Excitation Control System & Dynamic Brake)

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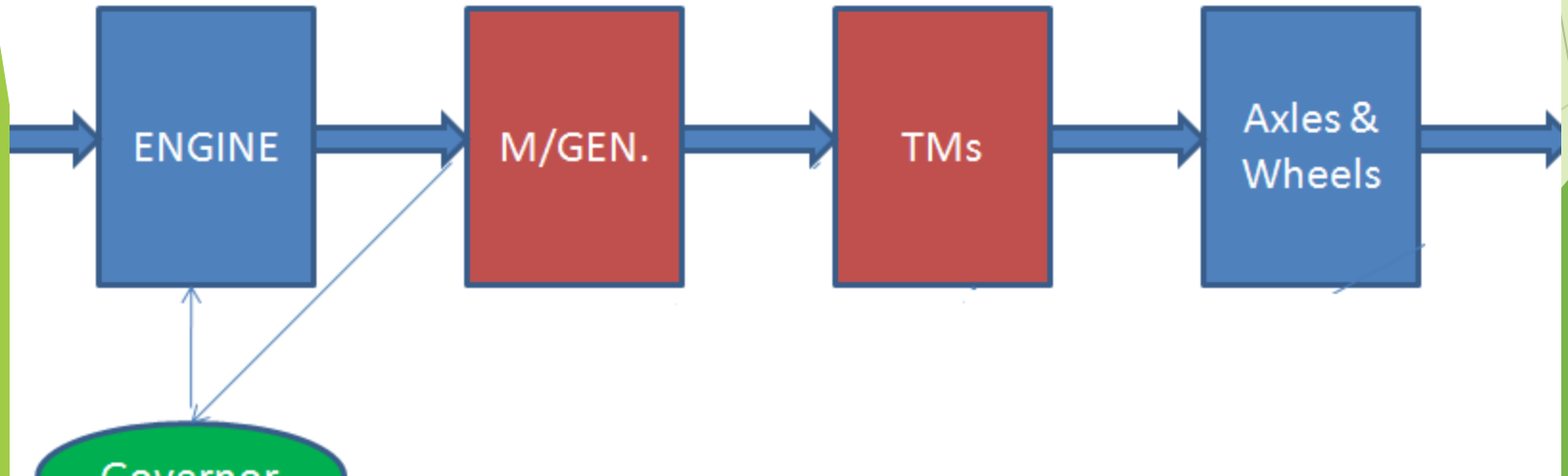
OBJECTIVE: Excitation System

- What is Electrical Transmission
- Voltage & Current limit
- constant power transmission
- Excitation Control System
- Main Components: Exciter Gen, Control Panel, Magnetic Amplifier
- Basic E –Type Excitation control System

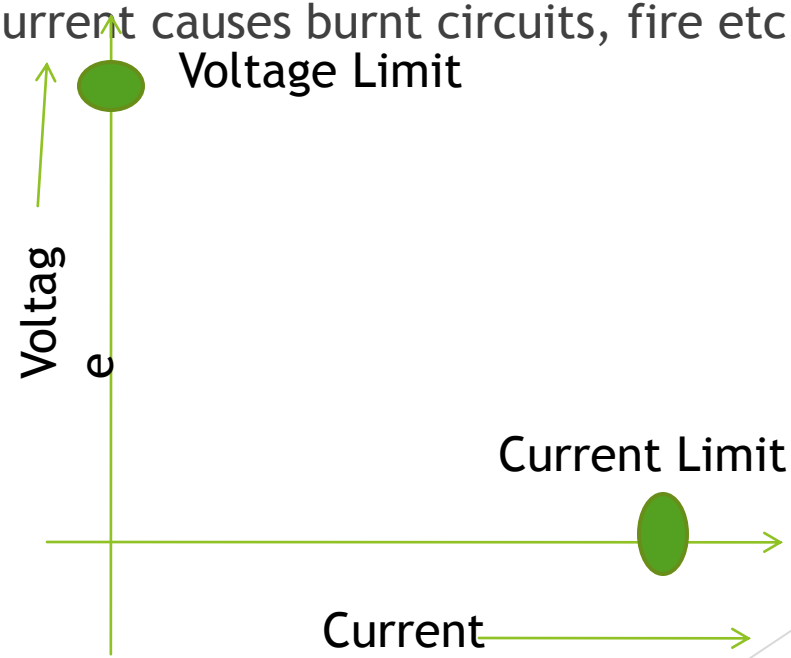
ELECTRICAL POWER TRANSMISSION -BASIC REQUREMENTS

- Voltage & Current be under limitations.
- Power transmission be constant



BASIC REQUIREMENTS- VOLTAGE & CURRENT LIMITS

- Very high voltage causes insulation break down., Flash over etc.
- Very large Current causes burnt circuits, fire etc.



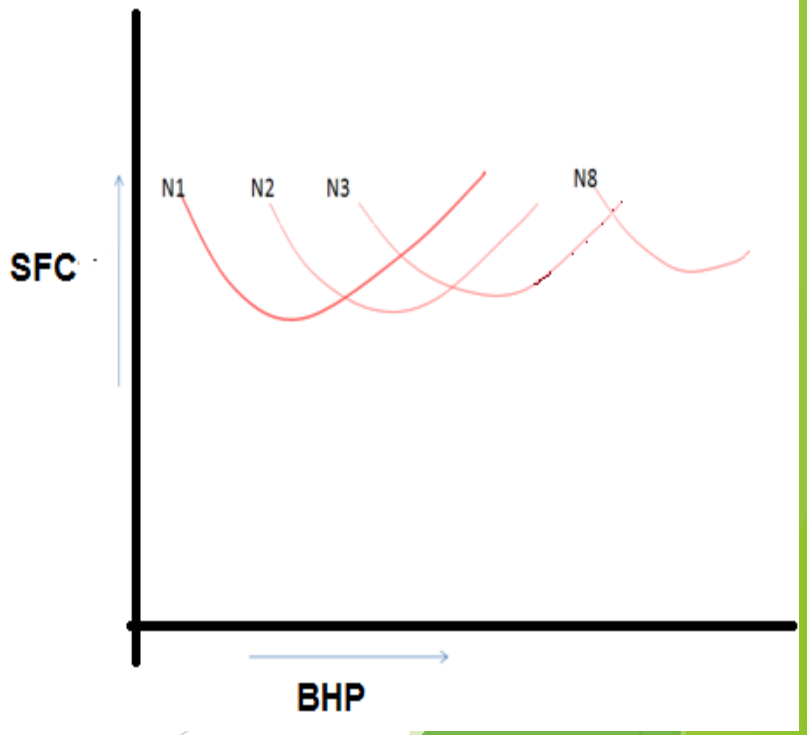
BASIC REQUIREMENTS- CONSTANT POWER TRANSMISSION

- **Means**

  P=V I=constant

- **Causes**

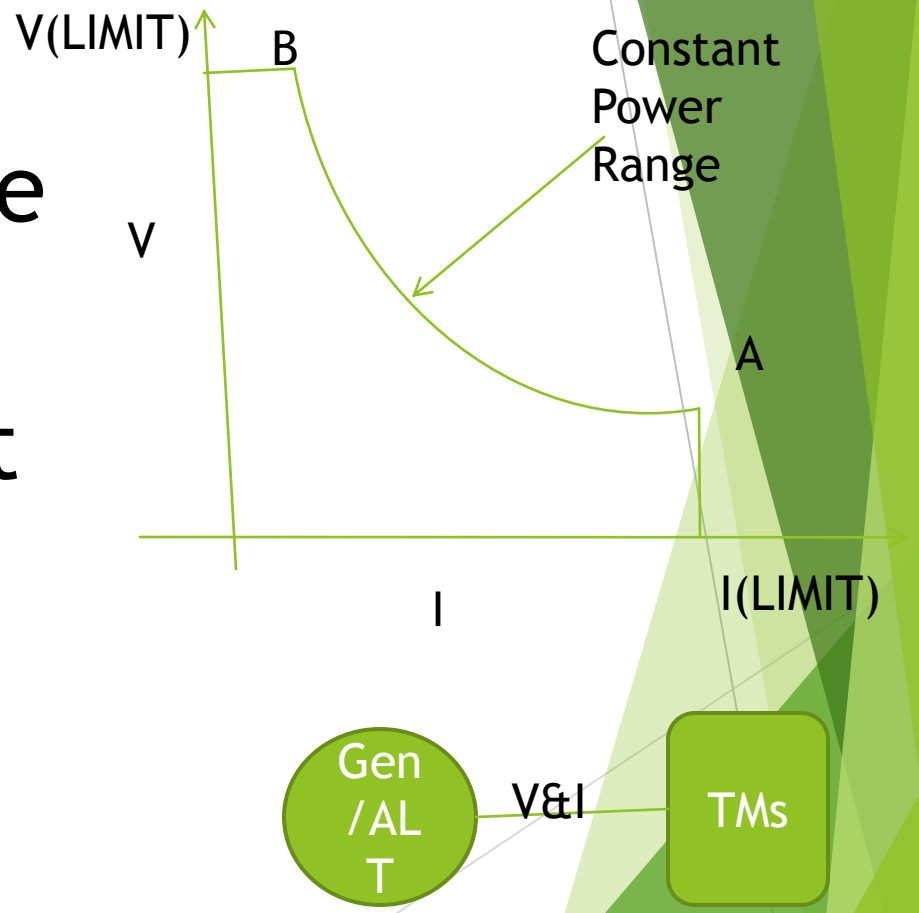
  better Sp. Fuel efficie



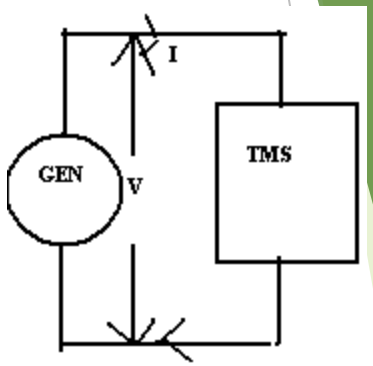
JOB OF AN EXCITATION CONTROL SYSTEM

Maintains-

- maximum voltage limit
- maximum current limit
- constant power transmission

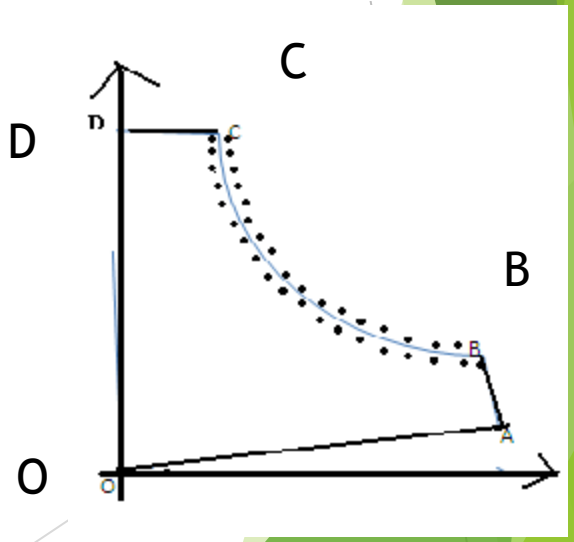


A TYPICAL GENERATOR LOAD CURVE (FOR 8th NOTCH)-WITH EXCITATION SYSTEM

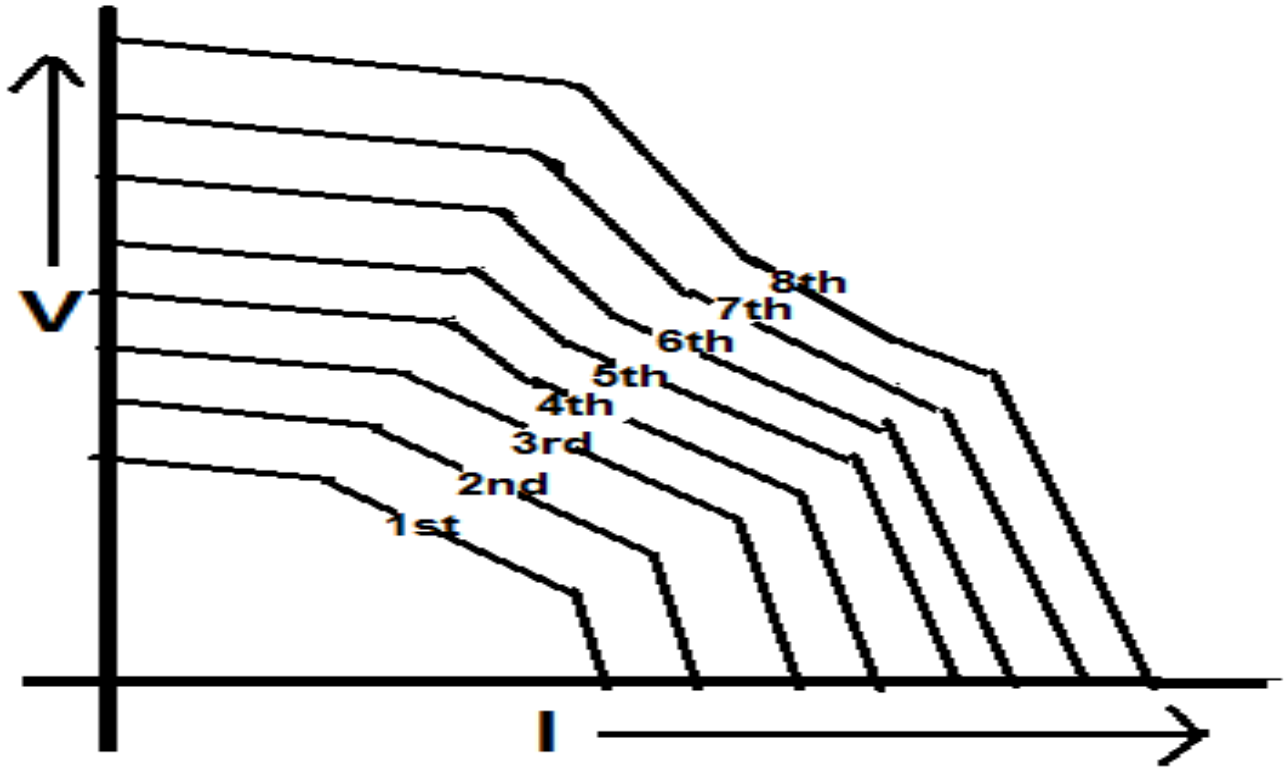


- OA →IR line

  (when the train is not moving)
- AB → the current limit of the Gen.
- BC → constant rated engine HP
- Dotted lines -System tolerance (2.1/2%)
- CD →Voltage limit



FAMILY OF NOTCH CURVES
1st Notch through 8th Notch

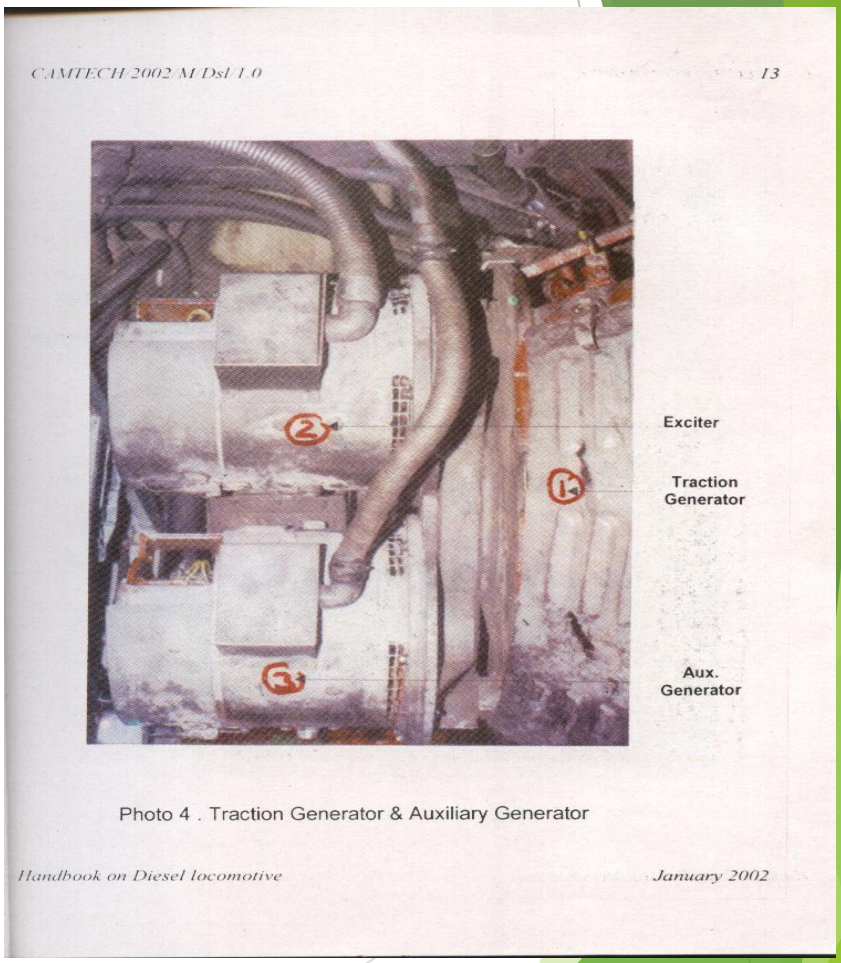


Electronics Excitation System-Main Components

- Exciter Generator
- Excitation Control Panel
- Magnetic Amplifiers

EXCITER GENERATOR

- A 4-Pole separately excited d-c Generator
- Mounted on the Tr.Gen/Alt. gear box
- Driven by the bull gear
- Specially designed to excite the field of the Main Gen./Alternator



Excitation Control Panel

- A steel fabricated housing
- Mounted on seven plug in type cards

Magnetic Amplifiers

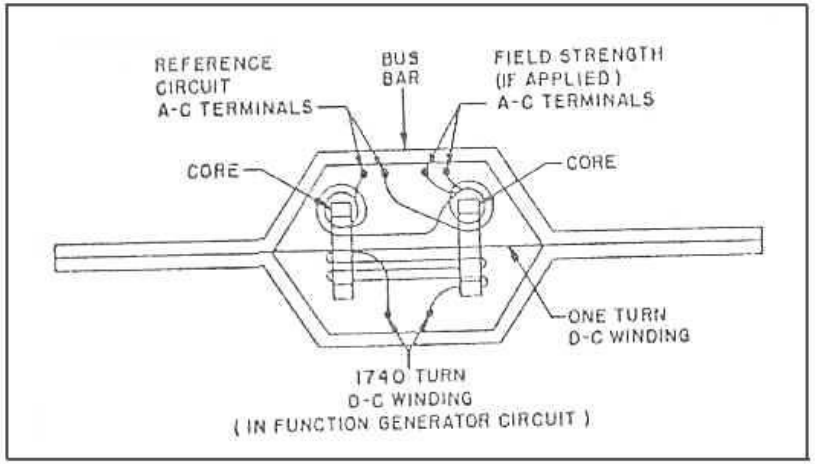
Uses Reactors namely,

1. Armature Current Control Reactor(ACCR)
2. Voltage Control Reactor(VCR)
3. Pulse With Modulator (PWM)

- Magnetic Amplifiers input AC signals comes from Oscillator Card

ARMATURE CURRENT CONTROL REACTOR(ACCR)

- A large bus bar with 02 cores connected in series with the Main Gen.for measuring DC current indirectly.
- Produces ac signal proportional to dc input
- The reactor is calibrated and the complete magnetic structure is sealed in epoxy.

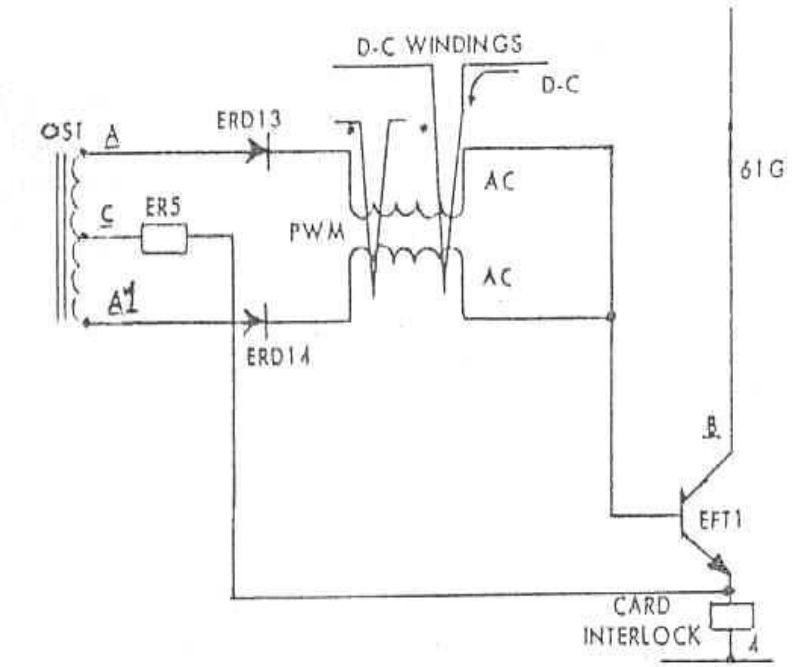


VOLTAGE CONTROL REACTOR(ACCR)

- Mounted in Excitation panel
- Produces ac signal proportional to dc input
- Measures voltage indirectly
- The reactor is calibrated and the complete magnetic structure is sealed in epoxy

PULSE WIDTH MODULATOR (PWM)

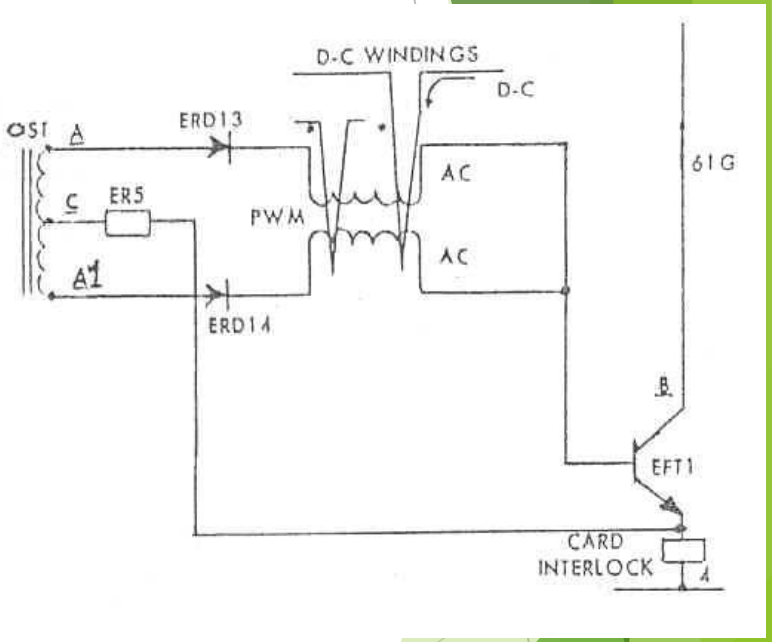
- A small self-saturating reactor with five dc. control windings and two ac. windings
- Mounted in excitation panel & fed by oscillator .
- Control On/Off period of power transistor in switching mode



PULSE WIDTH MODULATOR (PWM)

Five d.c. Windings for feedback control -

1. Exciter suicide and stabilization winding
2. Main excitation control winding
3. Wheel slip power reduction winding
4. Dynamic braking stabilization
5. Dynamic braking anti-negative control



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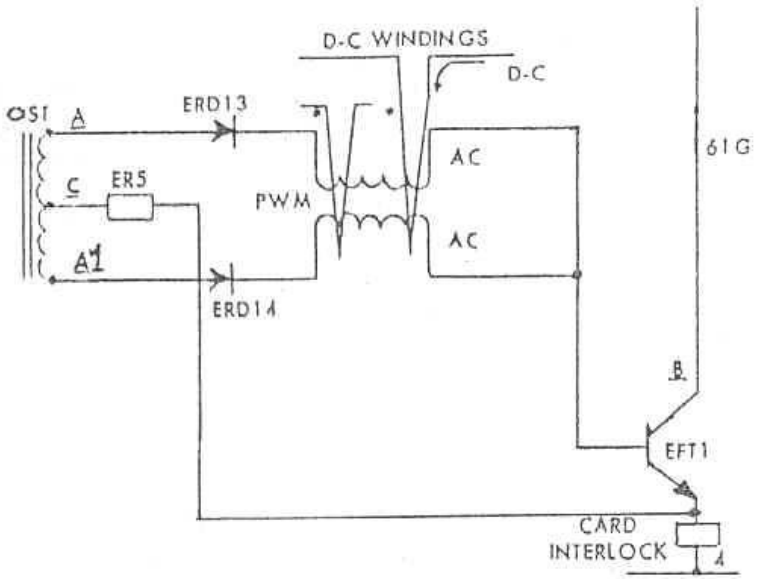
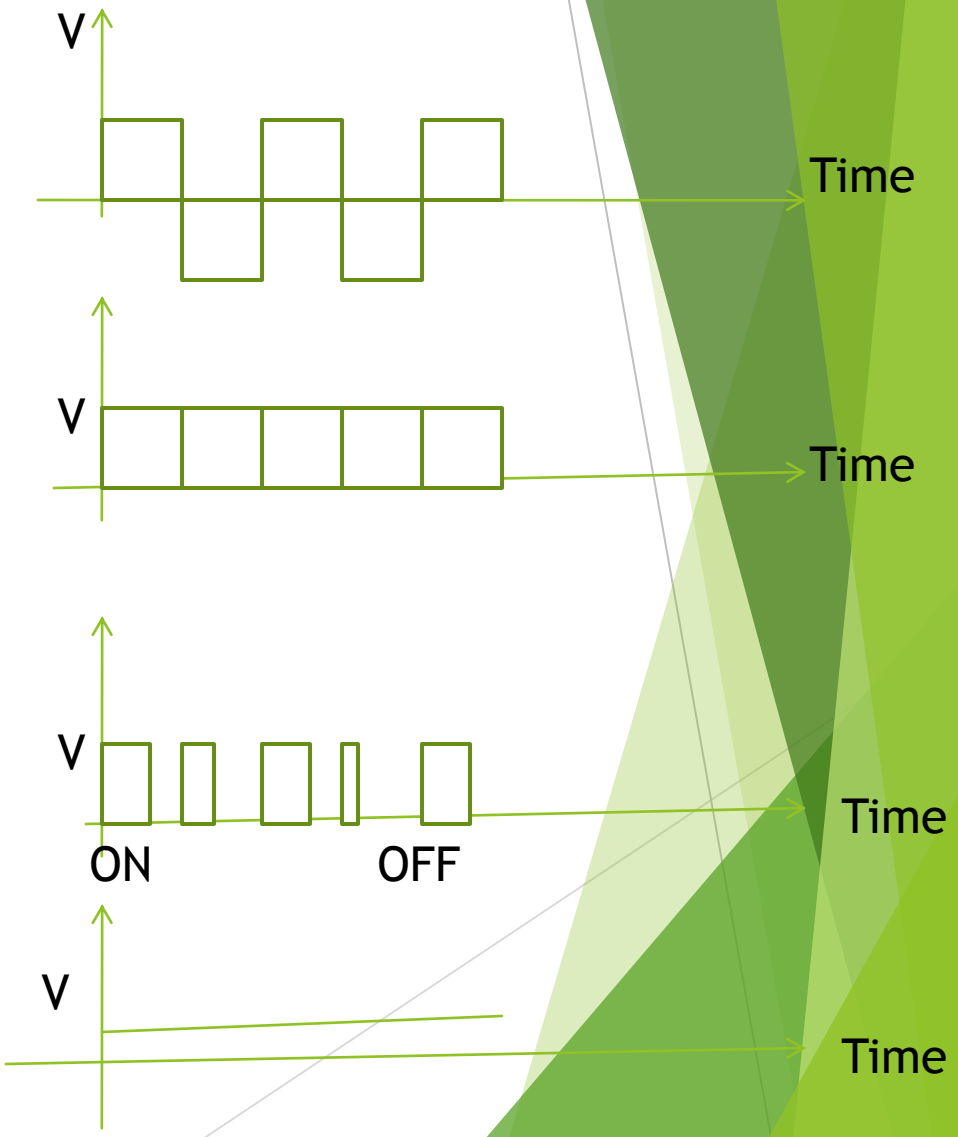
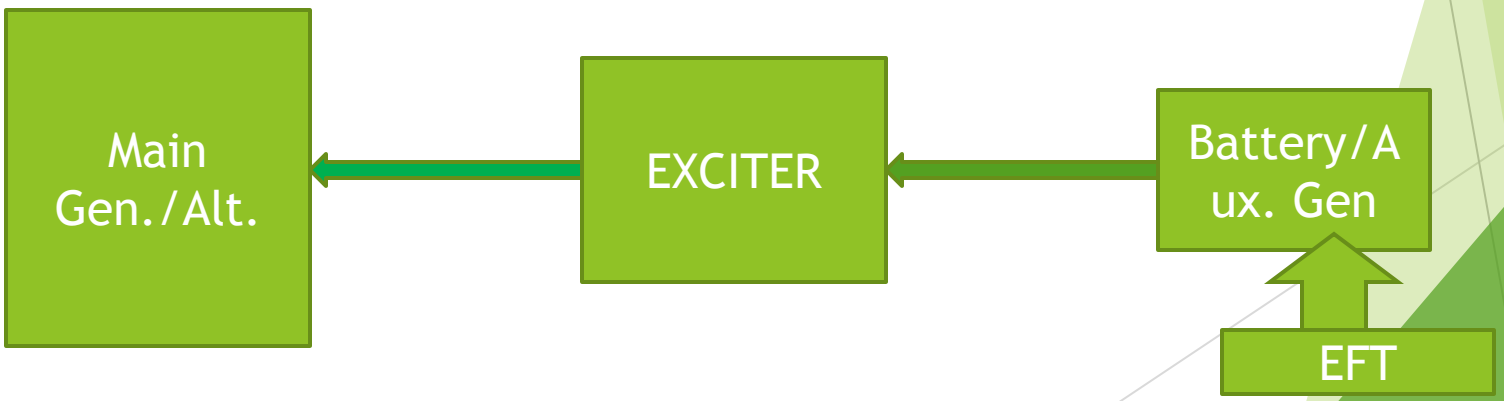




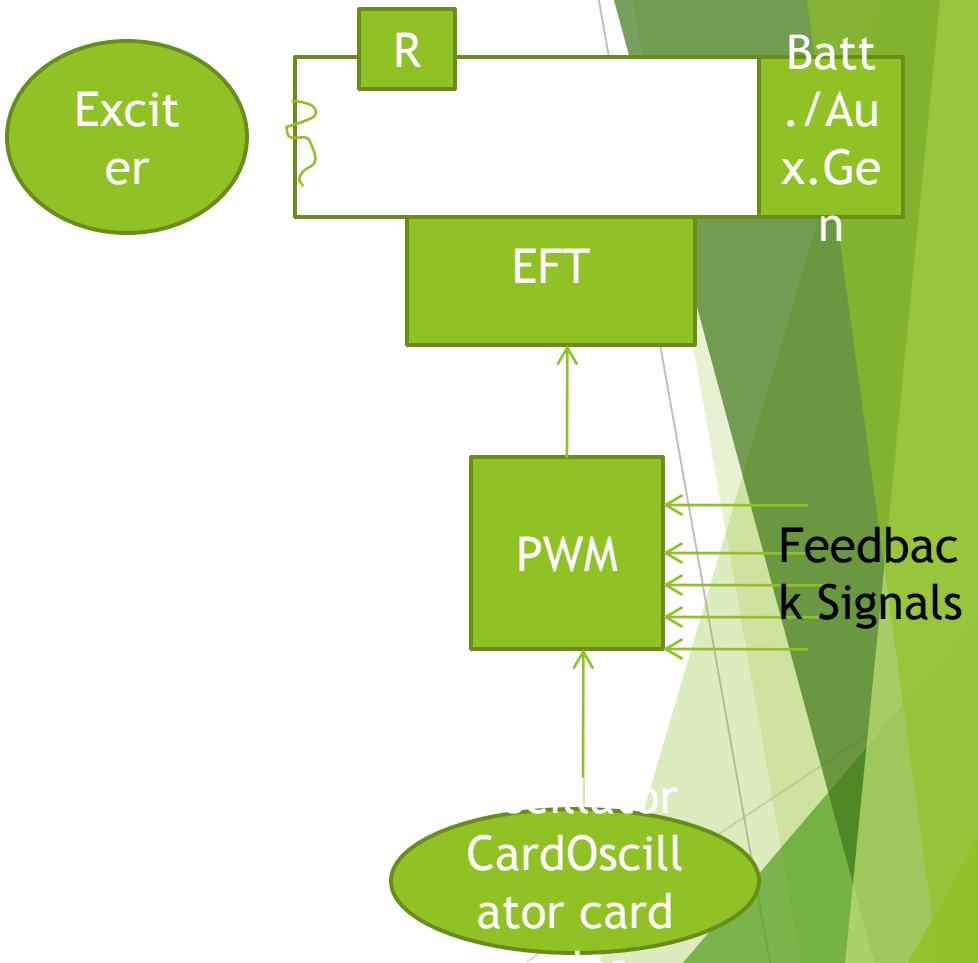
BASIC E-TYPE EXCITATION SYTEM

- Main Gen./Alt. excited by Exciter Gen. Current
- Exciter Gen. excited by Battery/Aux. Gen Current
- Batt./Aux. Gen. current controlled by a power transistor(EFT) in switching mode



BASIC E-TYPE EXCITATION SYTEM

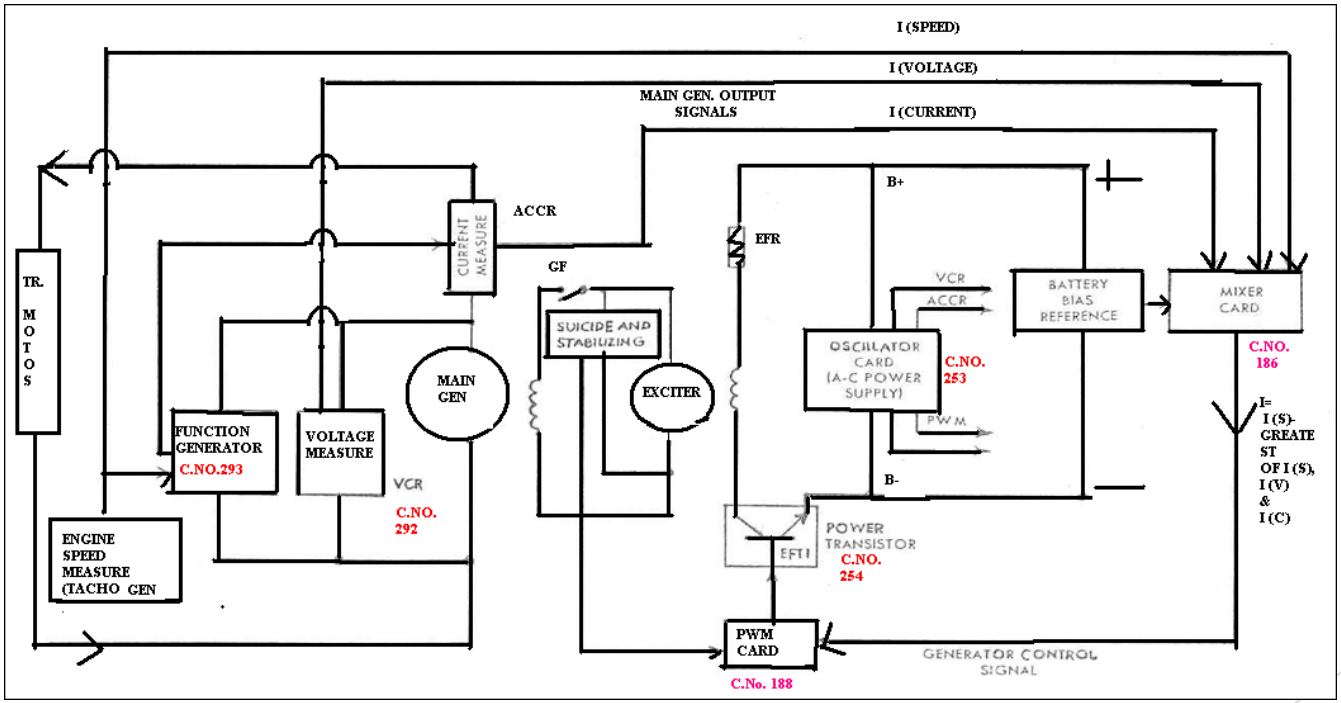
- Power Transistor gets pulses from Oscillator Card and gets 800 times turns ON & OFF in 1 sec.
- ON & OFF period is controlled by different feedback dc signals on PWM card
- OFF-period reduces excitation of Main Gen.



CREATION OF VOLTAGE & CURRENT LIMITS

- Greater of the signals proportional to M/Gen current and M/Gen Voltage are compared with the speed ref. signal in the Mixer Card.
- Speed ref. signal preset as voltage /Current limit at the given speed
- If the strength of voltage/current signal exceeds a signal will go to PWM .
- Main Gen. Voltage /current reduce and reaches under limits.

BASIC E-TYPE EXCITATION SYSTEM -BLOCK DIAGRAMME



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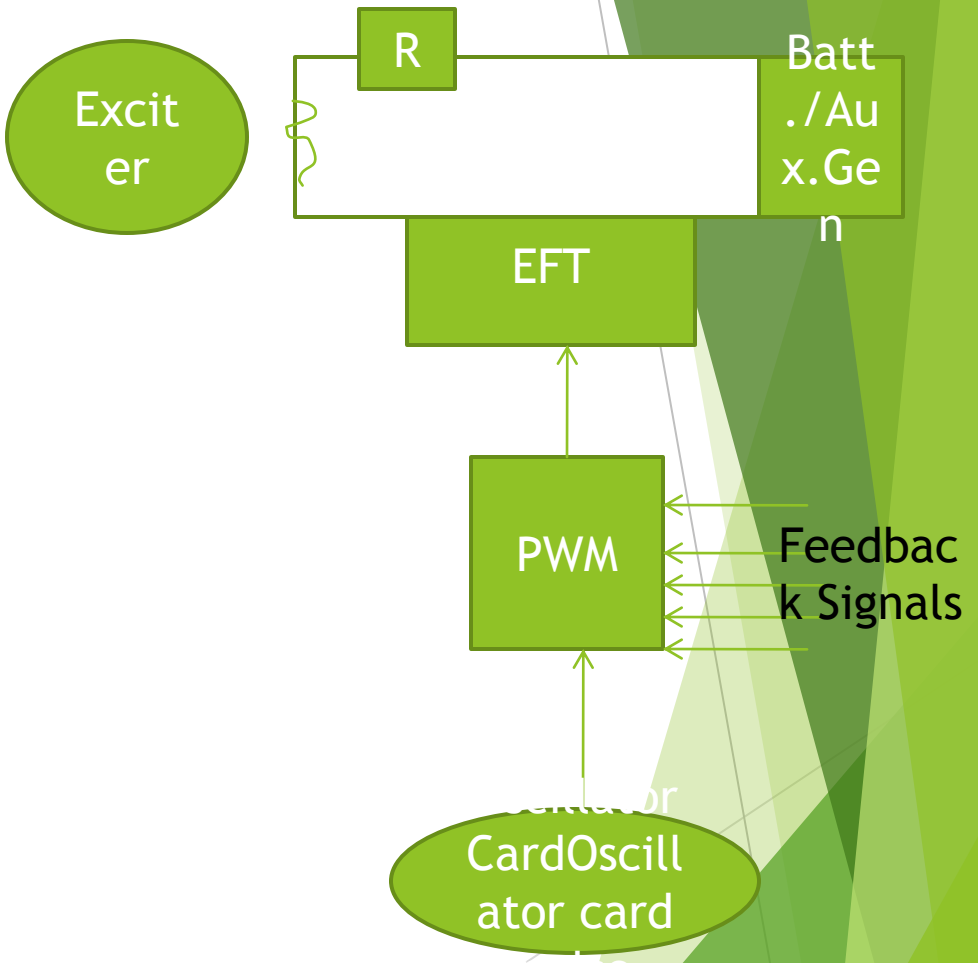
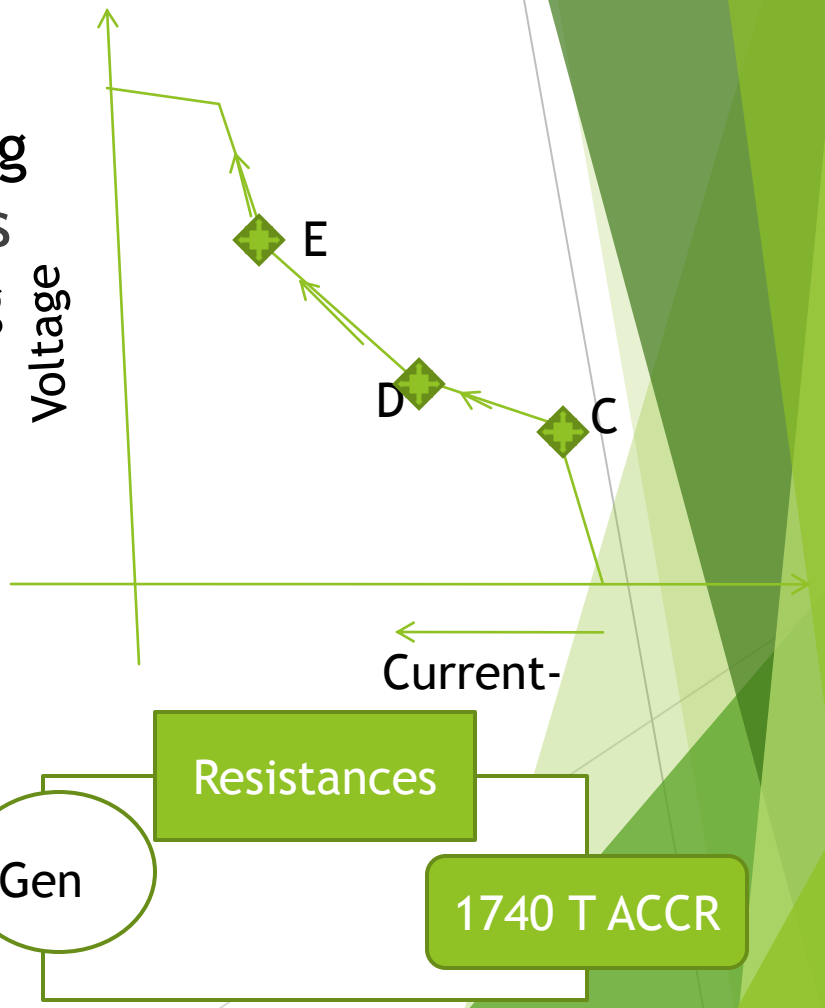


CREATION OF APPROX. CONSTANT POWER TRANSMISSION(AT 8TH NOTCH)

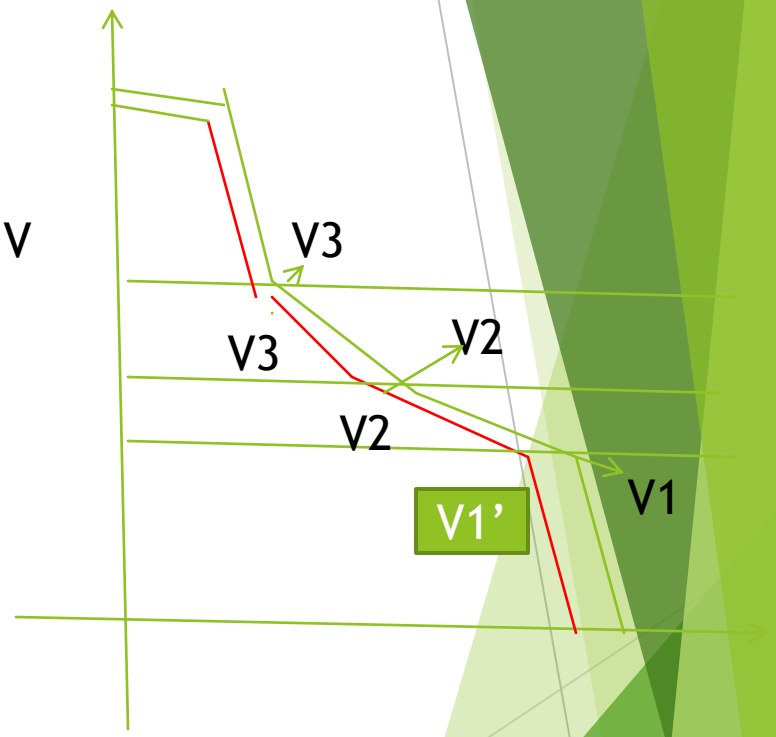
- Function Gen. allows 3 different current in descending order at different Gen.voltages through 1740 Turn DC winding of ACCR.
- ACCR gives signals to Mixer card accordingly
- Current also reduces in descending order.
- Slope of the Load curve increases



(At C high current at D less current and at D least current passes through 1740 T of

CORNER POINT SUPRESSION

- At lower notches also , slope changes at V1,V2 &V3 voltages
- Creates crowding of curves.
- Suppression circuit inside Function Gen. operates
- Changes the slope at less voltages V1',V2'andV3' than higher notch voltage
- Creates separate and better notch curves



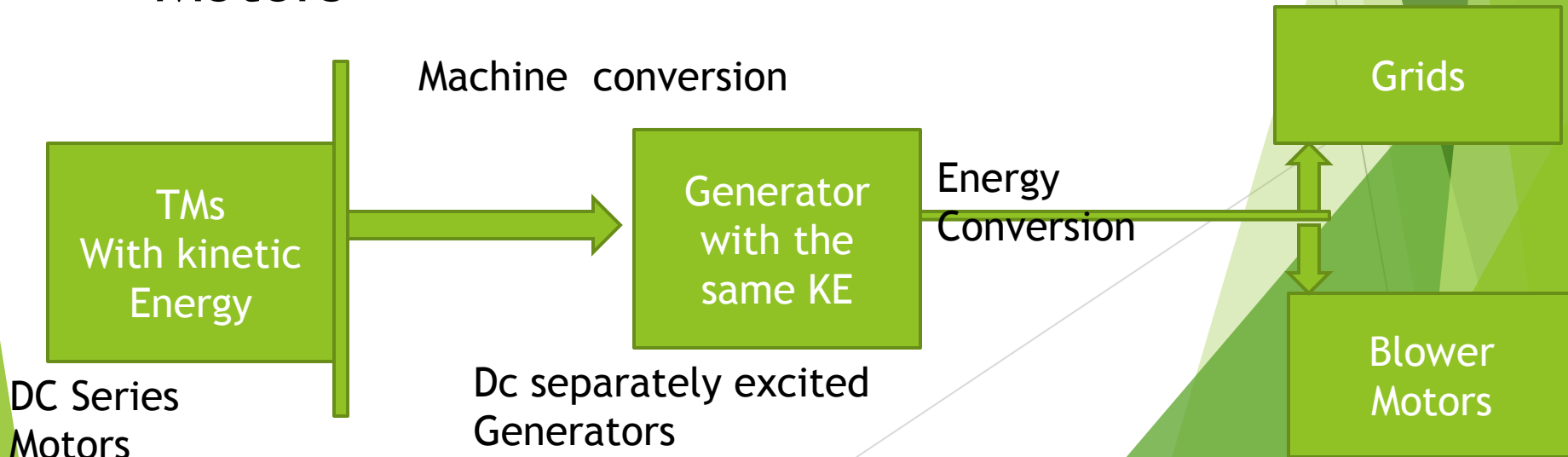
OBJECTIVE: Dynamic Brake System

- Dynamic Brake system :Advantages
- DC motor into a dc generator
- Different auxiliary systems associated with Dynamic Brake
- Distribution of armature and field currents of all six TMs during the application of DB..
- Explain Braking Torque, efforts and characteristics?
- Dynamic Brake operation
- Dynamic Brake Relays and BKCP

DYNAMIC BRAKE - INTRODUCTION

- An auxiliary brake
- Not effective at low & high speeds
- When applied TMs-

1. Converted into Generators
2. Gives supply to Grids & Blower Motors



DYNAMIC BRAKE INTRODUCTION

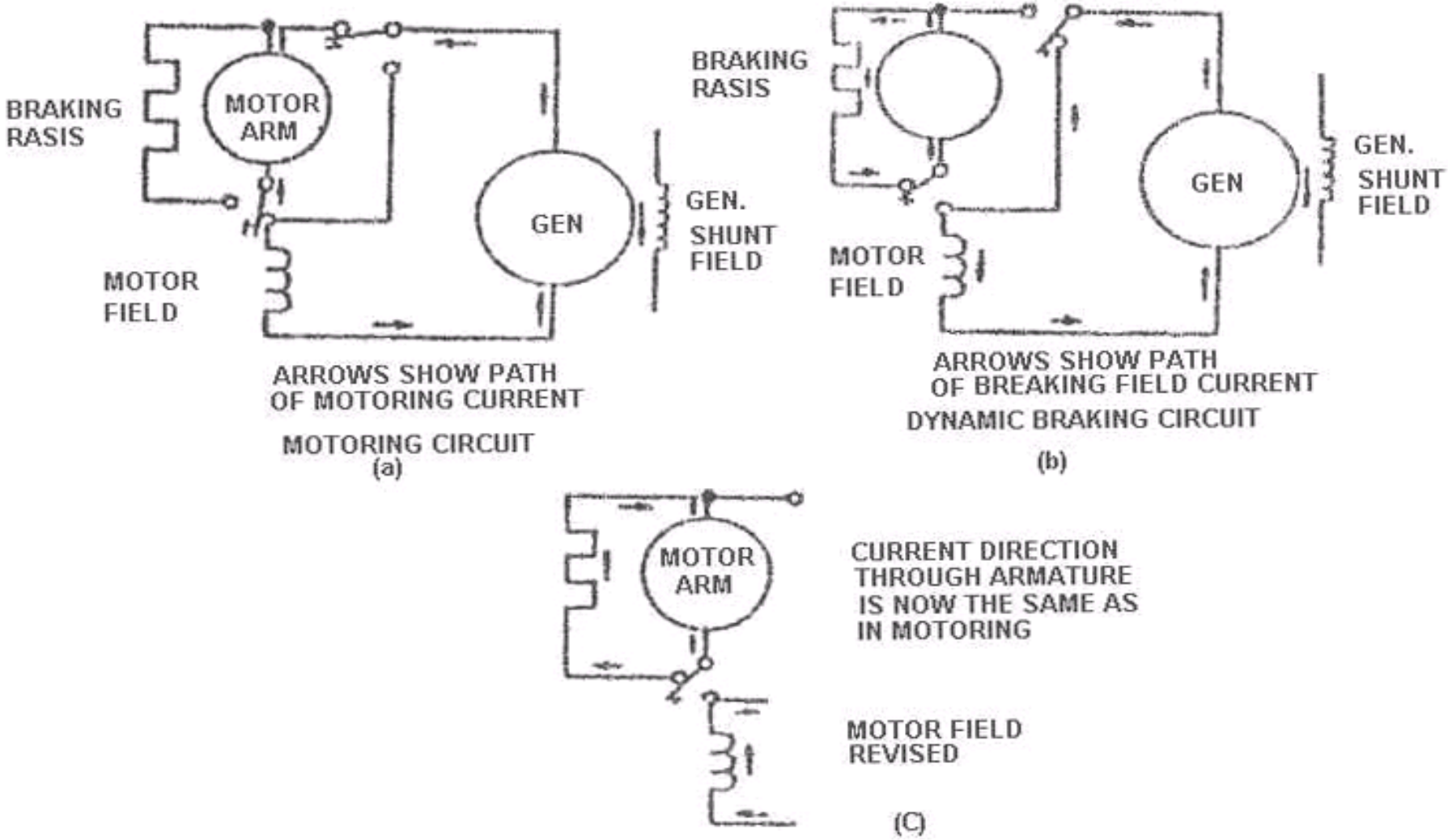
- GRIDS & BLOWER MOTOR

CONVERSION OF TM (DC MOTOR) INTO GEN.(DC GENERATOR)

Conversion is possible because both have

- Same construction
- Same design
- Same components

CONVERSION OF TM INTO GEN DURING DYNAMIC BRAKE



Conversion of TM into GEN (Showing only for one TM)

Switching Operation during Dynamic Brake Operation

BRAKING TORQUE

- Opposite to rotation of TMs
- Depends on field current & rotor speed ($T \alpha I_{\varphi}\omega$)
- I_{φ} —More M/Gen. voltage more field current
- ω— More loco speed ,more rotor speed

BRAKING TORQUE

- **Direction**
- Opposite to rotation of TMs
- **Dependency**
- rotor speed & Field current
- **Limitation**
- Torque increases, Armature voltage & Current also rises to danger mark.

BRAKING TORQUE

UP TO 35/40 KM -

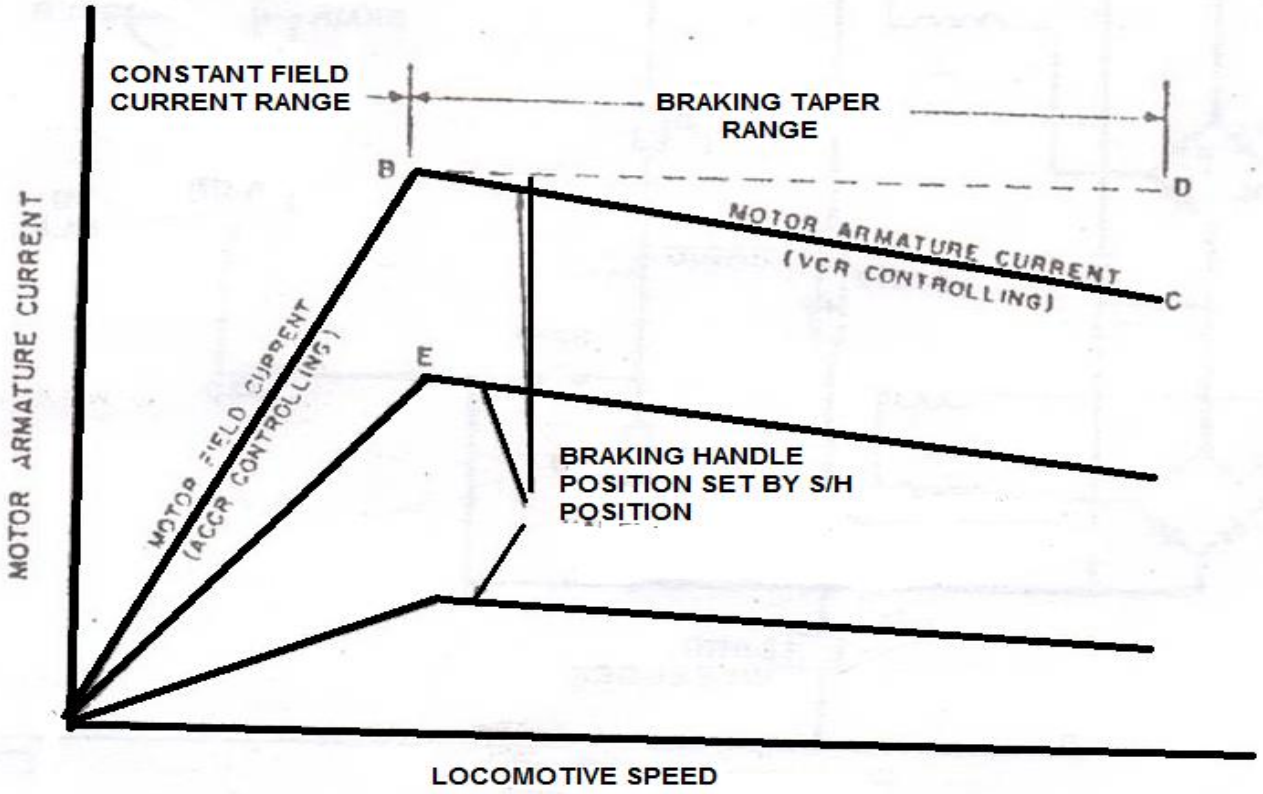
- Speed increases ,
- TM armature voltage/current increases,
- Braking Torque increases

BRAKING TORQUE

BEYOND 35/40 KM-

- Speed increases
- Main gen. excitation decreases by VCR of Ex. Control System
- TM armature voltage/current decreases
- Braking Torque decreases

BRAKING EFFORT & CHARACTERISTICS



DYNAMIC BRAKING TRACTION MOTOR CHARATERISTICS

DYNAMIC BRAKE APPLICATION

Causes-

1. BKT switch operation

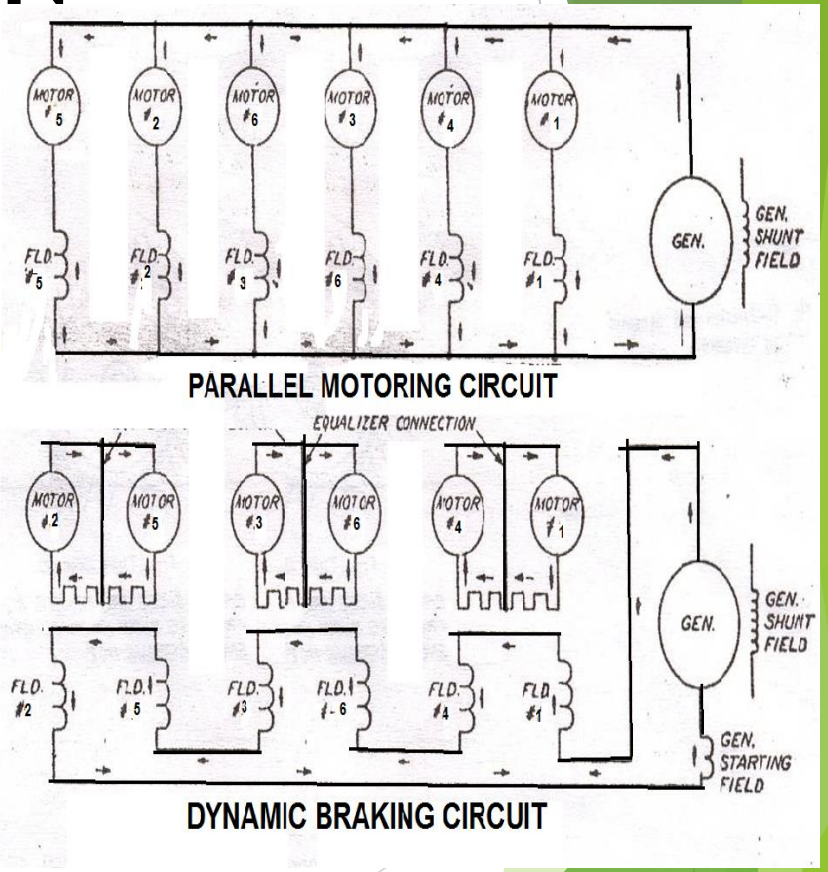
1. Braking relays (BKR1,BK2 & BKR3) operation

1. BKCP set up.

1.BKT SWITCH OPERATION

Brings –

- Fields into series across the M/Gen
- Armatures into different pairs cut off from Main Gen.
- Grids & BKBL into Armature Circuit



BKT SWITCH –COMBINATION OF CONTACTORS

LOCATED BELOW POWER CONTACTORS ON FRONT PANEL

2.BRAKING RELAYS OPERATION

Modifies-

- Engine speed setting

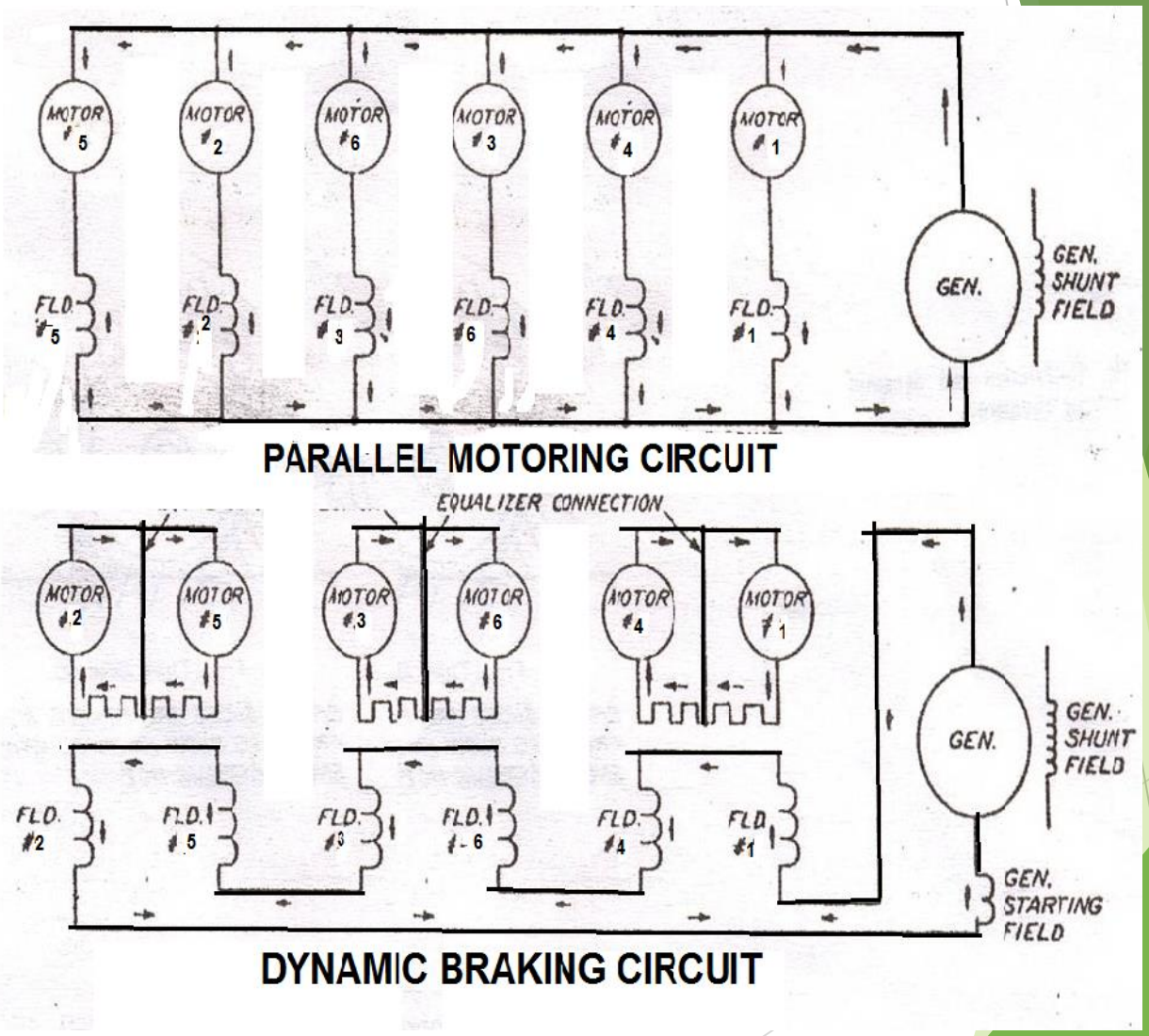
  -4th notch speed at IDLE

- Excitation Control System

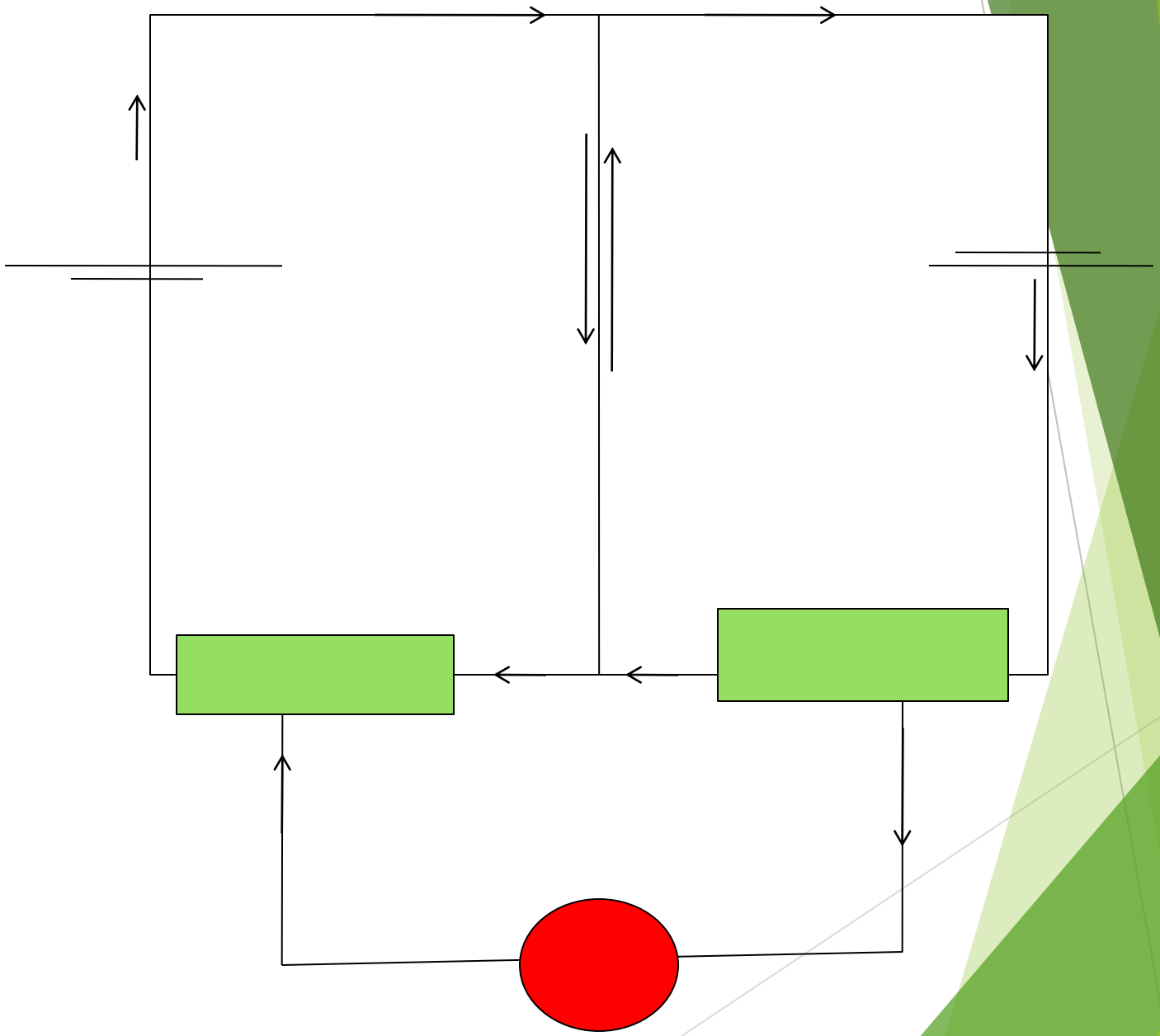
  -Speed ref. signal to mixer card replaced by braking control signal

CIRCUIT OPERATION-I

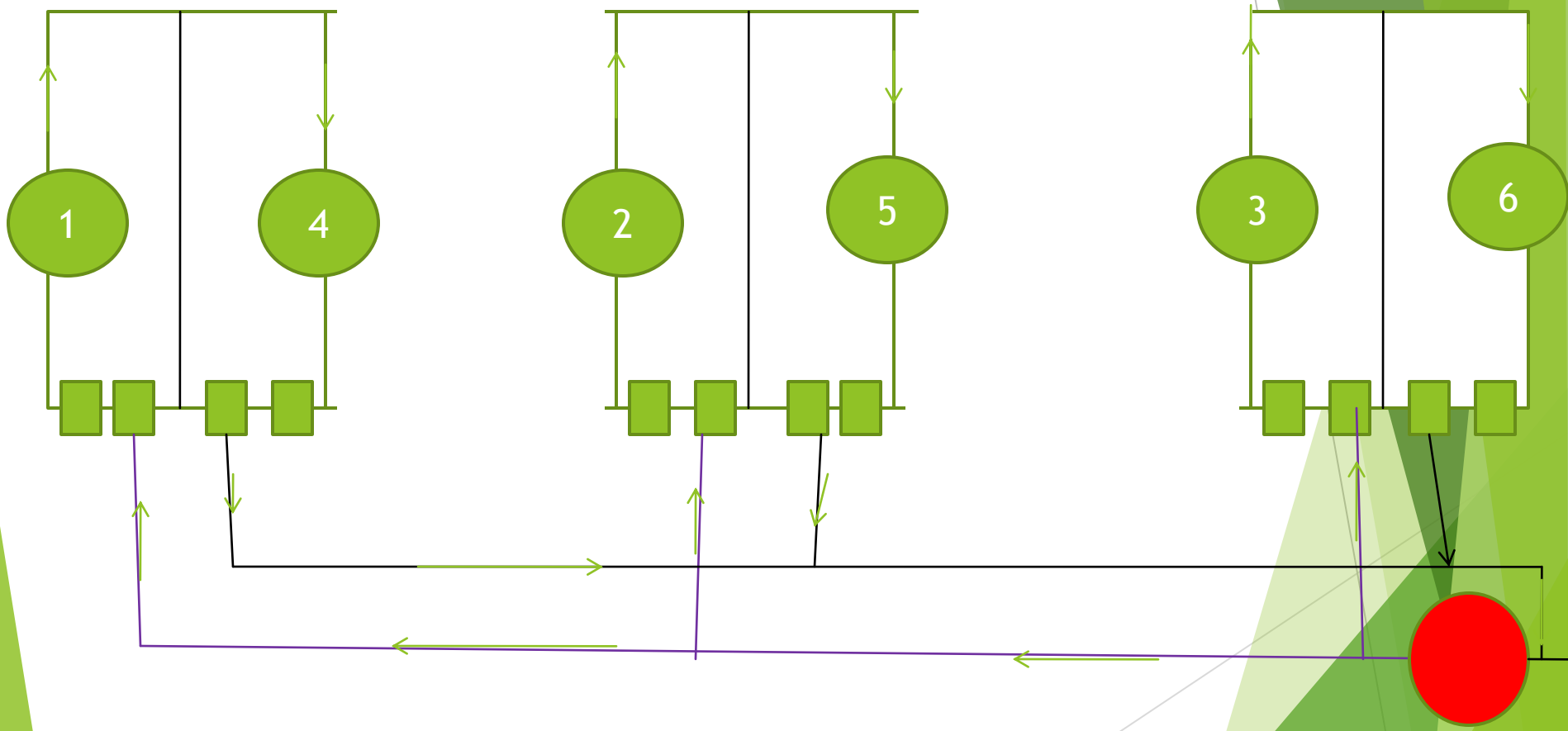
Simplified Diagram for Dynamic Brake Operation



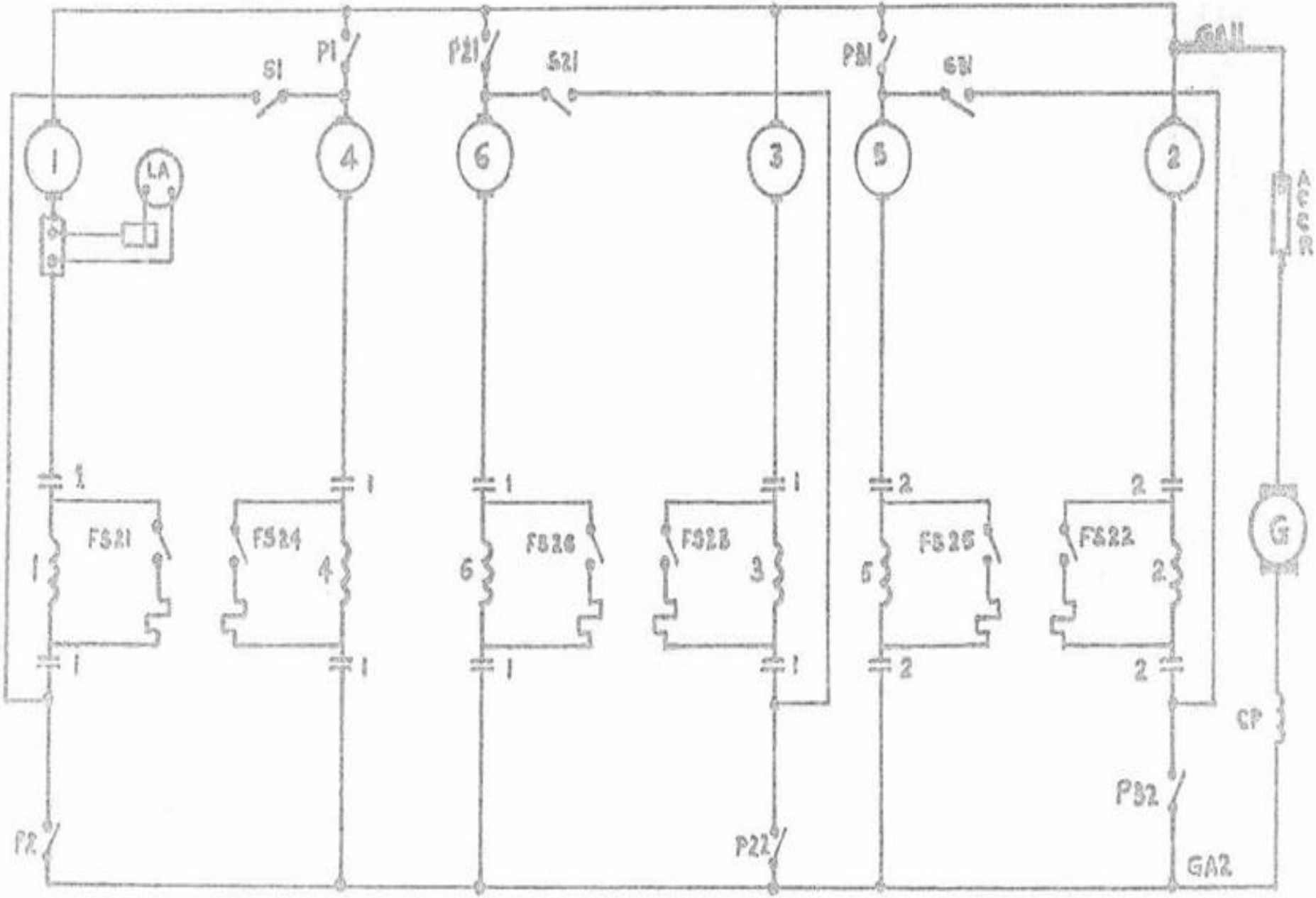
CIRCUIT OPERATION-II



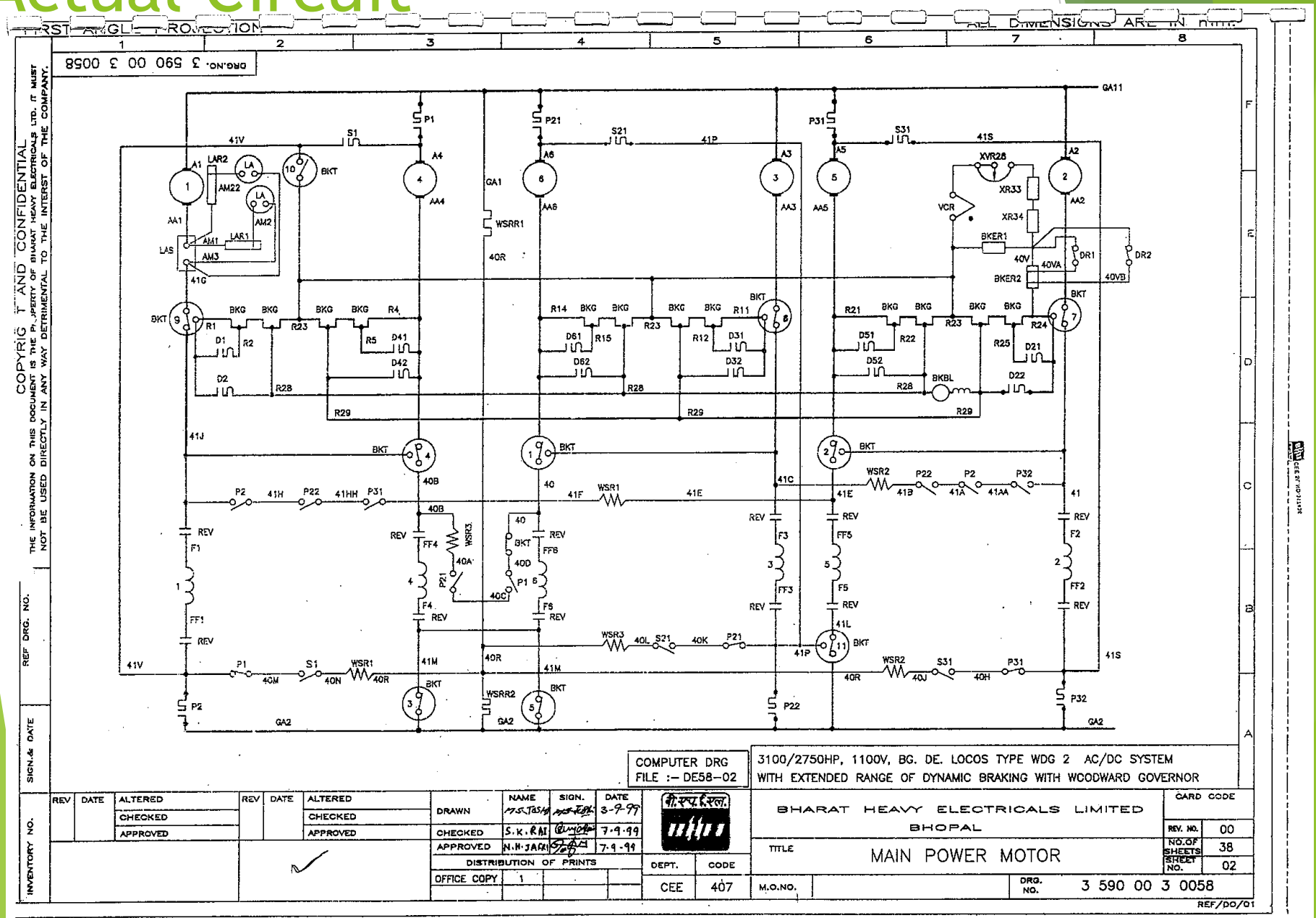
CIRCUIT OPERATION-III



Power Circuit



Actual Circuit



COMPUTER DRG FILE :– DE58–02

3100/2750HP, 1100V, BG. DE. LOCOS TYPE WDG 2 AC/DC SYSTEM WITH EXTENDED RANGE OF DYNAMIC BRAKING WITH WOODWARD GOVERNOR

REV	DATE	ALTERED	REV	DATE	ALTERED
		CHECKED			CHECKED
		APPROVED			APPROVED

	NAME	SIGN.	DATE
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CHECKED	S.K.RAI		7.9.99
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TITLE: MAIN POWER MOTOR

CARD CODE

REV. NO.	00
NO.OF SHEETS	38
SHEET NO.	02

DRG. NO. 3 590 00 3 0058

REF/DO/01

3.BRAKING CONTROL POTENTIOMETER (BKCP) SETUP

BKCP-

- A variable rotatory resistance
- Fitted in the bottom of the control stand
- Rotate with SH movement
- Controls braking control signal
- Bring down Main Gen. voltage from 1.8 V to 30V

AUXILIARY SYSTEMS

- Grid Cooling

 - By Blower Motor

- Traction Motor Cooling

-By FTTM & RTTM Blowers , rotate proportional to Engine speed.

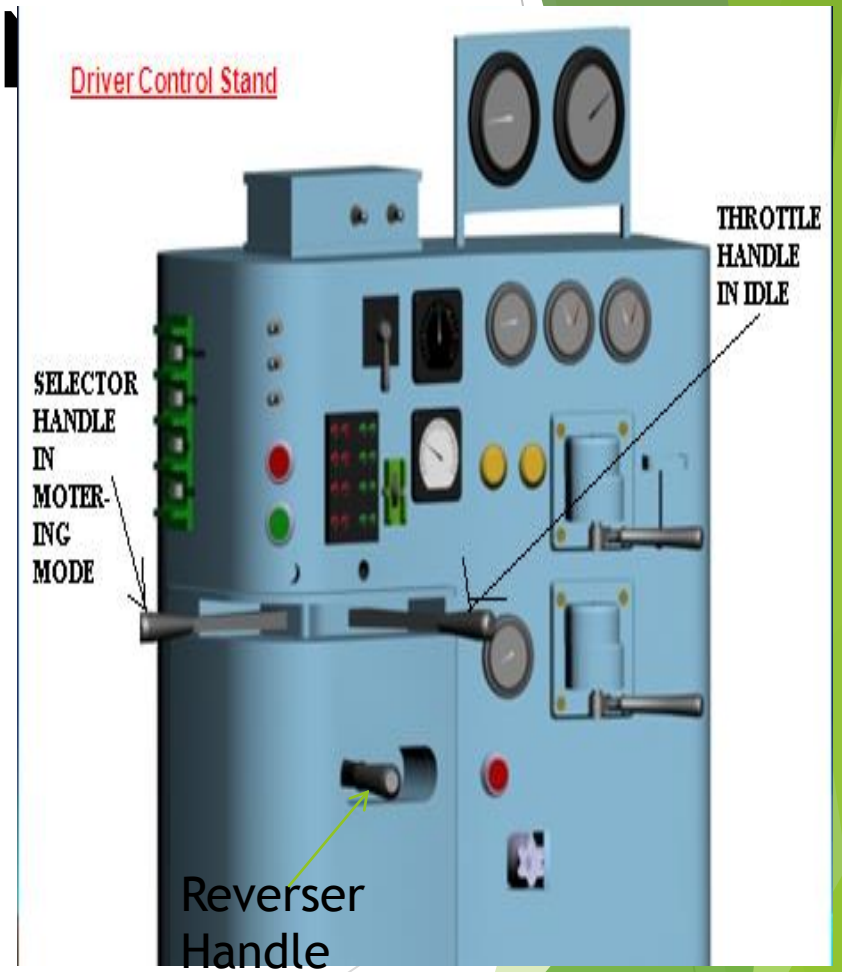
DYNAMIC BRAKE – ADVANTAGE

- Smooth & continuous control
- Minimum wears on brake block & Wheels

DYNAMIC BRAKE OPERATIOI

- TH to IDLE
- RH to forward or backward
- SH to Dyn. Braking mode

  (from ‘off’ to Big ’**D**’ to Small ’**D**’)



TRAIN BRAKING WITH DYNAMIC BRAKE

- Dynamic brake circuit include Dynamic brake interlock magnet valve(BKIV)
- BKIV is a part of loco air brake
- When applied dynamic brake the loco air brake will not work

THANKS