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ELECTRONIC COUNTING OF BIRDS

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1. The determination of bird DENSITIES has been performed in Denmark by a PHOTOGRAPHIC SYSTEM since 1968. The exposure time, of the polaroid films used, is normally 15 minutes. Birds are presented as thin characteristic lines on the polaroid photos. The amount of lines inside a specific area gives the bird DENSITY. A scale from zero to eight, for increasing densities, is used. (This scale follows a square law).

The PHOTOGRAPHIC SYSTEM (Fig. 1.) has many disadvantages (parameter variations), some will be mentioned here:

- a. Loss of information in the video processing.
- b. Type of radar indicator, calibration etc.
- c. The photographic processing.
- d. Density variations, when judged by different persons.

2. Because of the above mentioned disadvantages, Denmark in 1971 started to experiment with an ELECTRONIC COUNTING SYSTEM, the goals of which were to get a more reliable, more accurate, faster and cheaper bird warning system.

The fundamental principles of this system are based on the following:

- a. Knowing that a radar only can distinguish echoes (objects) which are separated a certain minimum distance in range and azimuth (and for some radars in elevation) one will find, that inside a fixed volume of space all objects are reproduced as one single echo. This volume of space is called a RESOLUTION CELL, the size of which depends on the pulse-width, the horizontal- and vertical beamwidth of the radar and not to forget the distance from the radar.
- b. Knowing the specifications of the radar used one will find, that an echo from one RESOLUTION CELL can be composed of few big birds or many small ones. Unfortunately the radar cannot tell which is the case. The amplitude of the received signal (amount of energy) is proportional to the total mass of the objects inside the RESOLUTION CELL (INTERCOM) and therefore the threat of damage to an airplane can be entirely different from case to case. In general it can be assumed that a bird echo, of a certain received power, will not indicate that the echo has been composed. From a FORWARD VIEW point of view the quantities of resolution cells, within a certain volume of space, (AZIMUTH, in elevation) depend, because an airplane has to pass through a lot of resolution cells within a short period of time.

3. The ELECTRONIC COUNTING SYSTEM also is able to give information about the percentage of unoccupied RESOLUTION CELLS inside a specified area. (Actually it can not give the possible remaining time, inside the specified area, bird echo has remained).

Information about the received signal (amount of energy) from one or more specific resolution cells is possible simply by introducing a sophisticated attenuator in the receiver scale, by this we are approaching the eyeball test (Mr. J. Jørgensen) used in the AMERICAN F-105 case.

Looking at Fig. 2, the basic schematic of an ELECTRONIC COUNTING SYSTEM with some logic systems can be seen, it is not obvious that:

- a. The FORWARD VIEW does in fact not tell the amount of unoccupied resolution cells, but in how much of the possible resolving time, inside the azimuth and range cone, echoes are received.
(See APPENDIX 1 & 2)

THE PHOTOGRAPHIC SYSTEM

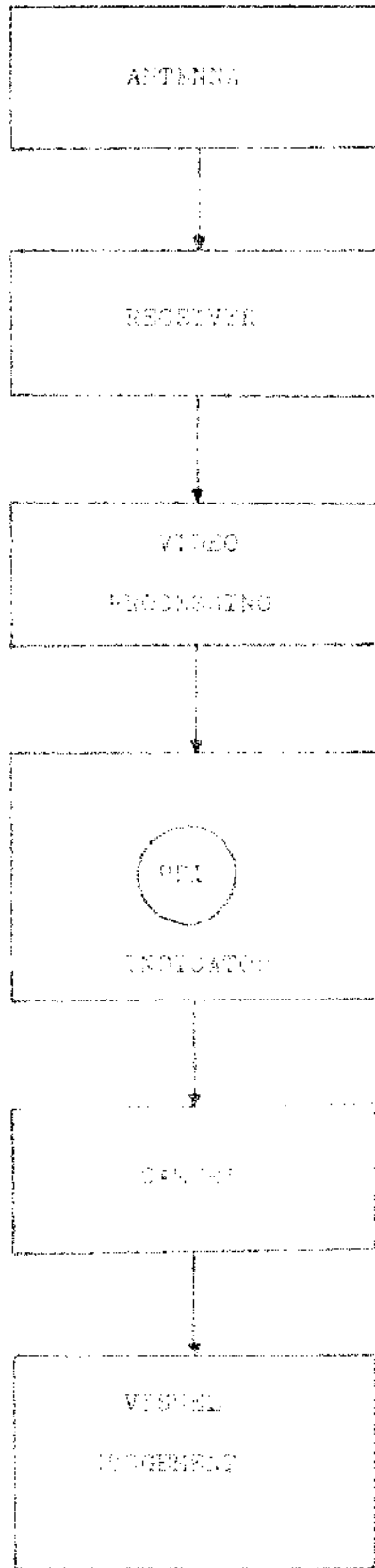


FIG. 1.

"ADVANCED" ELECTRONIC COUNTING SYSTEM

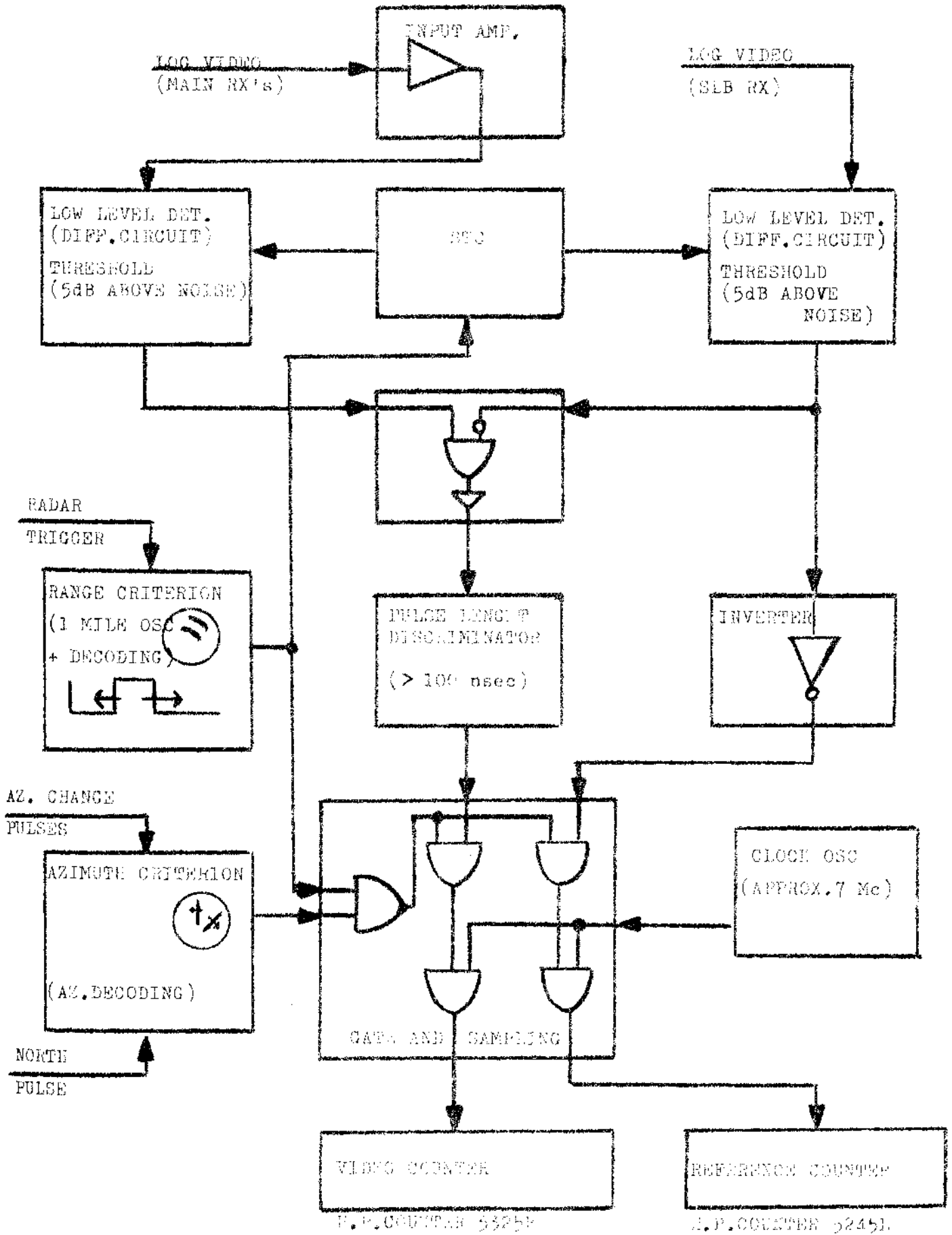
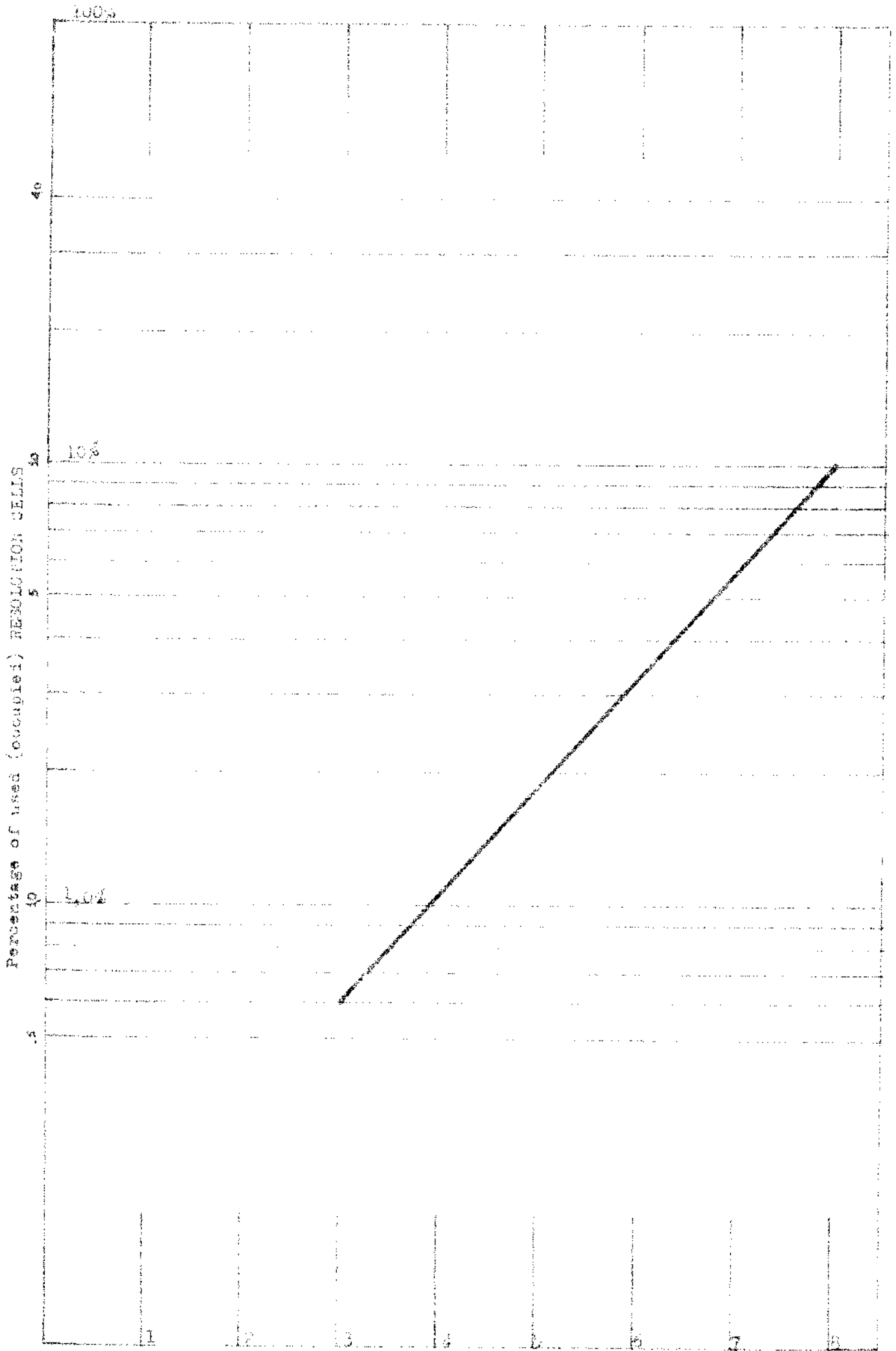


FIG. 2.



DENSITY, from the PHOTOGRAPHIC SYSTEM
 FIG. 3.