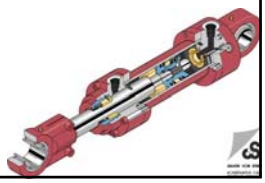
Hydraulic Power Systems

Introduction



Overview

- **Introduction.**
- **Power Systems.**
  - Comparison.
- **Hydraulic Power Systems.**
  - Types of HPS.
  - Adv. And Disadvantages.
  - Basic Principles.
  - Applications.

Overview

- **Introduction.**
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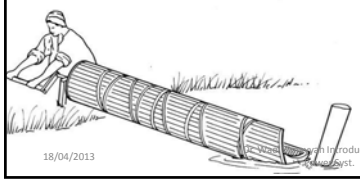
  - Basic Principles.
  - Applications.

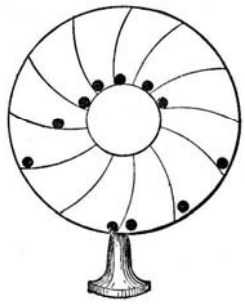
Introduction

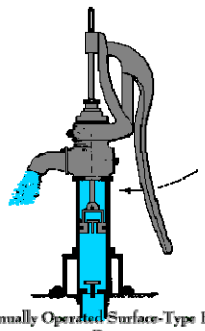
Introduction

Archimedes Screw



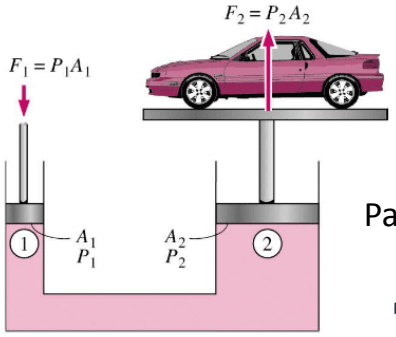
Introduction





Manually Operated Surface-Type Piston Pump

Introduction

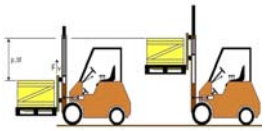


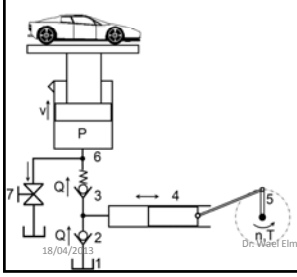
Pascal's Law

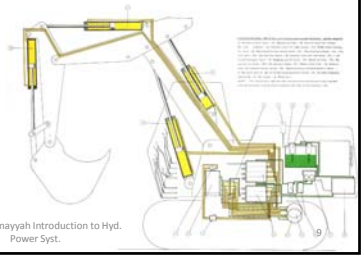
P1=P2=P
F1/A1=F2/A2
F2= F1 (A2/A1)

Introduction

Fluid Power is everywhere







Introduction

Excavator

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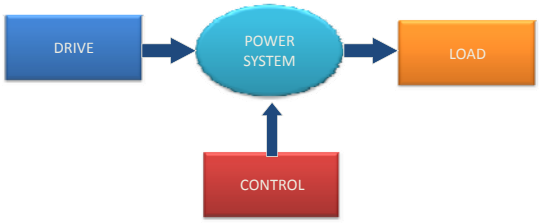
Power Systems

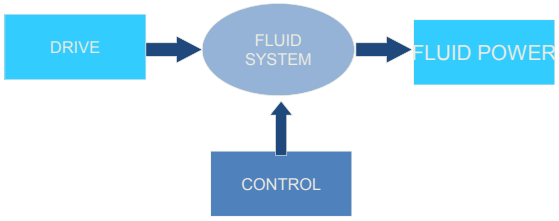


TRANSMIT & CONTROL POWER

FROM DRIVE TO LOAD

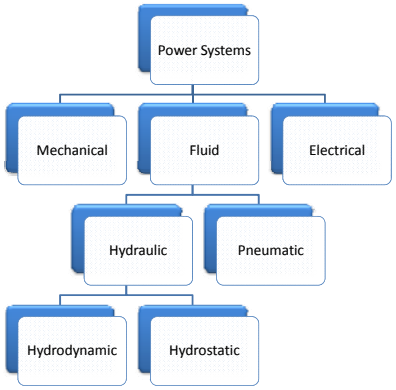
Power Systems

Fluid System

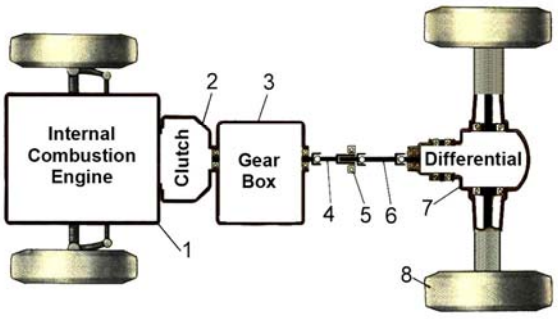


Increase the fluid power e.g. cooling, fuel systems,, ...

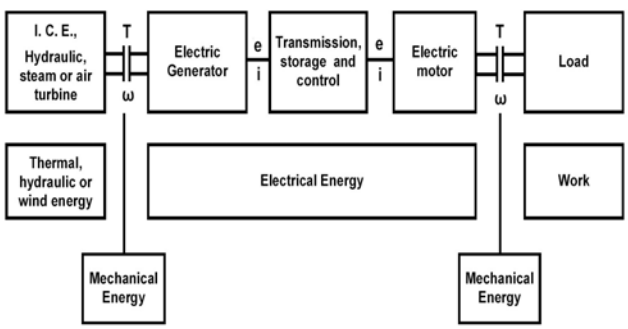
Types of Power Systems



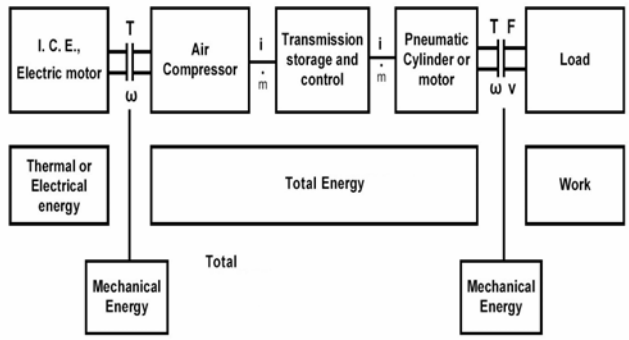
Mech. Power Systems



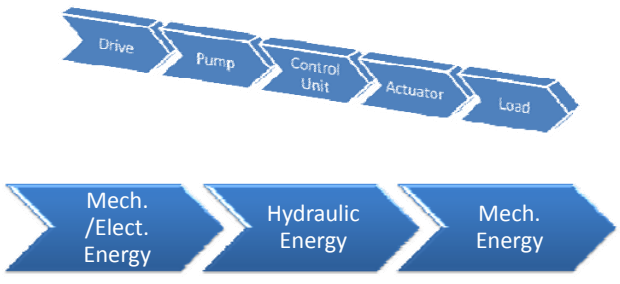
Elect. Power Systems



Pneumatic Power Systems



Hydraulic Power Systems



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Comparison (Energy)

PARAMETER	HYDRAULIC	PNEUMATIC	ELECTRIC
TRANSIM.	LIMITED, SLOW	LIMITED, SLOW	LARGE, FAST,
DISTANCE	100 m	1000 m	UNLIMITED
SPEED	2-6 m/s	5-10 m/s	30000km/s
STORAGE	LIMITED	SIMPLE	DIFFUCULT
COST	HIGH	V. HIGH	LOW

Power Systems

PARMETER	HYDRAULIC	PNEUMATIC	ELECTRIC
LINEAR MOTION	V. SIMPLE	V. SIMPLE	LIMITED
POWER/Wt	V. HIGH(700)	LOW(300)	LOW(20 -80)
FORCE	V. HIGH	LIMITED	DIFFICULT
STROKE	1O m	2 m	0.00
FORCE CONTROL	SIMPLE	SIMPLE	COMPLEX
SPEED CONTROL	SIMPLE	SIMPLE	COMPLEX
EFFECIENCY	GOOD	POOR	POOR

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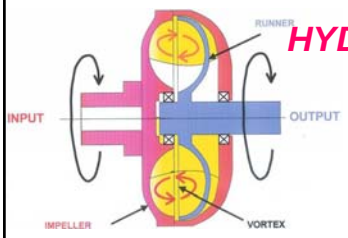
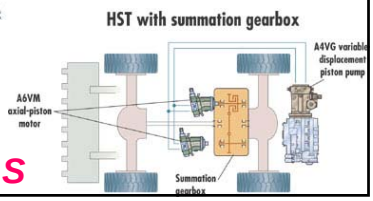
Types of Hydraulic Power Systems

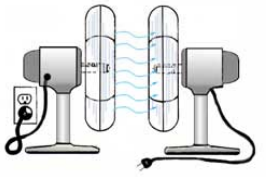


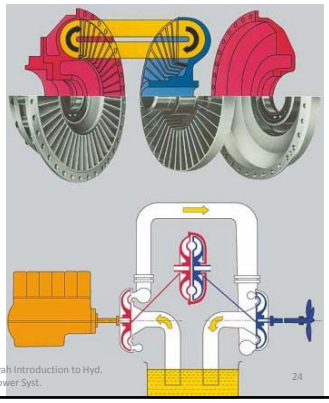
HYDRODYNAMIC P.S



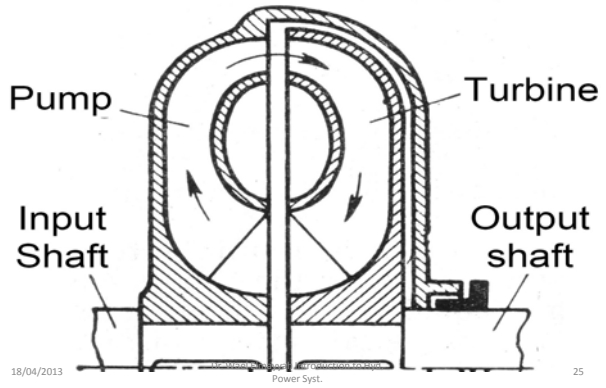
HYROSTATIC P.S

Hydrodynamic P.S. (Fluid Coupling)

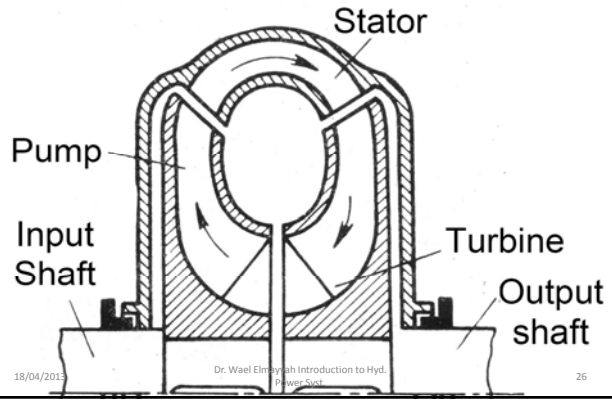




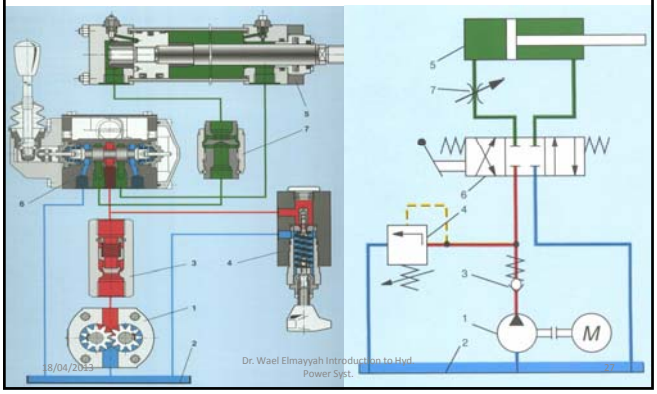
Hydrodynamic P.S. (Fluid Coupling)



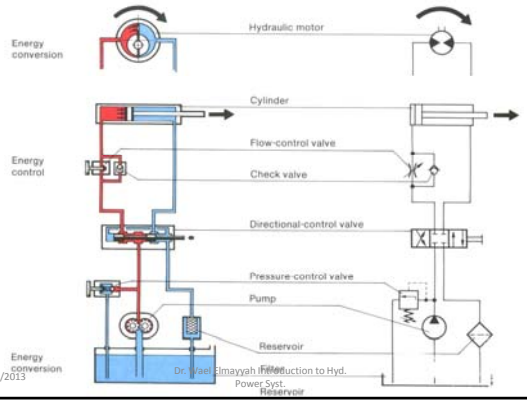
Hydrodynamic P.S. (Torque Converter)



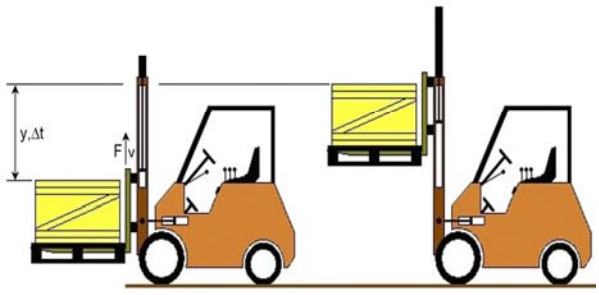
Hydrostatic P.S.



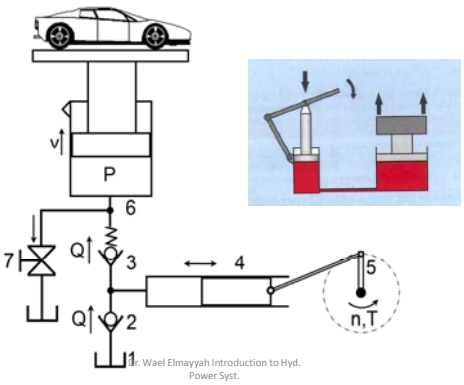
Hydrostatic P.S.

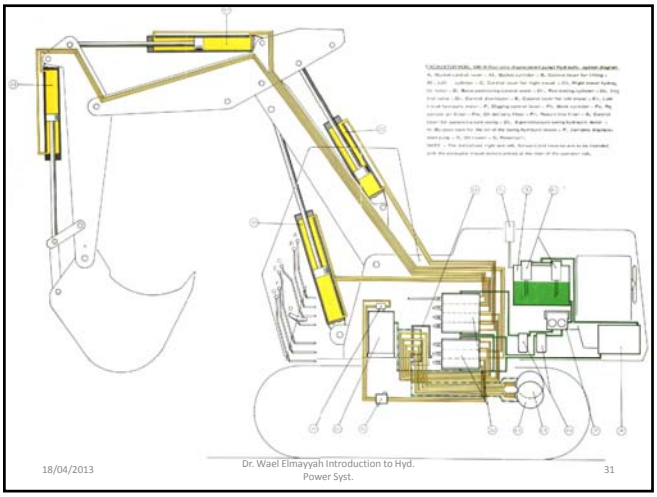


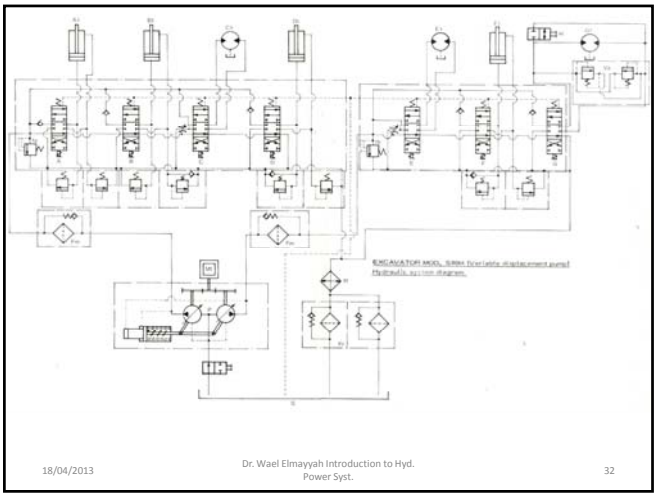
Examples



Hydrostatic P.S.







Industrial Consulting and Training Center

Overview

- **Introduction.**
- **Power Systems.**
  - Comparison.
- **Hydraulic Power Systems.**
  - Types of HPS.
  - Adv. And Disadvantages.
  - Basic Principles.
  - Applications.

ADVANTAGES OF H.P.S.

- HIGH POWER/WEIGHT
- HIGH TORQUE/INERTIA
- SELF-LUBRICATED
- NO SATURATION PHENOMENA
- HIGH STIFFNESS

ADVANTAGES OF H.P.S.

- OVER LOAD PROTECTION
- FLEXIBILITY
- LINEAR OR ROTARY MOTION
- MATCHED WITH ANY CONTROL SYSTEM
- SIMPLE INSTALLATION

DISADVANTAGES OF H.P.S.

- POWER GENERATION IN SITE
- ENVIRONMENTAL EFFECTS
- FIRE HAZARD
- SYNCHRONIZATION
- FILTERATION
- COST

Selection of H.P.S.

- POWER
- TYPE OF MOTION
- DISTANCE
- CONTROL
- RELIABILTY
- ENVIRONMENT
- MAITENANCE
- SERVICE LIFE
- LABOR
- COST

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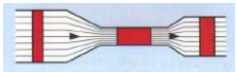
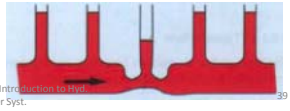
Basic Principles

- Fluid: liquid & gas
- Fluid Properties
- Basic laws of fluid mechanics:
  - Mass, energy & momentum laws
  - Hydraulic losses

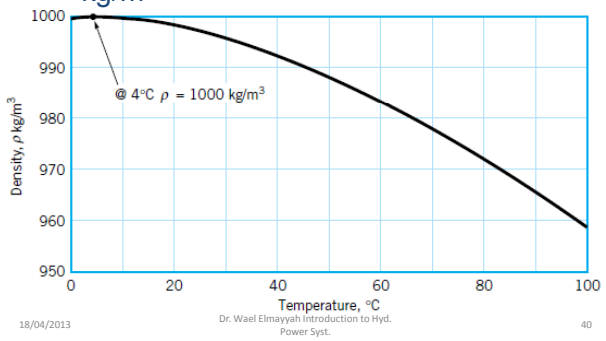




Basic Principles

Density = mass/Unit Volume

kg/m^3



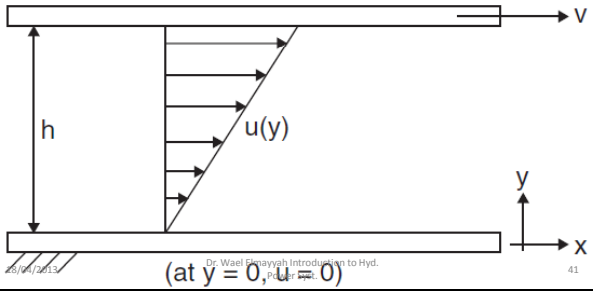
Basic Principles

Properties of fluids

Viscosity

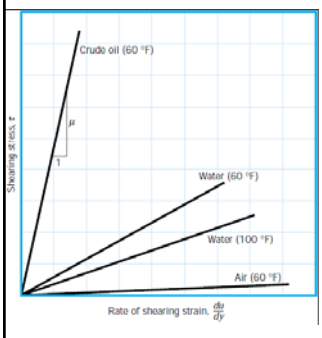
$$\tau = \mu \frac{du}{dy}$$

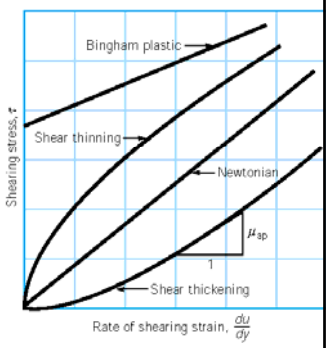
(at y = h, u = v)



(at y = 0, u = 0)

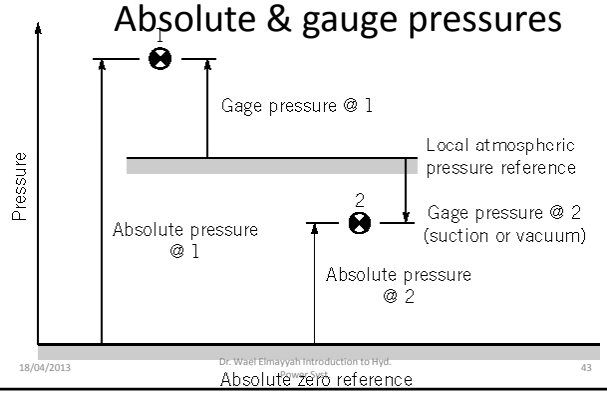
Basic Principles





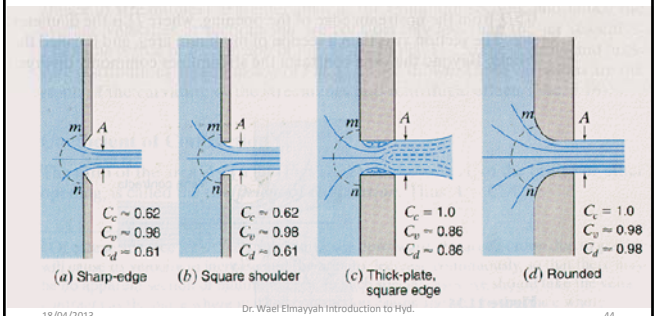
Basic Principles

Absolute & gauge pressures

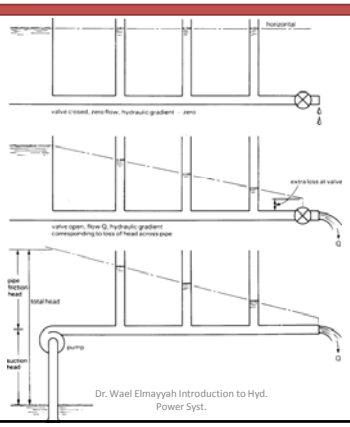


Basic Principles

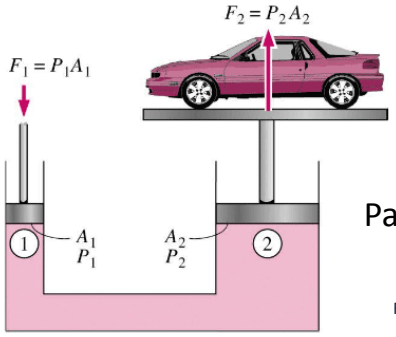
Flow through orifices



Hydraulic losses



Basic Principles



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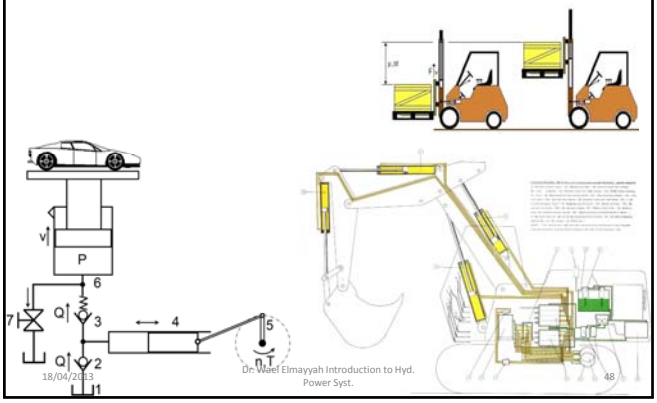
Applications



Applications

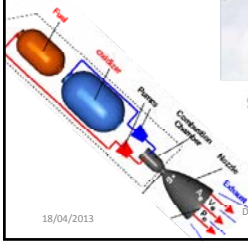
Printing Industry

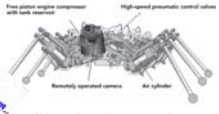
Applications

Drugs Industry

Food Industry

Chemicals Industry





Applications

- MILITARY : TANKS, AIRCRAFT, ...
- INDUSTRIAL: ROLLING, TOOLS, …
- EARTH MOVING EQUIPMENTS
- MARINE USES
- MOBILES
- MEDICAL USES
- PETROL ENGINEERING

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The Real Power !!!

Thank you

Questions ??