ANALOGUE SWITCHING
CROSS-BAR

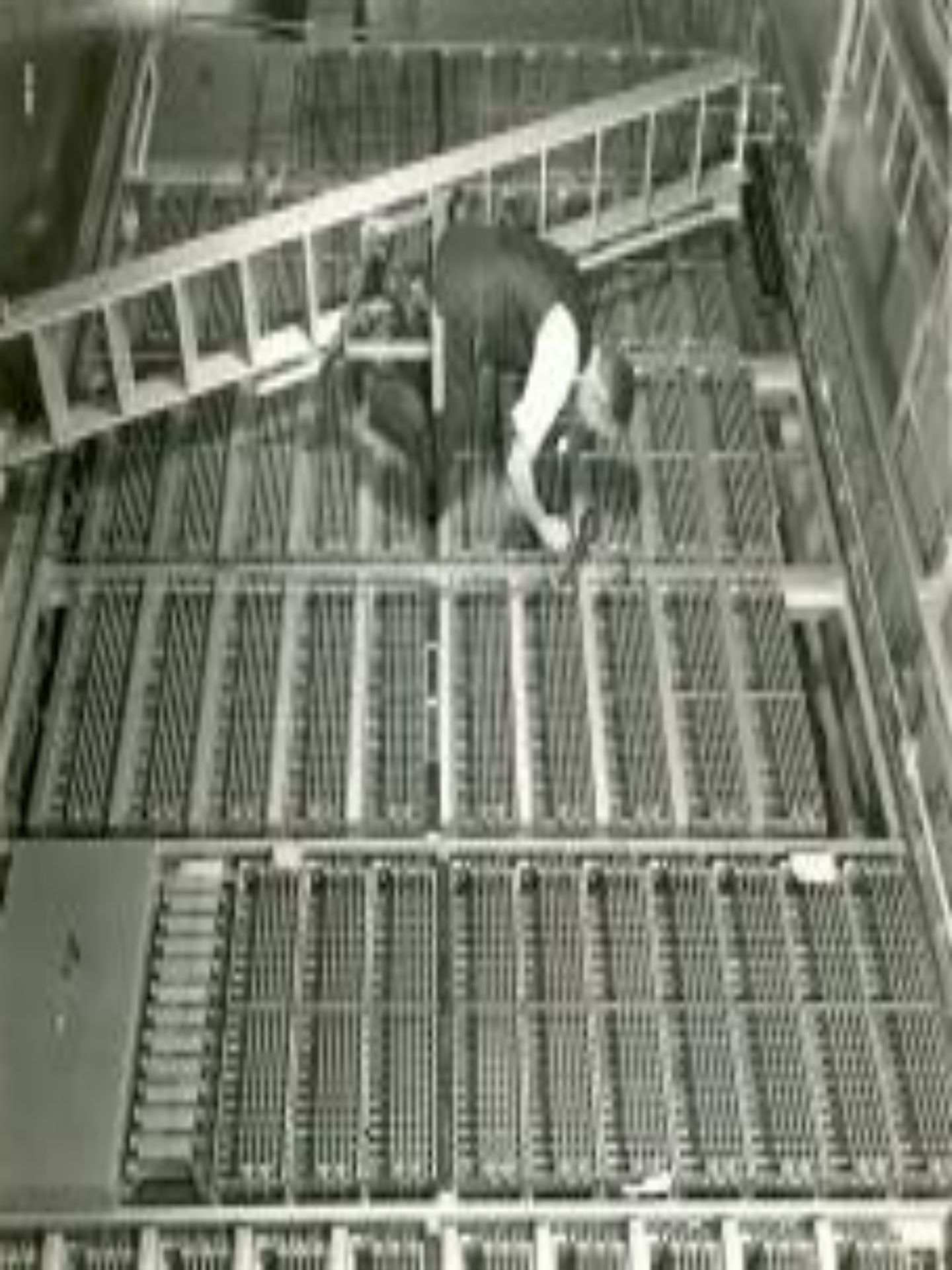
Monday 19 September 2016

HISTORY OF CROSS-BAR EXCHANGES

1. **1915:** Bell company Western Electric's "coordinate selector“

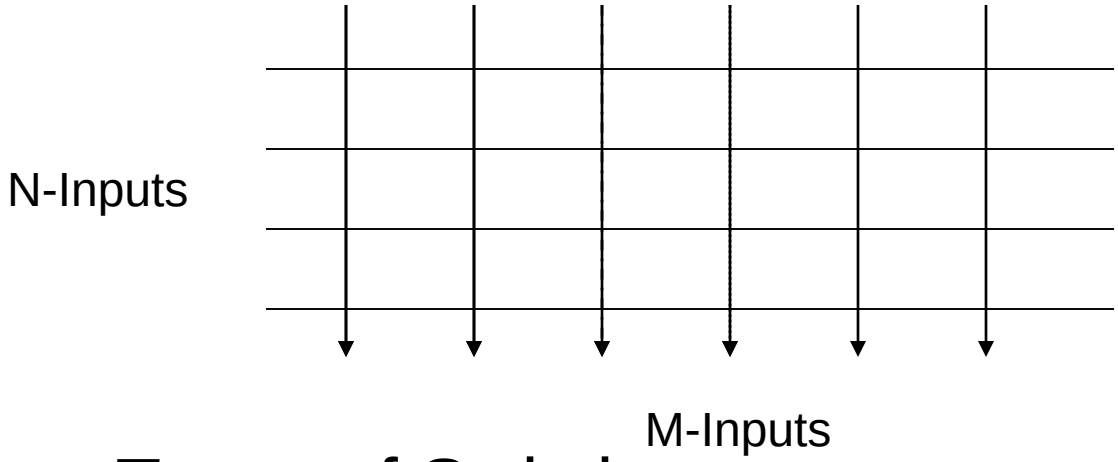
2. **1919:** Swedish governmental agency designs cross-bar based Gotthilf Betulander design.

3. **1938:** AT&T's 1XB crossbar exchanges developed by Bell Telephone Labs.



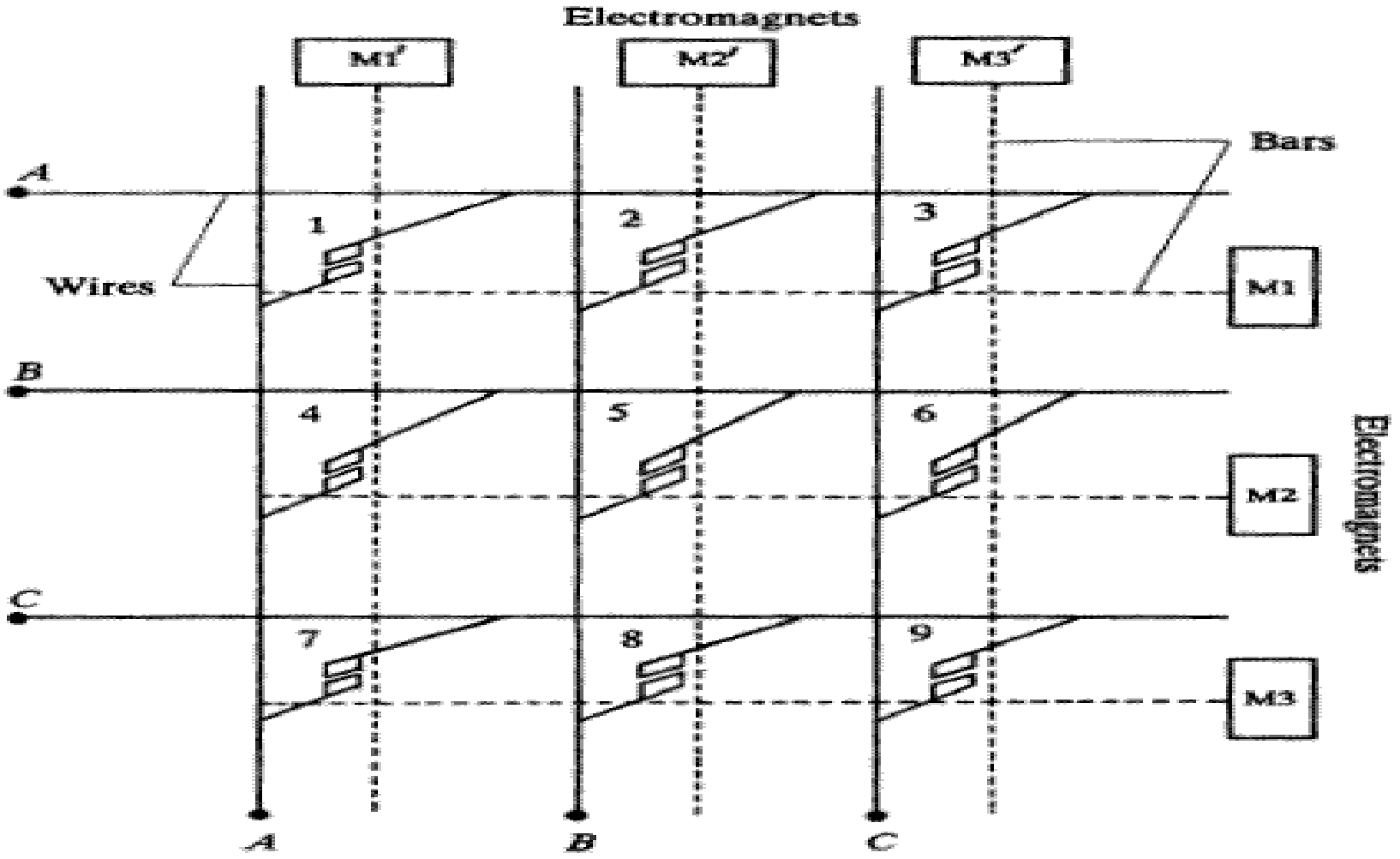
GENERAL DEFINITION

- A switch connecting multiple inputs to multiple outputs in a matrix manner.

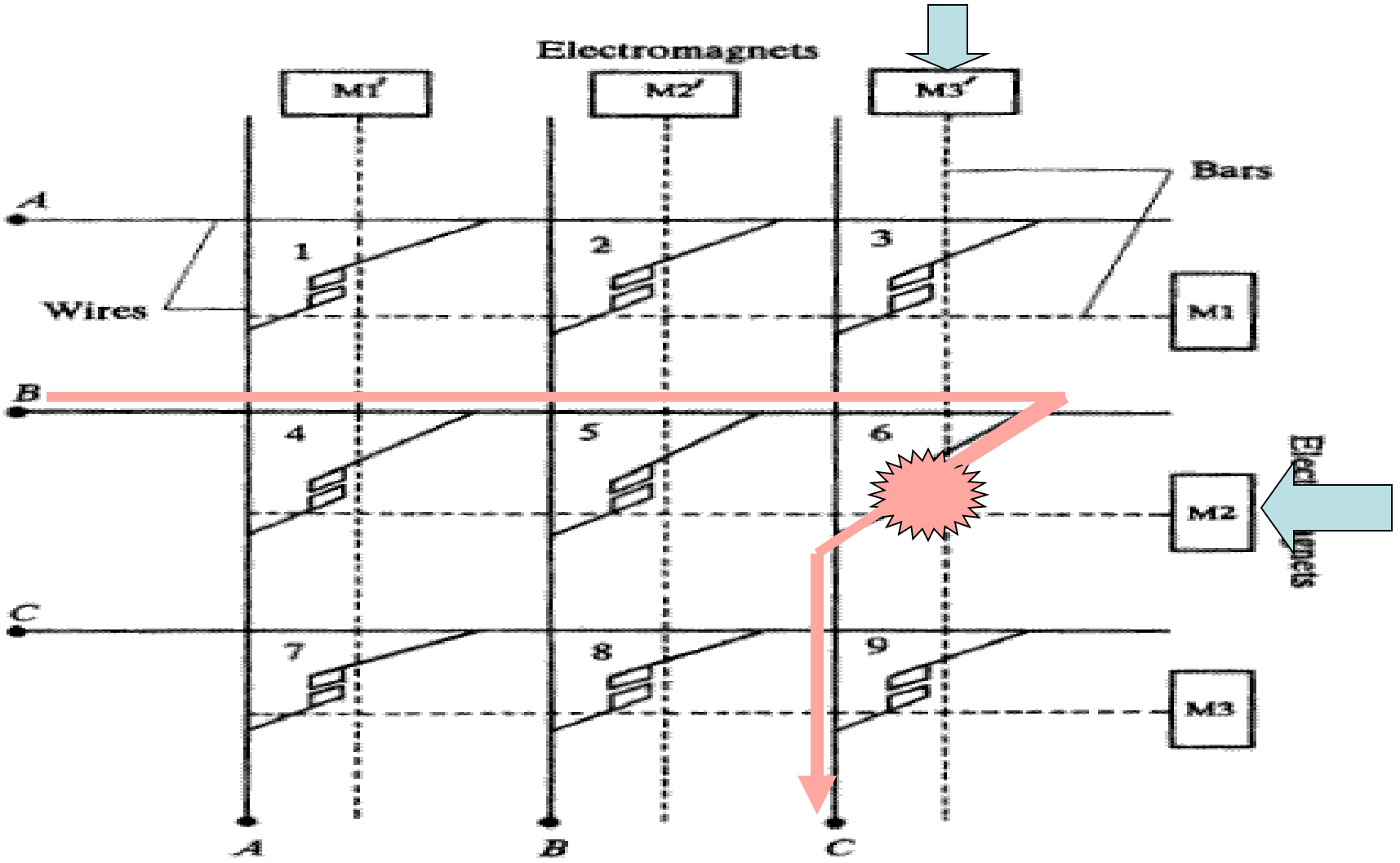


- Other Types of Switches:
  - Rotating Switch
  - Memory Switch

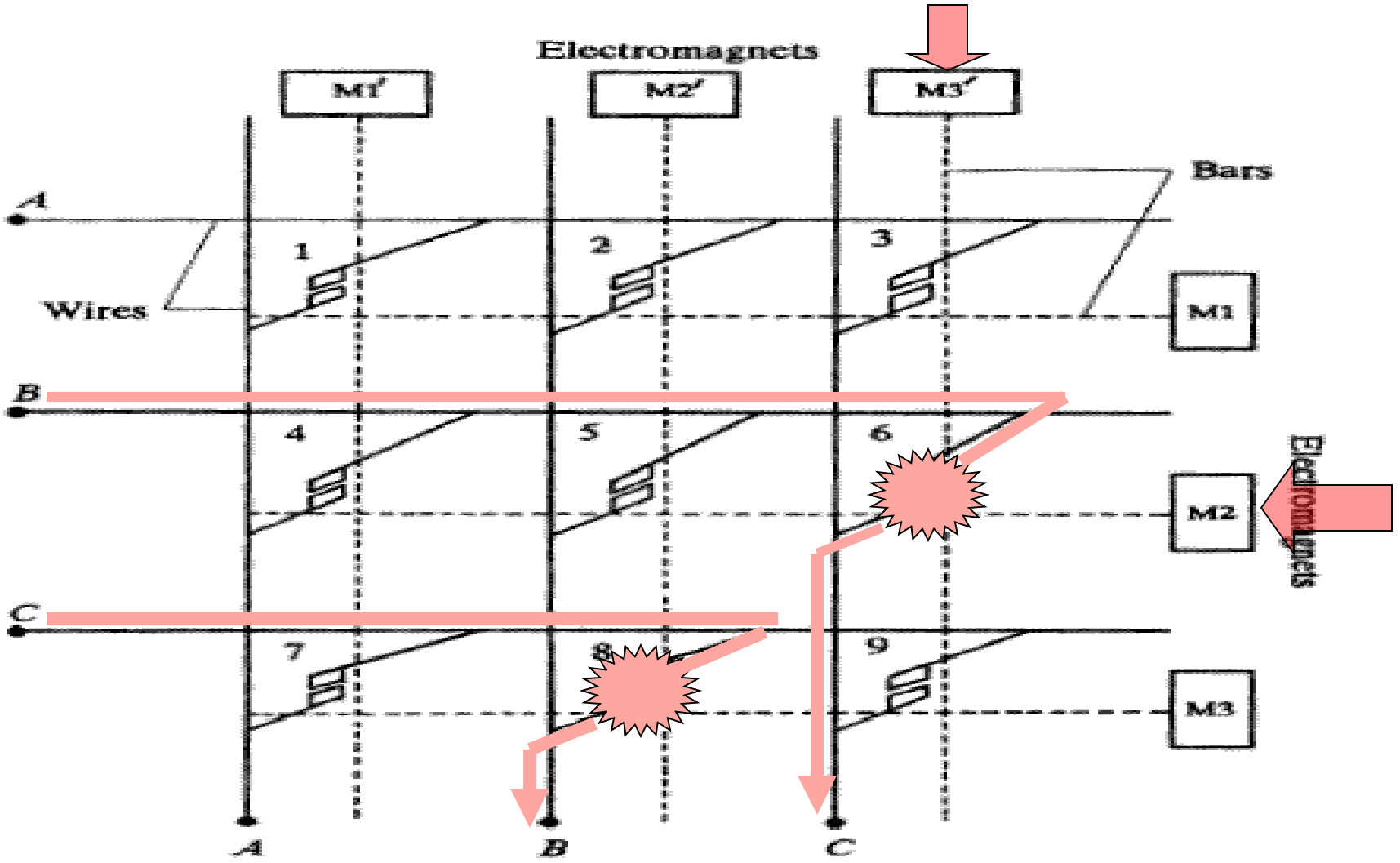
3X3 CROSSBAR SWITCH(1)



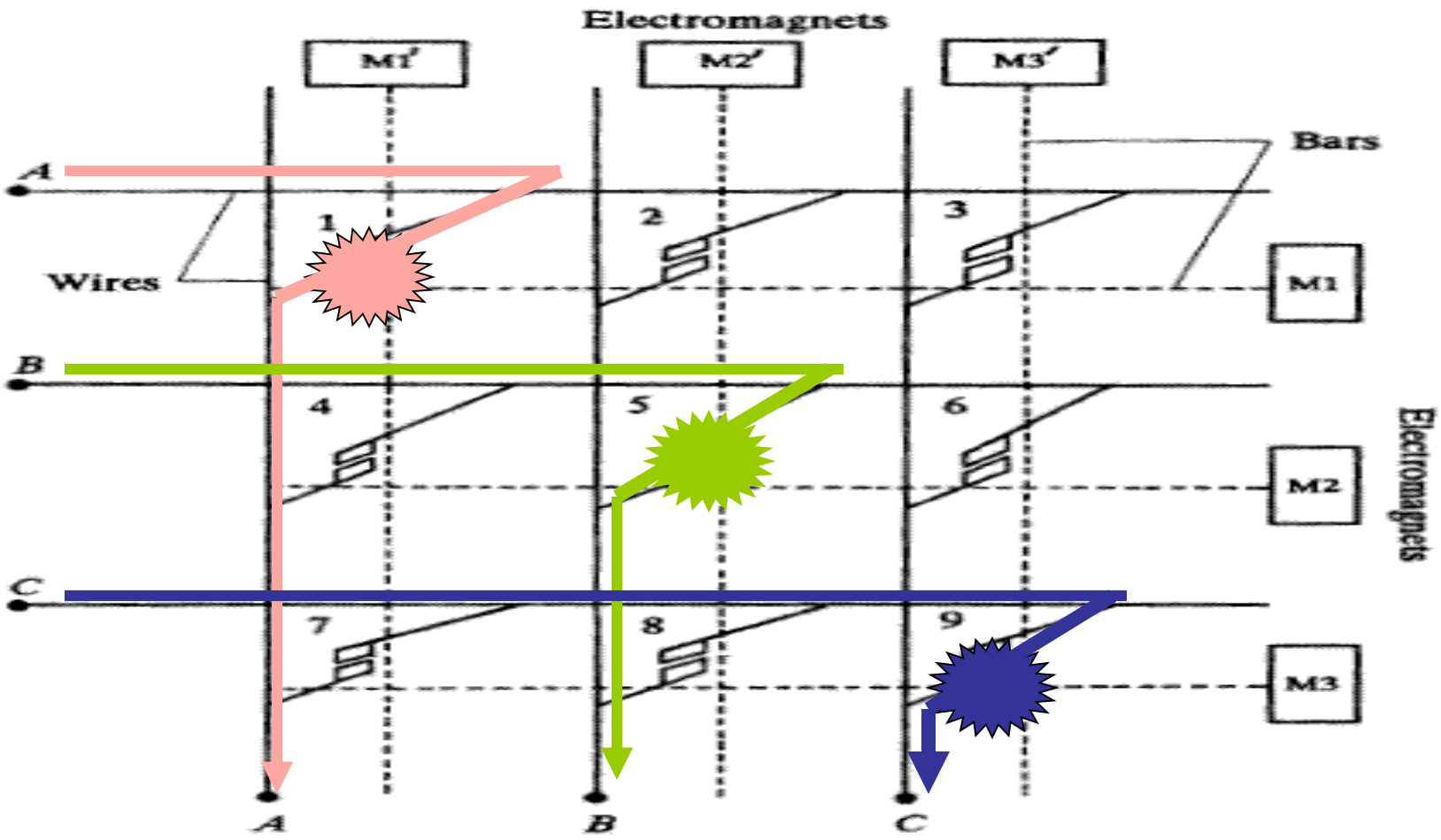
3X3 CROSSBAR SWITCH(2)



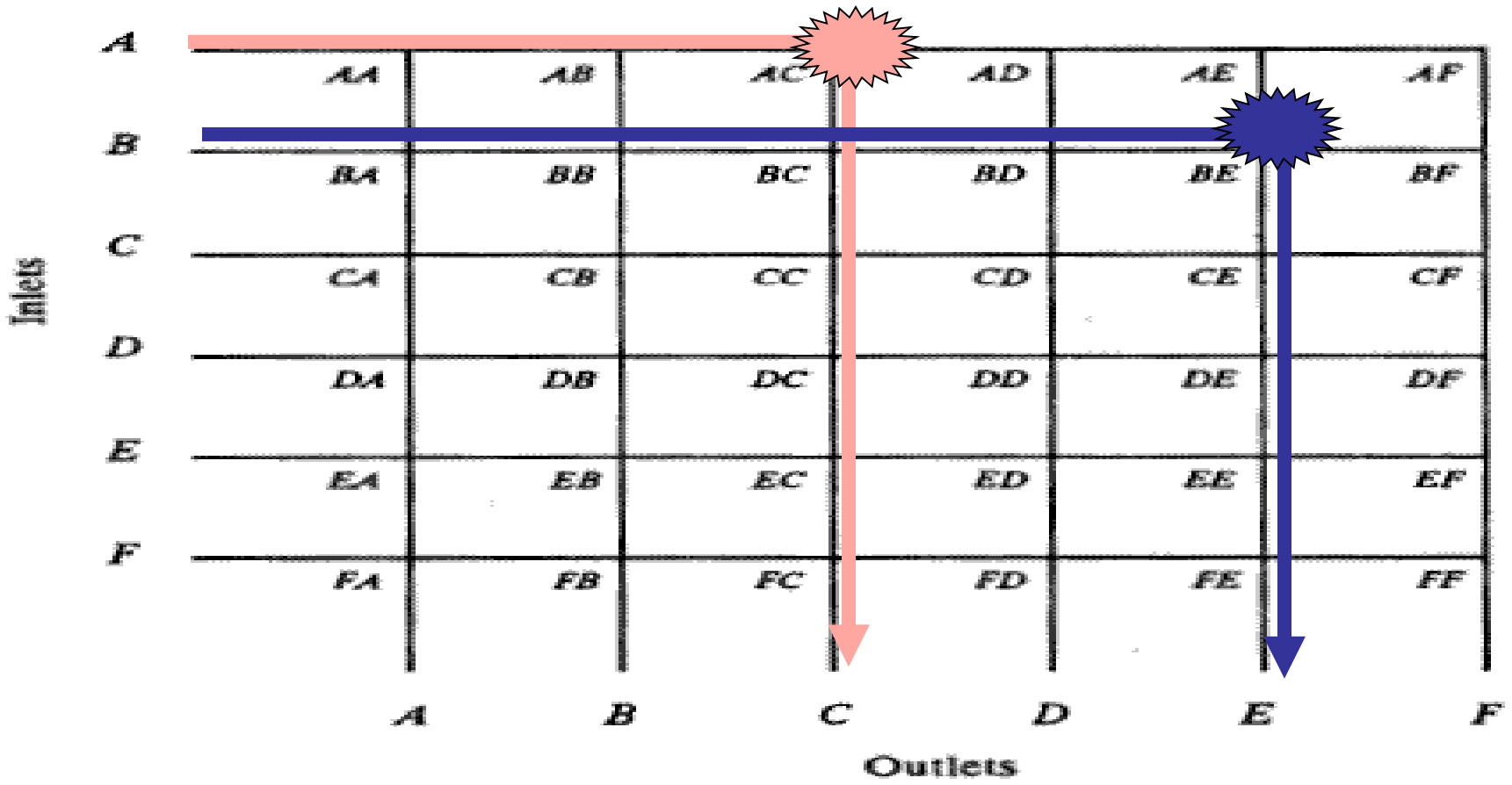
3X3 CROSSBAR SWITCH(3)



3X3 CROSSBAR SWITCH(4)



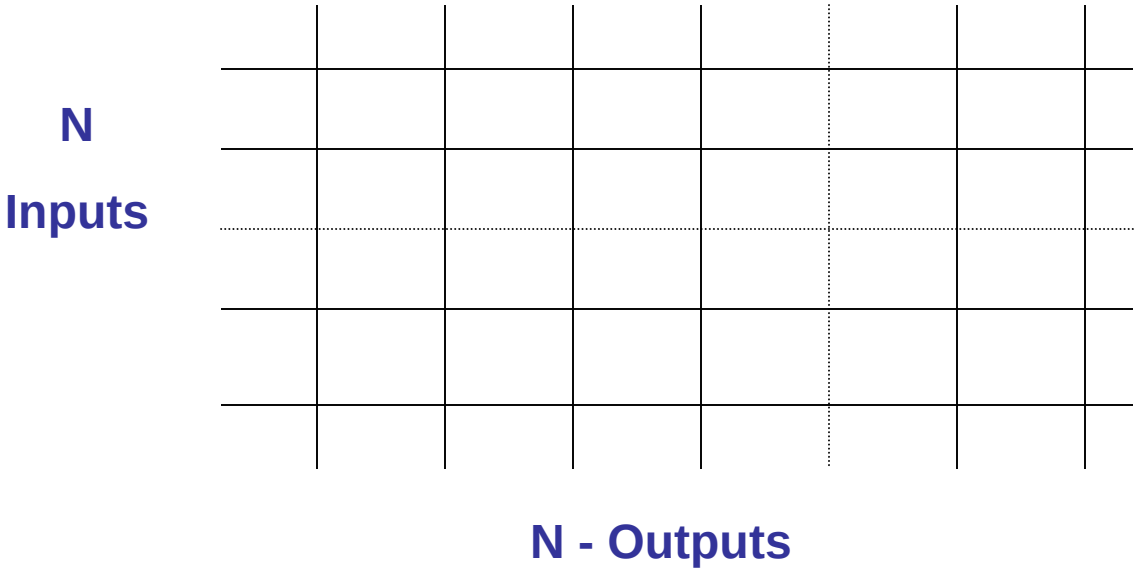
6X6 CROSSBAR SWITCH



Activation Sequence:

1. Energize Horizontal Bar
2. Energize Vertical Bar
3. De-Energize Horizontal Bar

NON-BLOCKING X-BAR



A non-blocking cross-bar switch has the following parameters:

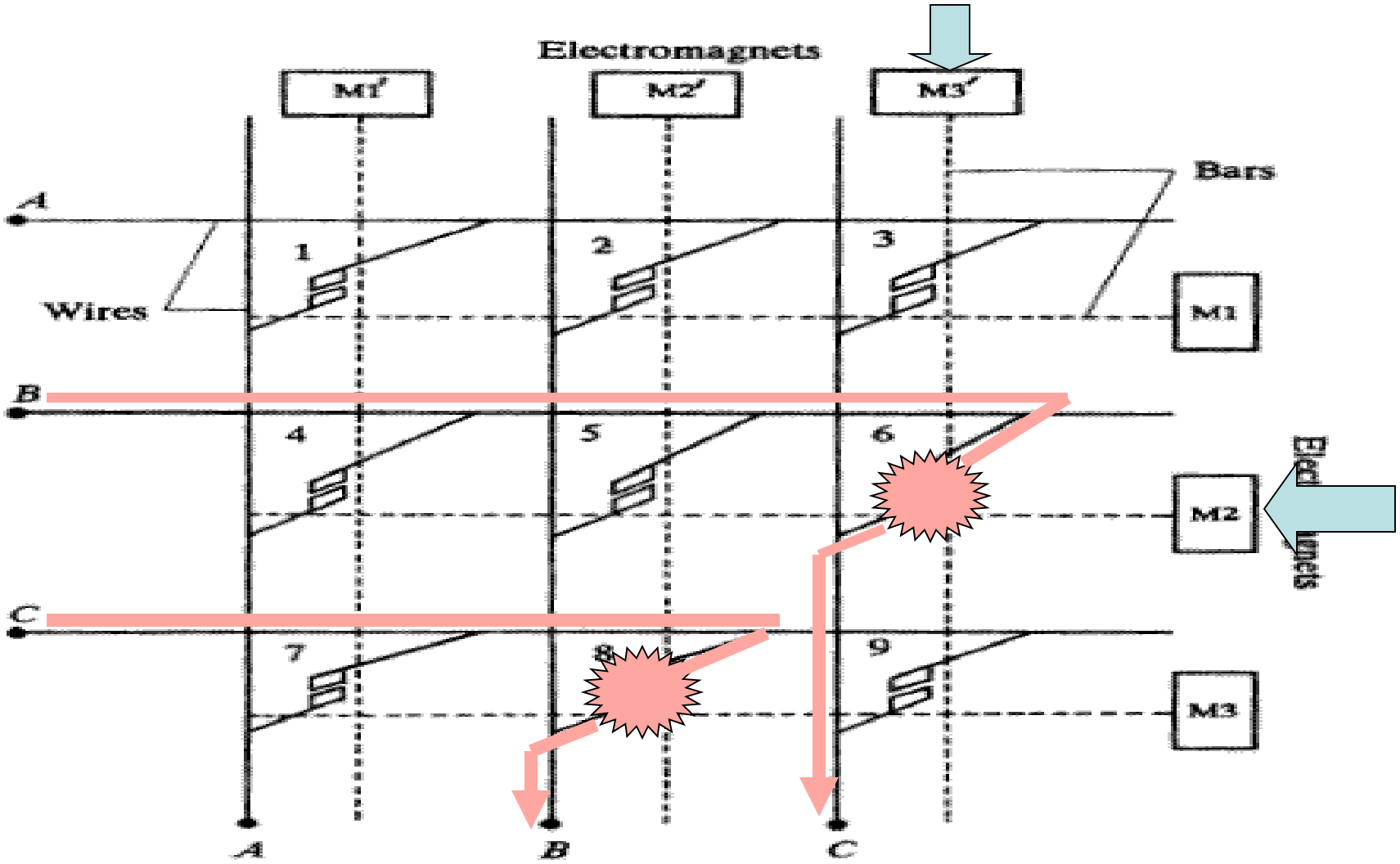
a) Number of Switches - N^2

b) Number of Connections – N/2

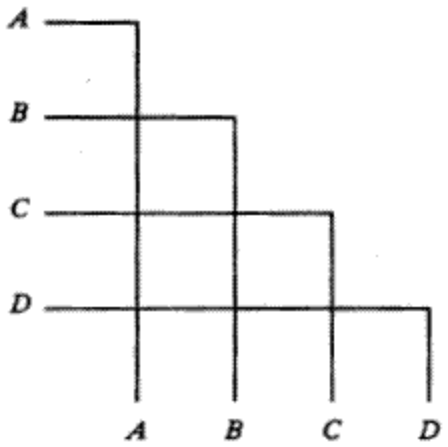
COST -CAPACITY

Number of Subscribers	Switches	Switch Capacity	EUF (Capacity/Switches)
4	16	2	0.125
16	256	8	0.03125
64	4,096	32	0.0078125
128	16,384	64	0.00390625

DIAGONAL CONNECTION X-BAR(1)



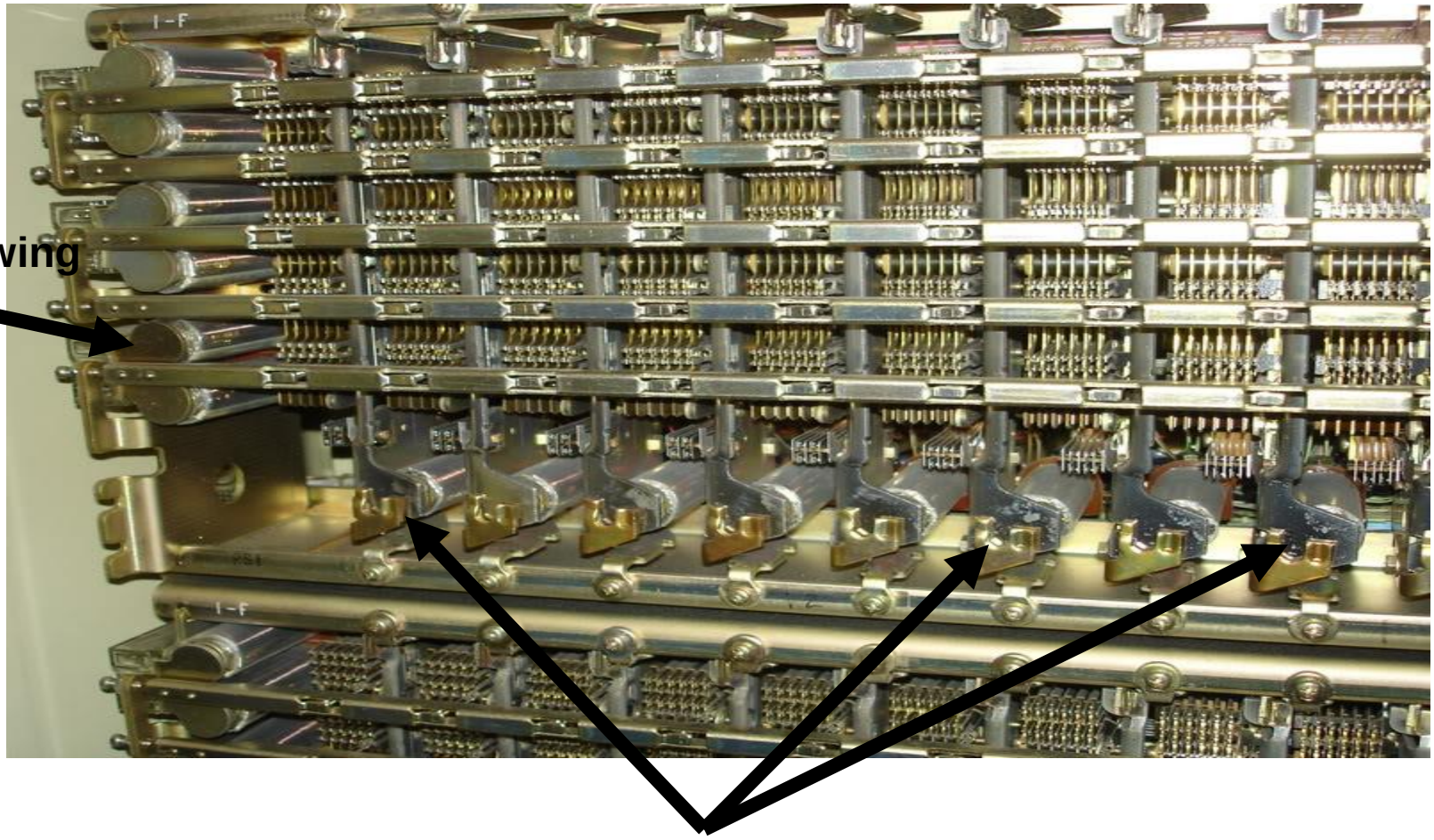
DIAGONAL CONNECTION X-BAR(2)



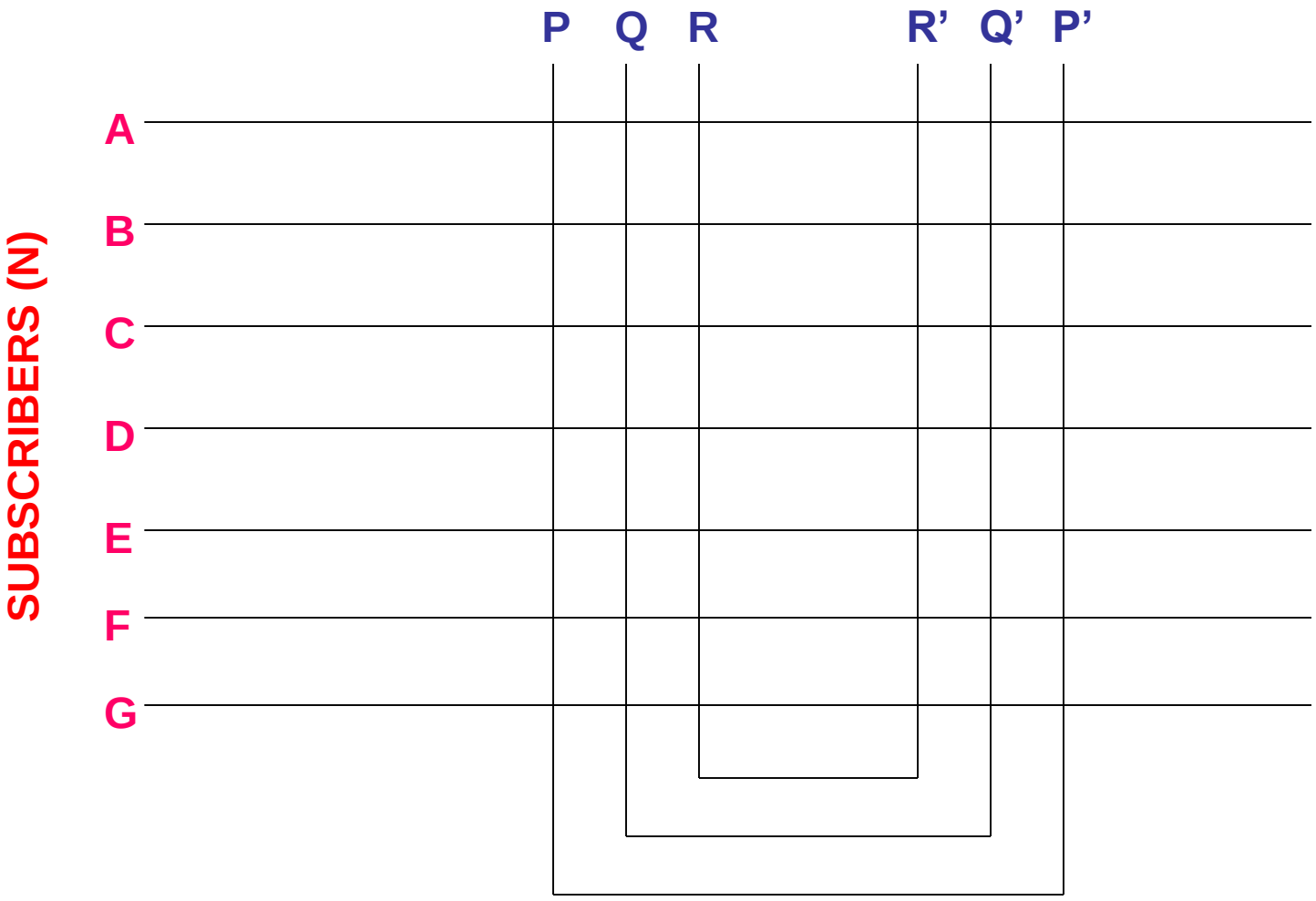
Number of Cross-points = N(N-1)/2

N	SW-XBAR	SW-DIAGONAL X-BAR
4	16	6
16	256	120
64	4,096	2,016
128	16,384	8,128

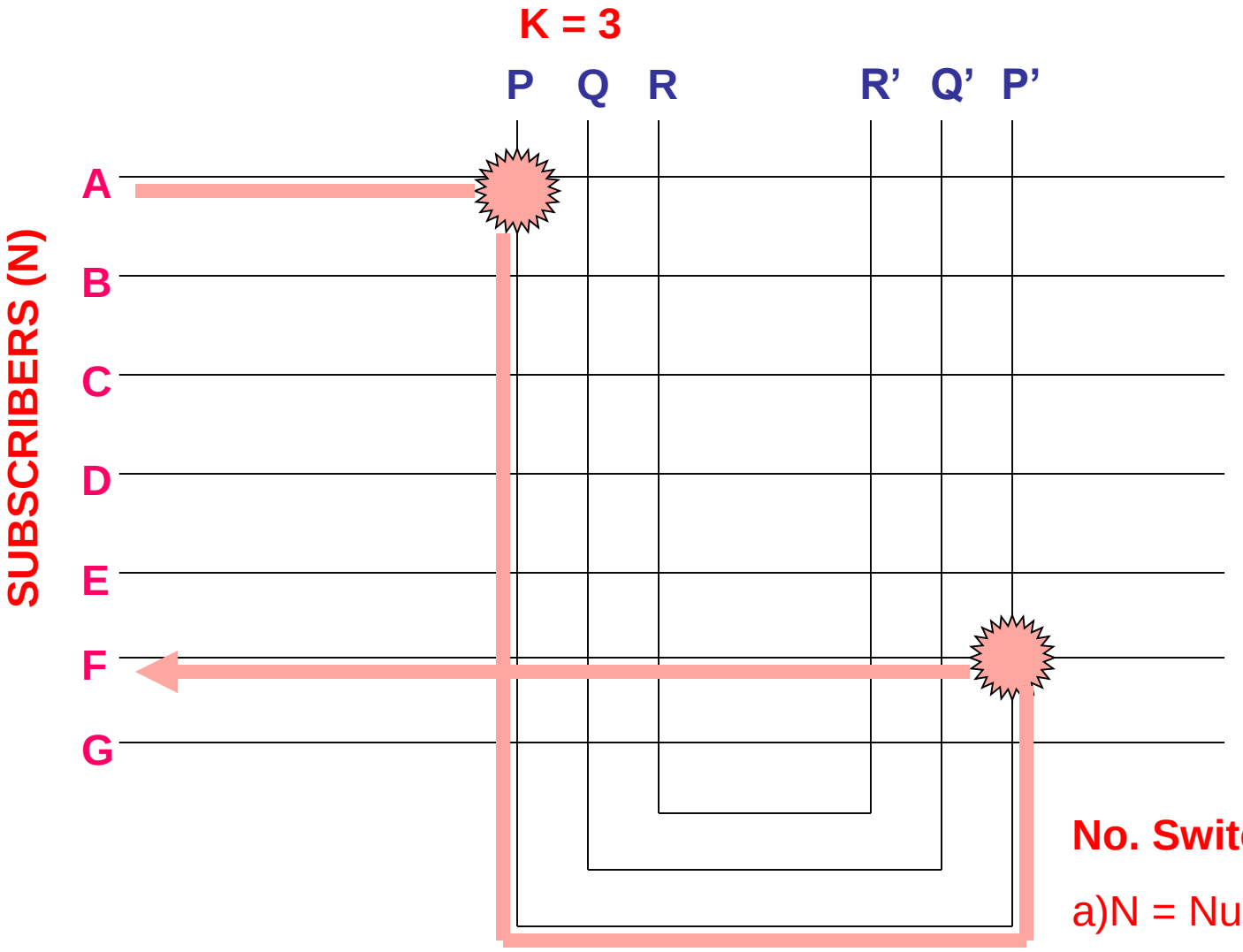
DOUBLE-SWING HORIZONTAL SWITCH BARS



BLOCKING CROSS-BAR (1)



BLOCKING CROSS-BAR (2)

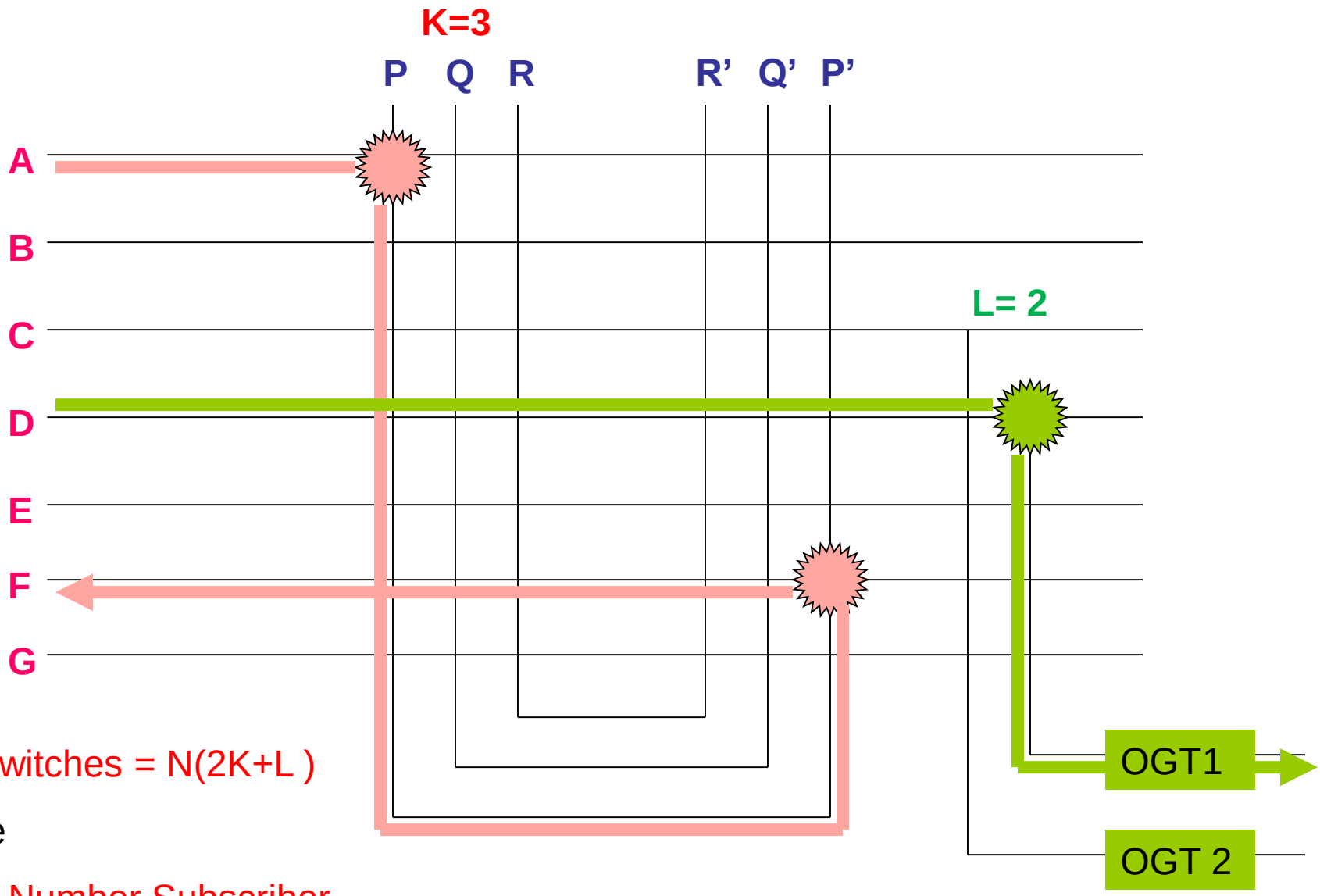


No. Switches = 2NK where:

a)N = Number Subscriber

b)K = Max No. of Connections

BLOCKING CROSS-BAR WITH TRANSFER LINES



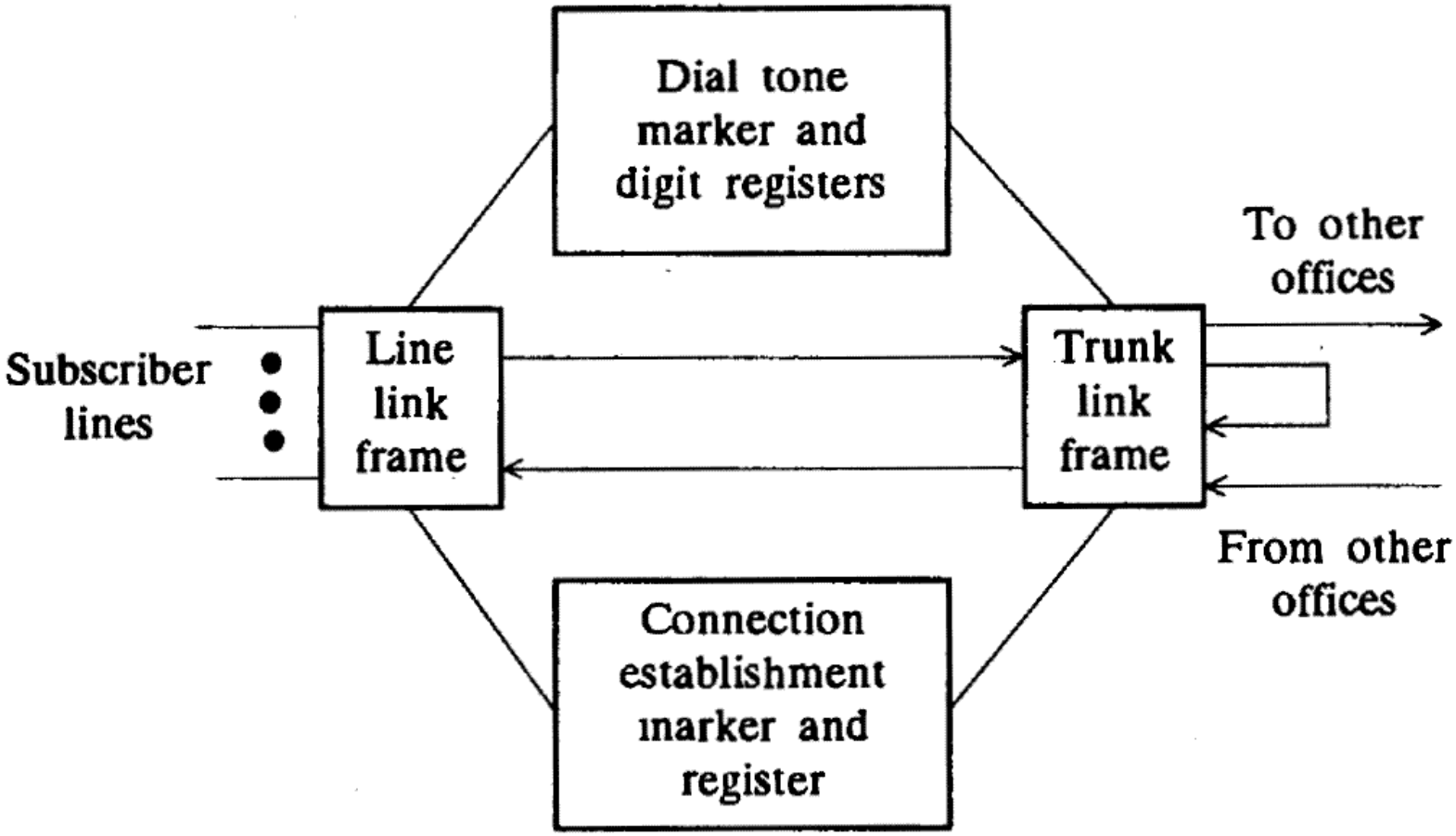
No. Switches = N(2K+L)

where

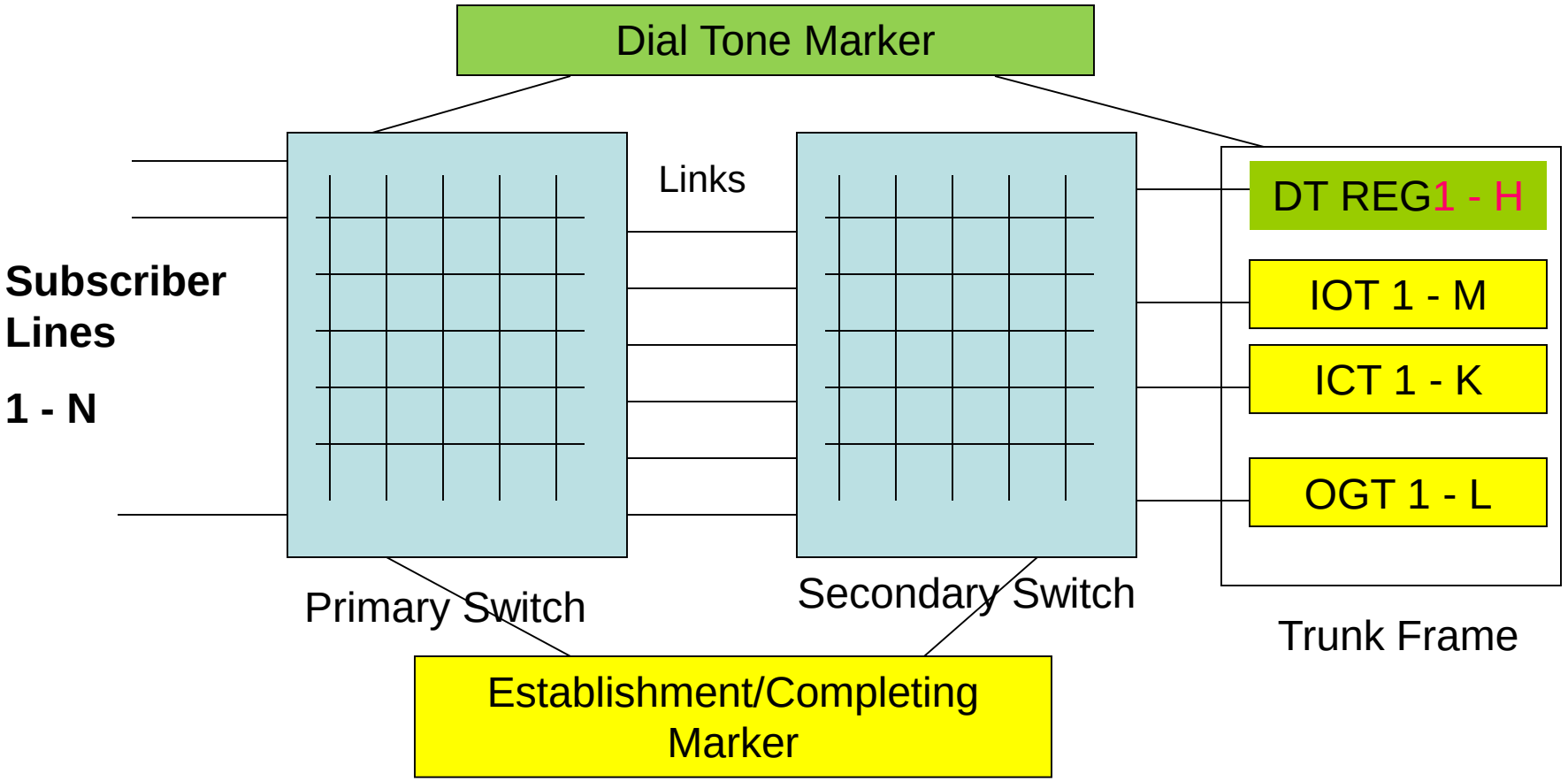
a)N = Number Subscriber

b)K = Max No. of Local Connections

CROSS-BAR EXCHANGE ORGANIZATION (2)



CROSS-BAR EXCHANGE ORGANIZATION (1)



LOCAL SIGNALLING

Sunday, September 25, 2016

TYPES OF SIGNALLING

There are two types of signaling in telephone networks:

1.Local Loop signaling which includes:

a) Exchange of dialed Numbers,

b) Dial Tone,

c) Ringing Current,

d) Busy Tone,

e) Number Unobtainable (NU) Tone;

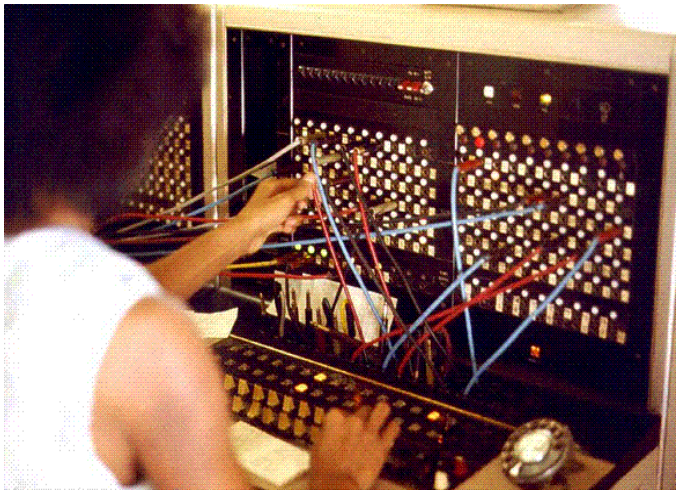
f) Synthesized voice announcements

2. **Inter-exchange signaling,** i.e passing of control information between different exchanges.

3. **Intra-exchange** i.e passing of information between different subsystems of a telephone exchange.

ORIGINS OF SIGNALLING: FIVE SIGNALLING FUNCTIONS BY OPERATOR

Before the advent of automatic exchanges, human telephone operators performed the following signaling functions:



1. Respond to the calling subscriber to obtain the identification of the called party.
2. Inform the calling subscriber that the call is being established.
3. Ring the bell of the called party.
4. Inform the calling subscriber, if the called party is busy.
5. Inform the calling subscriber, if the called party line is not obtainable for some reason.

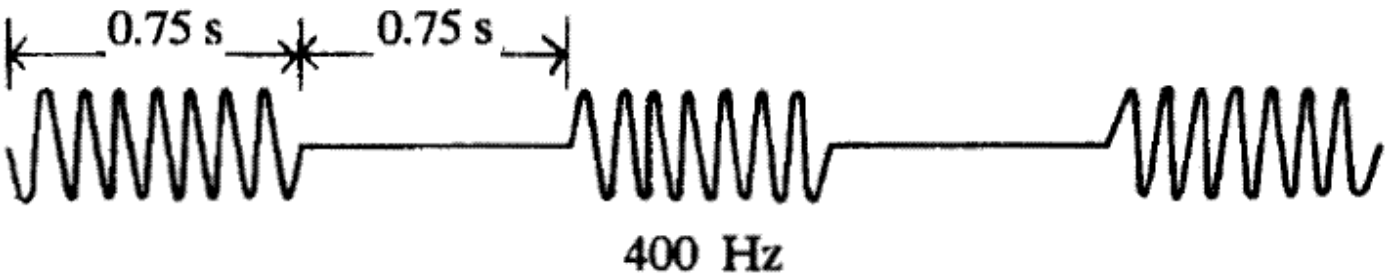
DIAL TONE

33 or 50 or 400 Hz continuous

1. Indicates that the exchange is ready to accept dialled digits from the subscriber.
2. The subscriber should start dialling only after hearing the dial tone.
3. Else, initial dial pulses may be missed by the exchange which may result in the call landing on a wrong number or exchange timing out

BUSY TONE

Busy tone is send to the dialler when the subscriber line is busy.



NUMBER UNOBTAINABLE

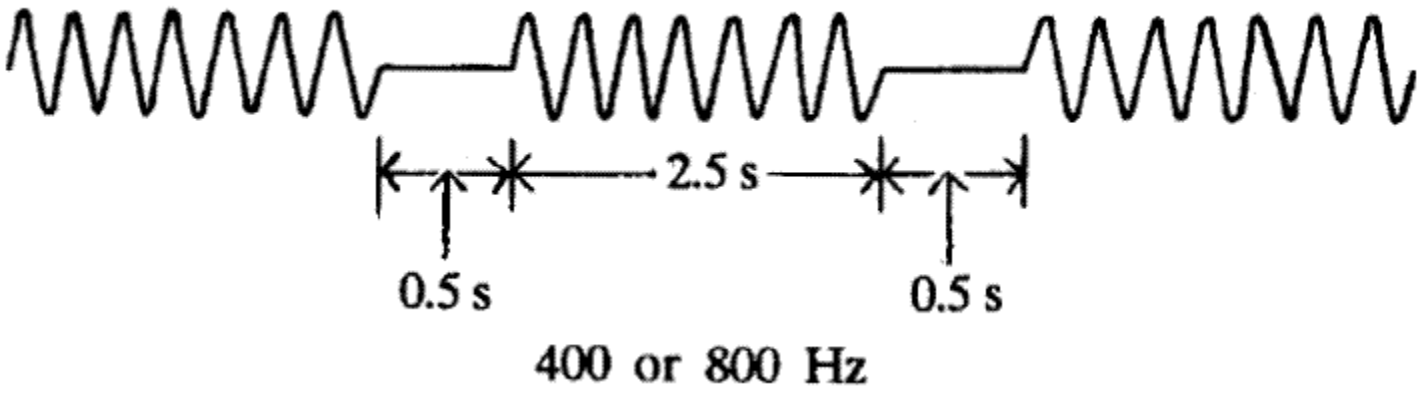
Number un-obtainable is send to the dialler when the number he has dialled is not in the valid, i.e, disconnected or not registered.

400 Hz continuous

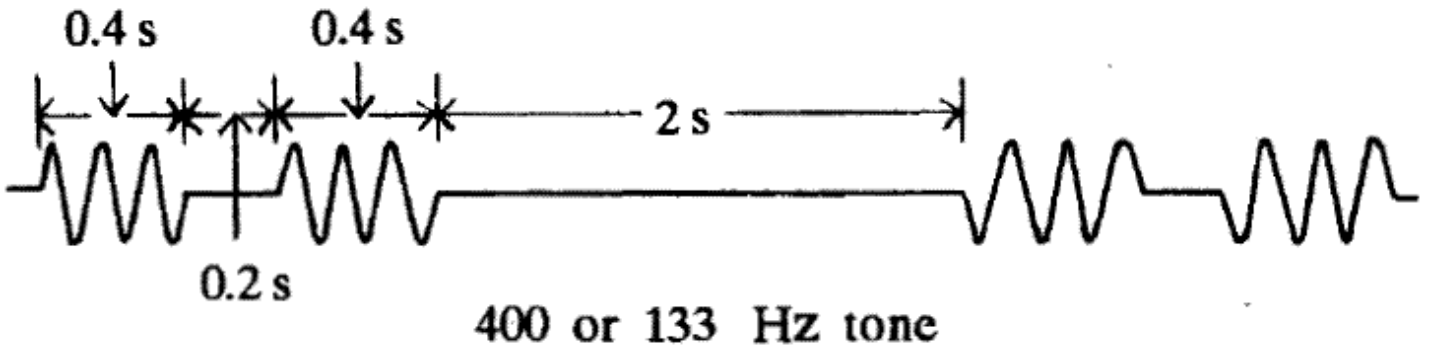
ROUTING TONE OR CALL-IN-PROGRESS TONE

1. Some exchanges used to send this tine to the dialler when the call was in progress of being connected.

2. With increased speed of telephone exchanges. This feature has been discontinued.



RINGING TONE



- As the ringing current is transmitted to the called subscribe, the control equipment sends out a ringing tone to the calling subscriber

REVIEW QUESTIONS

- What are the disadvantages of in-channel signalling?
- How are the traditional local-loop signalling functions implemented in GSM?