switches) the coincidence circuit resets the counter to zero. At the same time a gate opens which allows the following X_2 pulse to step on the stepping switch to its next position (the gate is then closed by the pulse X_3). This cycle of operations is then repeated on the following programme line. If any one or more of the positions i.e. (control lines) are to be cancelled in the sequence the action is as follows : When the stepping switch arrives at a cancelled position (cancel button pressed) an internal oscillator starts and generates another step on pulse and this continues to step on until an uncancelled position is reached.

Pulse distribution. Fig. 1 shows 10 output lines from the matrix, which pass via pulse repeaters to a coaxial patch panel. From this patch panel target timing and warning pulses can be fed to the various experimental areas. See note : - Distribution of target timing pulses. April 14th, 1961.

FUTURE DEVELOPMENT.

In the near future it is hoped to extend the target programming system by including 3 preset counters which can give programme cycles of up to 1000. This will accommodate the condition already requested of one pulse per 600 machine cycles, for a cloud chamber. Also from these counters it is intended to obtain variable warning pulses which may be several cycles before the associated event, (to allow the operation of mechanical shutters and beam transport magnets, etc.,).

As targetting and experimental techniques become more refined it appears that programming will have to be extended to other aspects of the machine, e.g. (beam intensity, slope or magnet flat top, beam stops and beam transport, etc.,) in the majority of foreseeable circumstances it appears that programmed conditions will be connected with target operation and therefore it may be convenient to incorporate these extensions within the target system. As a basic principle for such an extension, it is suggested that only the command of operation be generated within the target racks.

C.B. Brooks.

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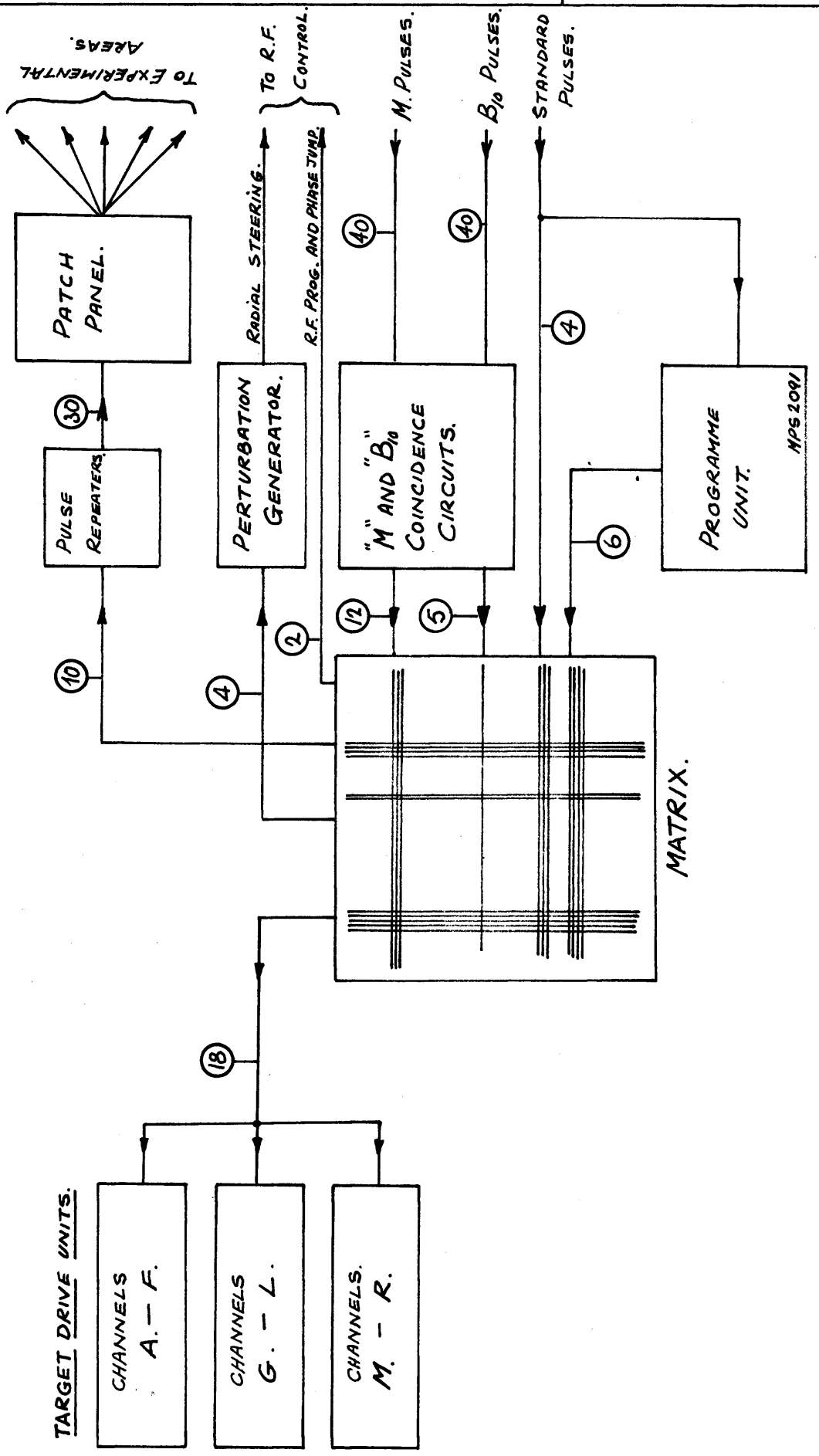
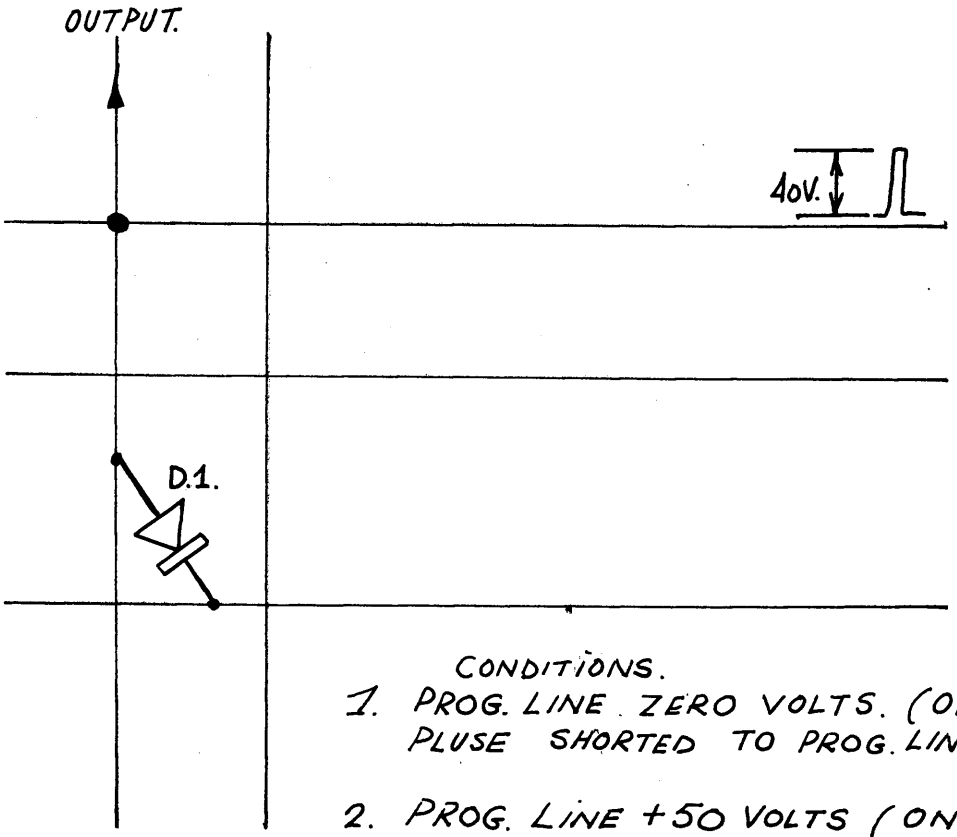


FIG 1.

CERN- GENÈVE	ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH	Page
Objet: Subject: DIODE GATE.	Nom - Name. BROOKS.	DATE: 13. 7. 61.



CONDITIONS.

1. PROG. LINE ZERO VOLTS. (OFF).
   PLUSE SHORTED TO PROG. LINE NO OUTPUT.

2. PROG. LINE +50 VOLTS (ON).
   DIODE REVERSE BIASED PULSE GOES OUT.

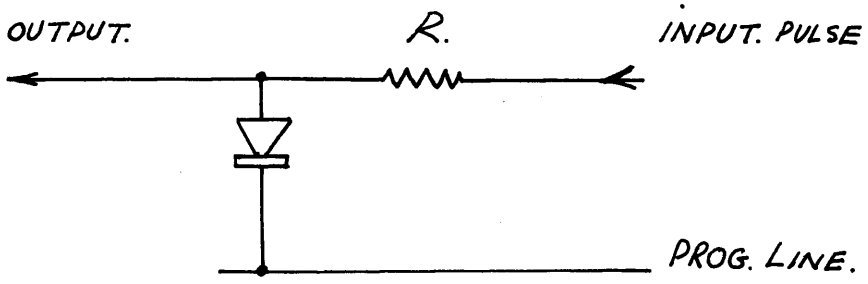


FIG. 2.

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Objet: Subject: TARGET PROGRAMME EXAMPLES	Nom - Name - BROOKS.	DATE: 13.7.61.

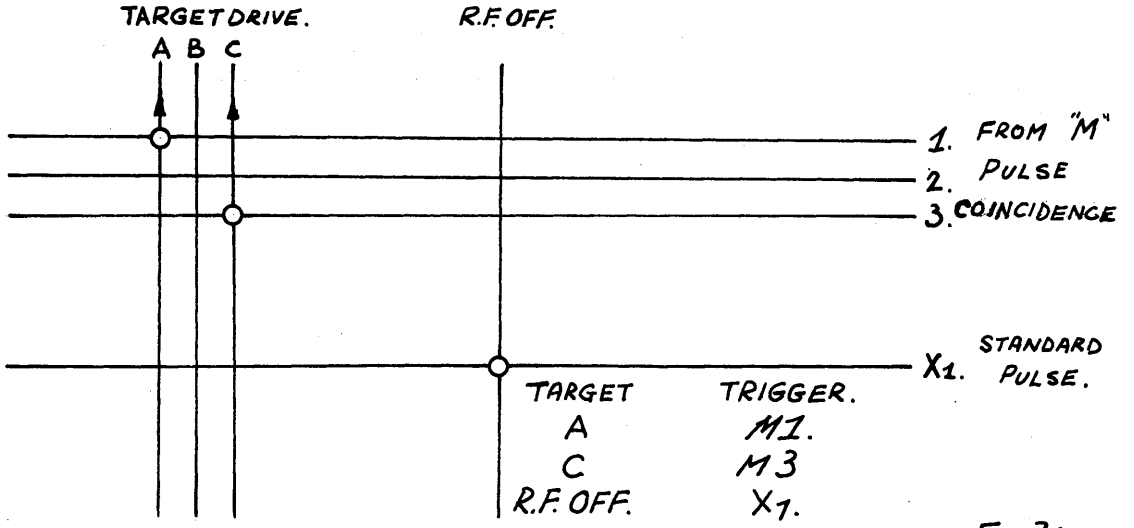

FIG 3A

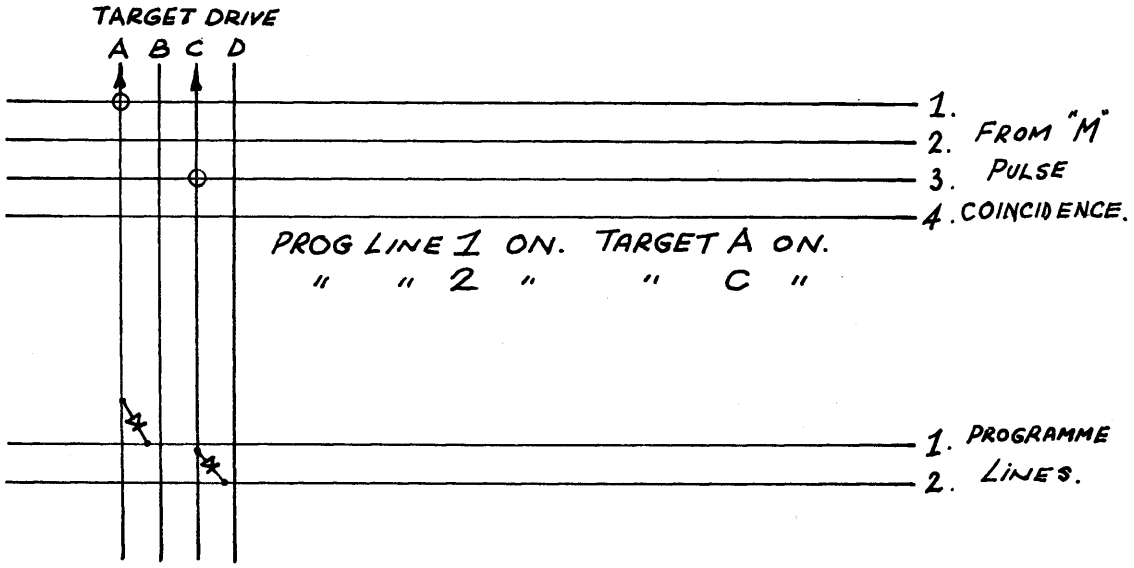

FIG 3b

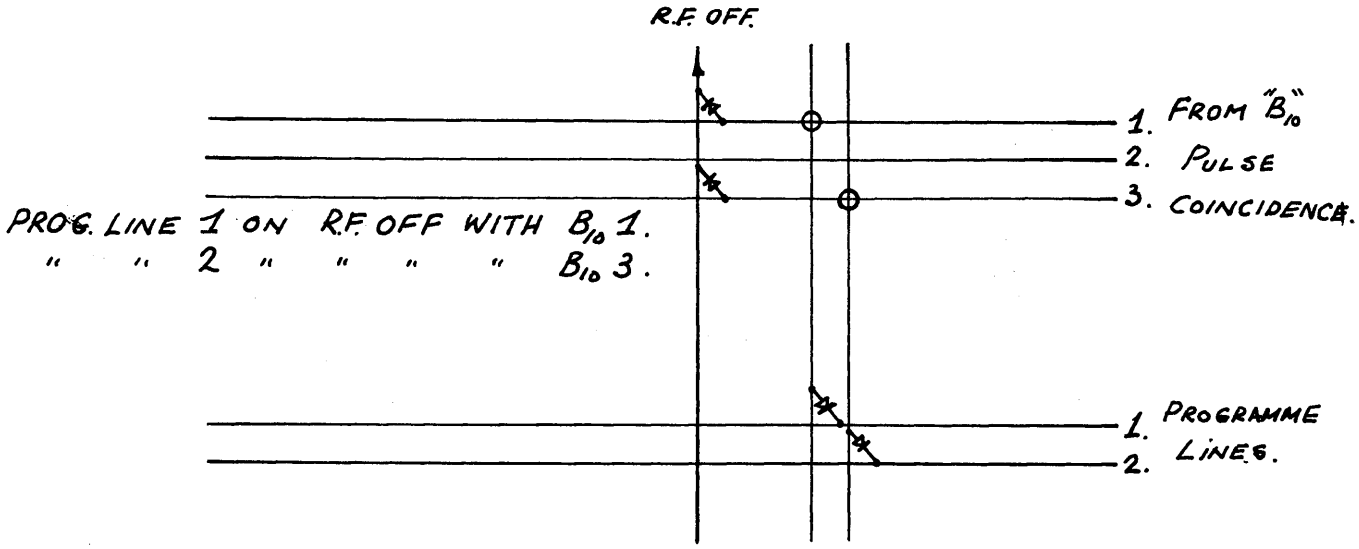

FIG 3c