Northern Technical university
Mosul technical institute
Agriculture tractors lecturers

Reclamation Machine and Equipment

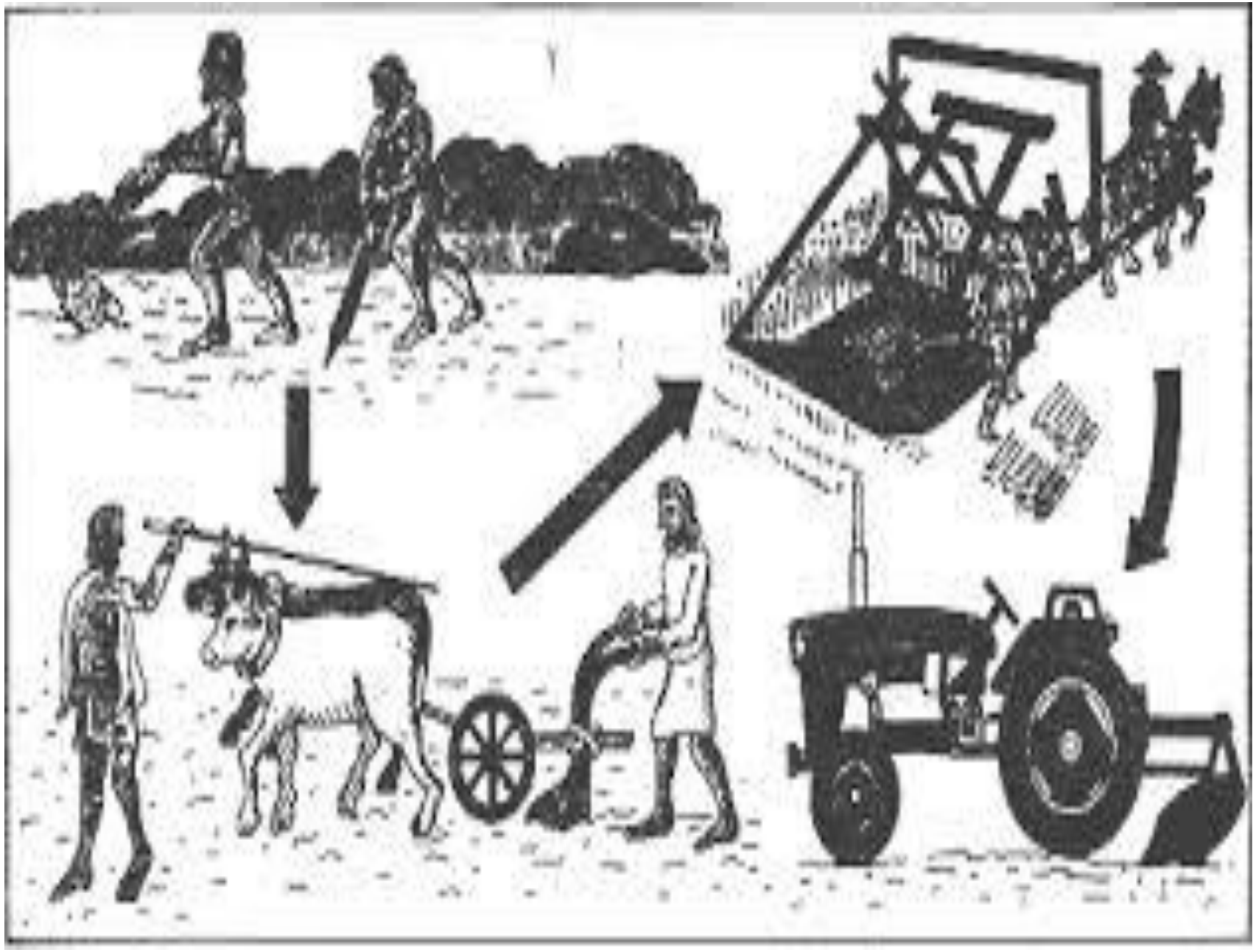
Assist teacher : YAHYA YOUNUS MOHSIN

Tractors

Agricultural tractors : are considered are the backbone of agriculture as they are indispensable for large areas (areas larger than hectares). The letters in the tractors must have functions and features.

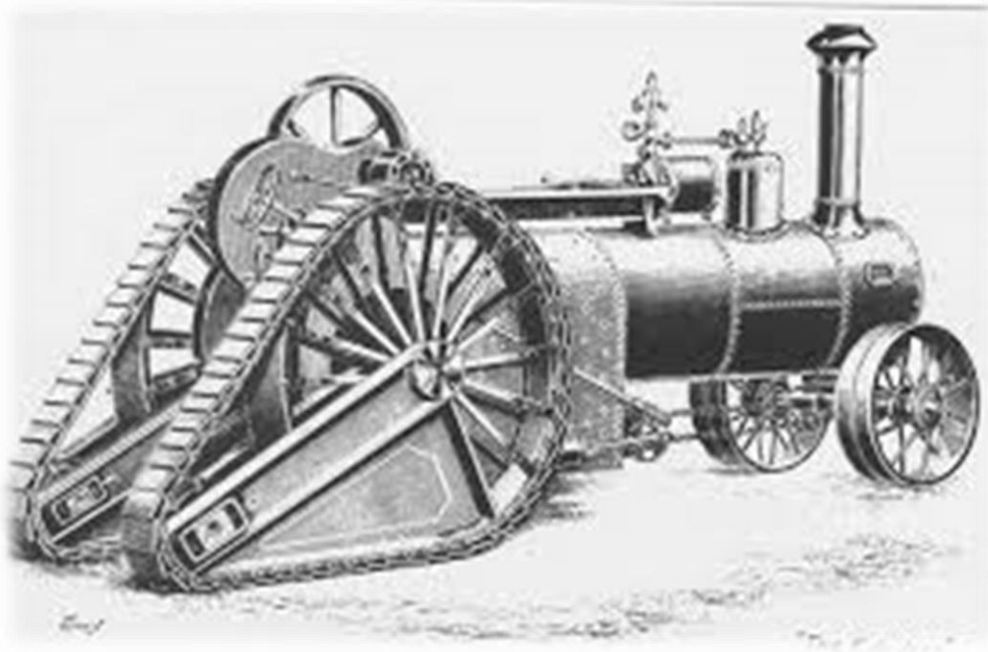
Agricultural Tractors are the source of power mechanical and hydraulic.

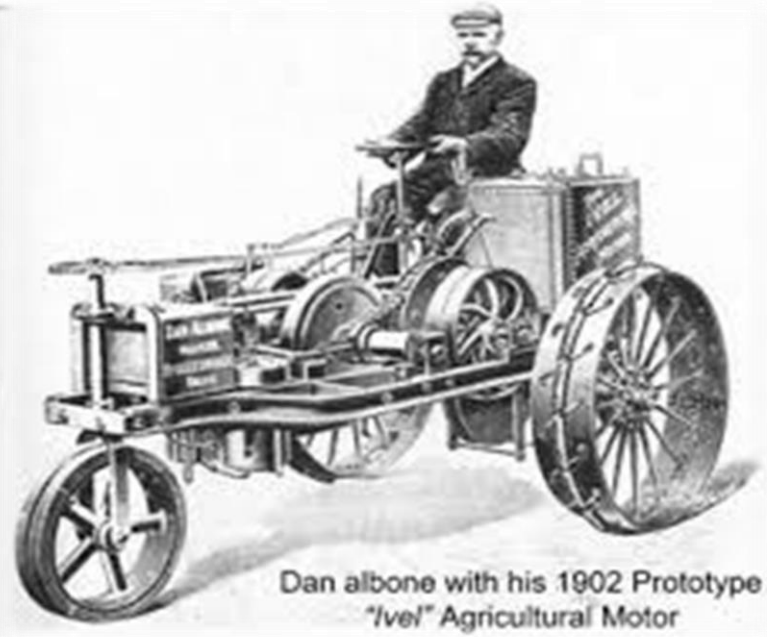
About the development of agricultural tractors



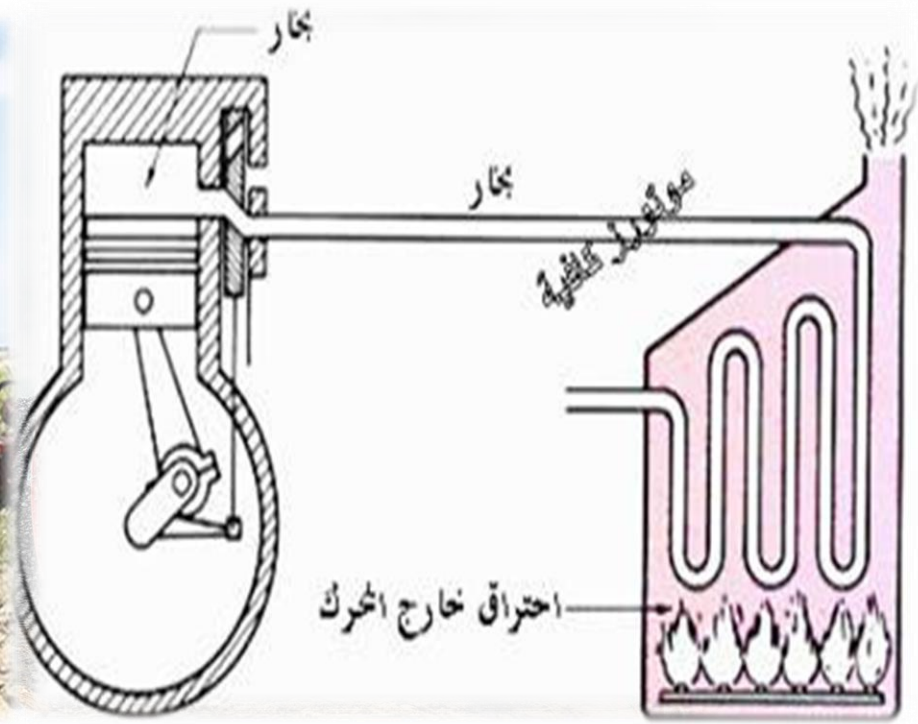
محركات الاحتراق الخارجي

1712من قبل توماس نيو كومن 1698

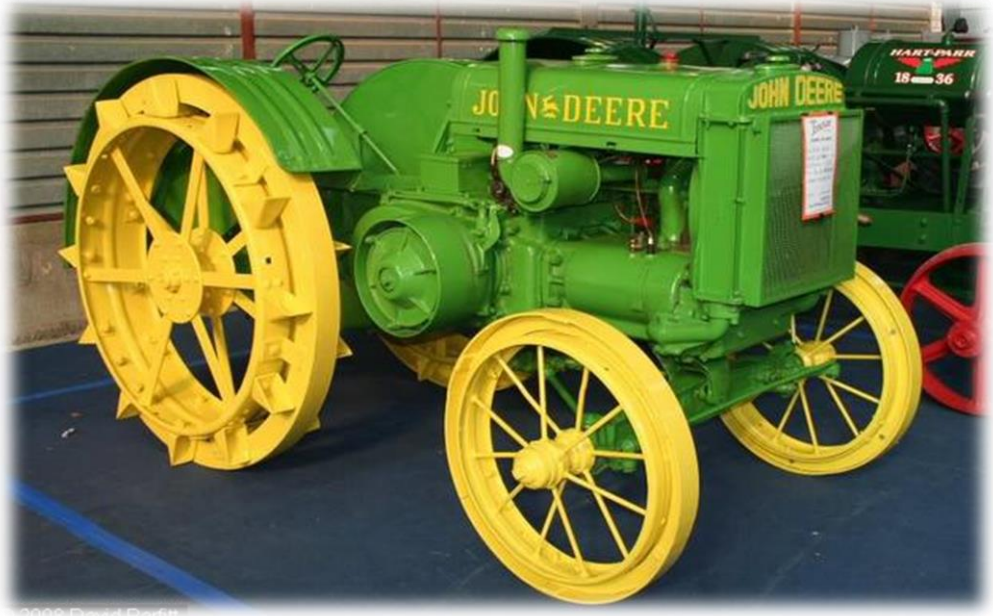




Dan albone with his 1902 Prototype
"Ivel" Agricultural Motor



محركات الاحتراق الداخلي



اول محرك احتراق داخلي يستخدم صناعياً 1823

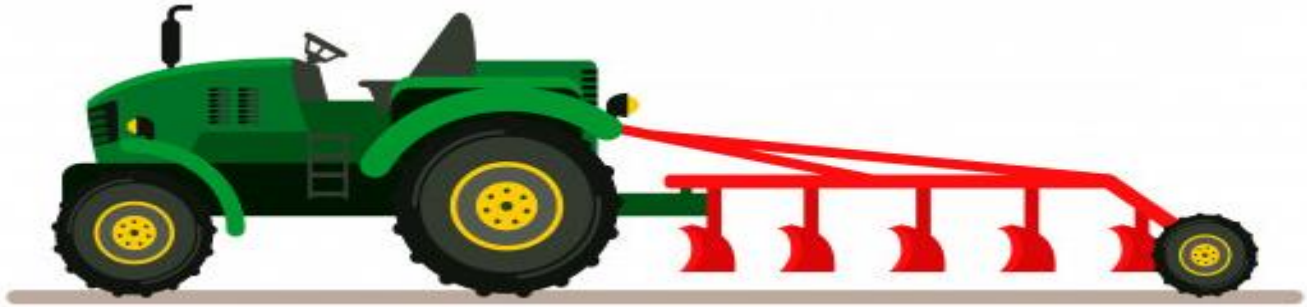
اول محرك احتراق داخلي رباعي الأشواط بواسطة نيكولاس اوتو 1876

اول محرك احتراق داخلي يعمل بالبانزين بواسطة كارل بينز 1879


WARDS

الآلات المحمولة

الآلات النصف محمولة



المقطورات الزراعية

Diagram of the Types agricultural tractors

2- By engine type

- A- Tractors with spark-ignition engines (petrol engines)
- B-Tractors with pressure ignition engines (diesel engines)

1- By goal

- A- General field tractors:
- B - Planting tractors in lines
- C - orchard tractors
- D- Garden tractors
- F- Special tractors
- E- Transport Tractors

Types of agricultural tractors

1- By goal

A- General field tractors: used to accomplish technological operations such as plowing. It is 30-300 horsepower and the clearance (the distance between its lowest point and the ground) reaches 25-35 hours and its speed is 9-15 km /

They are called multi-purpose tractors

are considered are the backbone of agriculture as they are indispensable for large areas (areas larger than hectares).

B – Planting tractors in lines: they are used to carry out all operations to serve the growing crop, such as hoeing, spraying, fogging and other others, and their horsepower is 30-100 horsepower – clearing the belt from 60 to 80 cm It is characterized by:

1- Its wheels are of short width

2- The possibility of adjusting the cross distance between the wheels

3- High clearance of traffic

C - orchard tractors: It is used for the necessary works between trees and its capacity ranges between 15- 60 hp.- The tractor is generally low and especially the driver's seat so as not to collide with tree branches and has the least possible parts to avoid clashing with tree branches

D- Garden tractors: They are the smallest types of tractors and their power ranges from 5-15 hp and are mainly designed to perform light agricultural operations in small spaces.

F- Special tractors: used for construction and excavation works.

E- Transport Tractors: It is used for transportation works on dirt roads and rugged paths, so it is equipped with wheels that bear the difficulties of road.

2- By engine type:

A- Tractors with spark-ignition engines (petrol engines)

B-Tractors with pressure ignition engines (diesel engines)

The preference for gasoline or diesel engines depends on the following:

1- The type of soil and its nature

Where in cohesive medium and light sandy loam soils : It is preferable to use wheel haulers, but in loose soil with severe fragmentation it is preferable to use crawler tractors

2- Land area: In small spaces it is preferred to use the wheel TRACTOR for ease of movement, but in large areas tracked tractors are used where agricultural machines with a large working width can be used.

3- Economic return: This depends on the price of the machines, the amount of work they provide, and their capacity .

2-حسب نوع المحرك

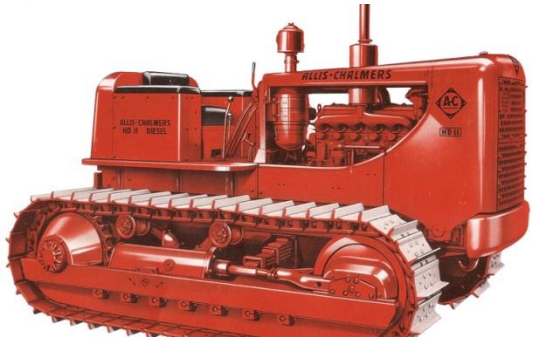
أ - ساحبات بمحركات اشتعال بالشرارة(محركات بنزين)

ب - ساحبات بمحركات اشتعال بالضغط (محركات ديزل)

اختيار حجم ونوع الساحبة الزراعية

1- نوع التربة و طبيعتها :

حيث في التربة الطينية الرملية المتوسطة و الخفيفة المتماسكة يفضل استخدام الساحبات المدولبة , أما في التربة الرخوة الشديدة التفكك فيفضل استخدام



في المساحات الصغيرة يفضل استخدام الساحبة المدولبة لسهولة التنقل, أما في المساحات الواسعة تستخدم ساحبات مجنزرة حيث يمكن استخدام آلات زراعية ذ

و هذا يتوقف على ثمن الآلات و مقدار العمل الذي تقدمه و قدرتها.

What are the functions of agricultural tractors ?

1 - Agricultural crop load, half part, portable
2- Dragging or pulling agricultural crops and trailers
3- Agricultural machines with rotating balls to operate them, such as rotary plows, potato pickers, grain studies, and pumps in spray machines.

What are the main requirements in the agricultural tractor ?

1- hydraulic system

Effective for raising and lowering the hoisting machines, as well as for remote control of some parts connected to the drawer, for example, to empty the cart loaded with the crop and connected by the tow.

2- A tractor for pulling drawbar machines

3- Power take off source: to rotate the agricultural machinery that we need in some agricultural operations (for example, "mashing")


KIOTI
عمود الإدارة الخلفى
P.T.O


sdyijia.en.alibaba.com
2012/04/18

قضيب الجرdraw bar

يستخدم قضيب الجر لسحب الآلات المجرورة و يوضع اسفل المنظومة الهيدروليكية وممكن تنظيمه على حسب الحاجة من حيث التطويل او التقصير و ممكن رفعة من الساحبةP.T.O فقد يحدث عند تخفيض اذرع ويجب الحذر عند استخدام ال الهيدروليك ان تتصادم بالجرار لذلك ممكن رفع (إزالة الجرار من الساحبة)

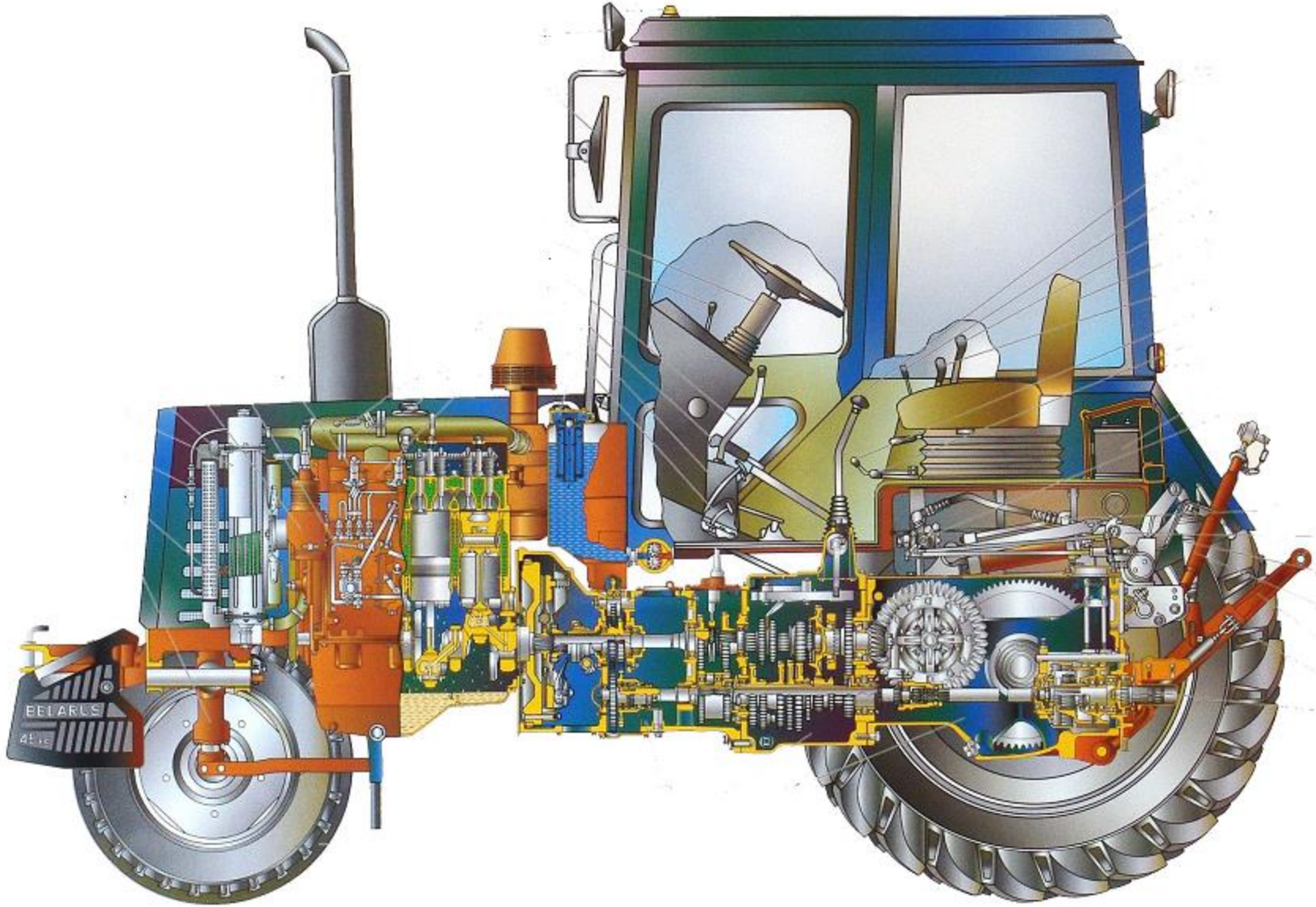
What are the main parts of a tractor?

The agricultural tractor consists of several groups connected to each other in order to accomplish the desired work and these groups

1. Power generation unit (engine)
2. Transmission devices
3. Ground contact device
4. Control devices
5. The tractor hull
6. Auxiliary devices and exploitation devices
7. Electrical devices and control gauges


exhaust stack
cab
steering wheel
fender
engine compartment
www.visualdictionaryonline.com
headlight
rim
counterweight
step
driving wheel
tread bar
front wheel


headlight
taillight
compression link
rock shaft lift arm
hydraulic coupler
lifting link
hydraulic cylinder
coupler head
power takeoff
towing hitch
draft link


BELARUS

Type/Performance Characteristics of Tractors

. Tractors are classified on the basis of running gear:

1. Crawler (track laying)
2. Wheel type

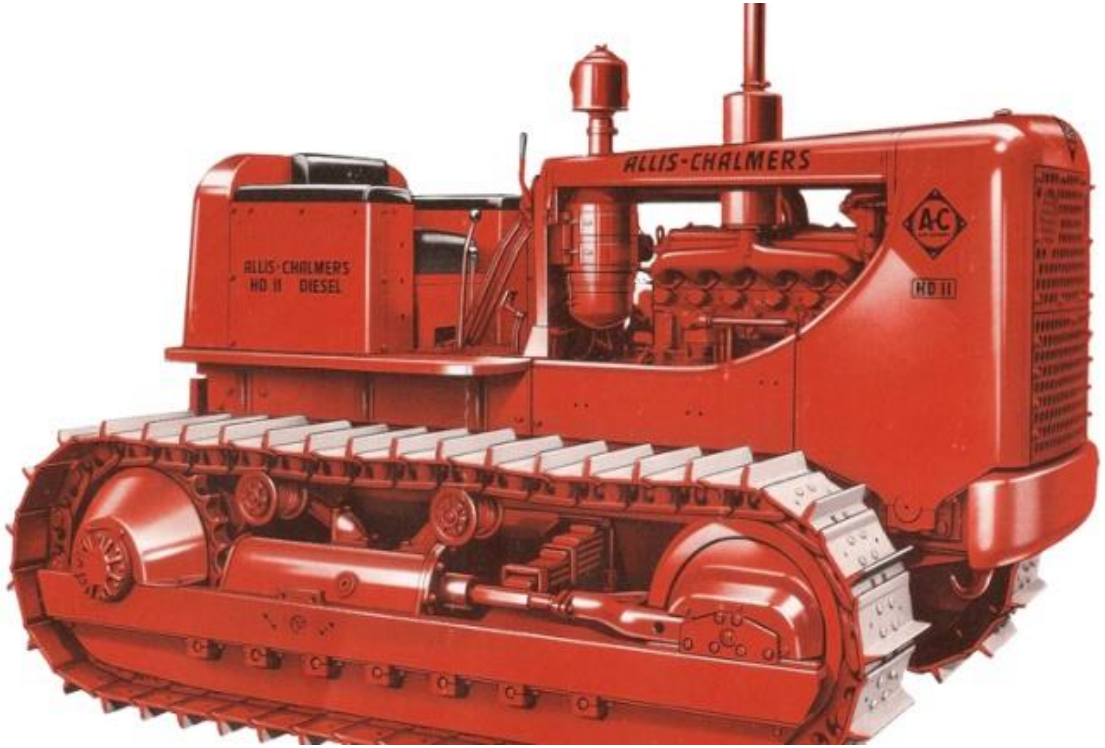
a. Single axle -usually part of a unit such as a scraper or bottom dump

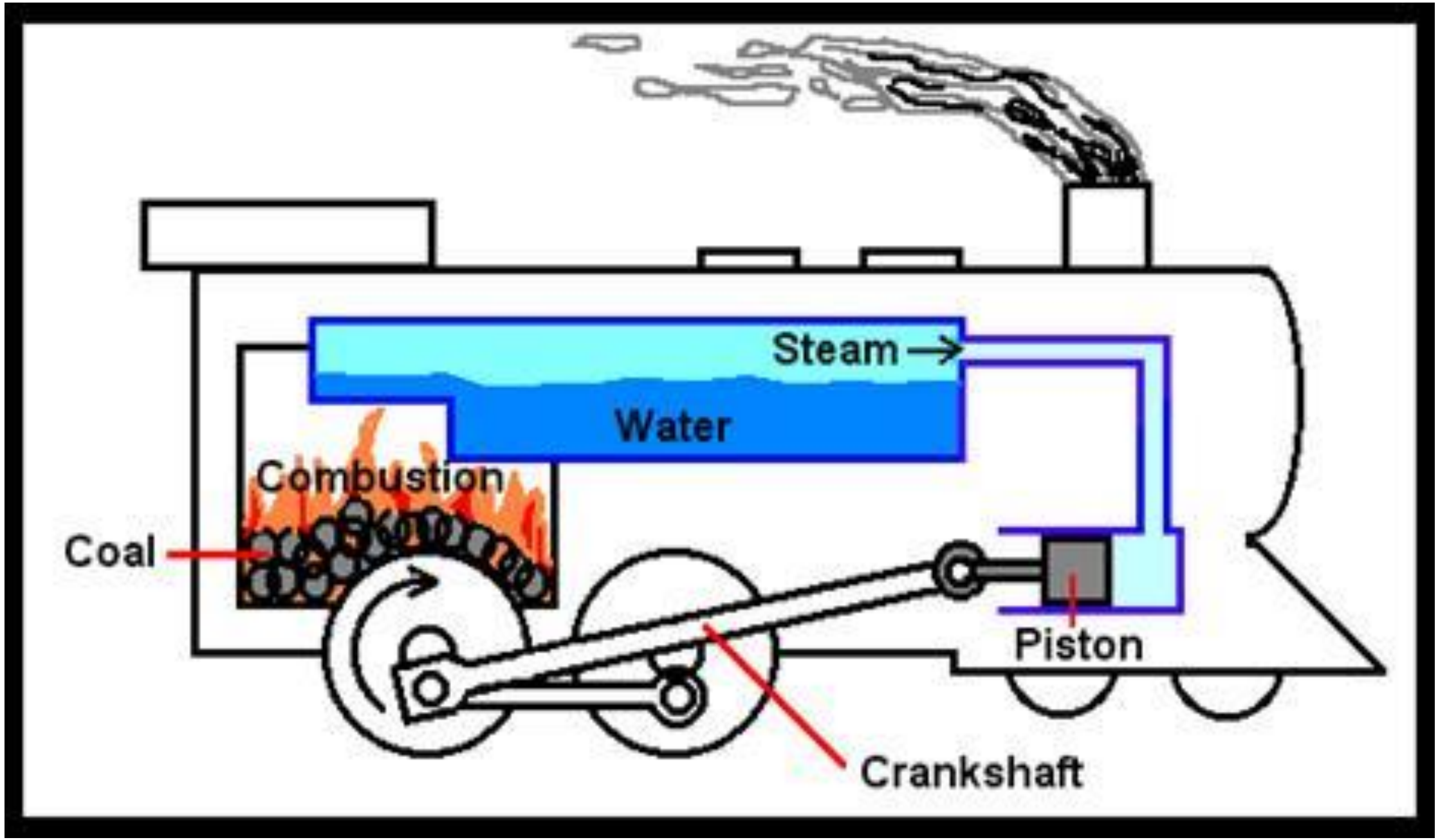
b. Two-axle single axle drive; two -axle drive

Crawler tractors

The crawler track type unit is designed for those jobs requiring high tractive effort. They are usually rated by size or weight and power. The weight is important on many projects because the maximum tractive effort that a unit can provide is limited to the product of the weight times the coefficient of traction for the particular road surface regardless of the power supplied by the engine. Table 1.4 gives the coefficients of traction for various surfaces.

An advantage of wheel-type tractors as compared with a crawler tractor is the higher speed that is possible with the former
tractors in excess of 30 mph for some models However, in order to
attain a higher speed, a wheel tractor must sacrifice pulling effort
Also, because of the lower coefficient of traction between rubber
tires and some soil surfaces, the wheel tractor may slip its wheels
before developing its rated pulling effort




Steam
Water
Combustion
Coal
Piston
Crankshaft


JOHN DEERE
7290 R

Fifth lecture

Air cleaner system

Most of the time, agricultural towers work in fields that contain dust particles, especially in dry and semi-arid regions, including Iraq, where the air contains dust and impurities, and the air must be purified before entering the engine for complete purification. The presence of particles of dust acts as a sanding paper inside the cylinder and thus speeds up the wear of the cylinder walls, and their early consumption.

Types of air purifiers used in tractors

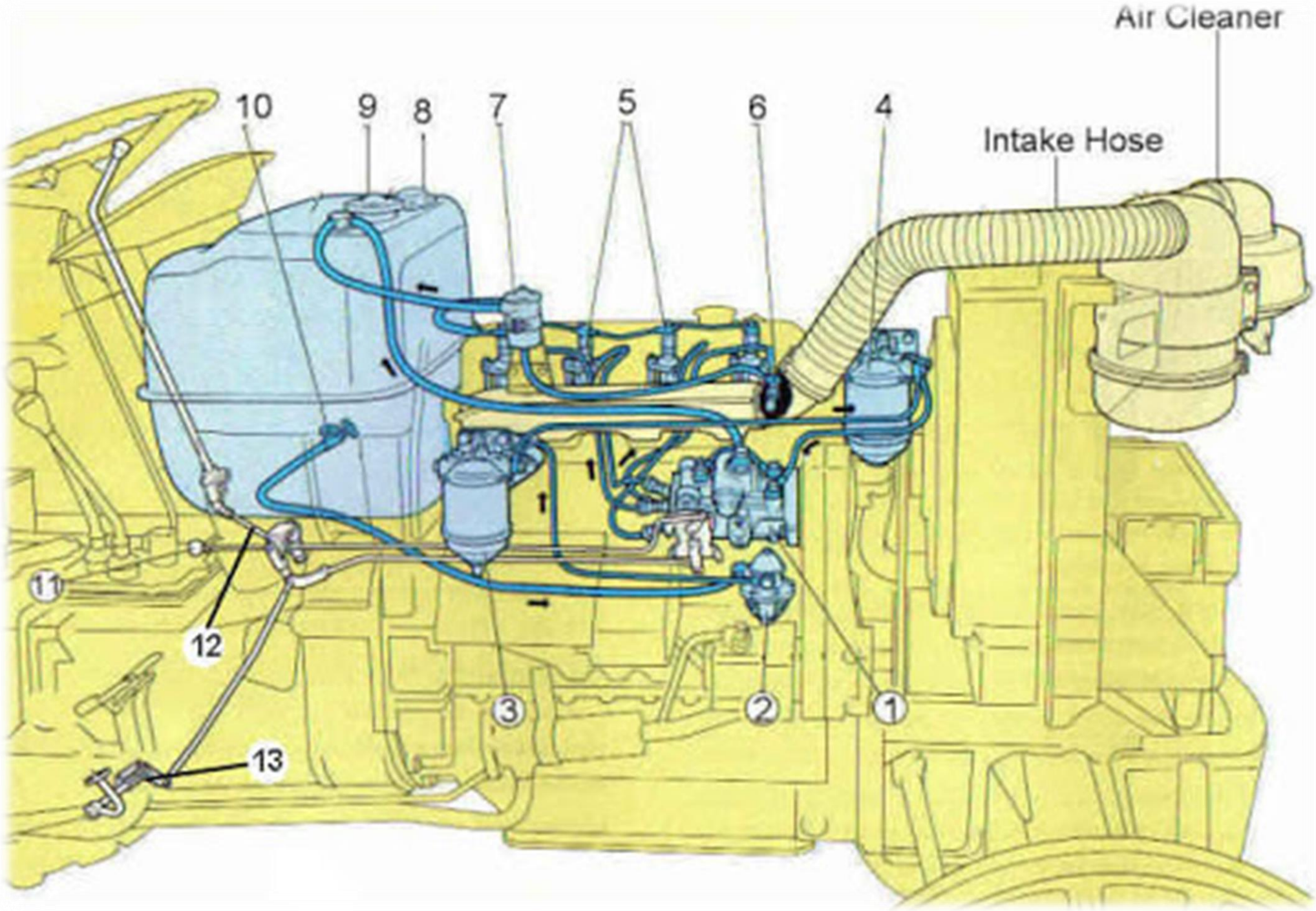
1- Inertia-based air purifiers

2- Air purifier containing filter elements

3- Oil bath air purifier

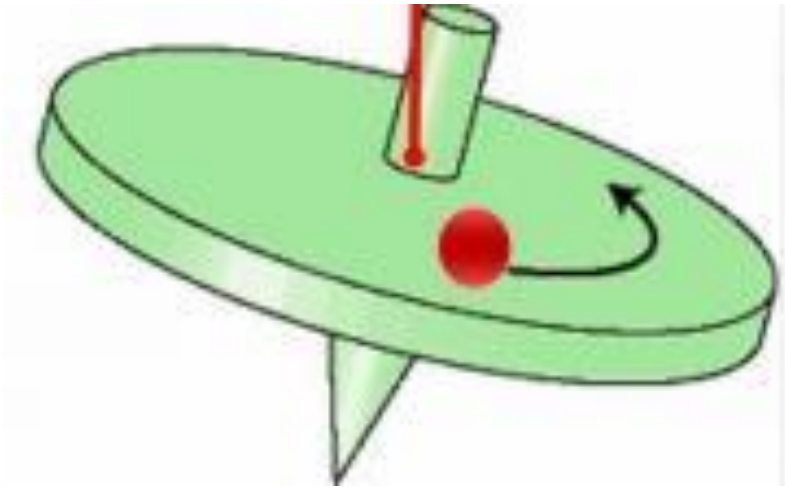
4- Composite air purifiers

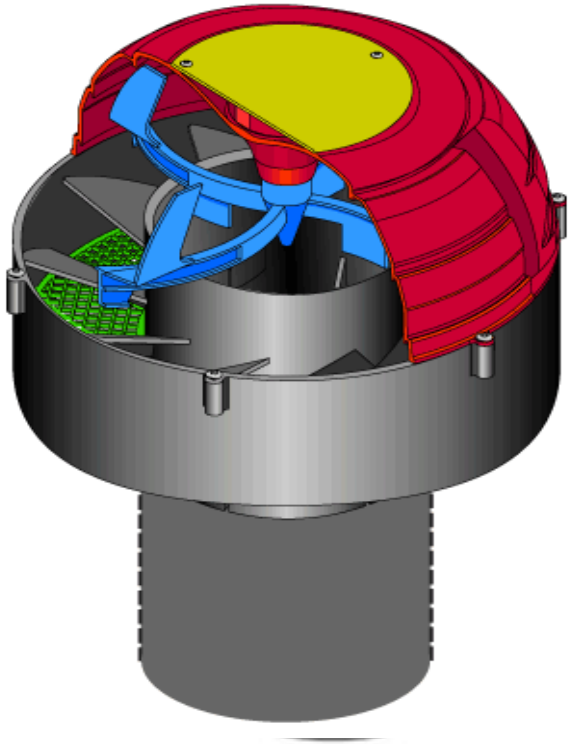

CASE IH
MAGNUM


Air Cleaner
Intake Hose
10
9
8
7
5
6
4
11
12
13
3
2
1

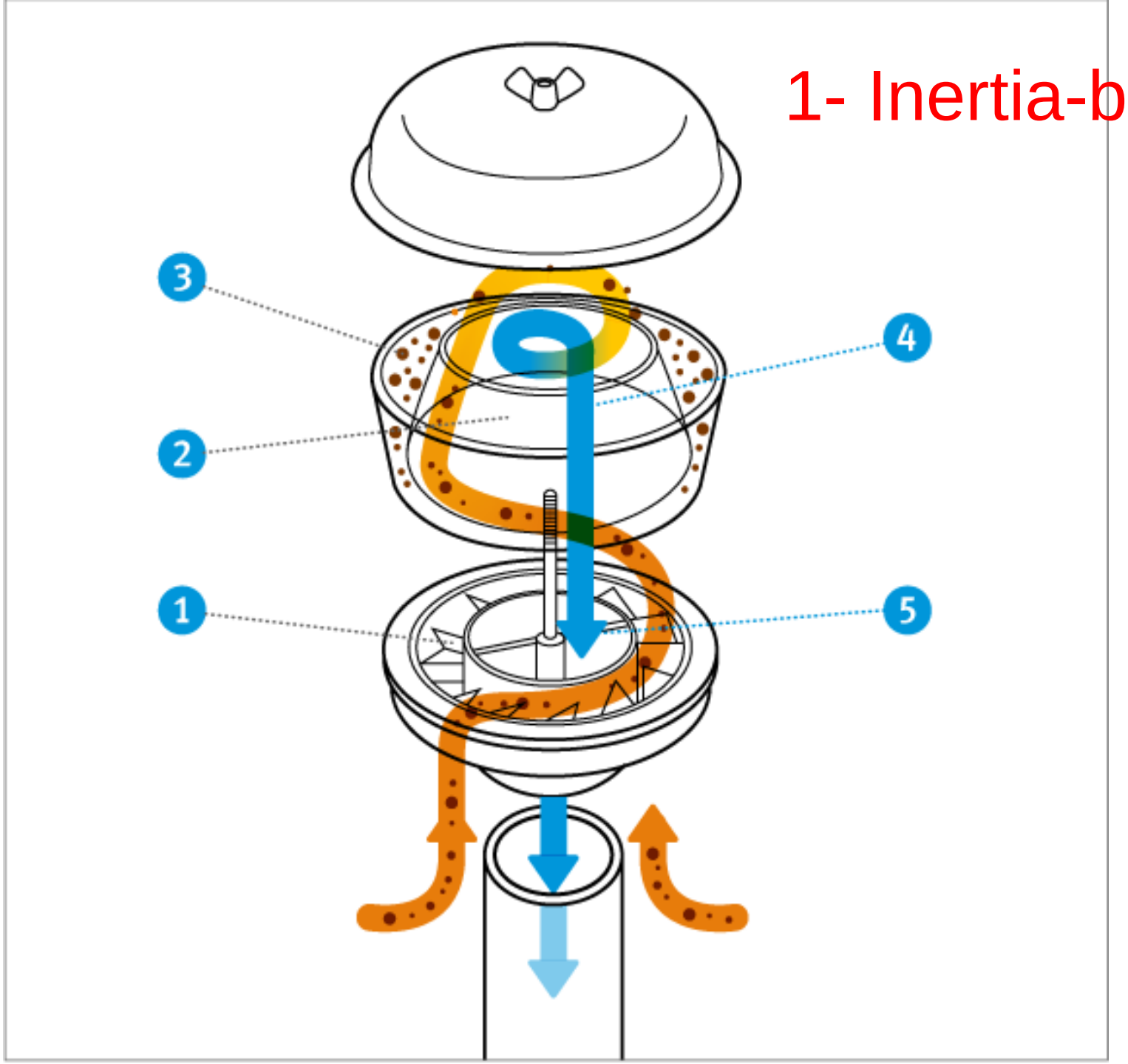
1- Inertia-based air purifiers

These purifiers contain fins that circulate the air and expose it to the phenomenon of centrifugation, which leads to the isolation of dust particles and relatively large impurities, and their fall to the bottom of the purifier. This type is used in agricultural towers as an air primary purifier.



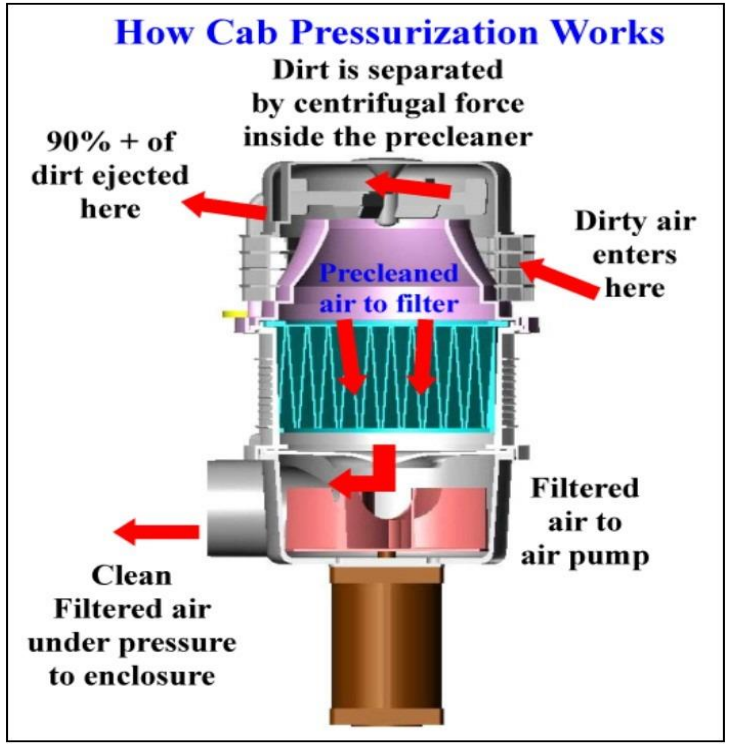


1- Inertia-based air pur



2- Air purifier containing filter elements

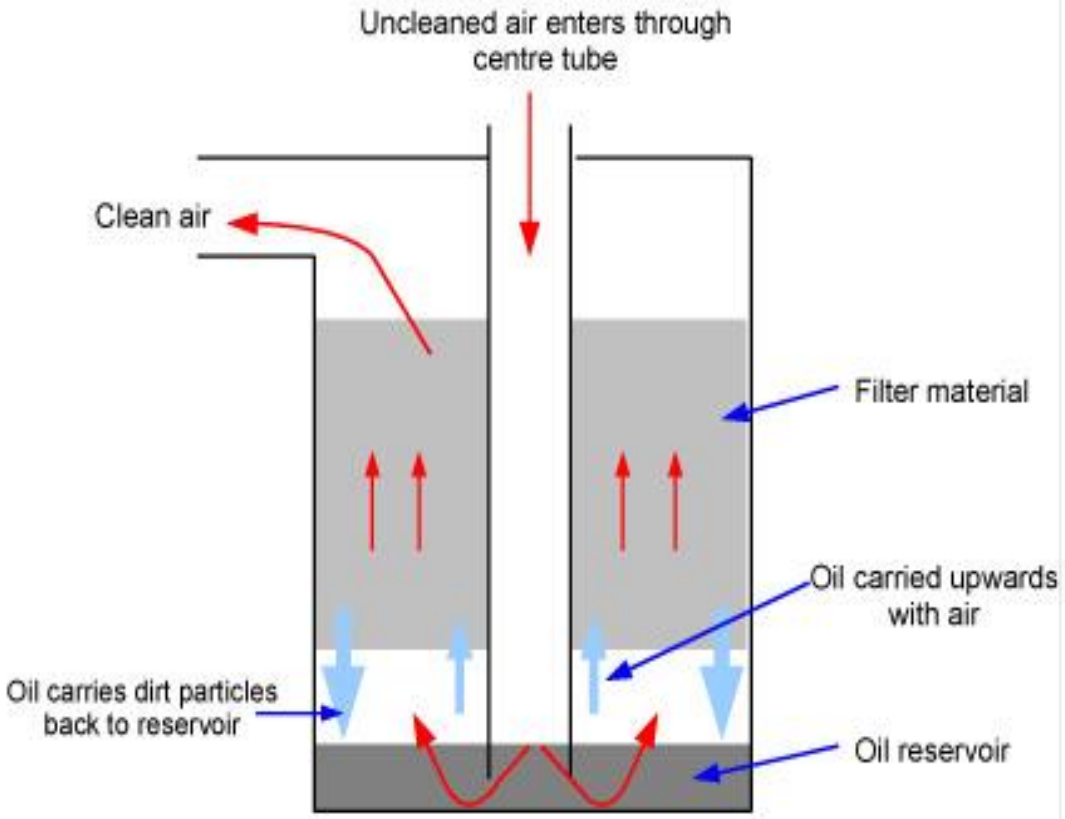
Filter elements may be wire mesh, wire mesh, or cotton yarn, and air passes through them as it is well filtered. In some advanced tractors, a sensor is placed at the base of the filter container, which gives an indication to the control panel of the filter being clogged due to the accumulated dirt and clogging on it. It must be replaced with a new
purifier .

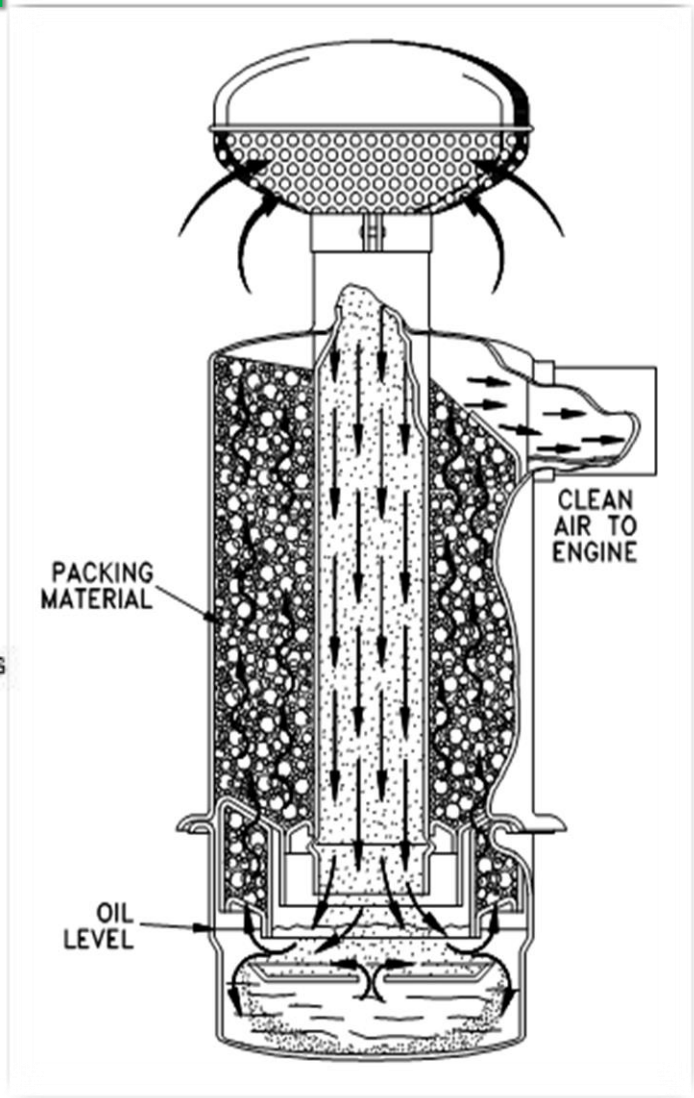


3- Oil bath air purifier

The use of this type of purifiers was widespread in many agricultural yards, as in the tractors of Antar, Masi Forksen and others. The idea of \ u 200 b \ u 200 b the work of these purifiers depends on the presence of an oil sump at the bottom of the purifier, and when the air enters the purifier, it collides with the oil surface, and dust particles and other minutes stick to the engine, and fresh air enters the engine cylinders as in Figure.

Oil bath air purifier

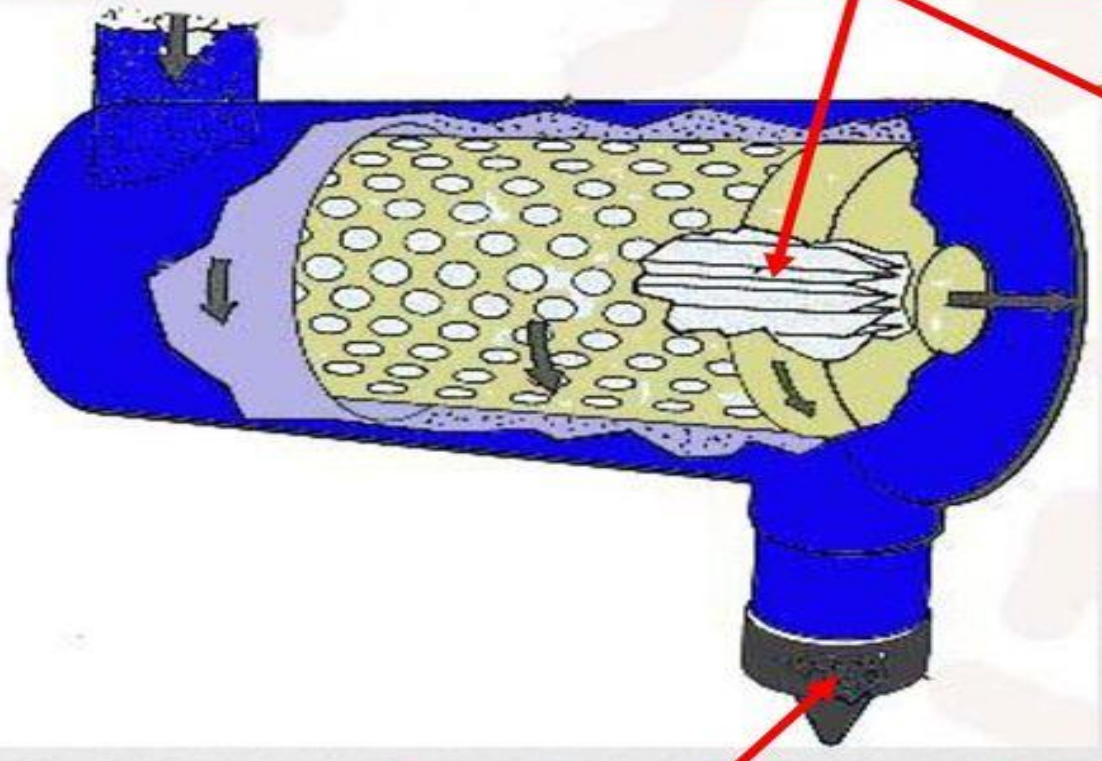




Engine
Intake & Exhaust
Systems

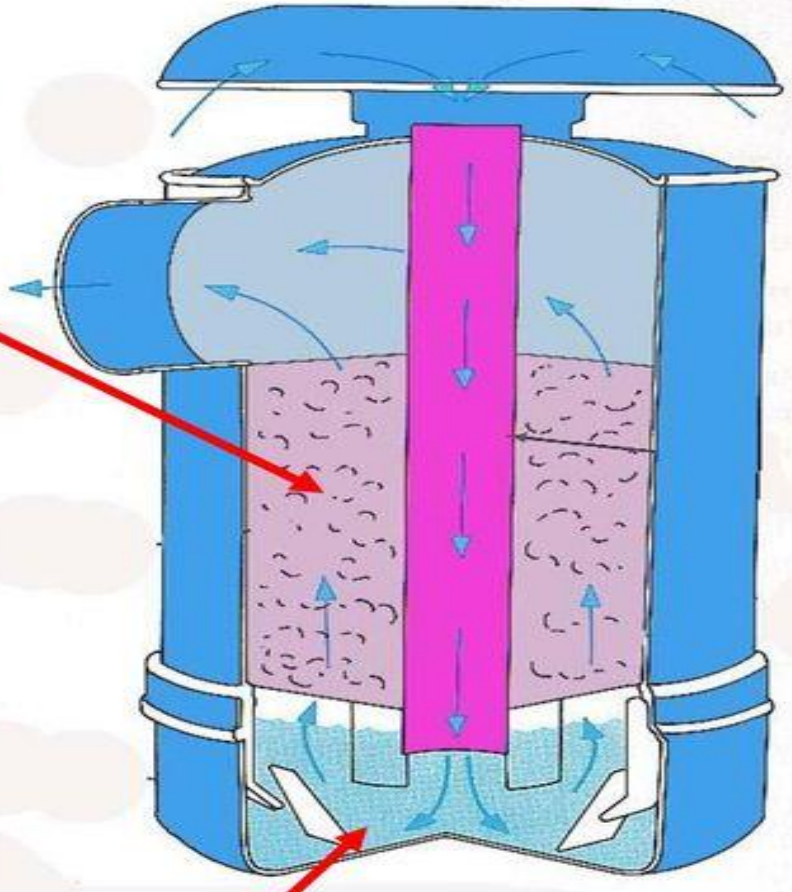
Air Filters

Dry or Cartridge Air Cleaner



Oil Bath Type

Found on Vintage Equipment



4- Composite air purifiers

Due to "the requirements of the work of the tractors and the need for effective purification of the air, the use of more than one type of purifiers within the same system has become an issue as in most of the global siphons that operate now."

Such as Massey Forksen, New Holland, Volvo , Antar, John Deere, Fiat and other Tractors

The composite purifiers consist of an elementary purifier that directs the air to the centrifugal phenomenon and drops the large minutes, then the air enters the oil bath and the remaining minutes collide in the incoming air and then exit to the top (note the arrows in the figure) where it passes through a metal wire filter to purify the remaining very small minutes i.e. That air goes through three purification stages.

These types will be further explained in practice.

Composite air purifiers

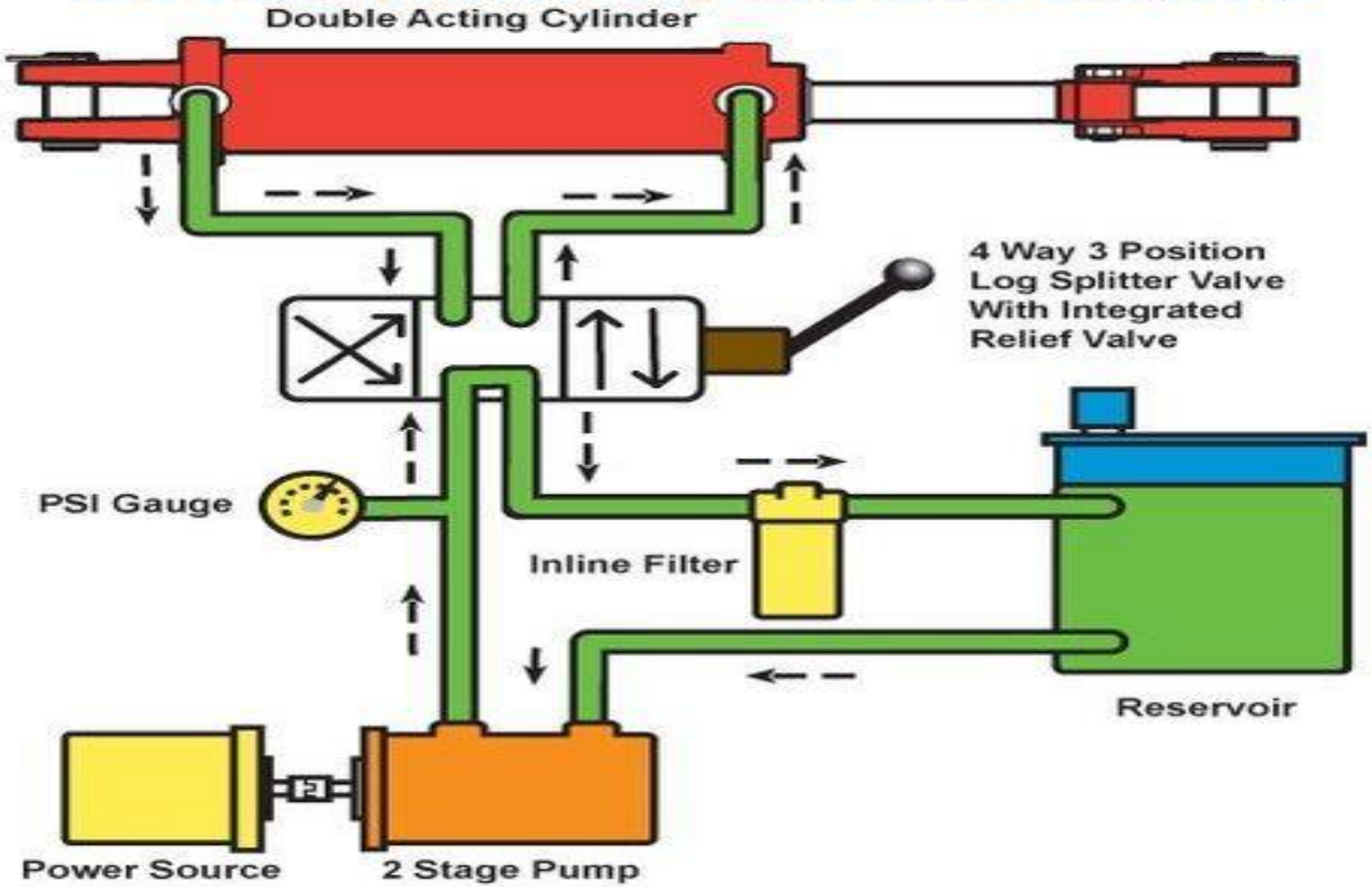
Tractor hydraulic device

The hydraulic towing device is part of the power devices of agricultural Tractors

In the past, most of the machines were pulled by agricultural Tractors, while nowadays most of the machines were used

It is lifted by the hydraulic system of the TRACTOR, it is possible to obtain more than one work in the hydraulic system of the tow. Before dealing with the functions and functions of the hydraulic system, it is necessary to identify the parts of the hydraulic system of agricultural Tractors

Wood Splitter Hydraulic Circuit



Parts of the hydraulic system for agricultural pullers

1- Oil tank

Most agricultural farms contain an oil tank, and this tank may be used for a speed box and for the hydraulic tank and for the speed differential device, in this case we use the same type of oil

2- Oil pump

There must be an oil pump for the hydraulic system and an oil filter connected to it, and it may contain a safety valve in case of increased pressure. The pump must be close to the source of the oil so that the oil reaches it even in cases of lack of oil. Most of the hydraulic pumps in the pulleys are of the gear type as in the Tractors of the Antar and may be of the piston type as in the Tractors of Massey Forksen

3- Oil Purifier:

The oil filter (filter) is used in the hydraulic system and it may be metal wire as in the Tractors of Antar, as it contains a magnetic wire filter to hold solid metal particles

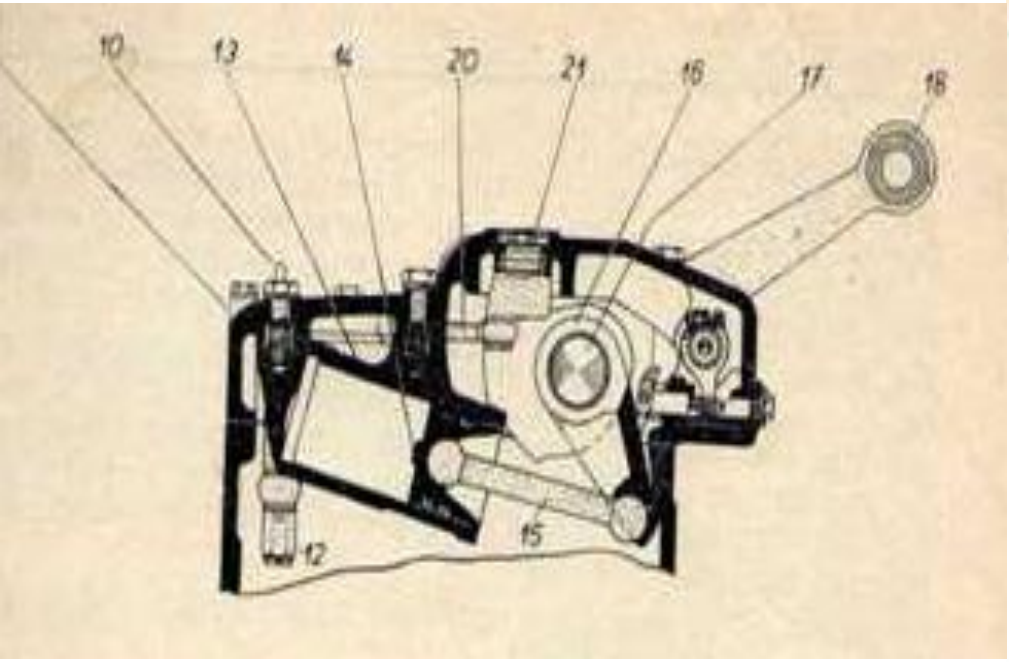
4- Hydraulic control device:

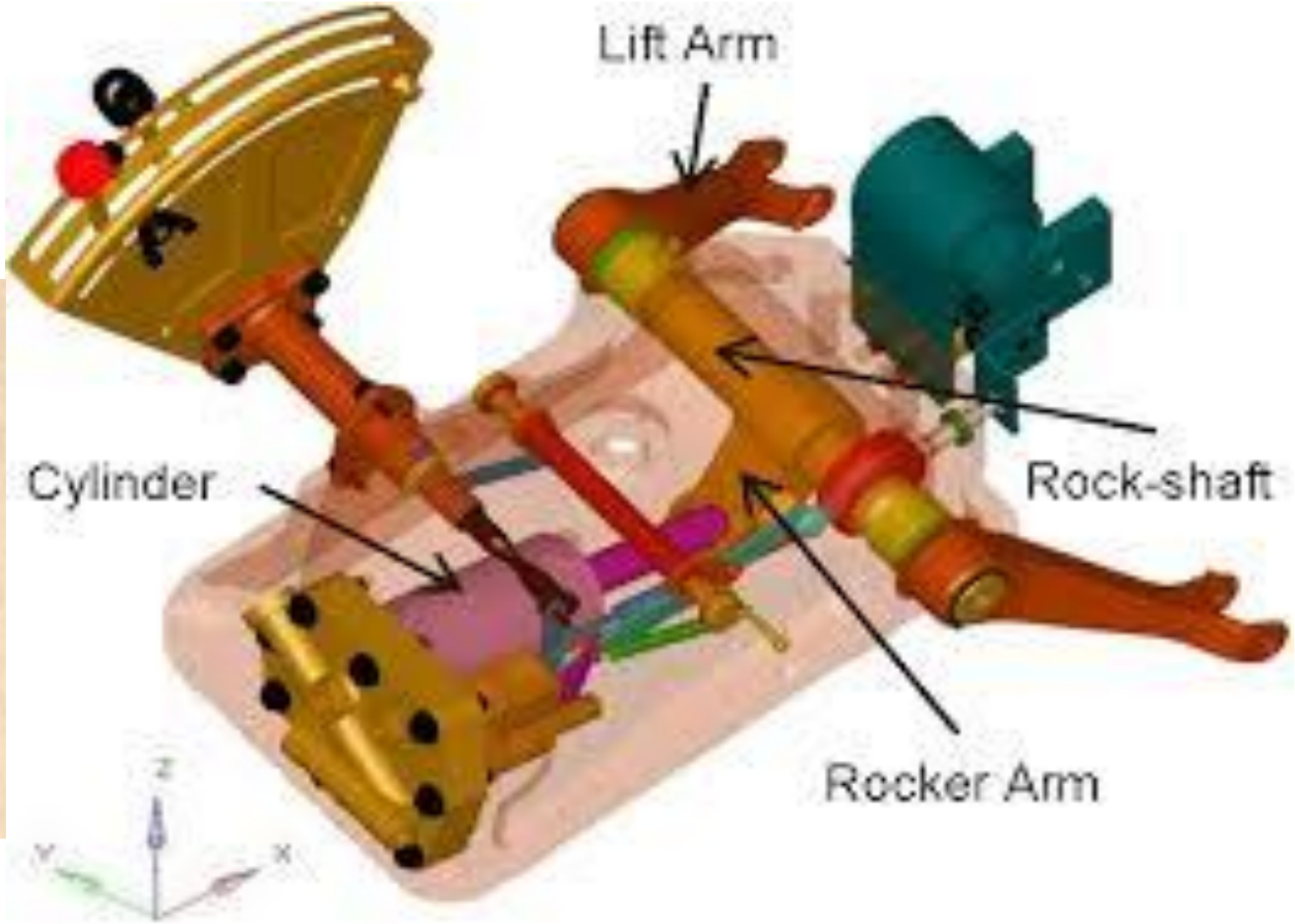
It is a device that contains several levers near the driver that can be controlled to deal with the machine .

5- System cylinder

Most hydraulic systems for pullers have an A-cylinder hydraulic cylinder

B- A piston moving inside the cylinder C- A lever connected to the piston on one side and the boom of the lifting arms On the other hand .


10
13
14
20
21
16
17
18
12
15

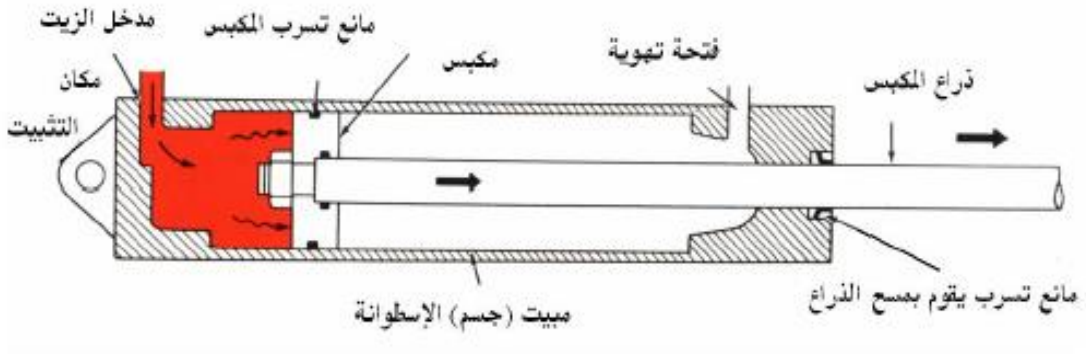

Lift Arm
Cylinder
Rock-shaft
Rocker Arm
Z
Y
X

How did the hydraulic system work in agricultural Tractors?

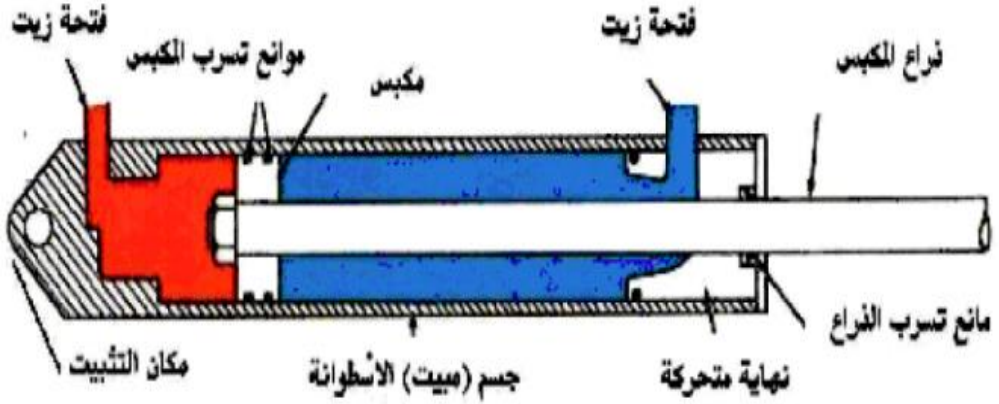
There are two main hydraulic cycles in Tractors, namely

1- The outer circuit

When the equipment is attached hydraulically to the agricultural drawer that contains cylindrical presses for lifting or lowering, or any other hydraulic operation, and as in the case of attaching a trolley that contains a piston (jack lift) , and when it is needed to raise the cart box to the top or to one side, we need the hydraulic system (Figure 41) And there is a place (coupling) to connect the tube of the hydraulic device of the puller with the piston of the machine, and this is called a single act cylinder system. Figure (42) There may be two places in the system and it is called a double or single acting system. Figure (42) Return or descend of the piston. It may be due to the weight of the lifted part (in the case of single work) or it is lowered by another cylinder or the same cylinder and two tubes connected to it on both sides)



شكل (٣) أسطوانة هيدروليكية مفردة التأثير



شكل (٥) نموذج لأسطوانة مزدوجة التأثير


TOWNSUNNY


Online-Car-Show.com

2- The inner circuit

These are within the Tractor itself used to raise and lower the machines, and this system is somewhat complicated and few who have full knowledge of its work and we will focus only on the main parts of the system's work.

As we explained previously, "There is a part called the hydraulic control device, which is by which we control most of the hydraulic system, as it generally contains the following parts:

A. lever that controls the position of the clouds below the surface of the soil and the machine works with the soil (paddles. Softeners. Disc harrows, rotary plows, etc.) This mode is called the position of clouds and work under the soil surface

draft control or depth control

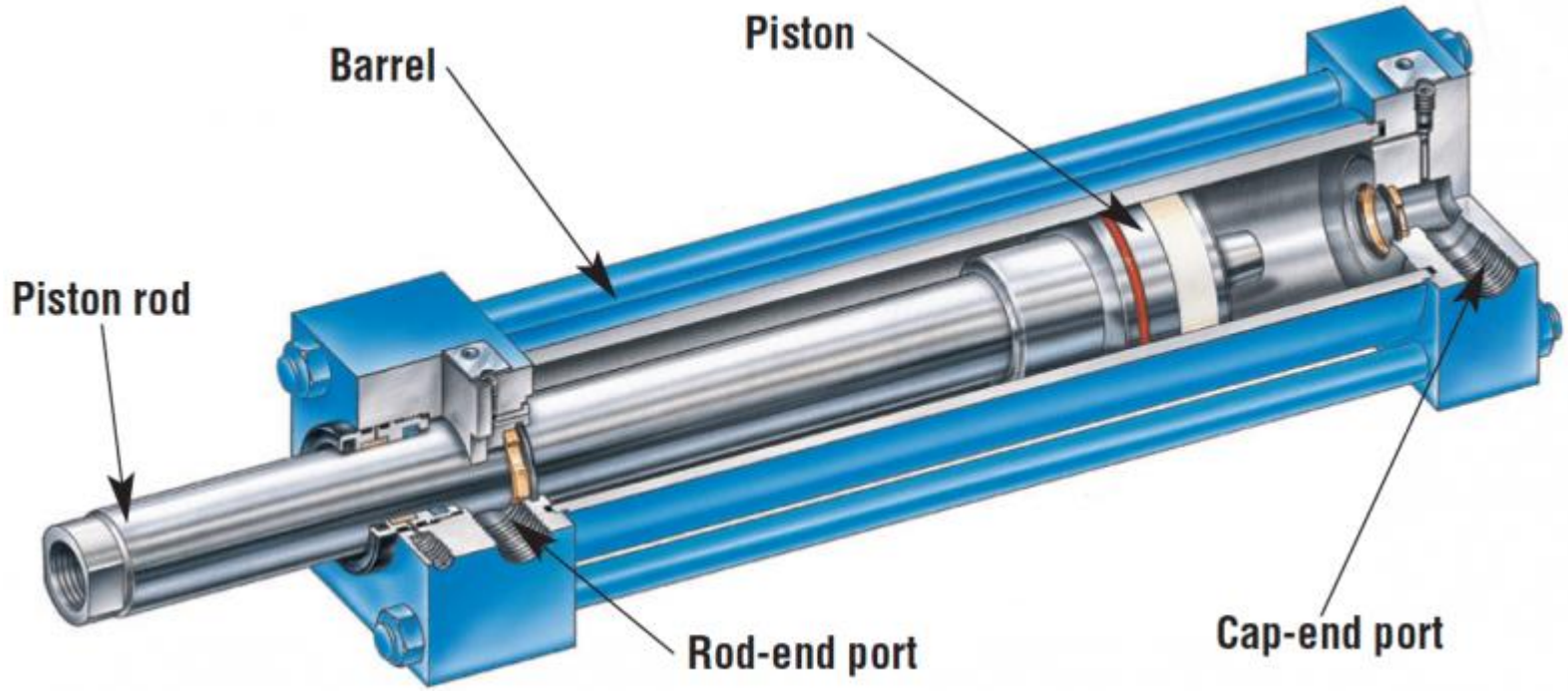
B . Position control

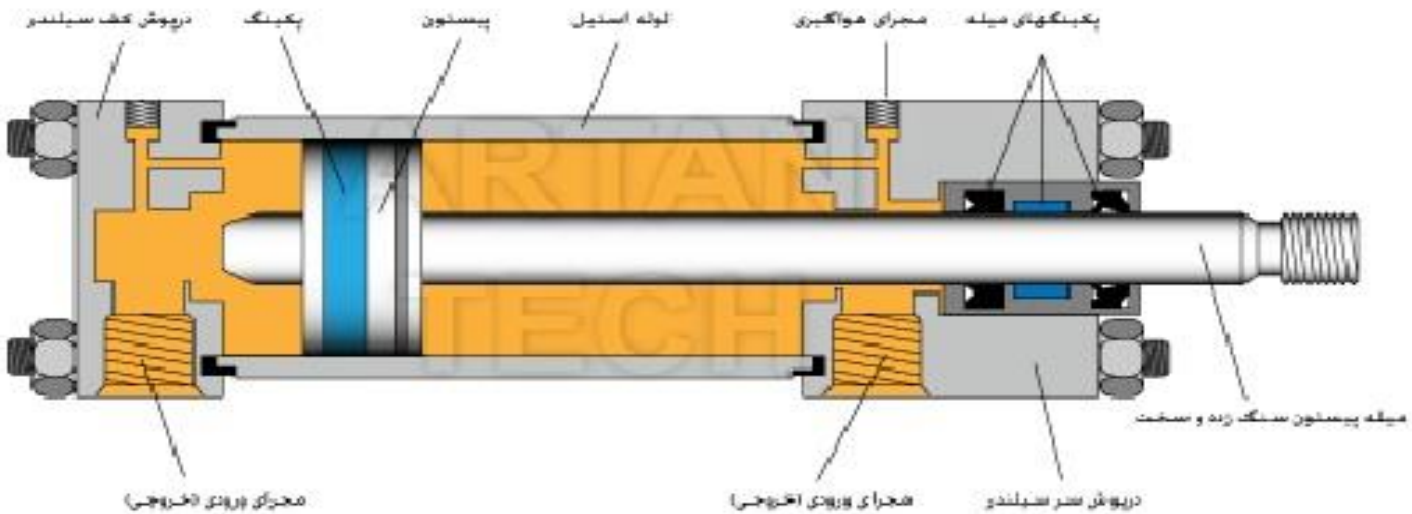
When we use the machine on the roof and it is at a specific height (70) cm height of the machine

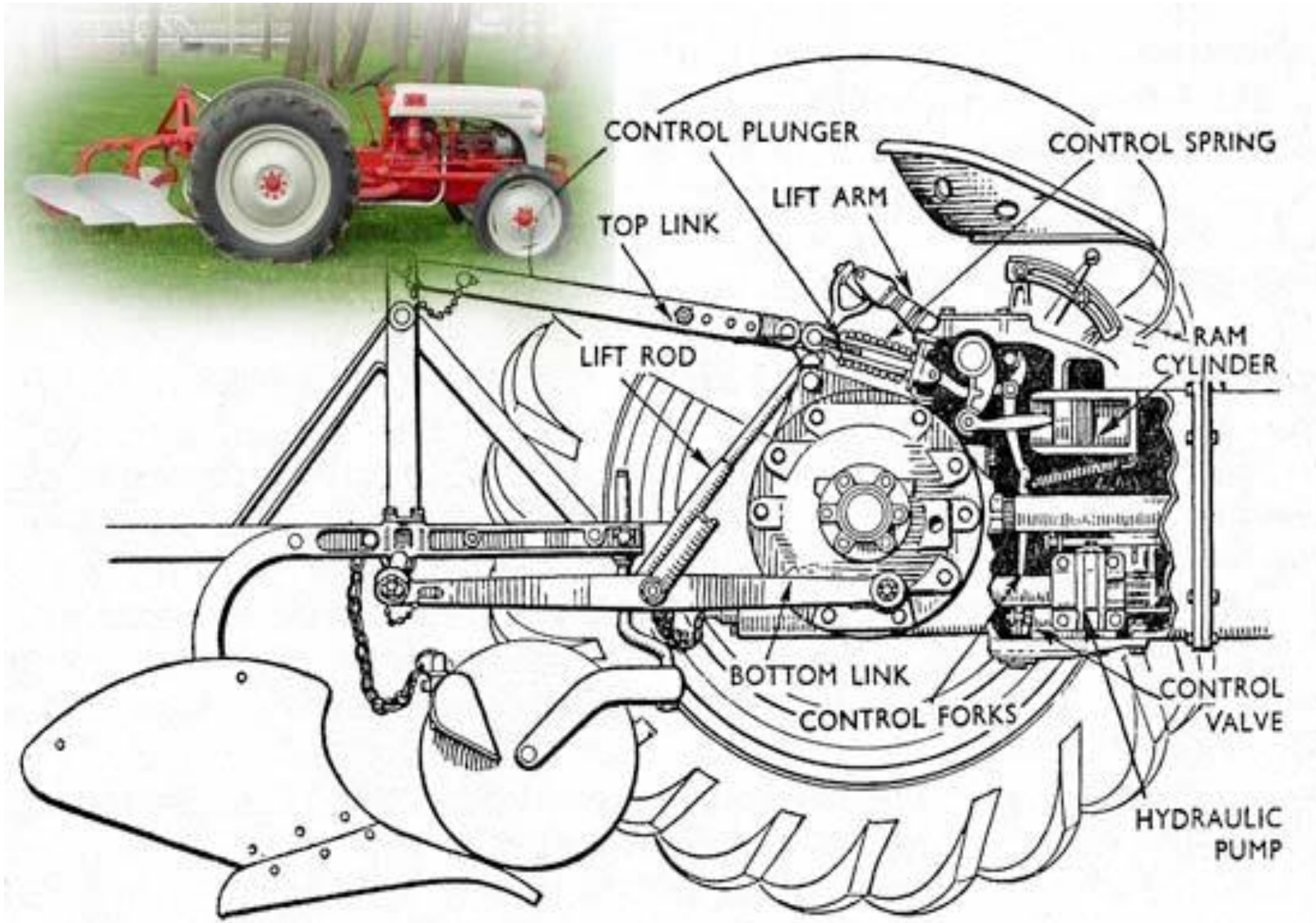
On the surface of the earth, for example) we use this lever

C - Mixed mode: the possibility of pairing the two currencies when we wish to plow at a fixed depth

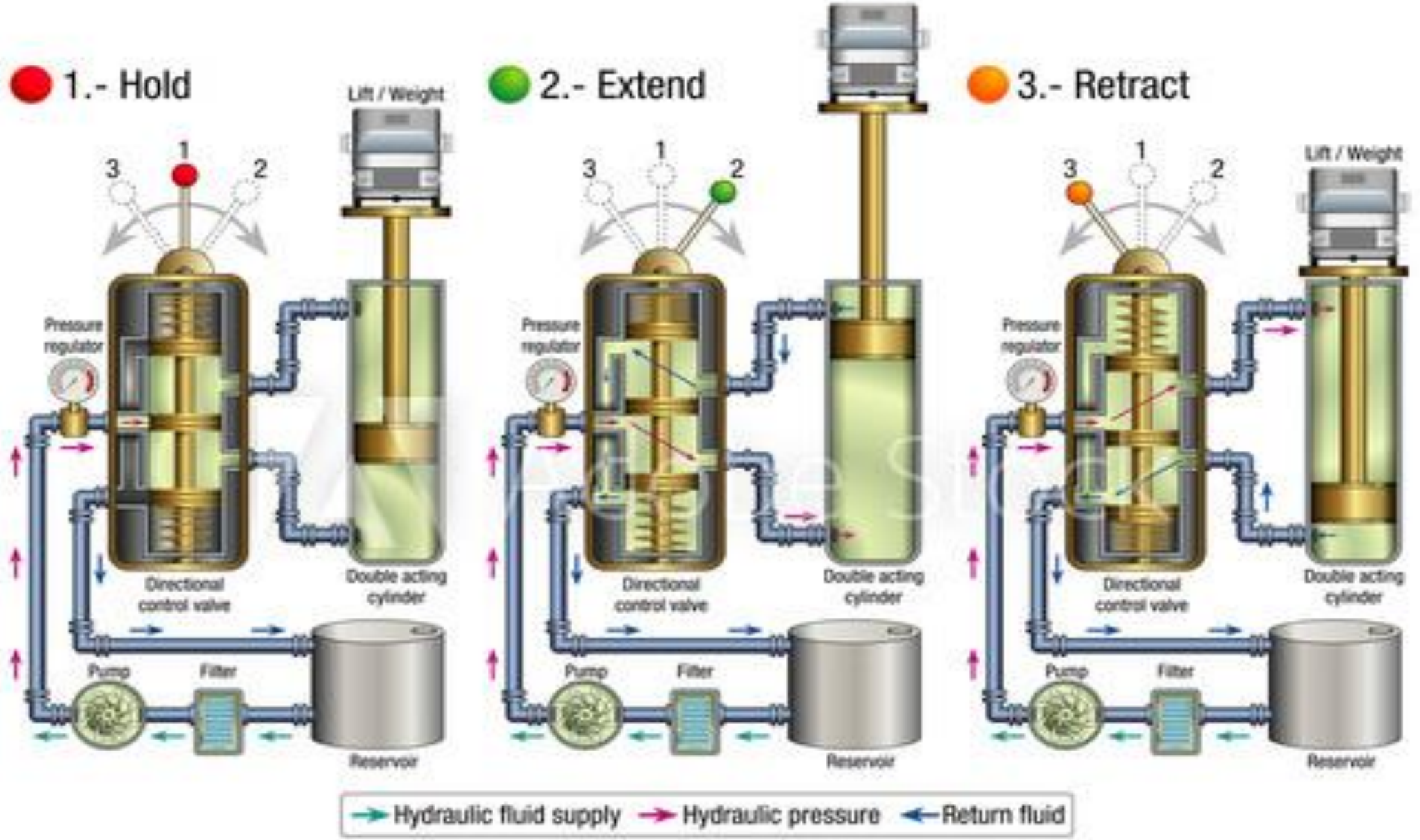
D- The oil pressure transfer lever to the outer circuit and it is with one of the two levers, where the lever is directed to a position on which pressure


Piston
Barrel
Piston rod
Rod-end port
Cap-end port


درپوش کف سیلندر
پکینگ
پیستون
لوله استیل
مجرای هواگیری
پکینگهای میله
میله پیستون سنگ زده و سخت
مجرای ورودی (خروجی)
مجرای ورودی خروجی
درپوش سر سیلندر



1948 Fordson 8N with a drawing of the Ferguson Three-Point Hitch system.

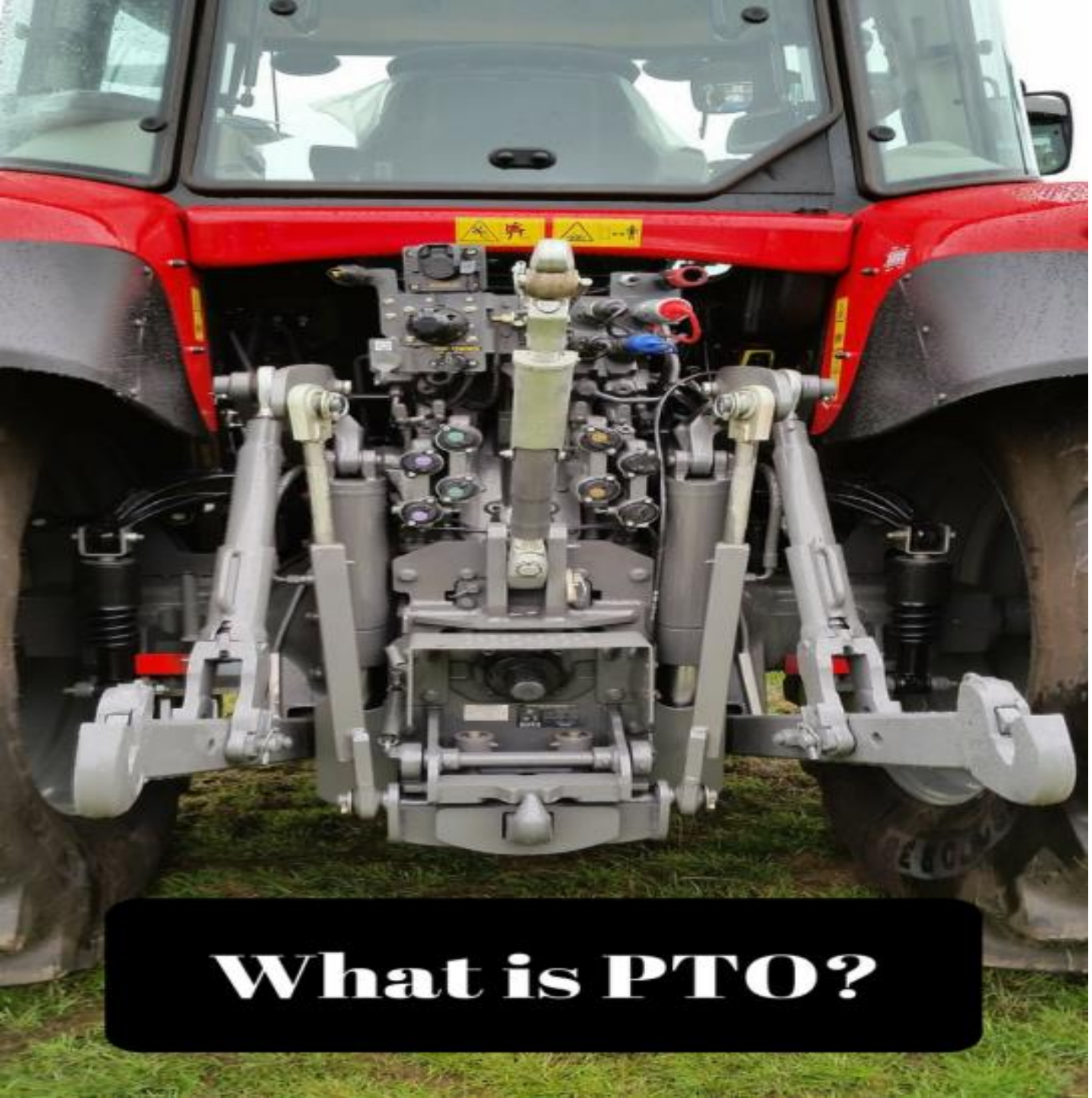


OPERATION OF THE DIRECTIONAL CONTROL VALVE

#206642039

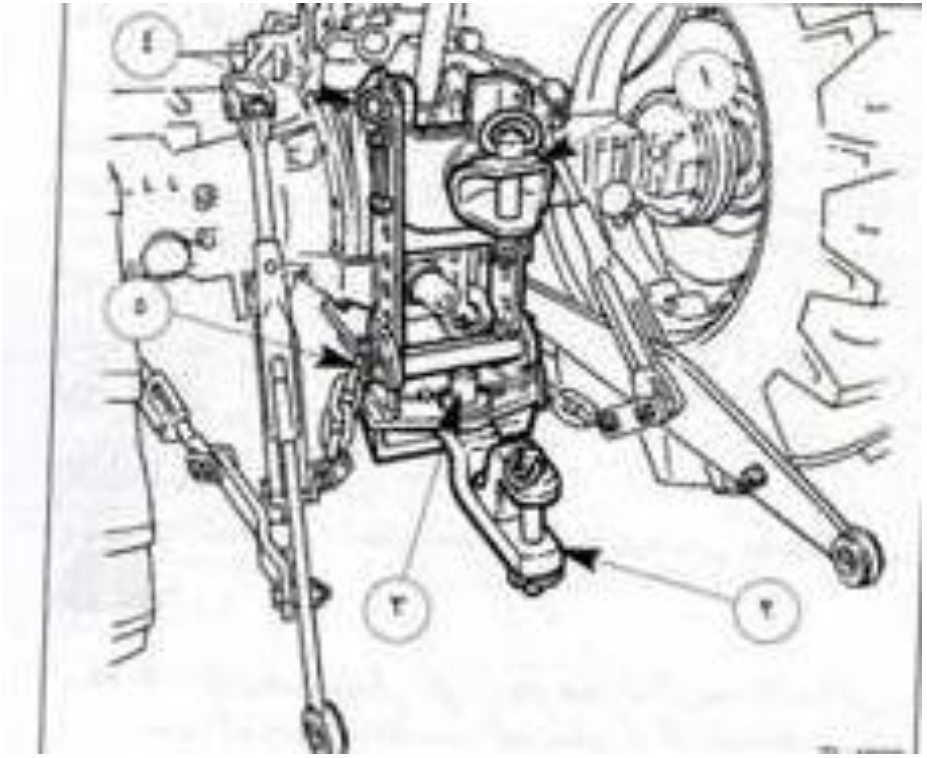
power take off (p.t.o)

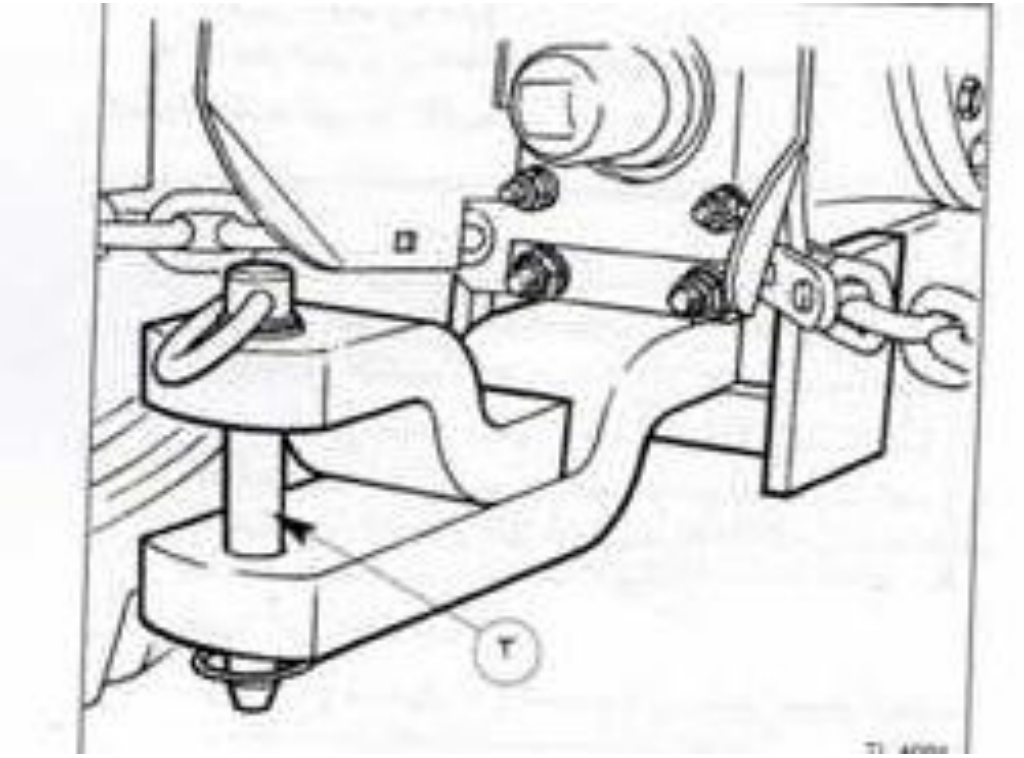
In agricultural works we need some machinery and equipment parts in which are rotated for no different purposes, such as in a rotary plow, a mower mower or a hay press machine, etc. In most agricultural Tractors there is a toothed rod that takes its movement from the gear box rotates at a constant speed, and in most of the Tractors rotates at a speed of 540 Revolutions per minute or 1000 revolutions per minute. There is a clutch lever to control the separation and connection of the P.T.O. It is also possible to link the P.T.O to the gearbox speed or the engine speed. The power take-off source may be straight, not independent, or synchronous. There is a link (cardin) as in the figure connecting the machine and the puller and it is of the telescopic type, capable of shortening or lengthening to deliver the movement .


What is PTO?

Drawbar :

The drawbar is used to pull the Tractors, and it is placed under the hydraulic system and it can be regulated according to the need in terms of lengthening or shortening, and a lift is possible from the puller and it is necessary to be careful when using the P.T.O .





What are the safety measures?

1- The tractor may not be driven by persons under 16 years old

2- It is not permitted to ride another person with the driver, especially when working

3- Wearing protective equipment when working (loose-fitting clothes. Mask or glasses, gloves, protective shoes, hard hat)

4- Not smoking while at work

5- Not to eat foods while spraying with pesticides

6- Do not open the caps of the cooling water tank and the fuel tank cover while the engine isidle

7- It is not permissible to move between the tractor and the equipment attached to it while working

8- It is not permissible to use the fastening tools behind the tractor as a staircase to cross to the other side

9- Not to put the hand under the fuel dispensers when checking the fuel system, because it may puncture the skin of the hand

10 - Read the agricultural tractor manual before using the tractor

11- There must be several first aid with the tractor

12 - Do not run the tractor for a long time inside the warehouse (garage) of the tractor because the exhaust gases

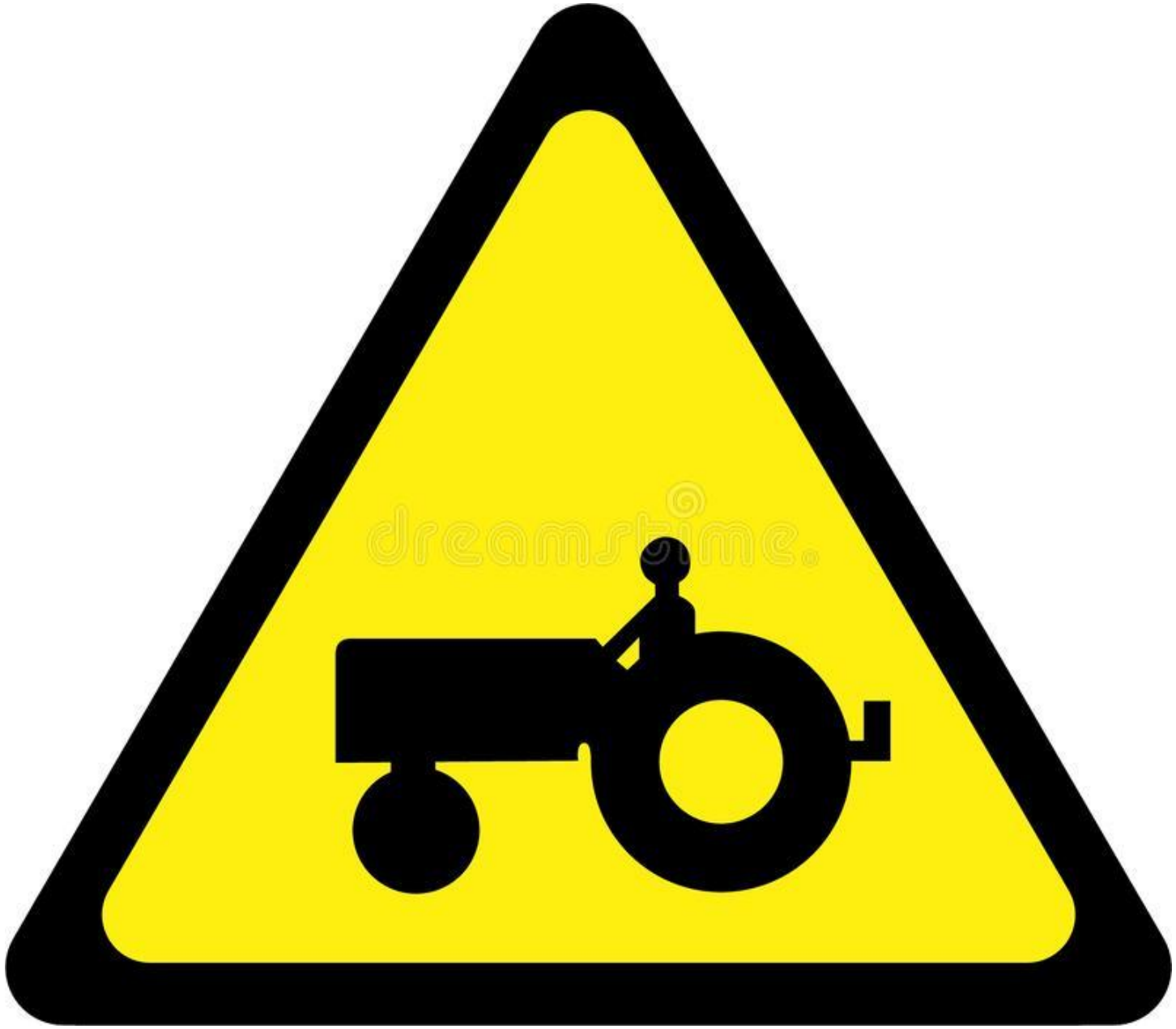
It may cause poisoning

13- Notice all the warning signs on the tractor, which include danger - warning

- Caution - Note

LABEL

LABEL



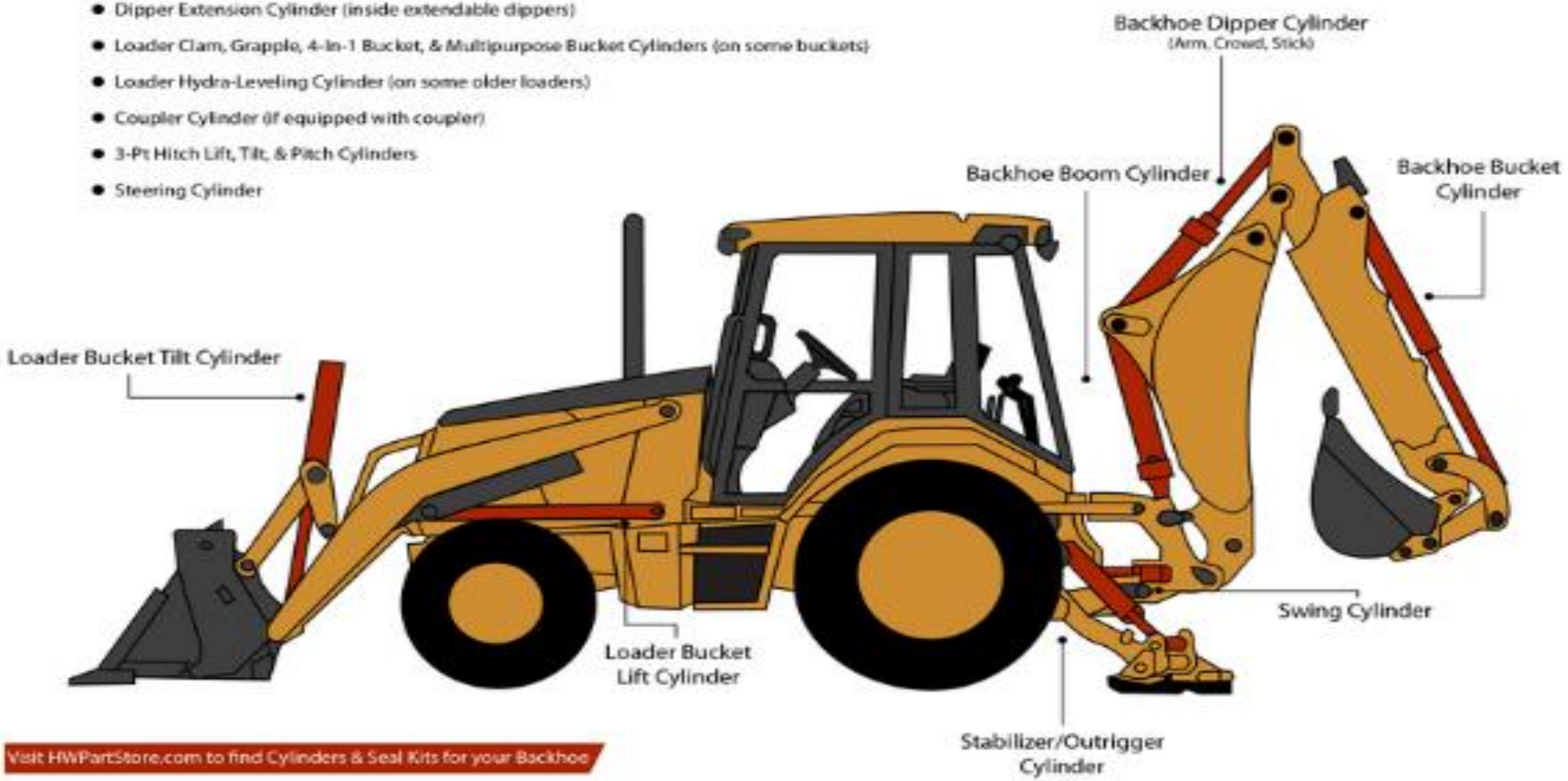

BULL
BULL
Mahindra
BULL
BULL

BACKHOE CYLINDER IDENTIFICATION DIAGRAM

HW PART STORE

NOT SHOWN

- Dipper Extension Cylinder (inside extendable dippers)
- Loader Clam, Grapple, 4-In-1 Bucket, & Multipurpose Bucket Cylinders (on some buckets)
- Loader Hydra-Leveling Cylinder (on some older loaders)
- Coupler Cylinder (if equipped with coupler)
- 3-Pt Hitch Lift, Tilt, & Pitch Cylinders
- Steering Cylinder



Visit HWPartStore.com to find Cylinders & Seal Kits for your Backhoe

LOADERS

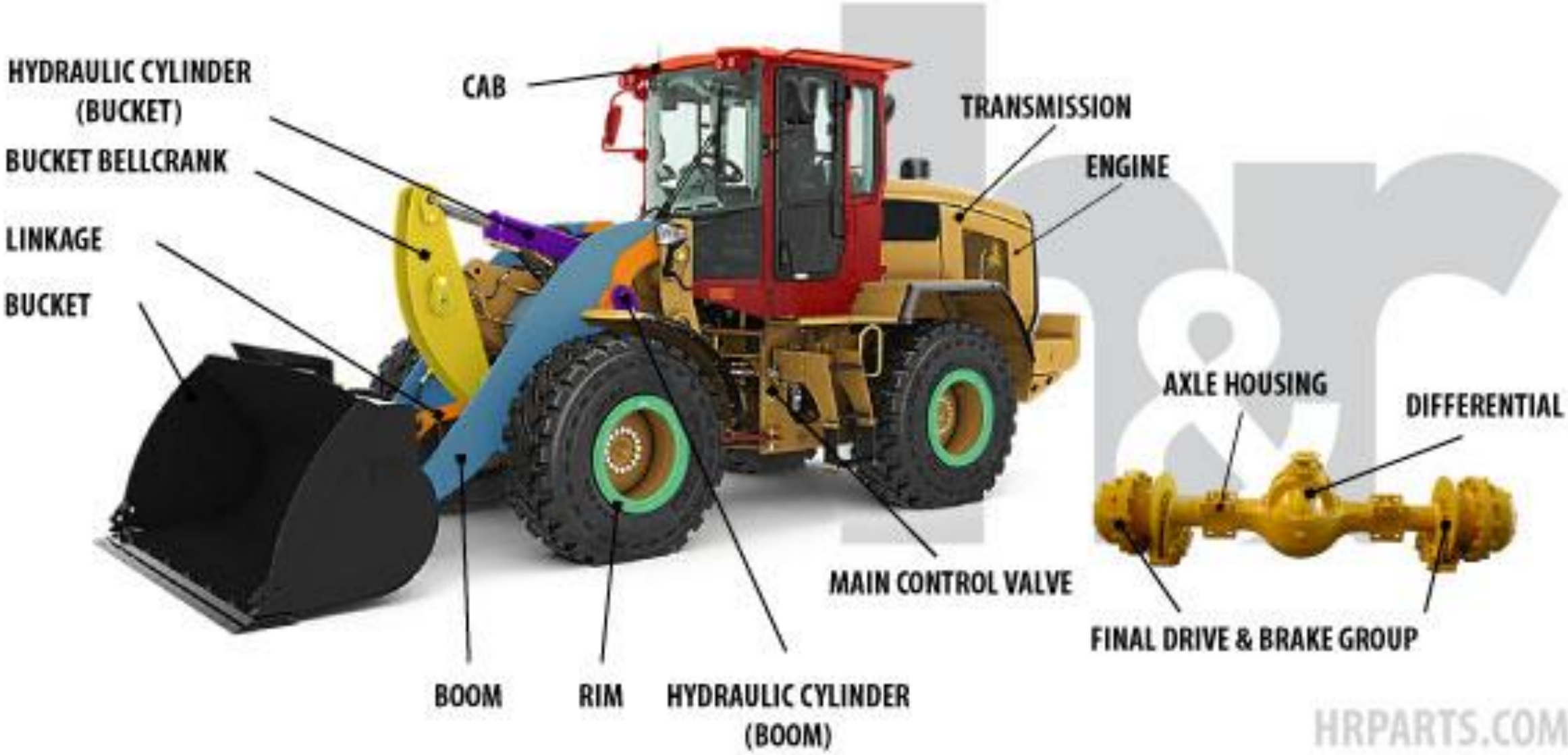
Back loader hyd. kb 104

Color of The Machine May Change

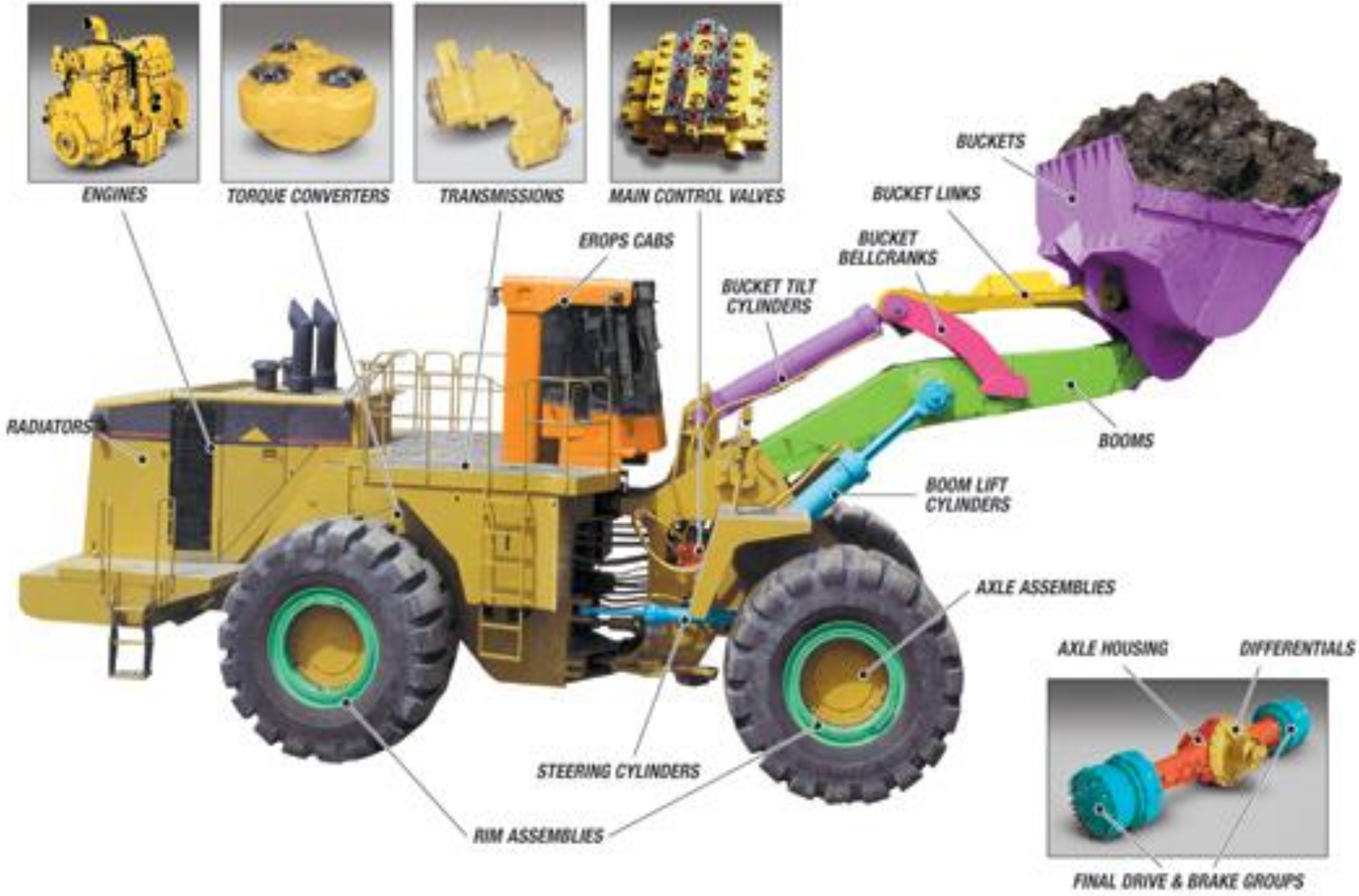
A loader is one machine in common use to pick up excavated material.

It consists of a crawler or wheeled tractor with a shovel or a bucket mounte in front .

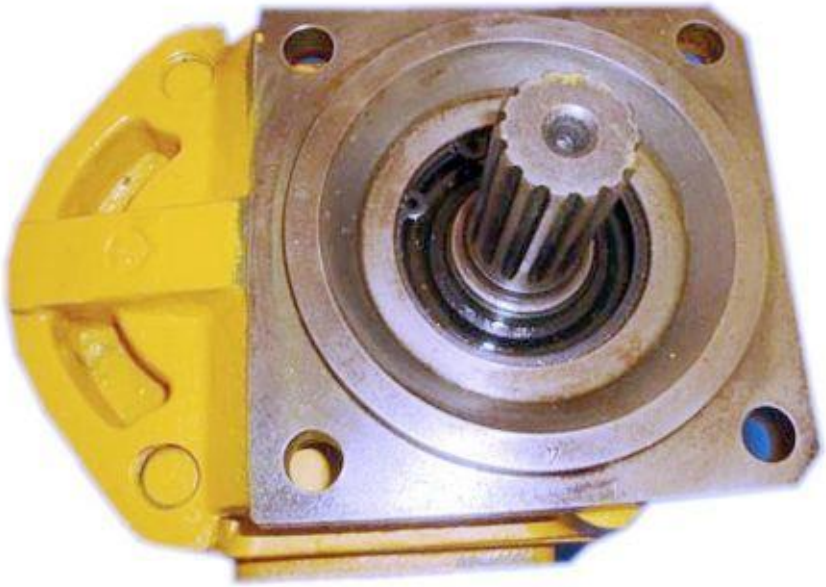
Components of Shovel



WHEEL LOADER


ENGINES
TORQUE CONVERTERS
TRANSMISSIONS
MAIN CONTROL VALVES
BUCKETS
BUCKET LINKS
BUCKET BELLCRANKS
EROPS CABS
BUCKET TILT CYLINDERS
RADIATORS
BOOMS
BOOM LIFT CYLINDERS
AXLE ASSEMBLIES
STEERING CYLINDERS
RIM ASSEMBLIES
AXLE HOUSING
DIFFERENTIALS
FINAL DRIVE & BRAKE GROUPS

A **LOADER** is also known as a front-end loader, loader, a bucket loader or sometimes a scoop loader. it is a bucket that is on the end of movable arms. it tilts and is used to lift and move material. the shovel is part of a tractor. it is either a permanent-mounted version or a removable attachment. the bucket at the end of the arms can be replaced with other tools, such as forks for lifting pallets or bale tools that are specifically designed to handle bales of hay.



Shovels are used for:

1. digging operations
2. levelling operations
3. pushing operations
4. load and carry operations
5. handling loads similar to crane
6. mounting other equipment and acting as a tool carrier
7. preparing and levelling stock storage pads
8. towing loads and other equipment similar to a tractor
9. general clean-up of work areas

there are many makes and models of shovels. You must locate the operator's manual for your shovel and study the operating and safety features. You will find that the position and operation of the controls vary considerably.

Before starting or operating your shove (LOADERS)

1. locate and identify each control and familiarize yourself with its function .
2. check the position and operation of park brakes and emergency devices .
3. know how to stop the engine .

Some shovels are tracked machines. the tracks allow them access to rougher working areas that would damage tires.
Larger shovels have a steering feature known as articulated steering. they steer from a pivot point set between the front and rear axles. this allows the front axle to be solid and support more weight. the driver can steer the loaded bucket in a tight arch to reach a truck. there is danger of tipping over, because the weight is shifted away from the body of the shovel.

Shovel controls

there are a number of pedals and levers to operate. Various combinations will be used at the same time, depending on what work you will be doing. Check the operator’s manual for your shovel for details of position and operation.

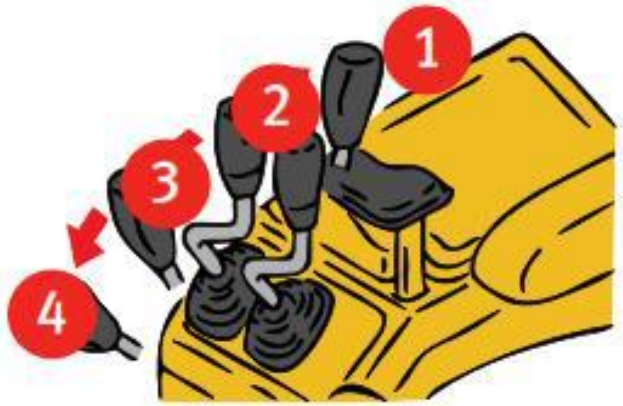
Typical controls

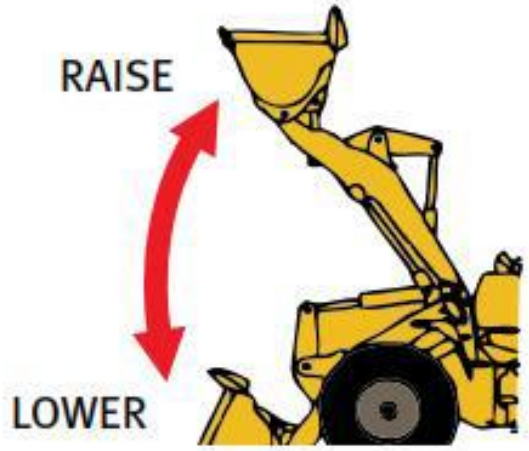
1. transmission gear selection lever
2. forward and reverse shift lever
3. Park brake switch
4. Safety lock lever
5. Bucket control lever
6. Lift control lever with transmission kick down switch
7. Brake pedals
8. Accelerator.

As well as the control levers and pedals, shovels have alarms and gauges to help you check the condition of the shovel. Alarms let you know when the shovel is not operating properly or when there is a danger.

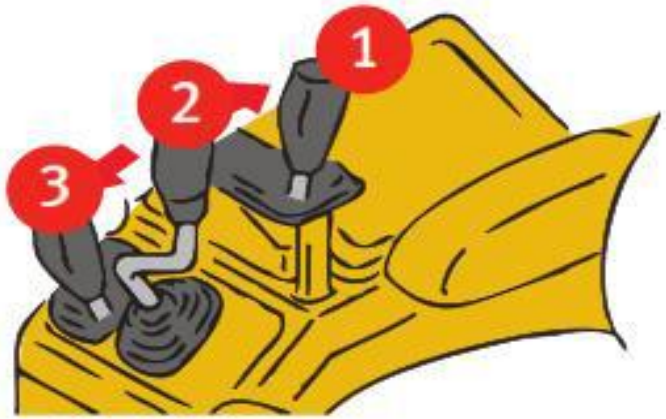
Bucket Controls

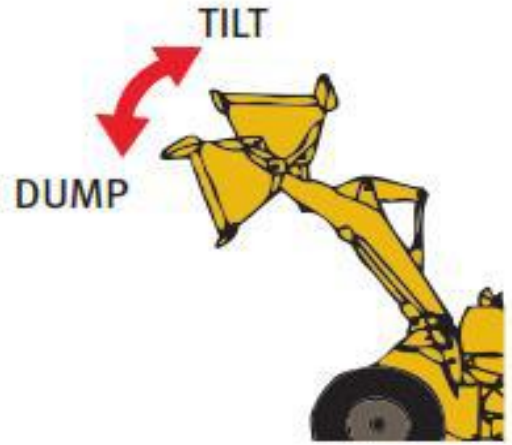
The controls to lift the bucket are: 1. Raise 2. Hold 3. Lower 4. Float





The controls to tip the bucket are: 1. Roll back, crowd or tilt 2. Hold 3. tip or dump



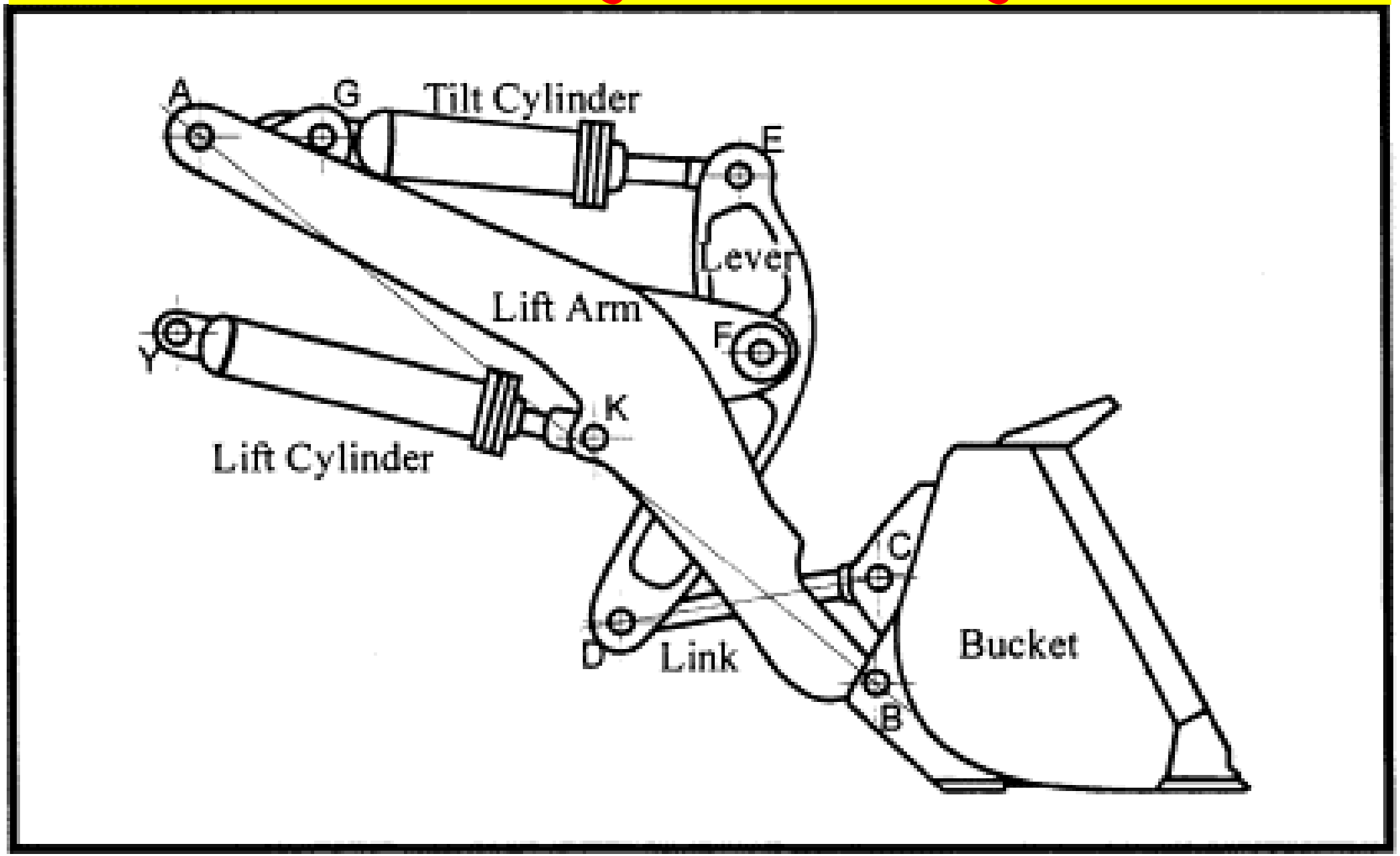


Types of buckets for loaders

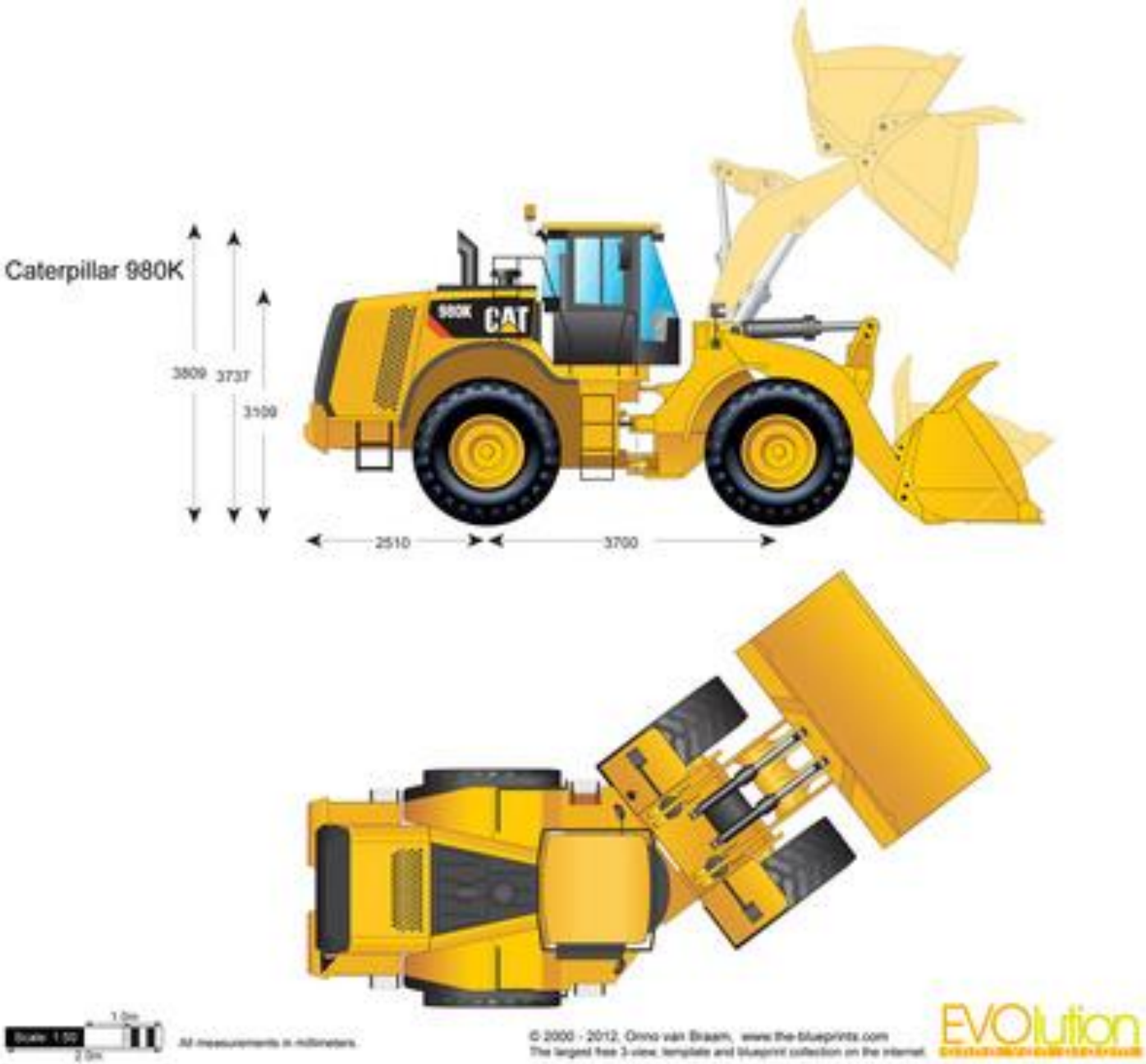
1- With pointed toes

2- The flat knife

Mechanism for raising and lowering the Bucket



Caterpillar 980K

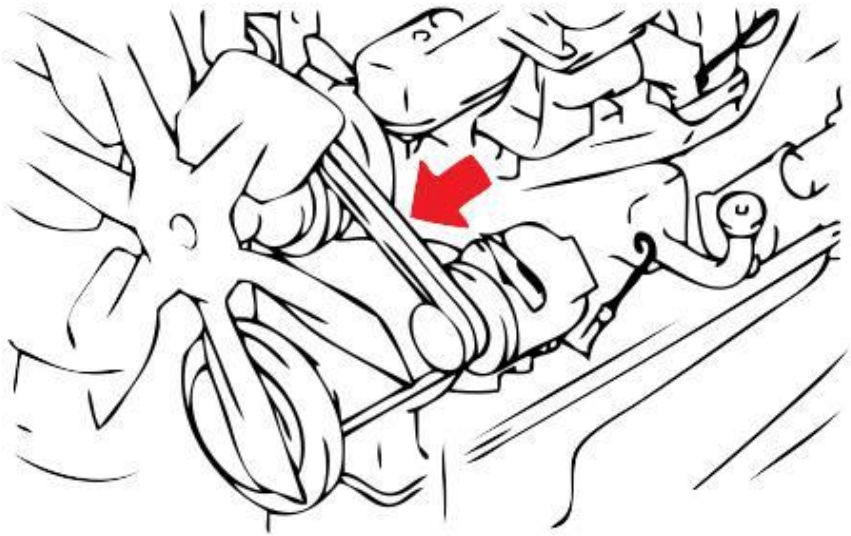


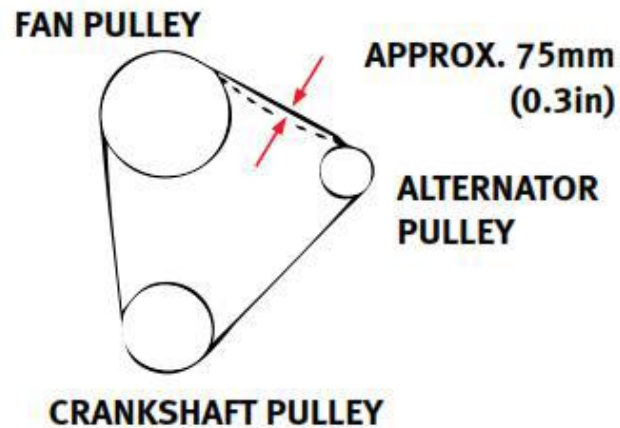
All measurements in millimeters.

EVOlution

Fan Belts

You will need to check the tension of the belt by depressing between the fan and the alternator pulleys.

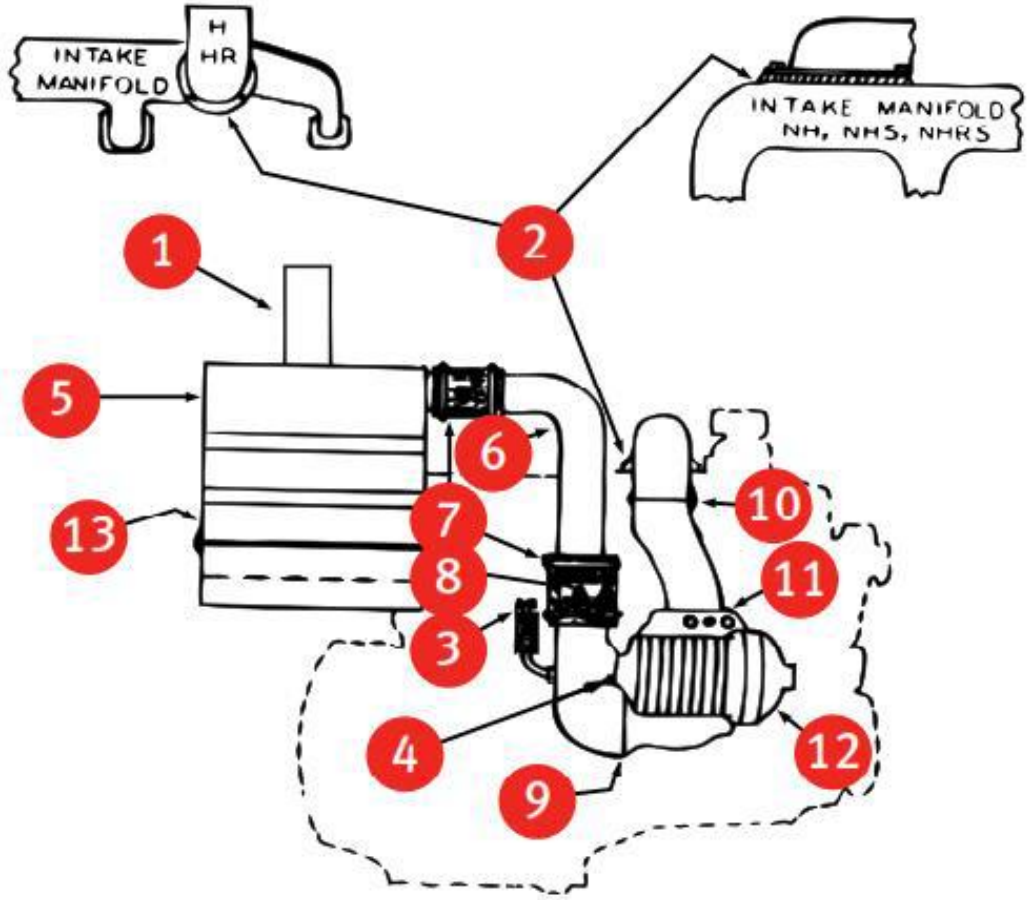




AIR Filters and Air Intake

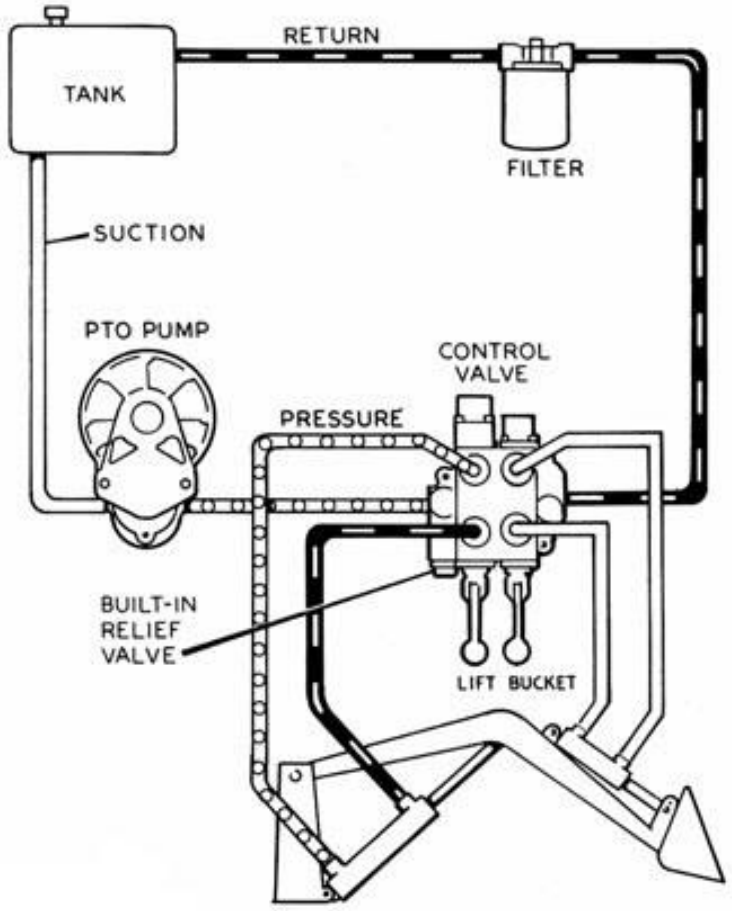
Air cleaner systems also need regular maintenance. the most common sign that the air cleaner system needs attention is that the indicator will change color or the gauge will show into the red, or an alarm could sound, depending on the system. Check for clogging of the air cleaner. Check all tubing, hoses and clamps for security and sealing. Check your operator manual for the air cleaner warning system on your shovel. Some air cleaner elements can be cleaned and reused and some will need replacing.

1. Raw air intake area
2. intake manifold pressure seal
3. Air cleaner restriction indicator
4. Low pressure (super charger) manifold
5. Air cleaner
6. Clean air tube
7. Hump hose clamps
8. Hump hoses
9. Supercharger intake seal
10. trunking support bracket
11. High pressure air seal
12. Super charger



Lubrication and Hydraulic Systems

Check for leaks and have any leaks repaired. Check around the engine, all hydraulic cylinders and hoses, under the shovel engine, transmission and oil cooler. Adjust levels to manufacturer's specifications, if needed. Check the operator's manual for your shovel for details of lubrication that is required before each use.



Fuel System

fuel levels may be checked by fuel gauge, dip stick, sight gauge or mobile warning device.

Before removing the fuel cap, clean dirt and dust from around the filler to prevent contamination.

Add fuel through an acceptable fuel filter to the required level. Replace the filler cap when finished.

equipment should be refueled after use to cool the remaining fuel and minimize the intake of moisture from atmosphere

overnight.

Check the breather on the fuel tank. A blocked breather may cause a vacuum in the fuel tank and reduce or stop fuel flow. Clean

the breather at regular intervals.

Oil Levels - Engine Sump

ensure that the shovel is on level ground and allow engine to cool.
1. Remove the dipstick and wipe clean with a cloth.
2. Replace the dipstick fully into the hole.
3. Remove the dipstick and check the oil level.
4. Add oil to the correct level if found to be insufficient. Make sure that the oil is of the correct type.

Hydraulic Oil Level Reservoir

1. oil level may be checked by dipstick or sight gauge.
2. if checking by dipstick, use the same method as checking for engine sump oil levels.
3. Add oil to the correct level if found to be insufficient. Make sure that the oil is Of the correct type.

Engine Coolant Level

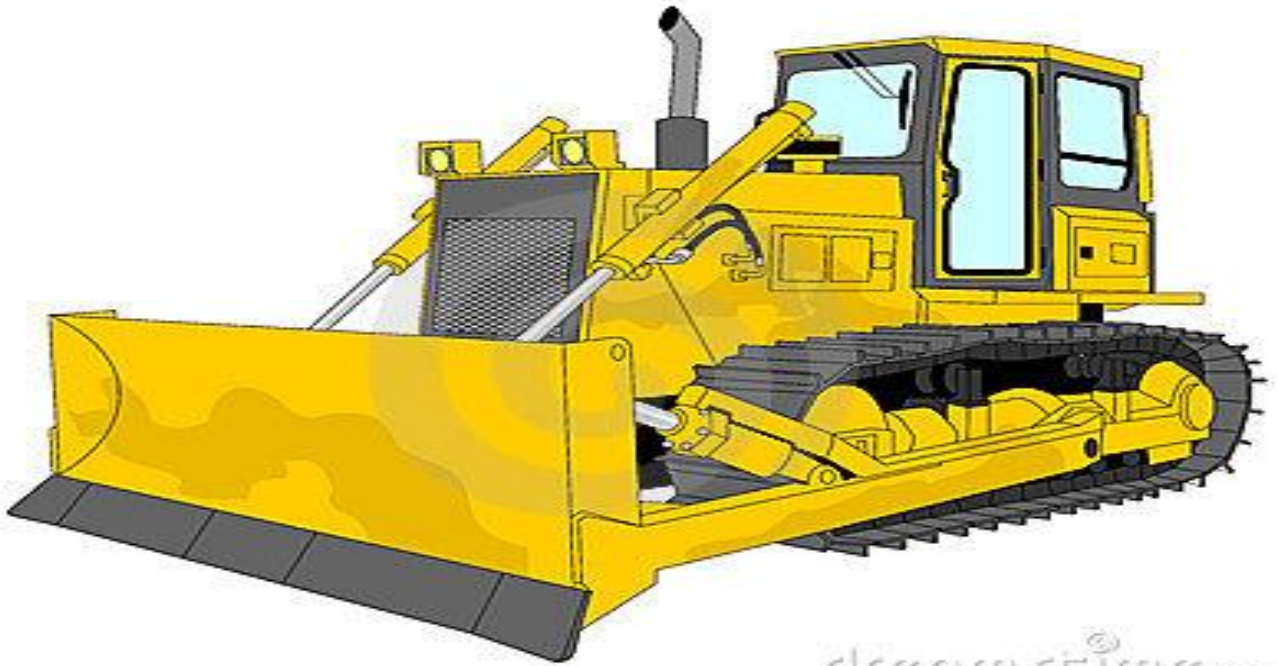
if the engine has been running, remove the radiator cap with caution to avoid serious burns.

Modern engines use recovery cooling systems. this system has a small external container or bottle attached to the radiator overflow tube which stores coolant. this is forced out during operation due to expansion. Some of the contents of the recovery bottle are drawn back into the radiator as the engine cools after shut-down.

Reclamation Machine and Equipment

BULLDOZERS

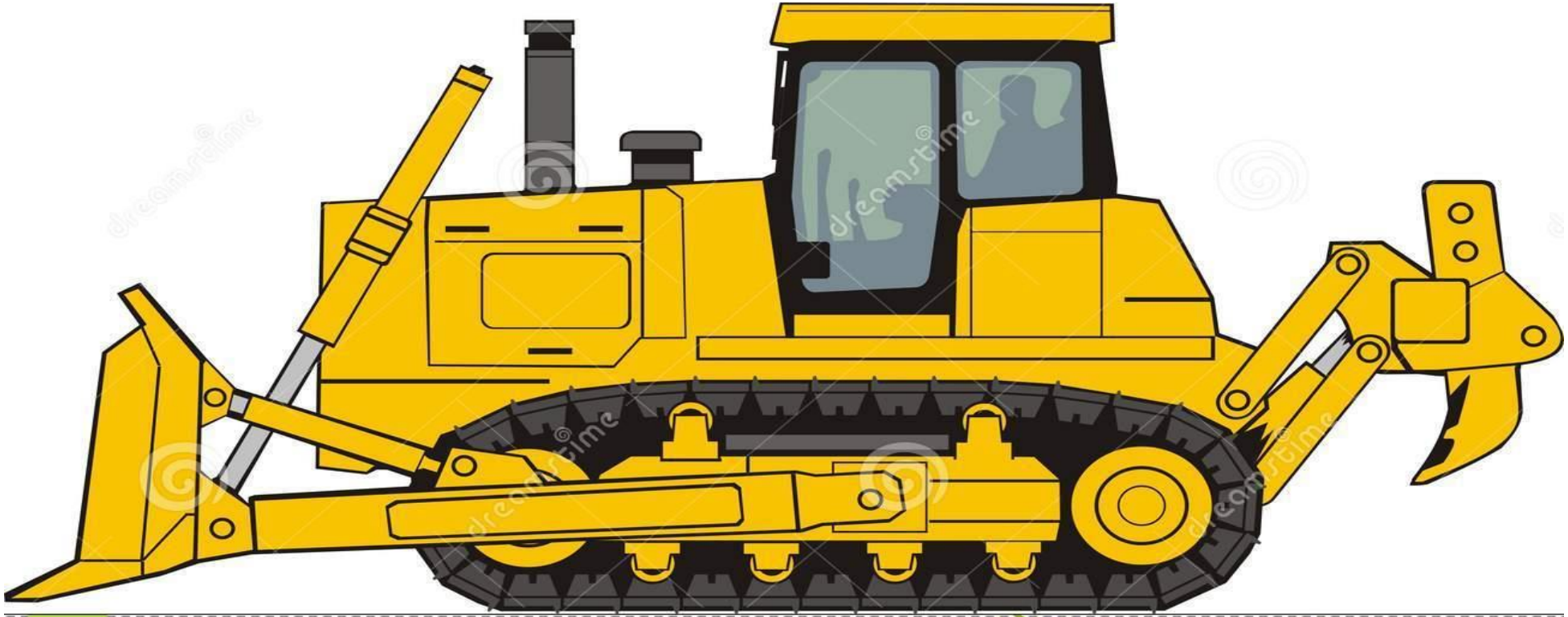
Assist teacher: yahya younis Mohsen



BULLDOZERS

A bulldozer is a tractor unit which has a blade attached to its front. That is the meaning used here Bulldozers are heavy equipment capable of moving heavy loads, clearing rubble, and are very helpful in civil engineering and agriculture works. Modern bulldozers are no uglier and too heavy to handle. They are equipped with electronic devices and they look good, too.

A bulldozer is a crawler (continuous tracked tractor) equipped with a substantial metal plate (known as a blade) used to push large quantities of soil, sand, rubble, or other such material during construction or conversion work and typically equipped at the rear with a claw-like device (known as a ripper) to loosen densely- compacted materials

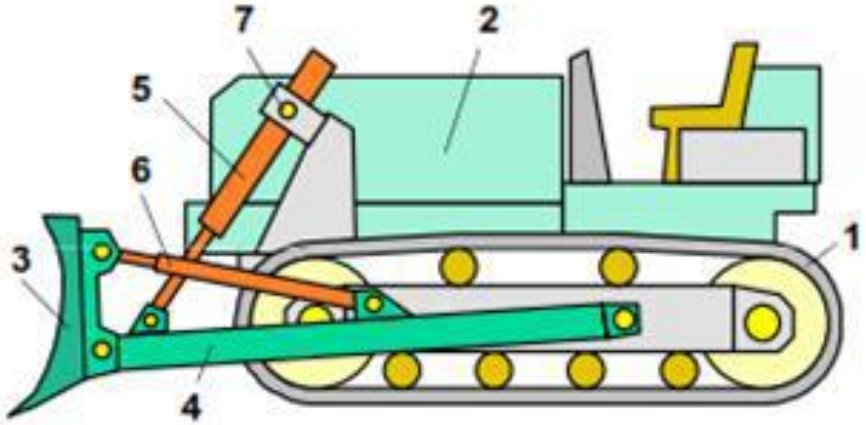


1. Blade
2. Tracks/Tires
3. Ripper
4. Engine

The Anatomy of a BULLDOZER

Blue Diamond MACHINERY

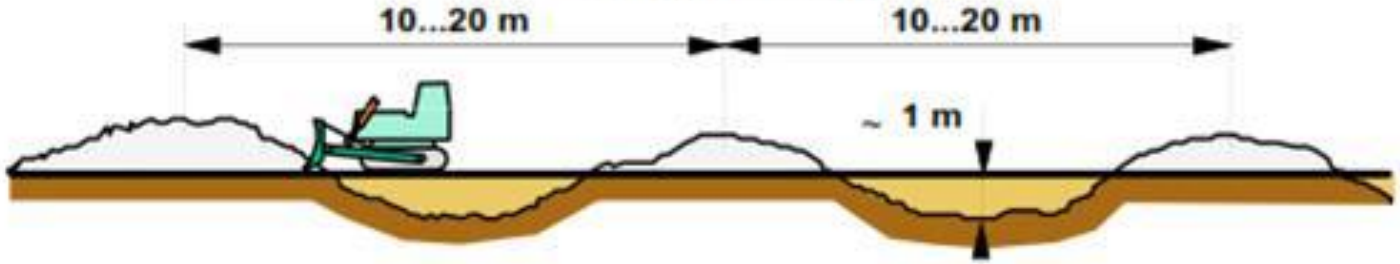
The blade is used to push, shear, cut, and roll material ahead of the tractor. The bulldozer is an effective and versatile earthmover Bulldozers are used as both support and production machines on many construct ion projects.



Adjustability of blade:

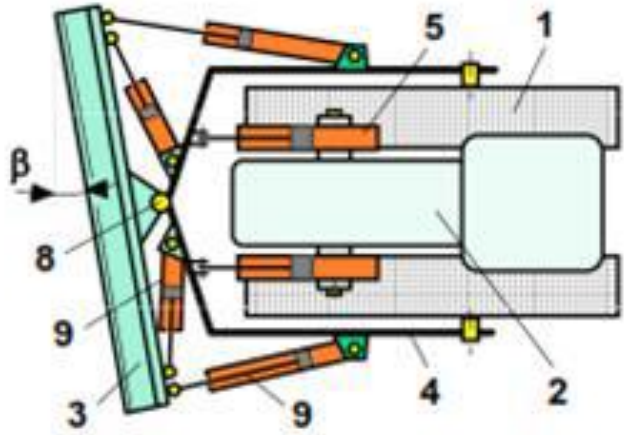
- ⇨ Cutting depth
- ⇨ Cutting angle (tilt, adjusted to soil type)
- ⇨ Slope angle (α) } Ball-jointed
- ⇨ Heading angle (β) } main frame only

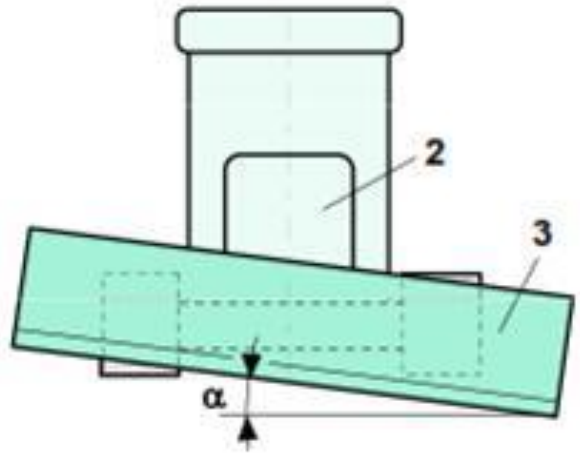
Landscaping (levelling) by dozer



1. track (caterpillar)
2. engine
3. blade
4. main frame
5. lifting cylinder
6. tilting cylinder
7. bolt
8. ball-joint
9. swivel cylinders

B. with ball-jointed frame





Where they may be used from start to finish for such operations as

1. Clearing land of timber stumps
2. Opening up pilot roads through mountains and rock terrain
3. Moving earth for short-haul distances, up to about 300 it
4. Helping to load tractor-pulled scrapers
5. Spreading earth and rock fills
6. Clearing the floors of borrow and quarry pits
7. Backfilling trenches

TYPES OF BALLDOZERS

1. Crawler (track laying) Tractor
2. Wheel Type Tractor

a) Single-axle
b) Two-axle
1. Single axle drive
2. Two axle drive

BALLDOZERS USES

1. Dozers (Tractors) are self-contained units that are designed to provide tractive power for drawbar work.

2. Consistent with their purpose as a unit for drawbar work, they are low center of gravity machines. This is a prerequisite of a good machine.

3. The larger the difference between the line of force transmission from the machine and the line of resisting force the less effective the utilization of developed power.

Typical project applications are:

1. Land clearing
2. Dozing (pushing materials)
3. Ripping
4. Towing other pieces of construction equipment
5. Assisting scrapers in loading.

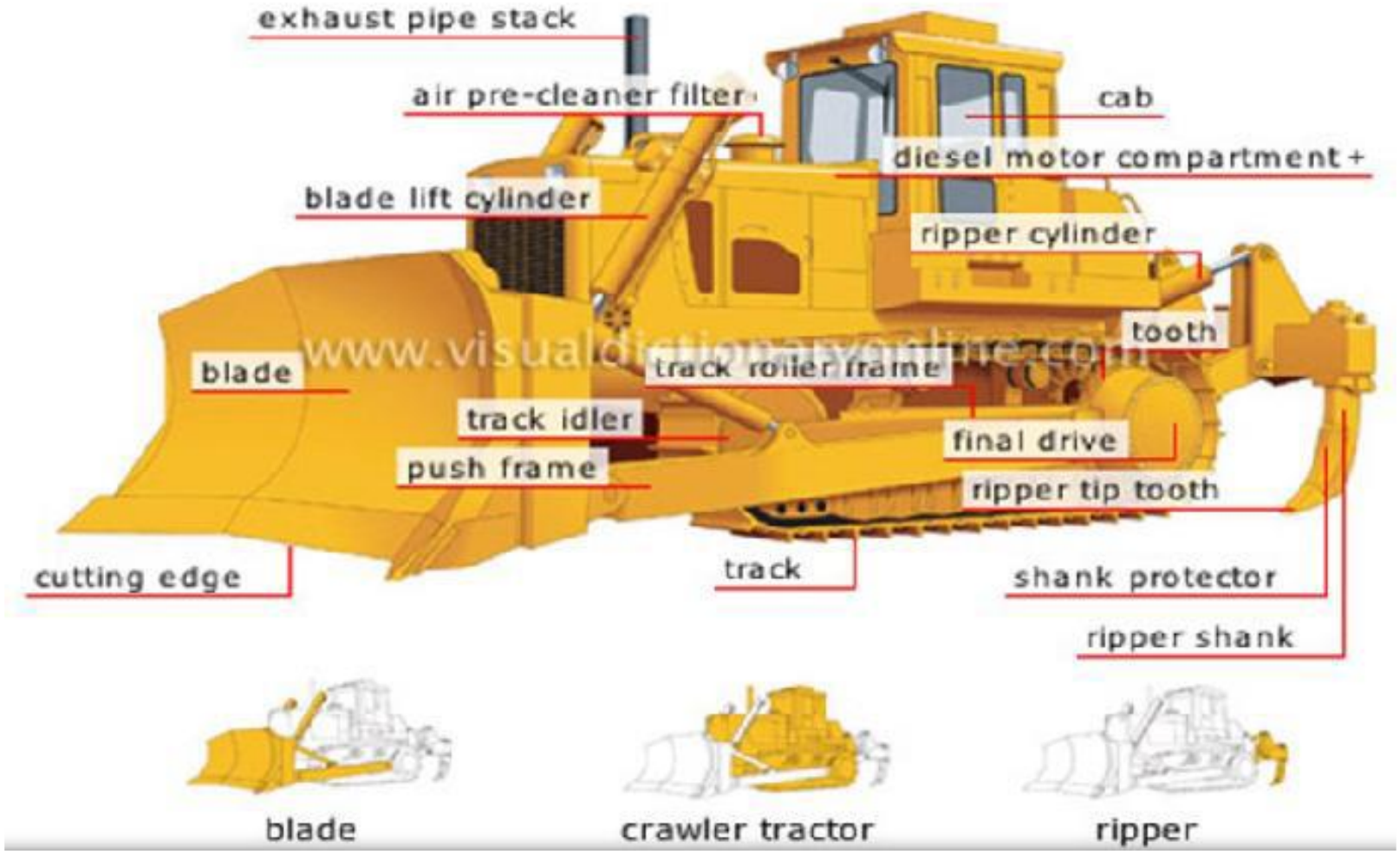
DESCRIPTION

Most often, bulldozers are large and powerful tracked heavy equipment. The tracks give them excellent ground hold and mobility through very rough terrain. Wide tracks help distribute the bulldozer's weight over a large area (decreasing pressure), thus preventing it from sinking in sandy or muddy ground. Extra wide tracks are known as 'swamp tracks' or "LGP (low ground pressure)tracks". Bulldozers have excellent ground hold and a torque divider designed to convert the engine's power into improved dragging ability.

The Caterpillar D9, for example, can easily tow tanks that weigh more than 70 tons. Because of these attributes, bulldozers are used to clear areas of obstacles, shrubbery, burnt vehicles, and remains of structures.

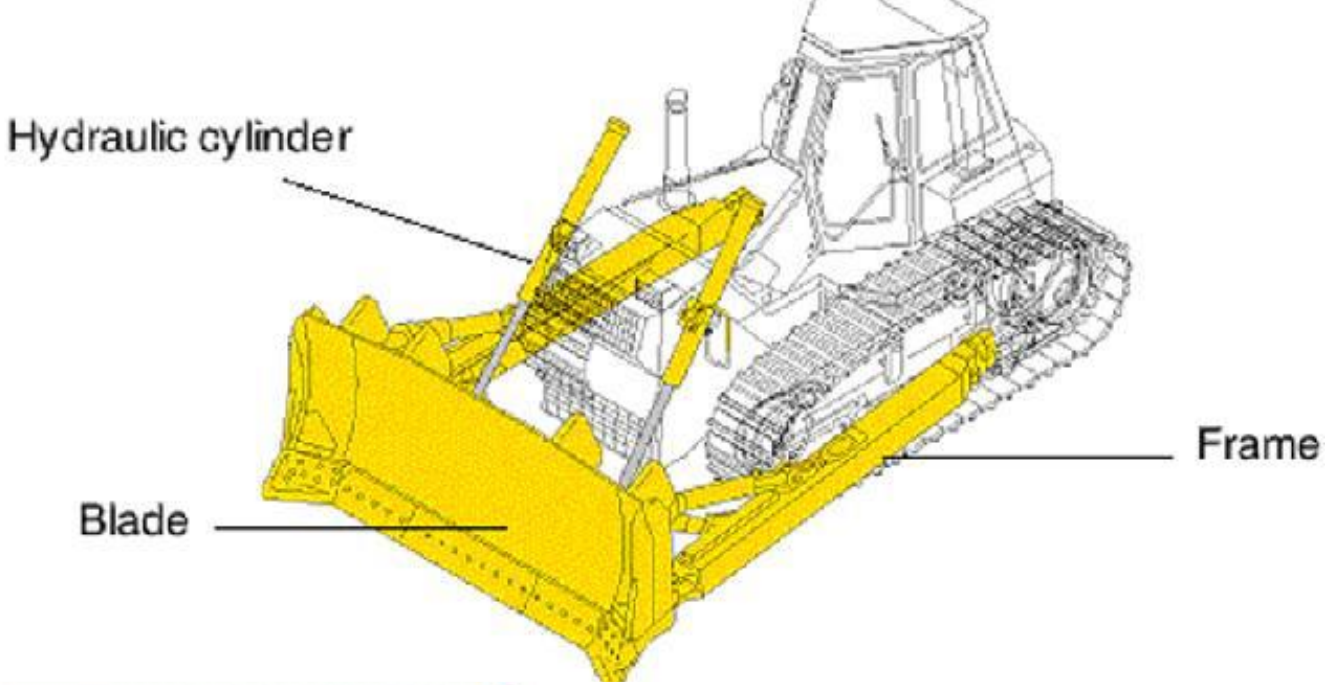
Bulldozer Assembly

1. Power take-off
2. Torque converter
3. Universal joint
4. Transmission unit
5. Main drive
6. Steering brake
7. Final drive
8. Track equipment
9. Control system
10. Working equipment
11. Cabin
12. Floor and Fender
13. Track fram

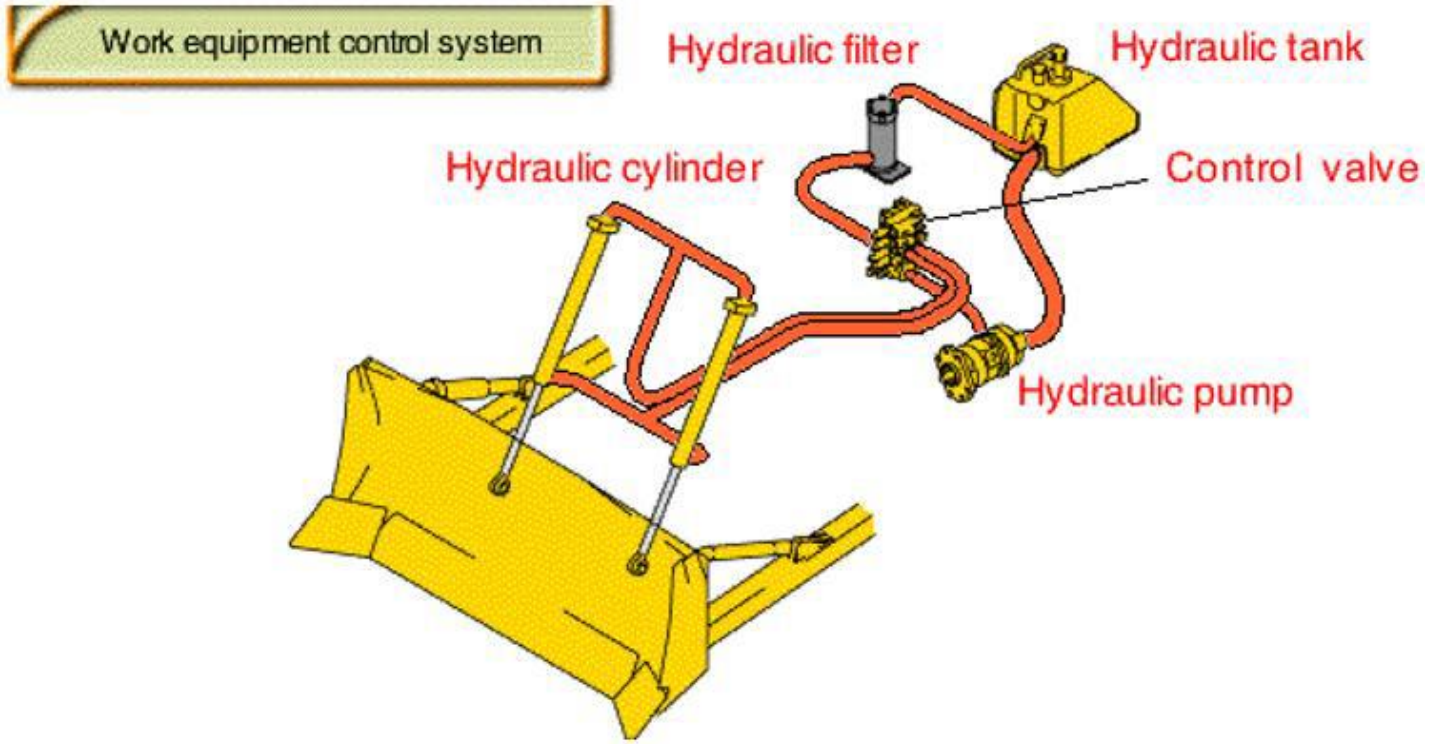


DOZER

Work equipment



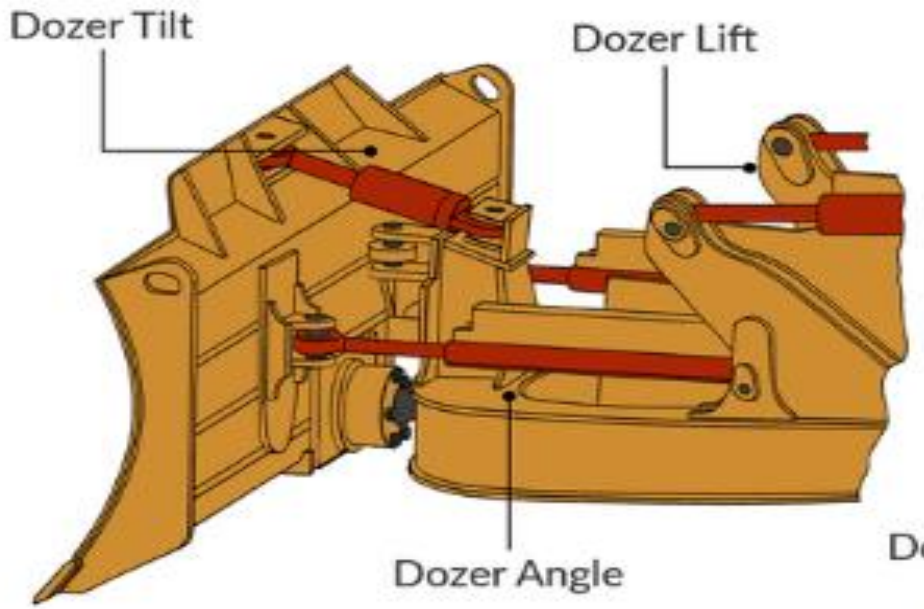
Work equipment control system



DOZER CYLINDER IDENTIFICATION DIAGRAM

HW PART STORE

Power Angle Tilt Models (6-way)



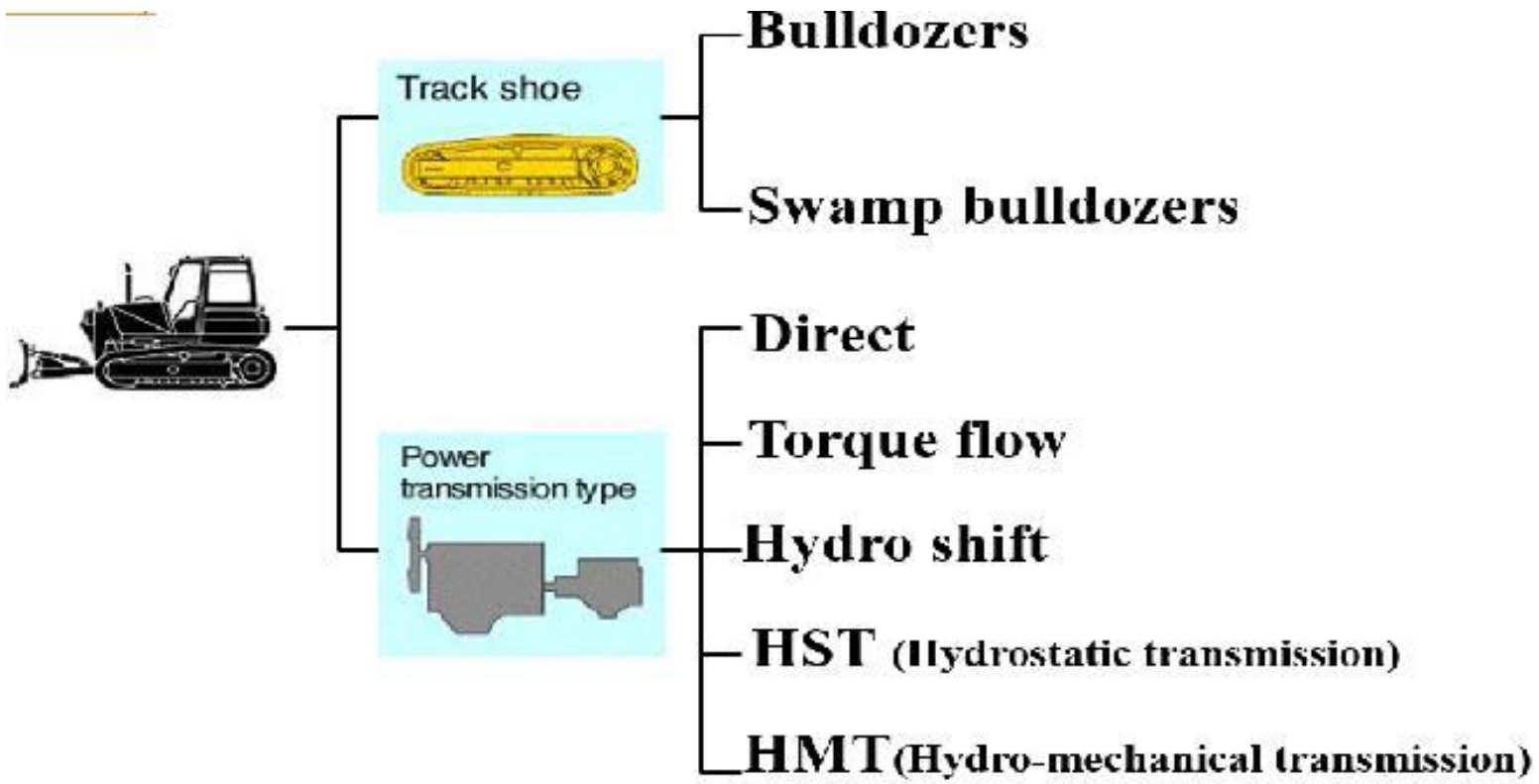
Dozer Tilt Models (4-way)

Visit HWPartStore.com to find Seal Kits for your Dozer

Power train

Engine → Torque converter → Universal joint → Gear box→ Main drive → Steering clutch → Final drive → Track system .

Classification of Bulldozer



Swamp bulldozers

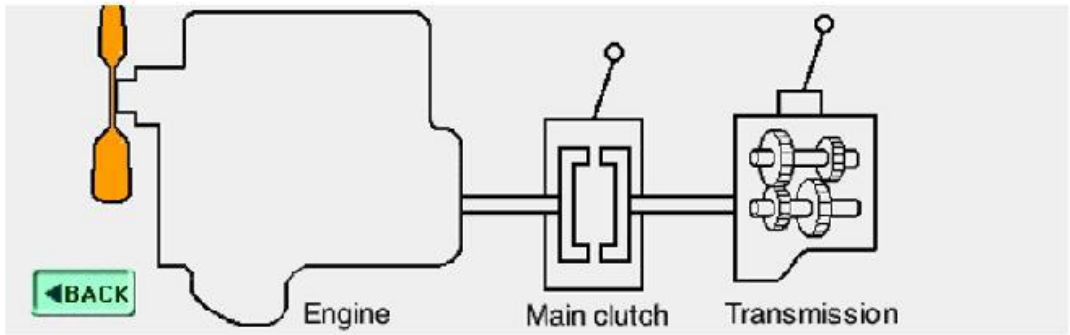
Super swamp bulldozers
(for extremely soft terrain)

Advantage

- Power transmission efficiency is high.

Disadvantages

- Gear shifting operation is complicated.
- Engine stalls is overloaded.
- Power transmission is interrupted when shifting gears.
- Engine output fluctuates according to load.

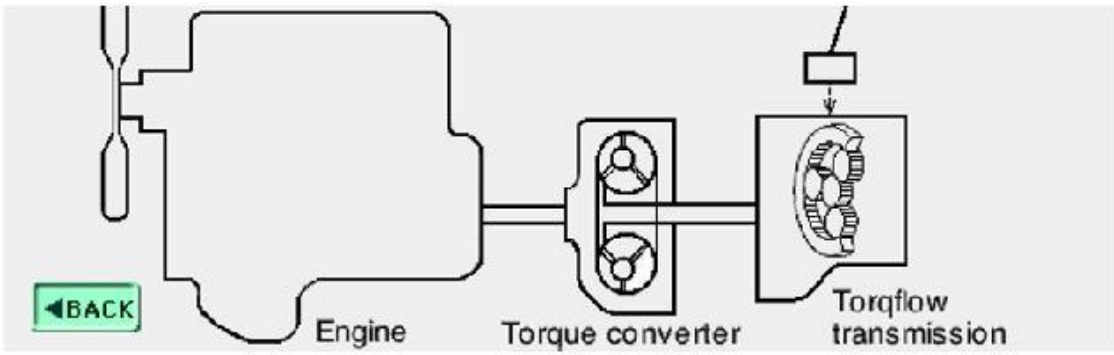


Advantage

- Gear shifting operation is easy.
- Engine does not stall even if overload.
- Less interruption of power transmission when shifting gears.

Disadvantages

- Power transmission efficiency is low.
- More expensive than direct drive machine.

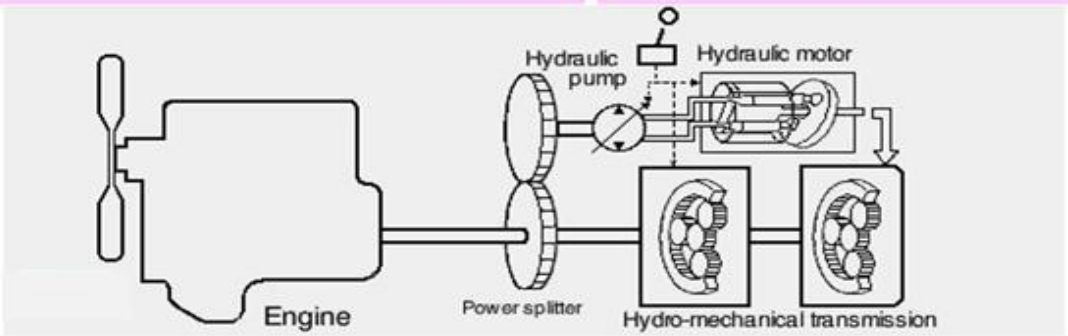


Advantage

- Power transmission efficiency is high.
- Gear shifting can be automated.
- Engine does not stall even if overload.
- Engine output is kept constant under any load.

Disadvantages

- More complicated structure than torque flew drive.

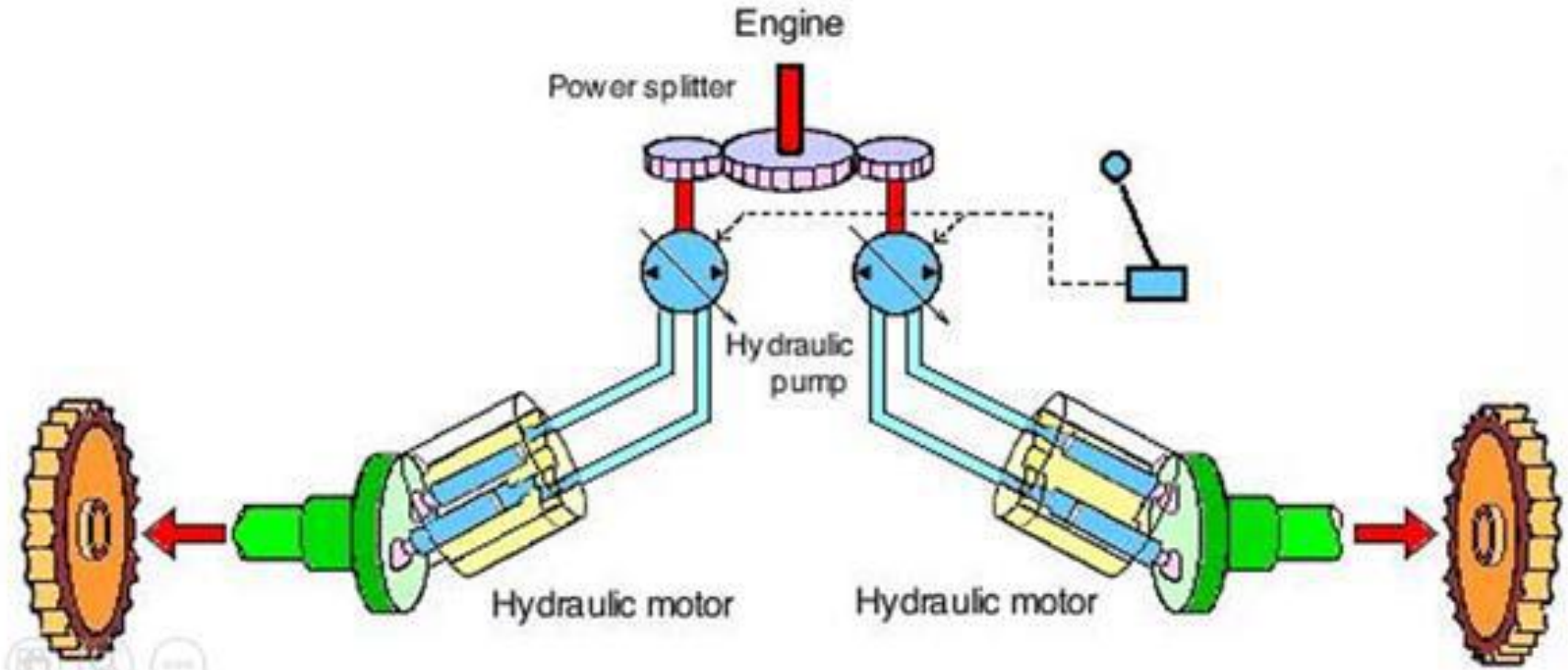


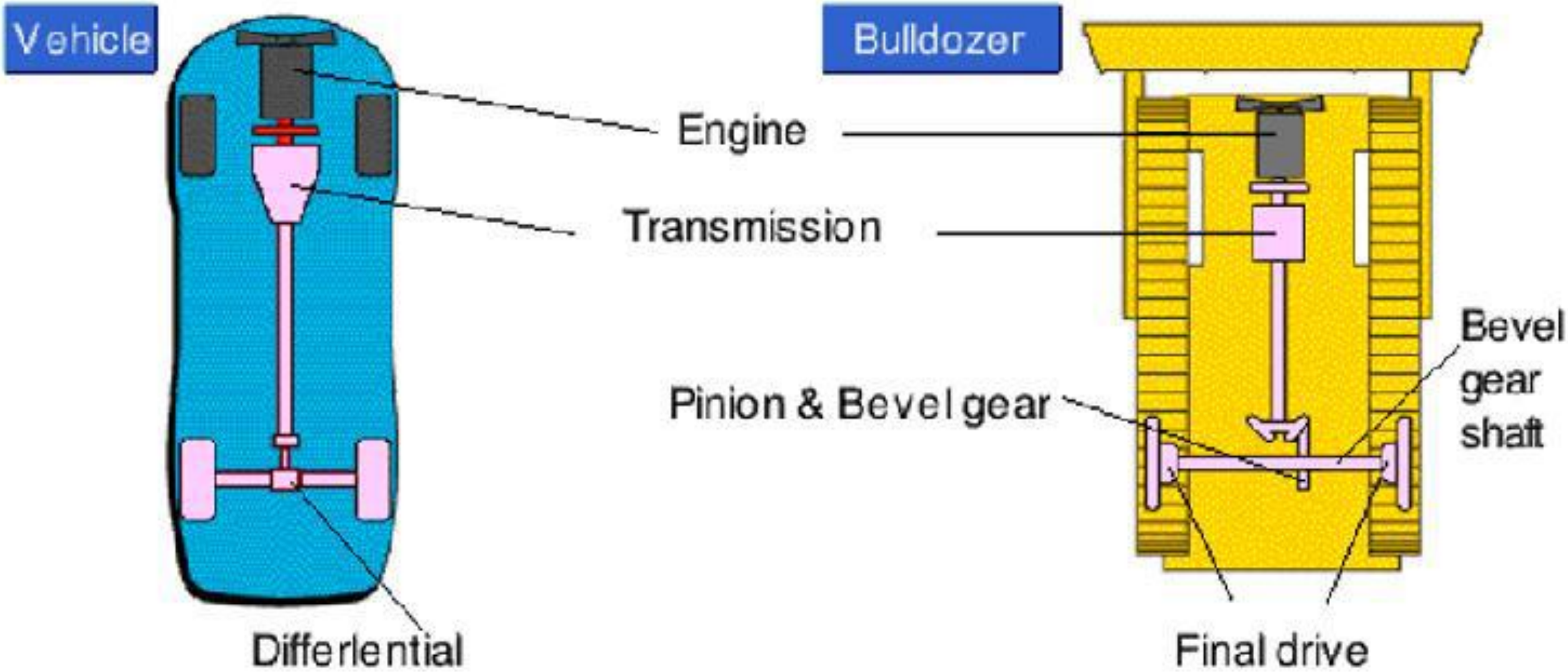
Advantage

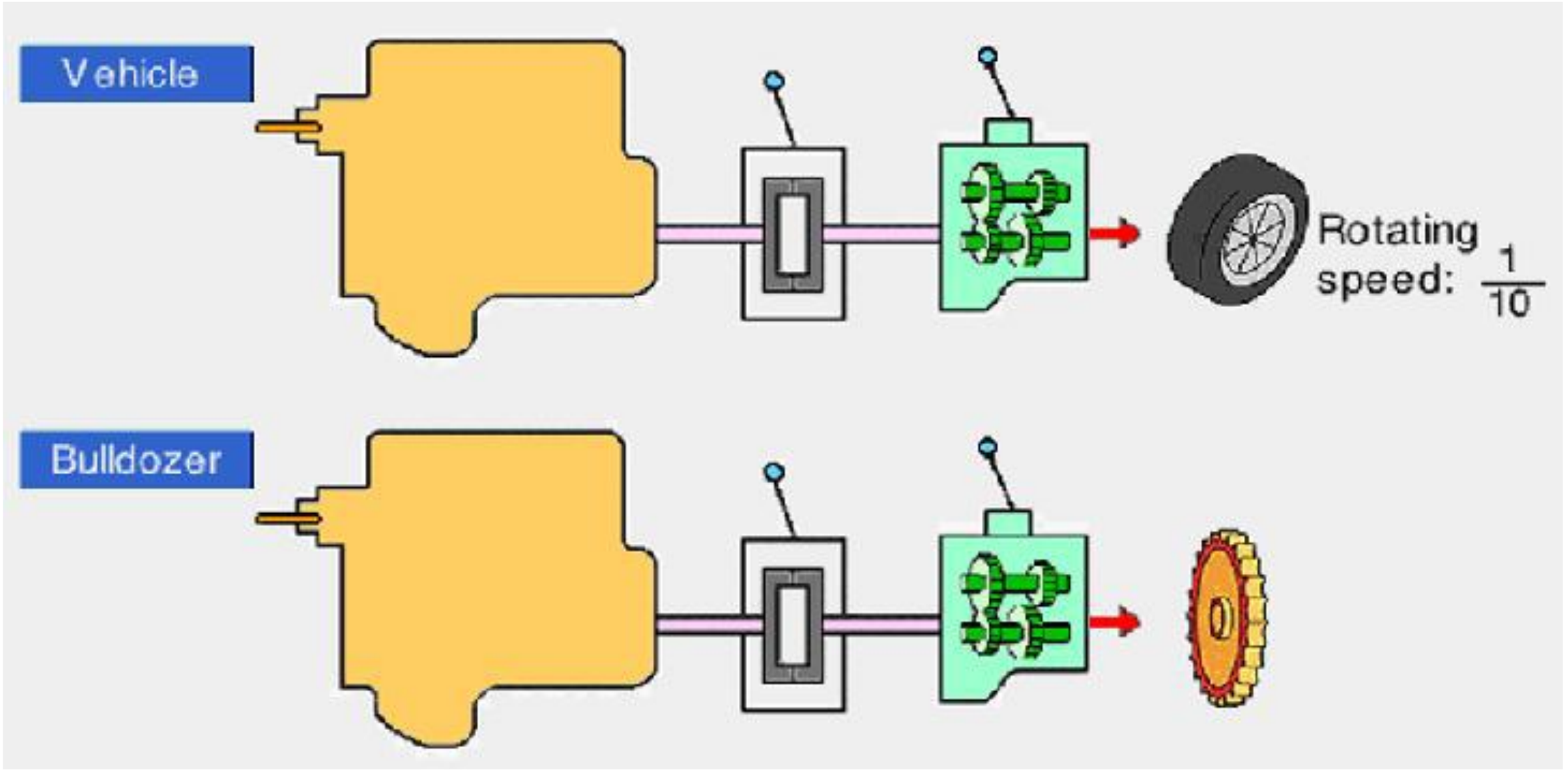
- Gear shifting is not required.
- Engine does not stall even if overload.
- Power transmission is not interrupted due to the continuous speed control.
- Maximum output range of engine can be always used.

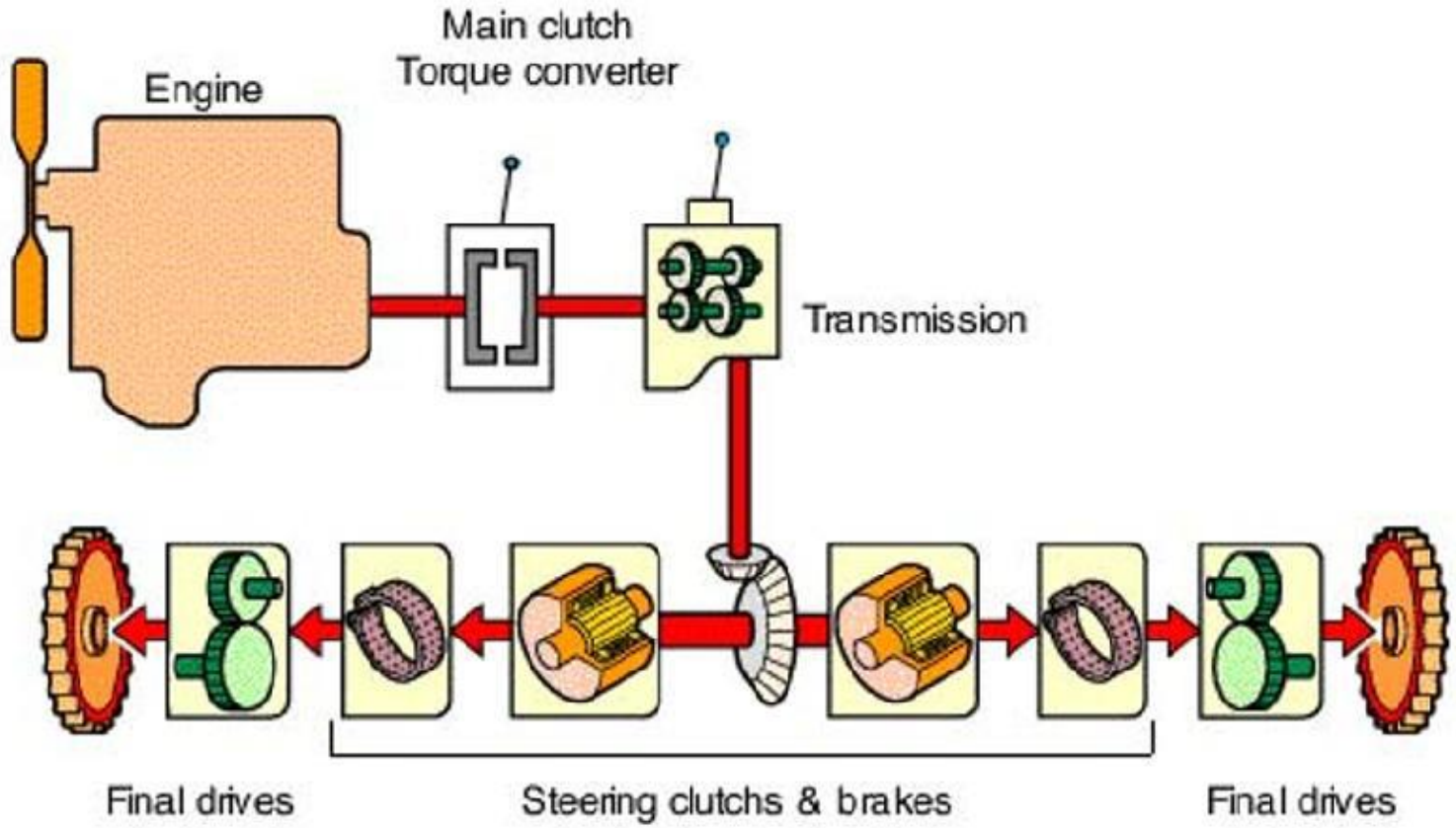
Disadvantages

Power transmission efficiency is very low.

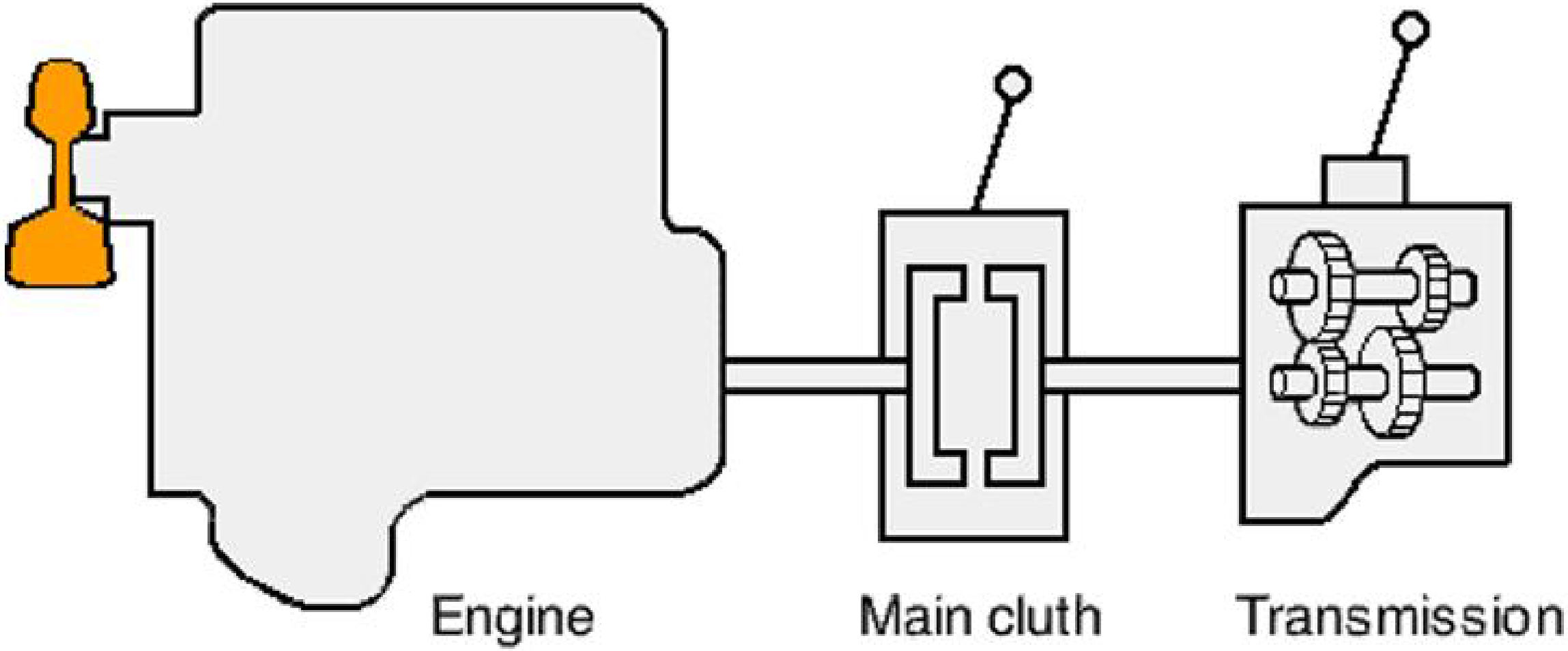



Vehicle
Bulldozer
Engine
Transmission
Pinion & Bevel gear
Bevel gear shaft
Differential
Final drive


Vehicle
Rotating speed: 1/10
Bulldozer

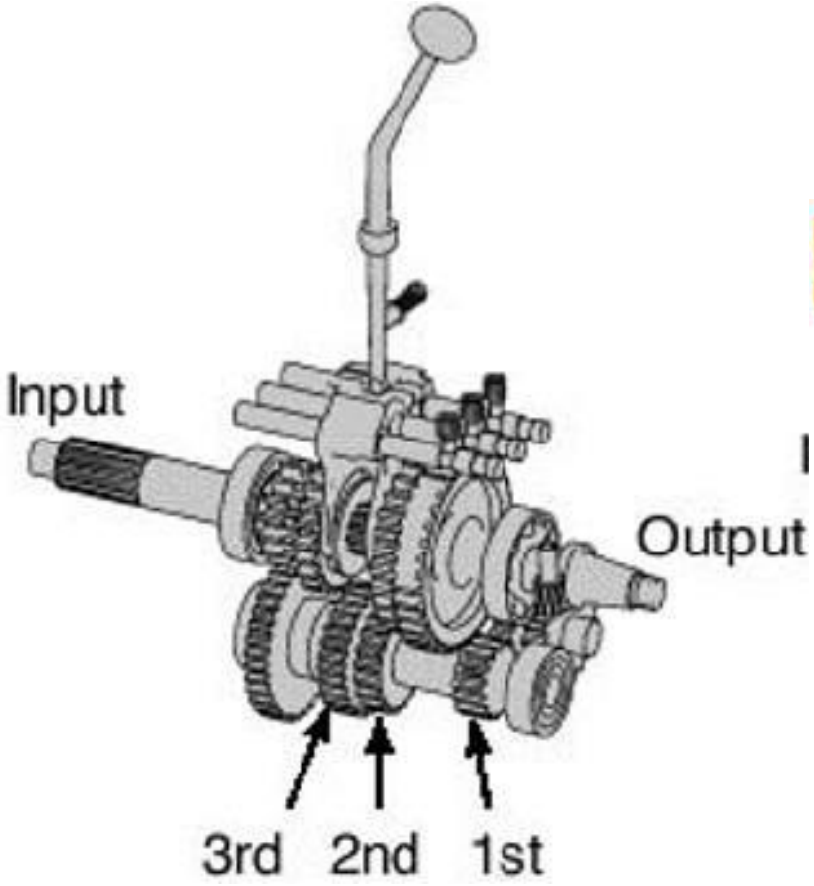

Main clutch
Torque converter
Engine
Transmission
Final drives
Steering clutchs & brakes
Final drives

Main clutch

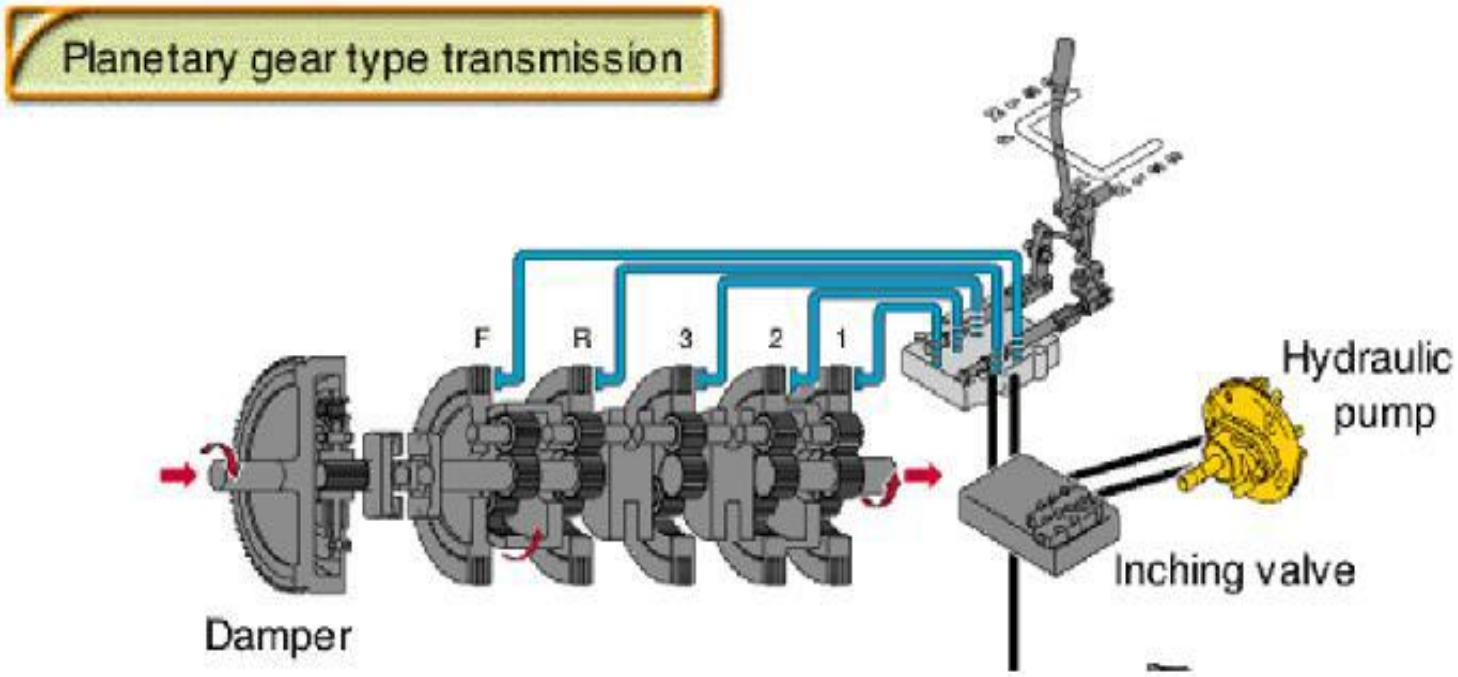


Transmission

1. Direct transmission (sliding mesh type)



2. Planetary gear type transmission

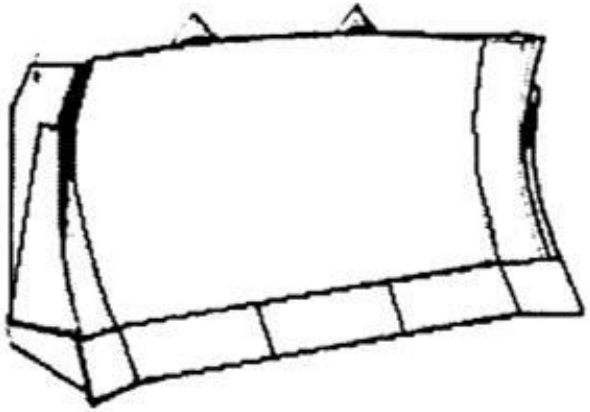


BLADES

The bulldozer blade is a heavy metal plate on the front of the tractor, used to push objects, and shoving sand, soil and debris.

Types of blades : -

a. Straight ‘S’ blade
b. Universal ‘U’ blade
c. Angle ‘A’ blade
d. Cushion ‘C’ blade
e. Rake



a. ‘S’ Straight Blade

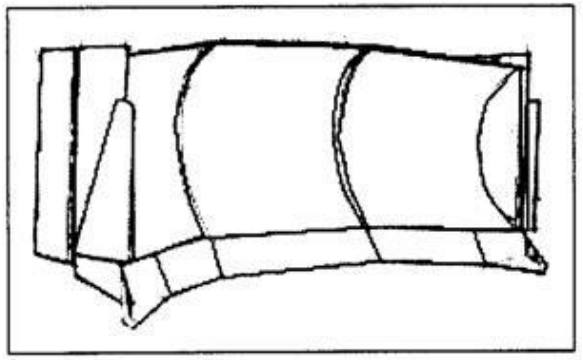
a. Straight ‘S’ blade

1. Used for heavy work
2. Most versatile bulldozer
3. Equipped with a push plate effectively used for loading scraper
4. Most blade are curved, but the section perpendicular to the line of push is straight
5. The maximum of push should not exceed 100m as the machine is uneconomical for earth moving over a greater distance

b. Universal ‘U’ blade

1. The blade in cross-section has a much deeper curvature, almost a ‘u’ shape.
2. Efficient for moving big loads over long distance as in land clearing, stockpile work and pushing up for loading

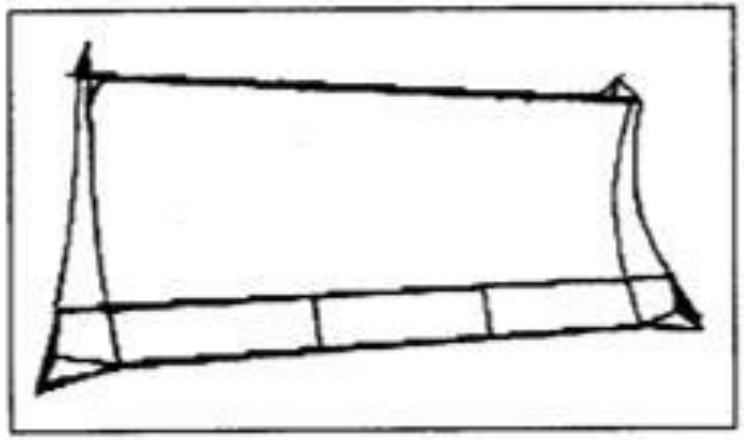
3. Shall combined with a tilt cylinder to improves its ability to ditch, pry out and level
4. Effecting to light flowing type of soil



b) “U” Universal Blade

c. Angle ‘A’ blade

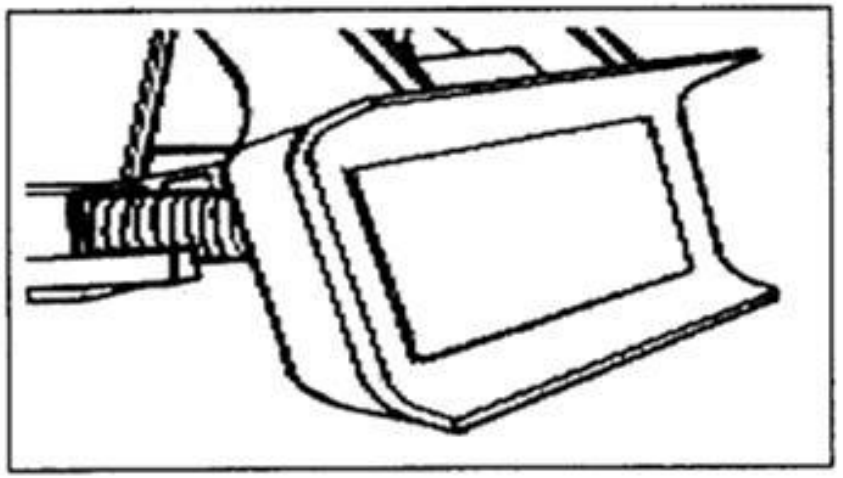
1. The blade in plain view is angled
2. Can also be positioned straight or angled 25 degrees to either side
3. Designed for side casting, backfilling and other similar tasks
4. Can reduce the amount of manoeuvring required to do this job



c. Angle ‘A’ blade

d. Cushion ‘C’ blade

1. Used on a large tractors for on-the-go push loading
2. Rubber cushion allow the dozer to absorb the impact of contacting a scraper push block and effective travelling speed is up to 5 km/h
3. When not push loading, the dozer can be used for general dozing jobs

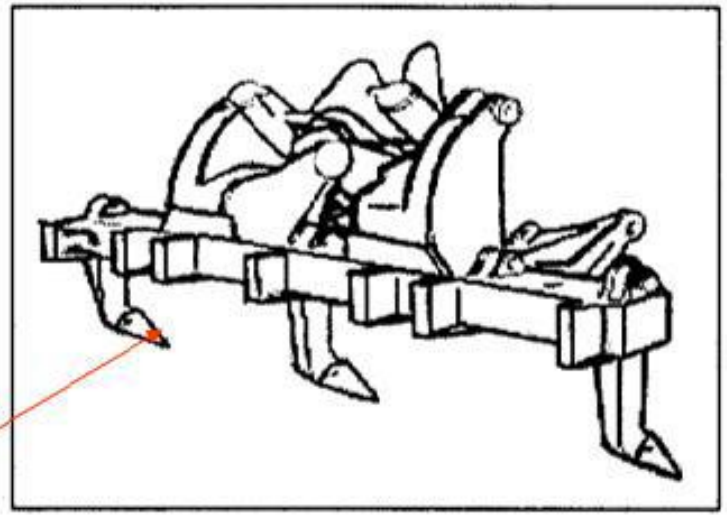


d) Cushion Pusher Plate

e. Rake

1. A blade consisting a heavy duty ribs which retained coarse rock, roots etc,
but allow finer material to pass through

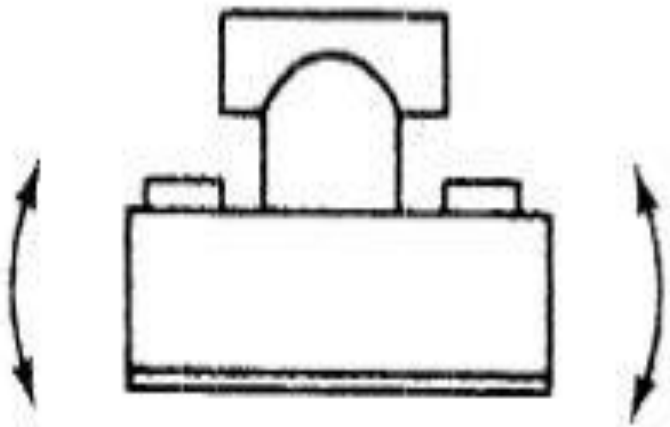
2. Used in digging and pushing stumps and rock and also in spreading of rock rip-rap



Rib

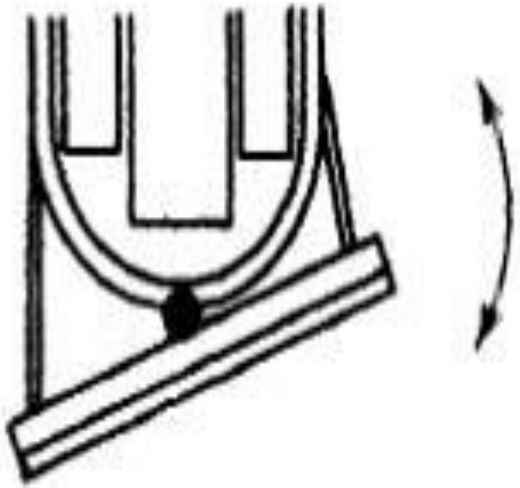
Common types of Bulldozer blades

1. Tilting
2. Angles
3. Ripper



Tilting

Pitching

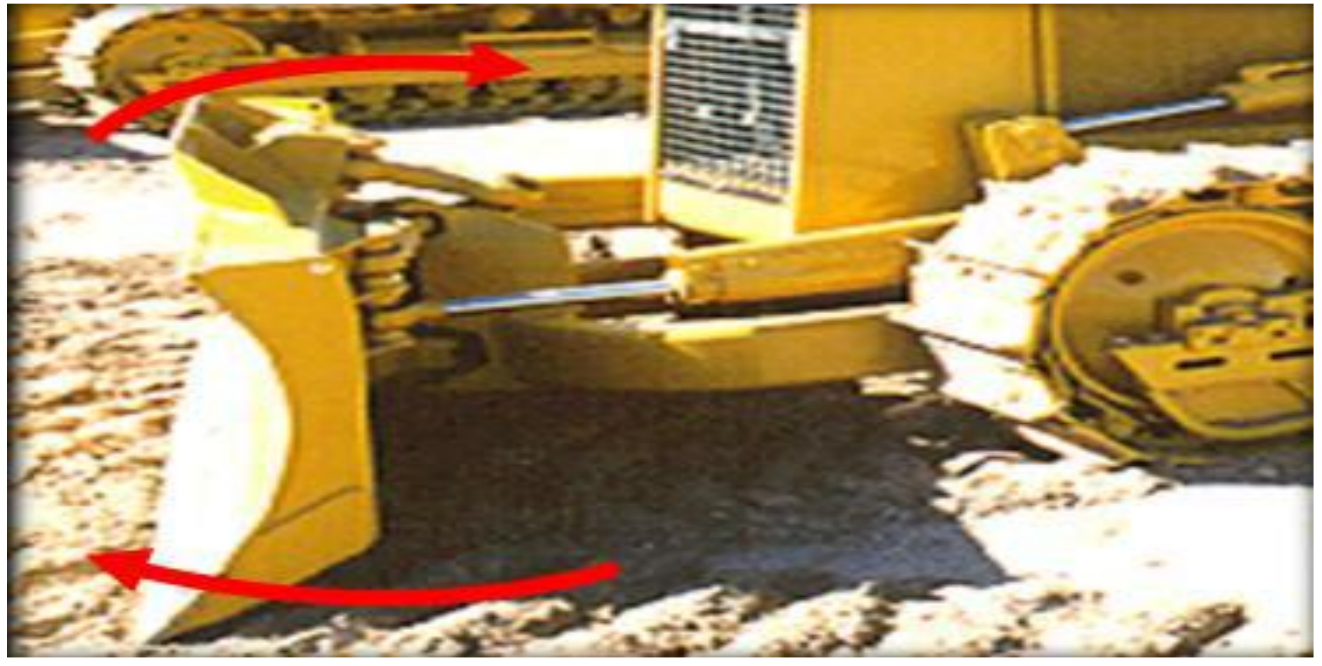


Angling

BLADE ADJUSTMENTS

1. Tilting

2. Angles

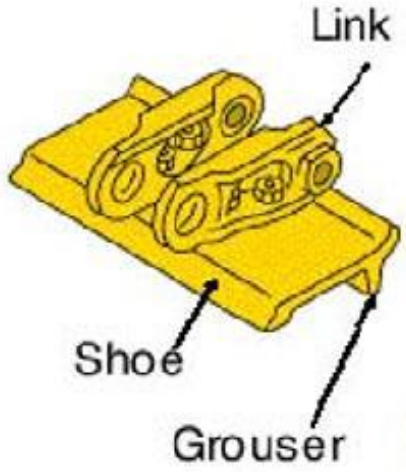


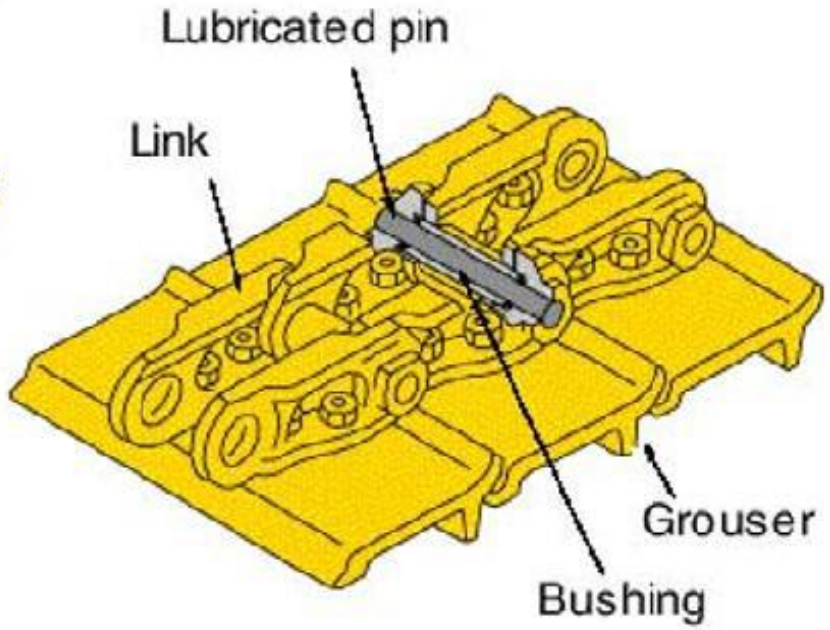
3. Ripper

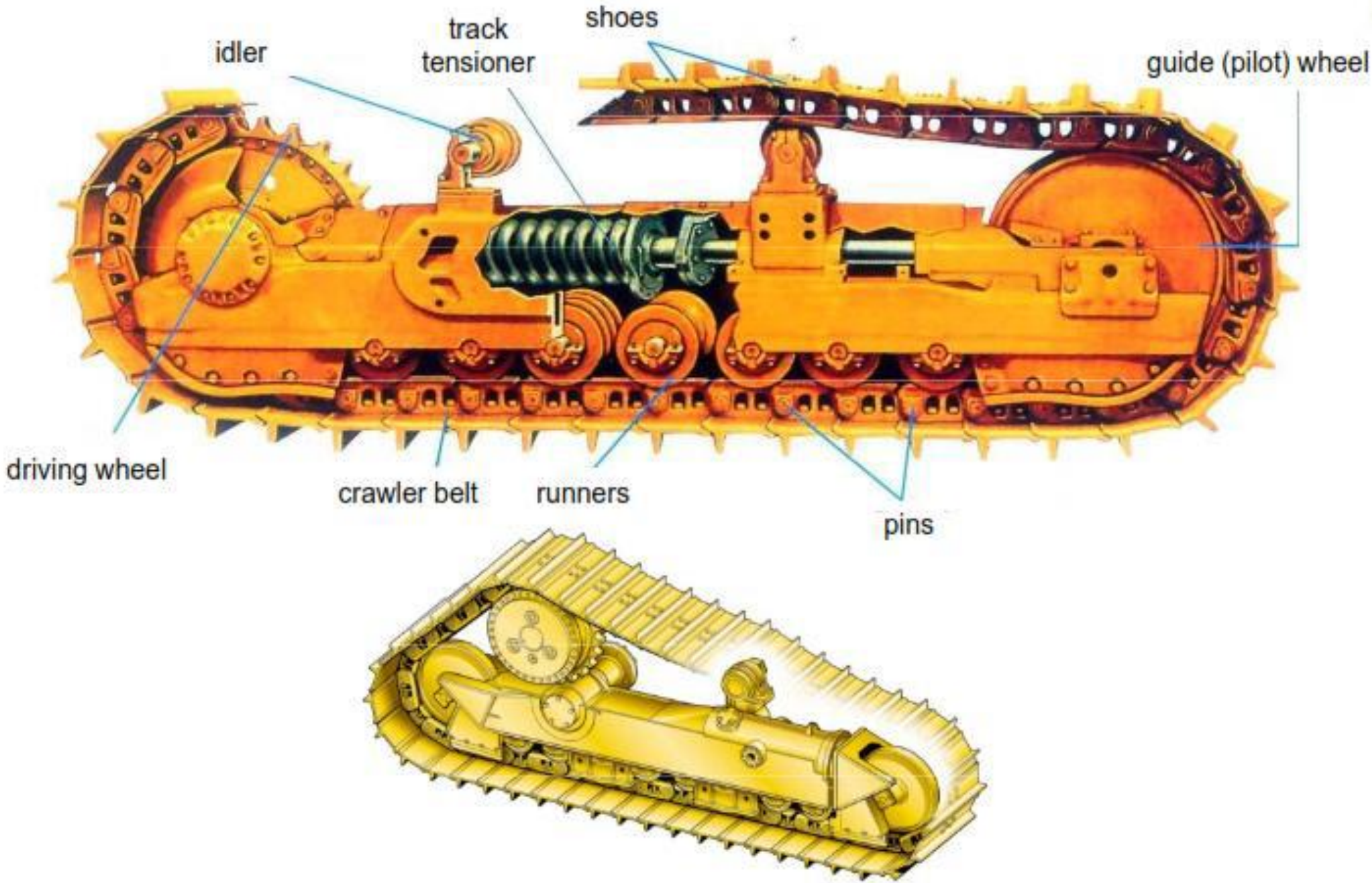
The ripper is the long claw-like device on the back of the bulldozer. Rippers can come as a single shank/giant ripper) or in groups of two or more (multi shank rippers). Usually, a single shank is preferred for heavy ripping. The ripper shank is fitted with a replaceable tungsten steel alloy tip

CRAWLER

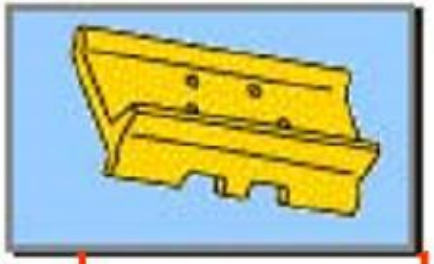
Lubricated track link



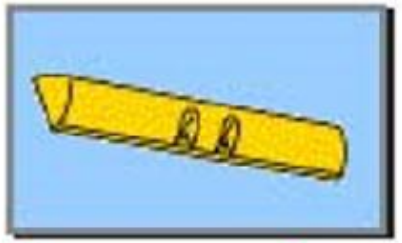



idler
track tensioner
shoes
guide (pilot) wheel
driving wheel
crawler belt
runners
pins

Shoe



Single grouser shoe



Swamp shoe

PRODUCTION FACTORS: BULLDOZERS

1. Soil conditions
2. Angle of swing
3. Bucket fill
4. Fill factor
5. Cycle Time
6. Cycle Time
7. Job efficiency
8. Operator
9. Site condition
10. Equipment conditions

Productivity Bulldozer

1. Swelling of the soil as a result of thrills
2. Coefficient of time
3. Operating cycle time per
4. Capacity arms


CAT
D6T
CAT


D6
CAT

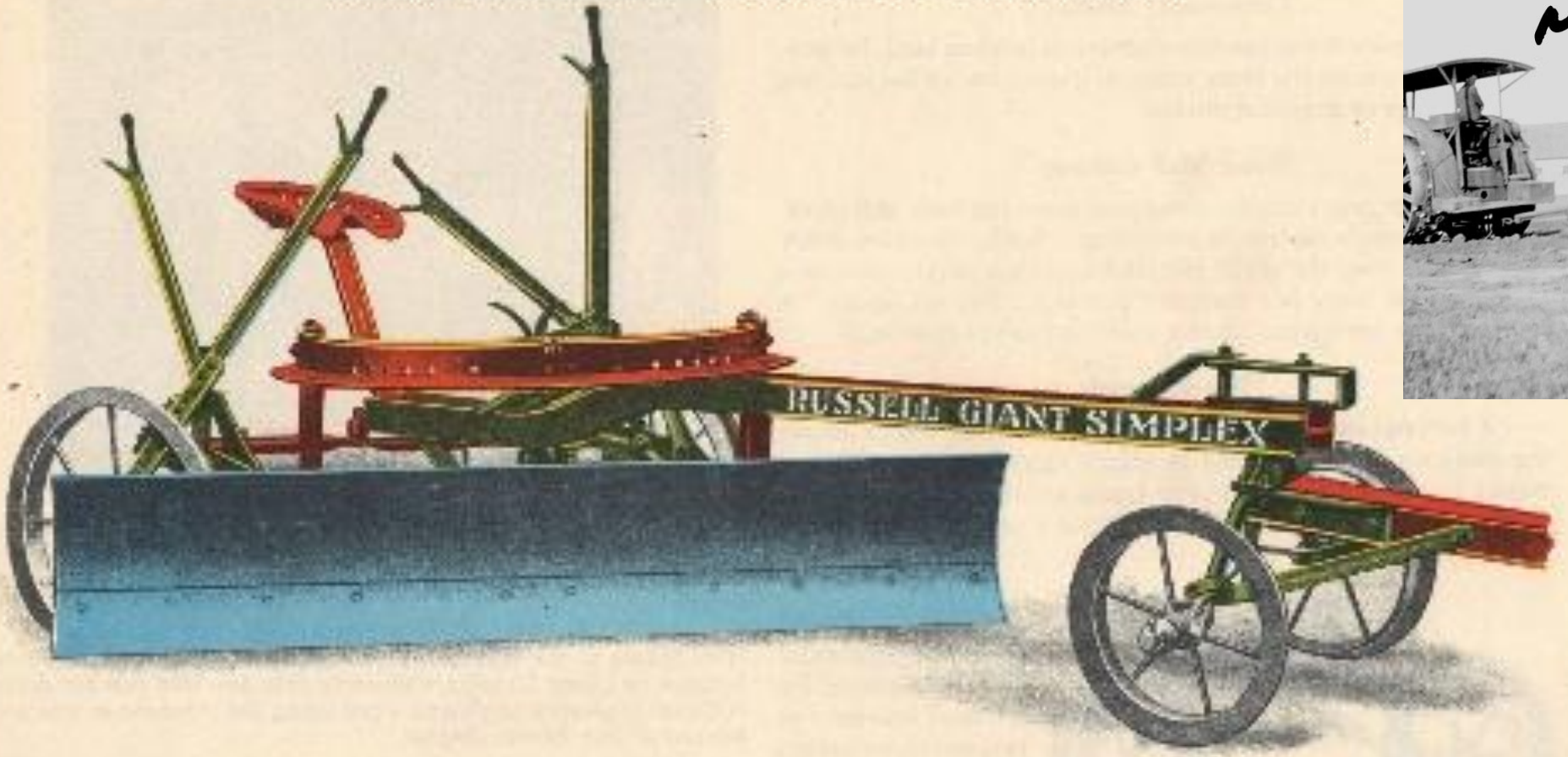
GRADERS

GRADERS

Graders are multipurpose machines used primarily for general construction and maintenance of roads and runways, moving large amounts of materials laterally by side casting. Additionally, the grader can be used for crowning and leveling roads, mixing and spreading materials, ditching and bank sloping, blade
mixing asphalt materials, snow removal, and scarifying. The grader is a rubber-tired hydraulically operated, for all grader functions. The steering system, moldboard, and scarifier are hydraulically controlled. Although the grader, at times, must be hauled to and from jobsites, the grader has an advantage over other heavy equipment because of its capability to travel over the road under its own power.

"Russell Giant Simplex" 7 Foot 3 Inch Blade

Reversible Road Machine. Weight 1000 lbs. For 4 or 6 Horses.



Patented April 22, 1920. June 15, 1920. April 5, 1927.

Price Net and Delivered, Freight Prepaid to Your Station

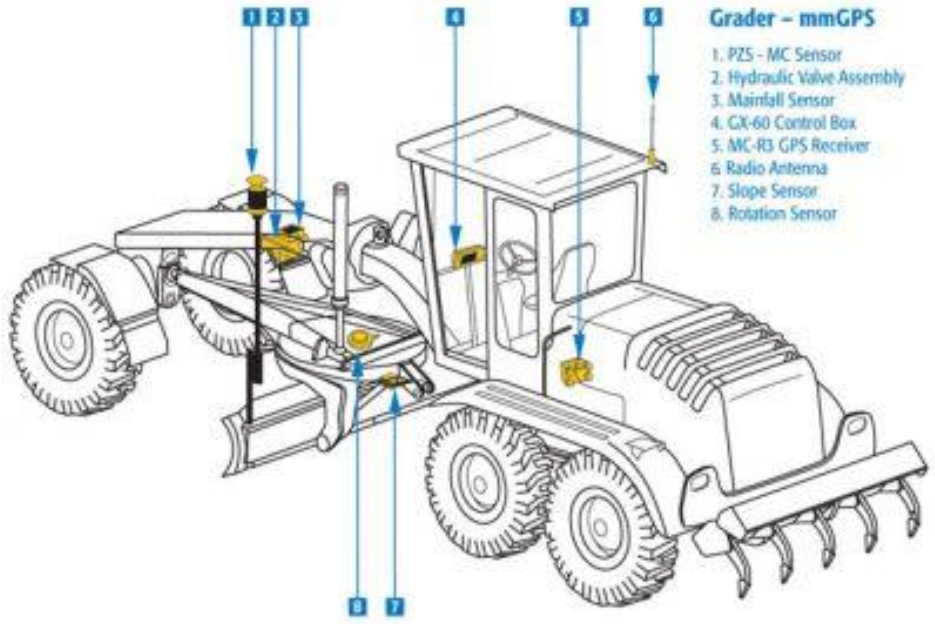
		Codeword
$100.00	Complete with horse pole, no hitch	Future
$105.00	Complete with horse pole, and full hitch for 4 horses abreast or (tandem hitch when so specified)	Futile

For extra hitch items other than specified above, see page 11.

1% discount allowed for cash with order; 2% discount allowed if paid in 15 days.

Short History of Motor Graders

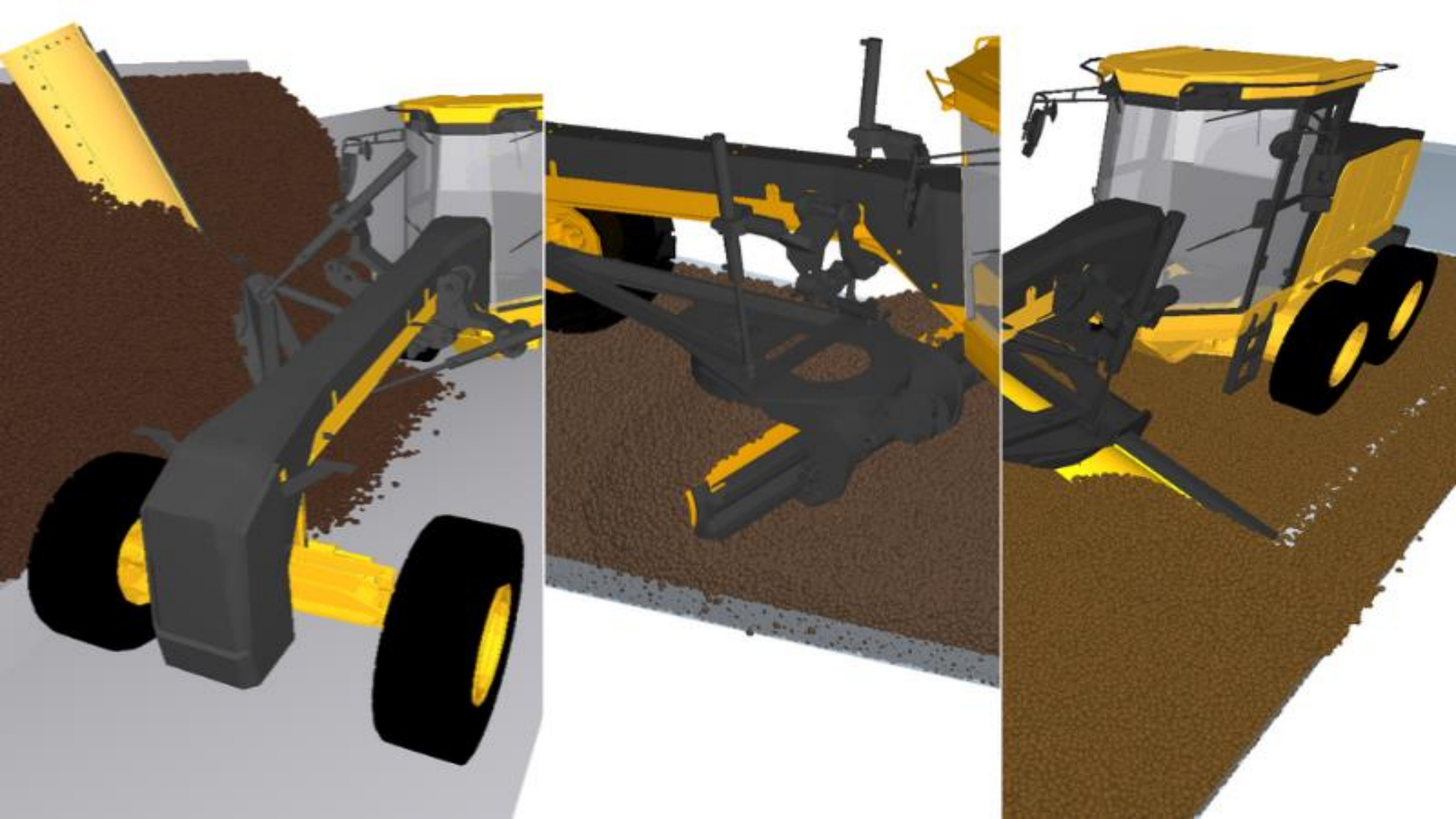
NOTE: When hauling a grader with a tractor- trailer, ensure the height of the grader cab clears all overhead obstacles. A variety of makes and models of graders are used in the NCF. Each operator is responsible for reading the operator's manual to obtain detailed information about each make and model. *Capacities range from a blade width of 2.50 to 7.30 m and engines from 93–373 kW (125–500 hp). Certain graders can operate multiple attachments, or be used for separate tasks like underground mining.*




Front Axle
Cab
Engine
Grader Blade
Rear Twin Axles

Graders are multipurpose machines used for:

1. Finishing
2. Shaping bank
3. Sloping
4. ditching




KOMATSU
GD675


VOLVO
VOLVO
640B

A grader’s primary purpose is cutting and moving with the moldboard.
Graders can work on slopes as steep as 3:1.
Graders and Grading options
There are two general types of graders:

- motor graders: they run on their own power source. They require only one
operator and no external equipment. They are expensive; and
- towed grader: they are towed by an external power source, usually by a tractor

They require one additional operator.
In addition, manual labourers may also be used to create correct shape and camber for a road. The labourers will require a number of hand tools including shovels and rakes

Grader availability in the region

There are many motor graders available in the region. Medium sized motor graders (between 120-180 HP) are the most common in the three countries. The most common model is the CAT 120H. Large motor graders (greater than 180 HP) are also available but they are not as common as the medium sized ones.
The general consensus among the contractors in the region is that they are not appropriate for works on rural roads. This is due to their large weight and wide turning circle. Small graders or compact graders (less than 120HP) are not common in the study countries.

Comparison grader with Bulldozers

A grader can move small amounts of material but cannot perform bulldozer-type work because of the structural strength and location of its moldboard.

Important Components of Grader

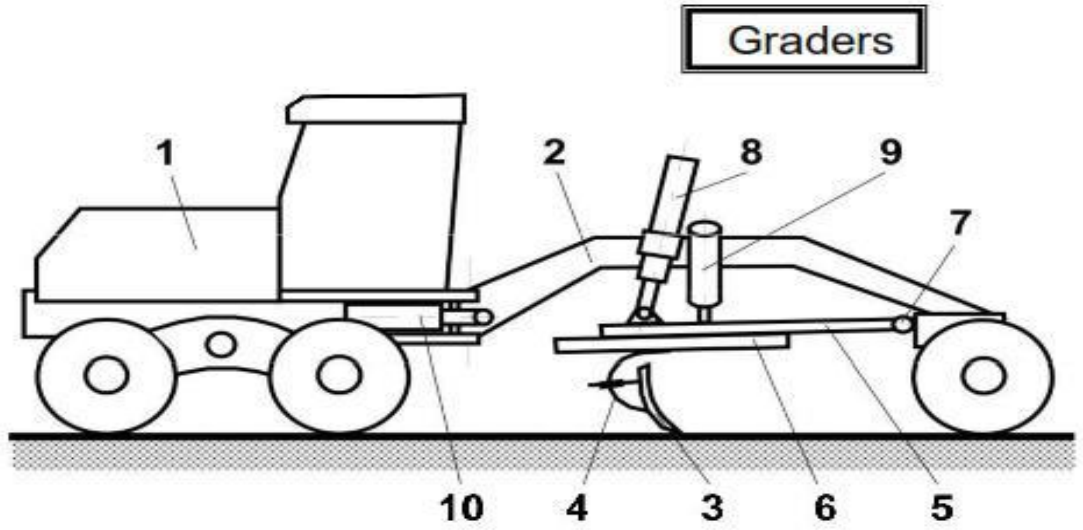
The components of the grader that actually do the work of finishing are:

1. Moldboard (Blade)
2. Scarifer

Graders may also be equipped with light rear-mounted rippers.

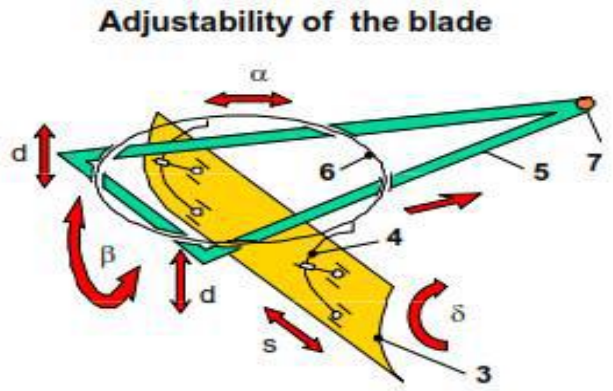
GRADER COMPONENTS

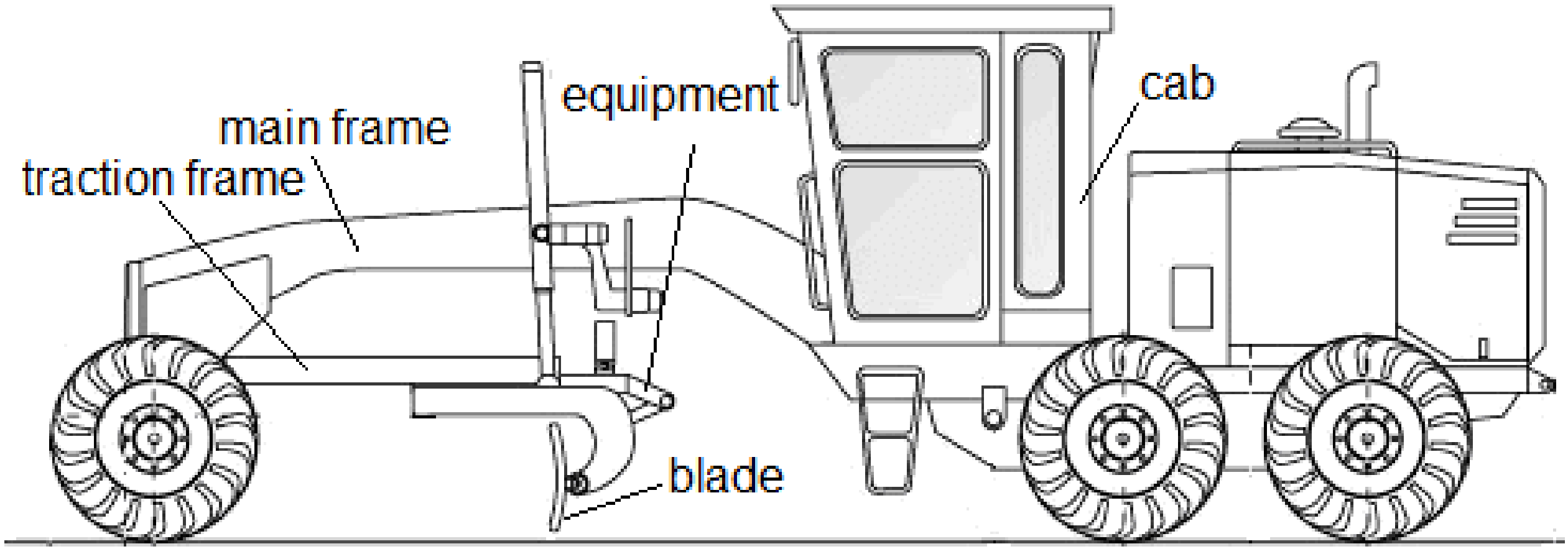
The basic grader consists of a prime mover and a grader mechanism. Theprincipal parts of a grader are — single-engine unit. The single engine provides
power shown in figure.



1. tractor (engine)
2. articulated carriage
3. blade
4. tilting frame
5. main frame
6. swivel ring
7. ball-joint
8. lifting cylinder (jack)
9. tilting cylinder
10. swivel cylinder

(d) cutting depth
(δ) cutting angle
(β) slope angle
(α) heading angle
(s) sliding




equipment
cab
main frame
traction frame
blade

Grader : Multi-purpose equipment used for:

1. Finishing
2. Shaping
3. Bank sloping
4. Ditching
5. Mixing
6. Spreading
7. Side casting
8. Leveling and crowning
9. Site striping operations
10. Earth road maintenance

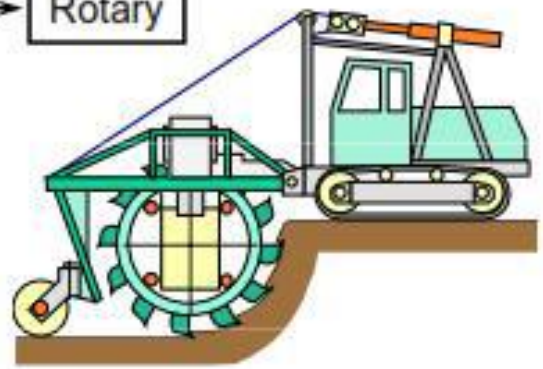
Reclamation Machine and Equipment

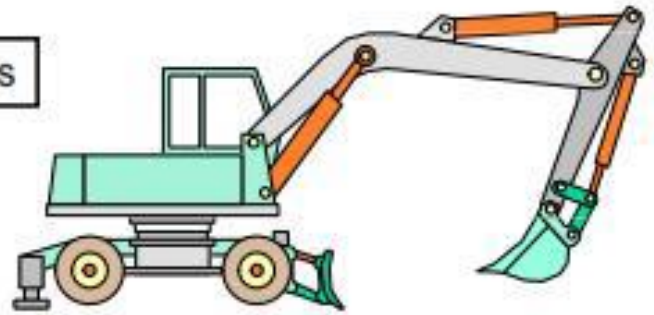
SCRAPERS

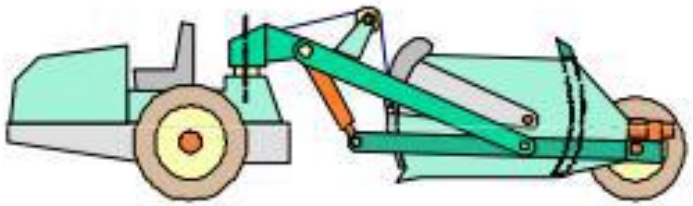
Assist teacher: yahya younis Mohsen

EARTHWORKS - HEAVY EQUIPMENT

- Excavators
  - Intermittent
    - Power Transm.
      - Mechanic
      - Hydaulic
    - Attachments
      - Loaders
      - Excavators
      - Grips
      - Jaws
  - Multibucket (trencher)
    - Rotary
    - Bucket-line (ladder)
- Rippers
- Extractor-Haulers
  - Bulldozers
  - Graders
  - Scrapers
- Compactors
  - Rollers
  - Tampers
  - Vibrators



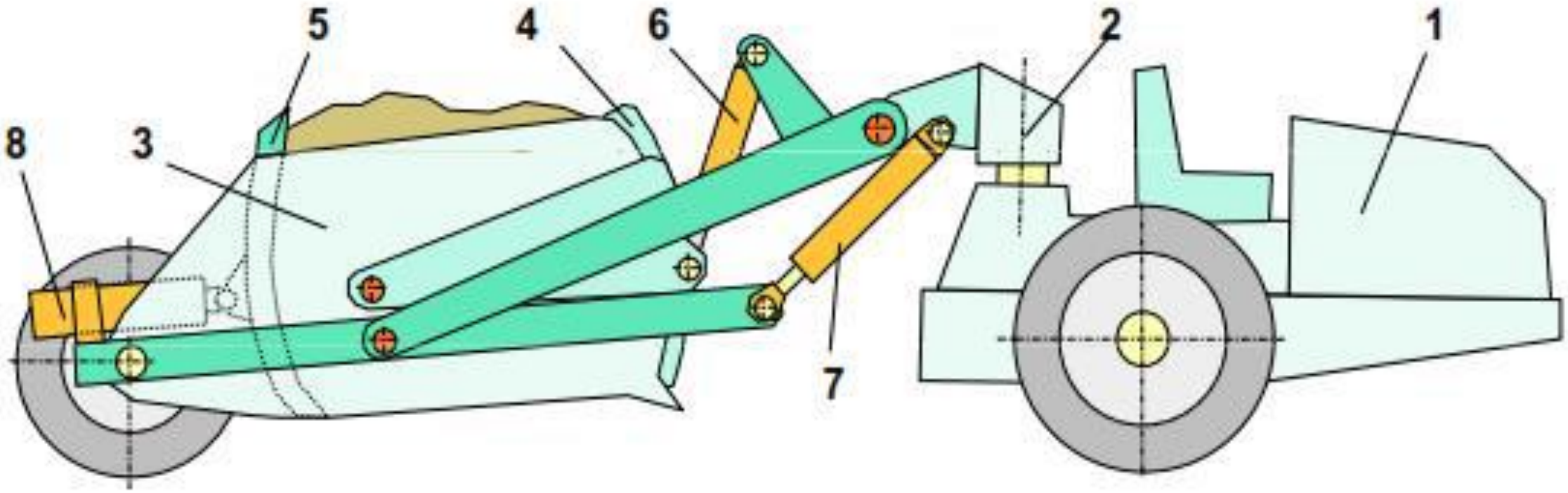




SCRAPERS

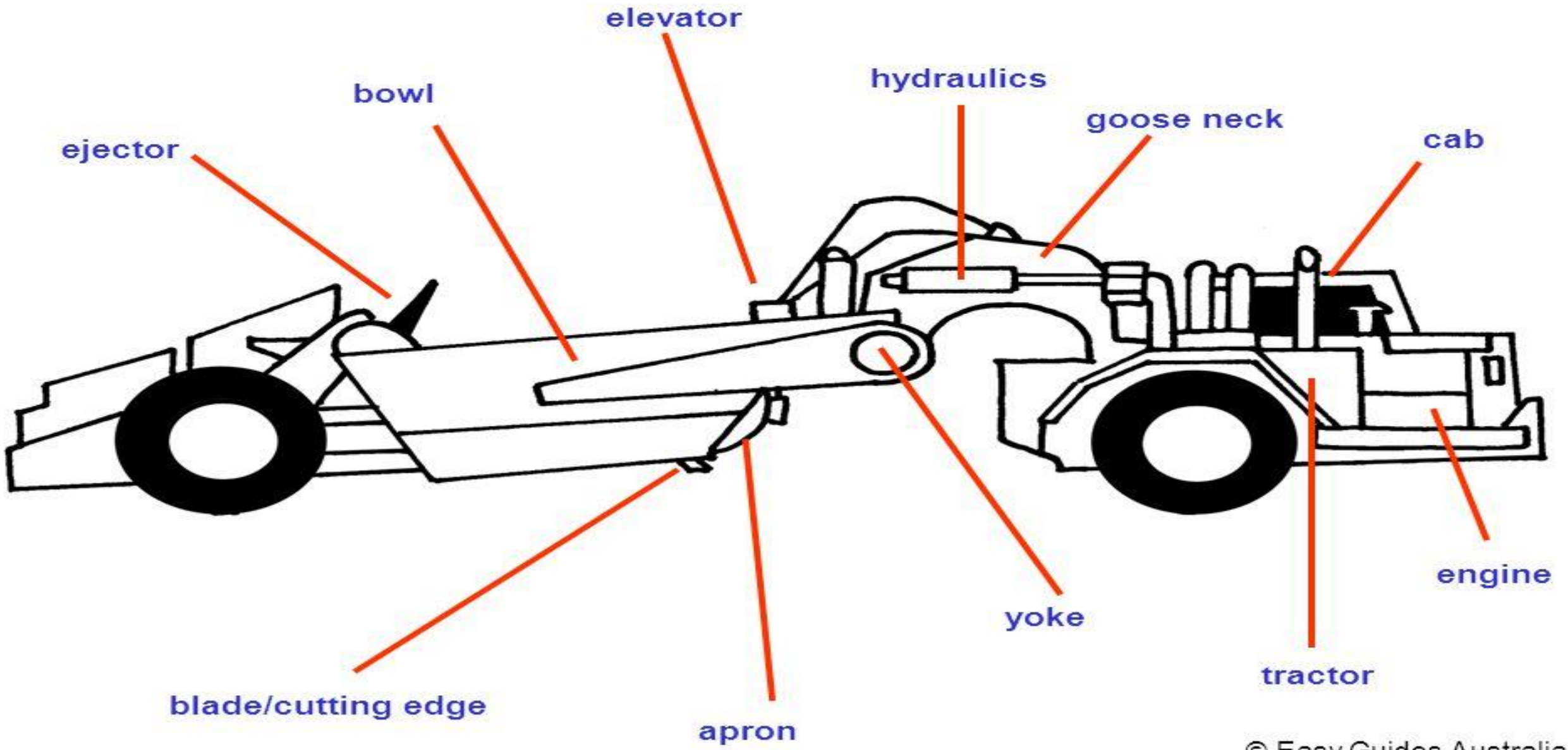
The design of scrapers (tractor scrapers) allows for loading, hauling, dumping, and spreading of loose materials. Use a scraper for medium-haul earthmoving operations and for moving ripped materials and shot rock. The haul distance (zone of operation), the load volume, and the type and grade of surface traveled on are the primary factors in determining whether to use a scraper on a particular job. The optimum haul distance for small- and medium-size scrapers is 3,000 feet or less.

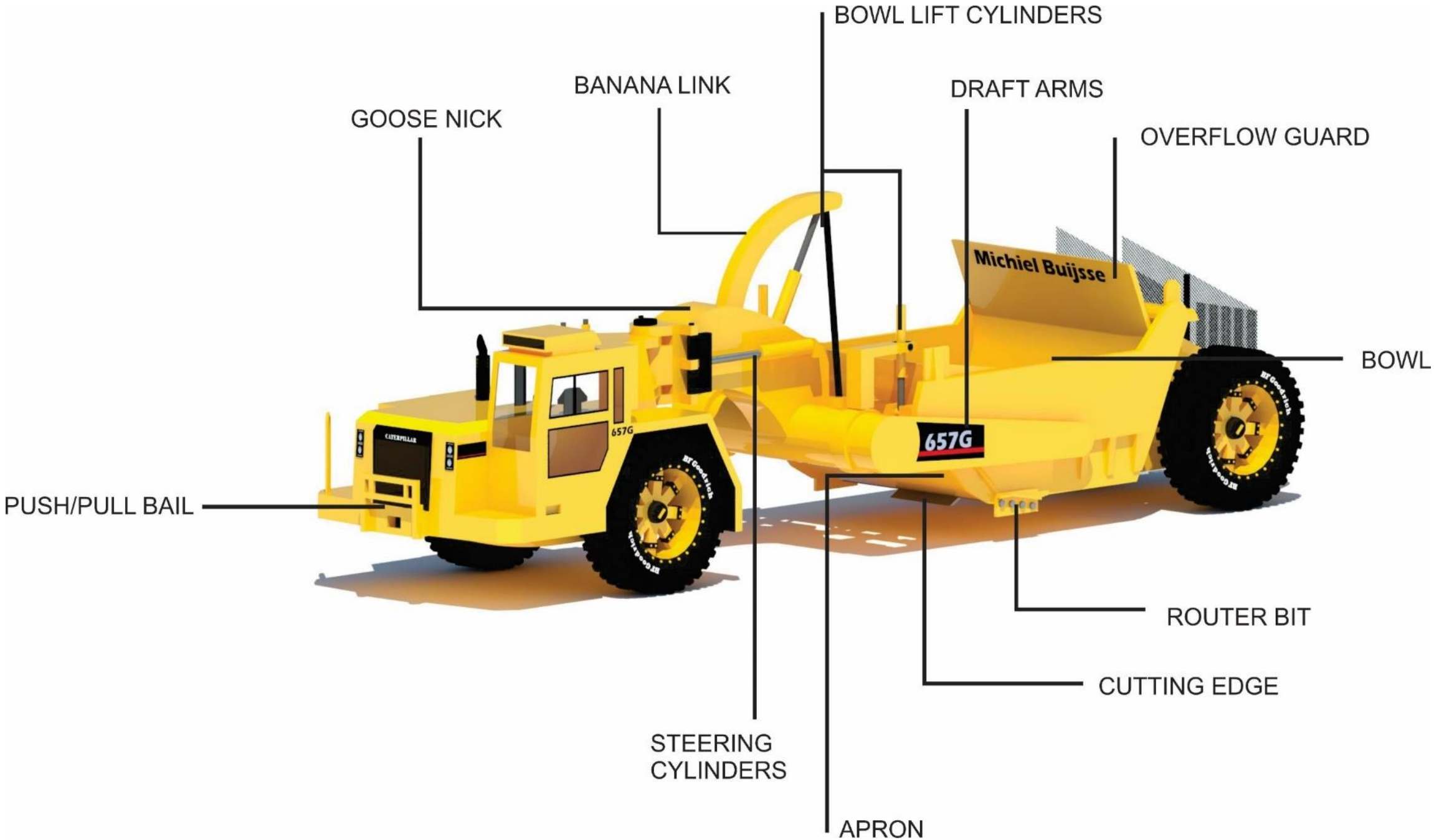
Scraper compounded



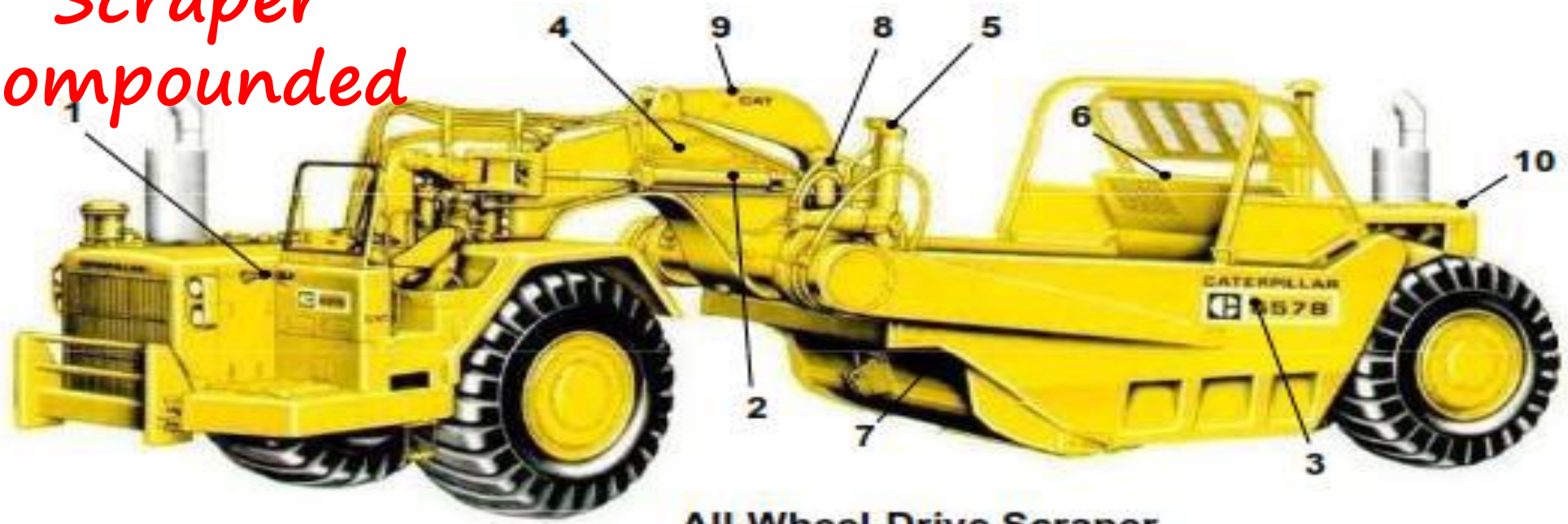
1. single-axle tractor
2. articulation
3. bowl
4. apron
5. ejector
6. apron cylinder
7. bowl cylinder
8. ejector cylinder

An example of a Scraper



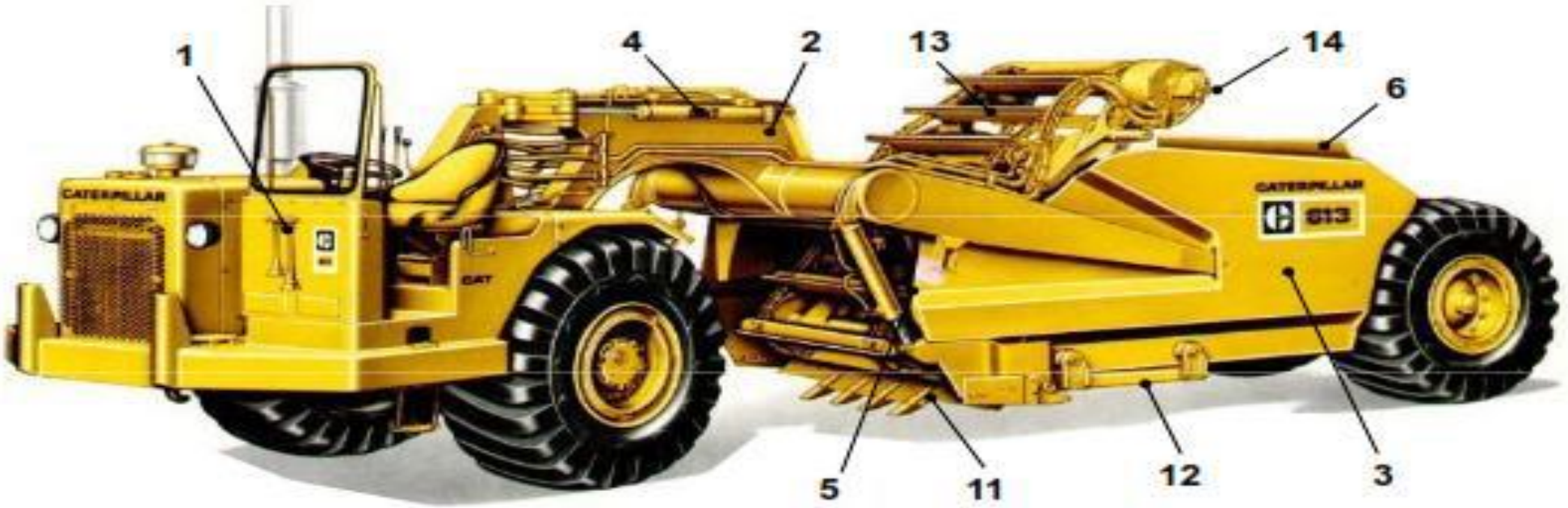

BOWL LIFT CYLINDERS
BANANA LINK
DRAFT ARMS
GOOSE NICK
OVERFLOW GUARD
Michiel Buijsse
BOWL
657G
PUSH/PULL BAIL
ROUTER BIT
CUTTING EDGE
STEERING
CYLINDERS
APRON

Scraper compounded



All-Wheel-Drive Scraper
(Charging and penetration provided by towing power of tractor)

1. tractor
2. gooseneck
3. scraper bowl
4. steering cylinder
5. bowl cylinder
6. ejector
7. apron
8. apron cylinder
9. apron rods
10. rear engine (rear wheel drive)



11. cutting edge
12. discharge slide
13. elevator
14. hydro-engine (of elevator)

Elevator-scraper


CAT
657G

MOVINGMACHINE – SCRAPERS

1. The piece of plants consist of a power unit and a scraper bowl
2. used to excavate and transport soil where surface stripping, site levelling, light clearing, rough and fine grading, bank sloping, ditching/channel and
cut and fill activities
3. Particularly for large volumes
4. Produce a very smooth and accurate formation level

Three basic types of scraper:-

1. Crawler-drawn scraper
2. Two-axle scraper
3. Three-axle scraper


CATERPILLAR


657G
CAT
SoCalEarthMovers.com


CAT


CAT
D8
CATERPILLAR
CJ&L
BUSHELMAN


K-TEC
1030
FIRST EDITION
CASE


10


DEERE
9620 R


K-TEC
K-TEC
CAT
CAT 70


AutoLoad
DEERE
2112D
JOHN DEERE

CRAWLER-DRAWN SCRAPER

1. Has truck and gooseneck arrangement
2. Consist of four-wheeled scraper bowl towed behind a crawler power unit
3. Hauling speed - less than 8 km/h
4. Scraping speed – less than 3 km/h

Wheel scraper

Is an integrated self-propelled unit

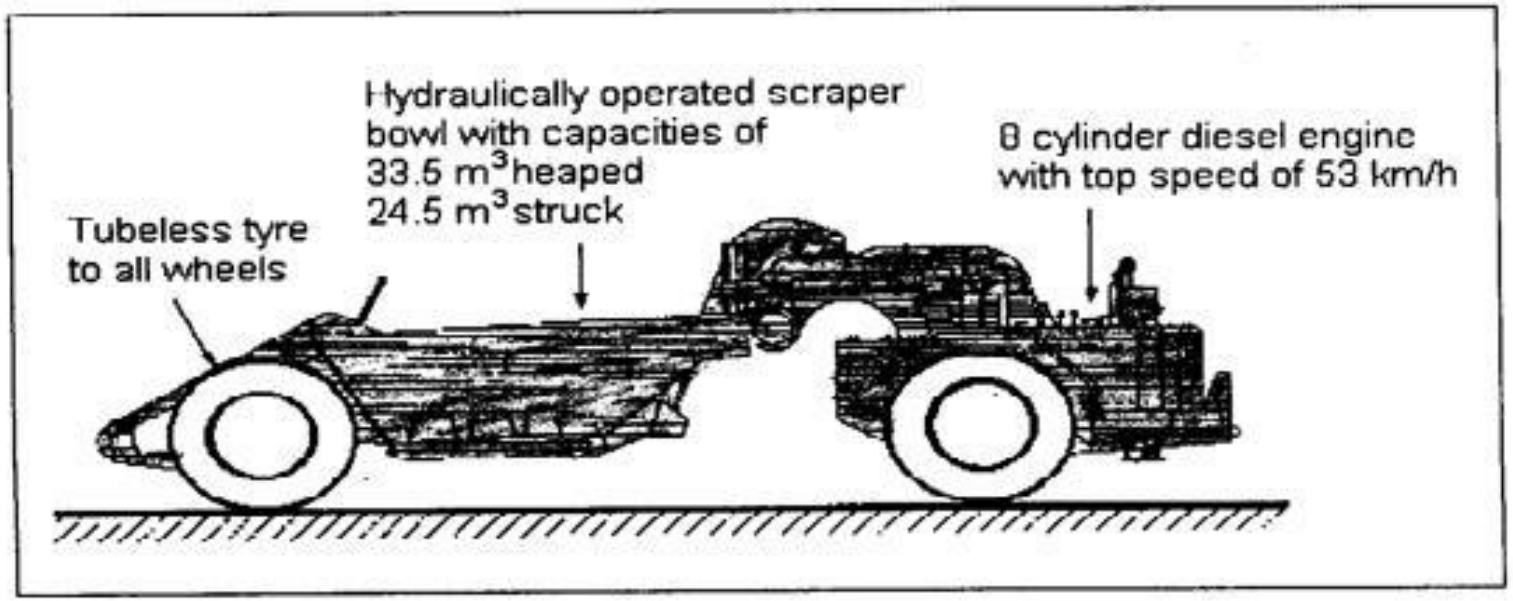
a. Two-axle

i. have two wheeled power unit has advantages over its four wheeled power unit or three axle due to its manoeuvrable

ii. Offers less rolling resistance and has better traction since the engine is mounted closer to the driving wheels

b. Three-axle

i. Advantages of being able to use its top speed more frequently, generally easier to control and power unit can be used for other activities which is not possible with most twoaxle



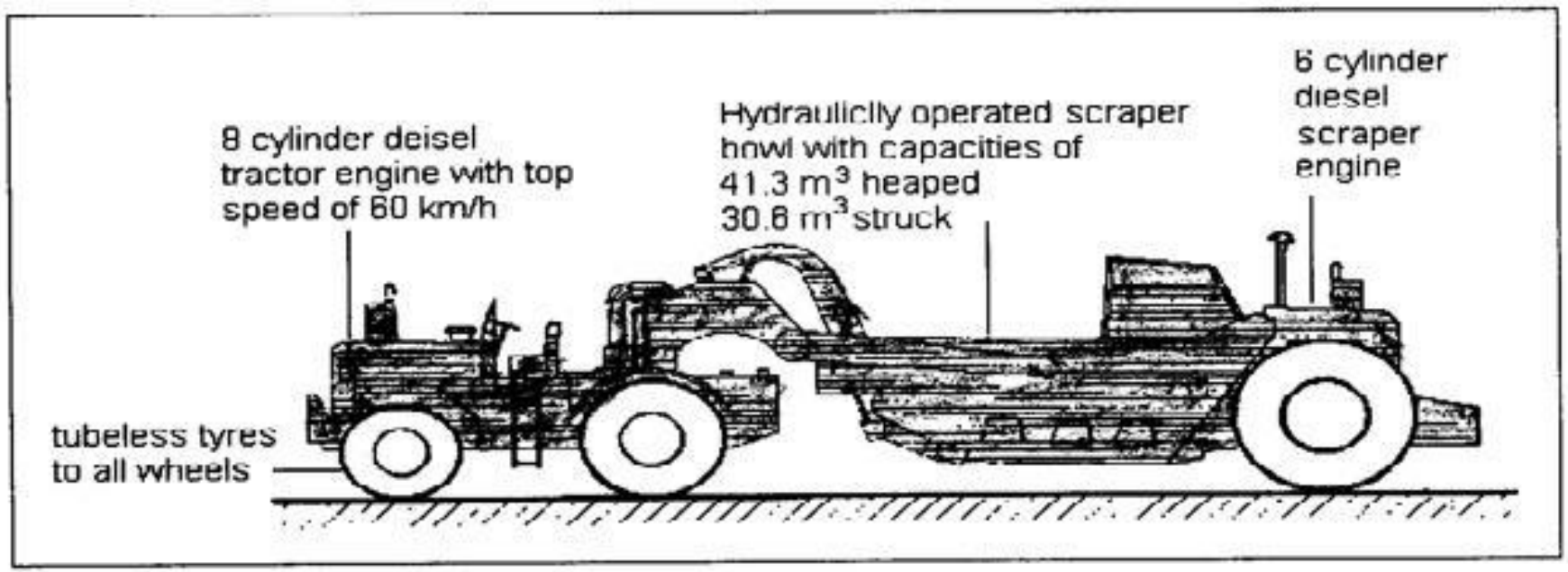
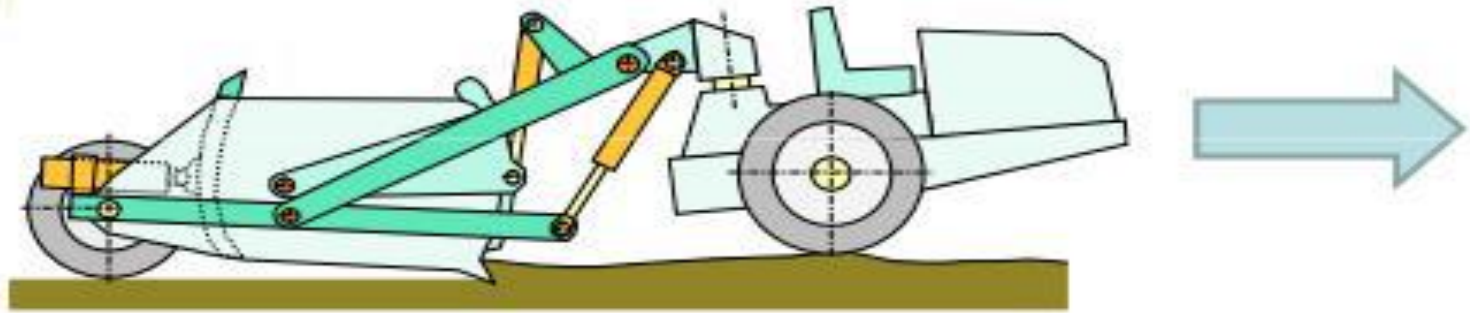
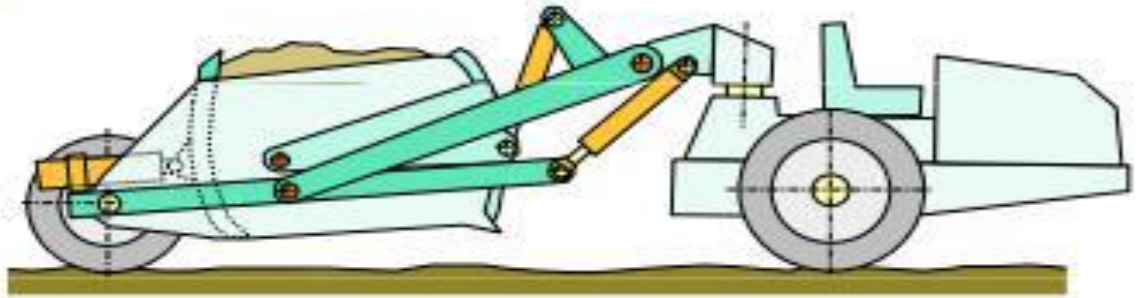


Figure- typical 2 and 3 axial scraper

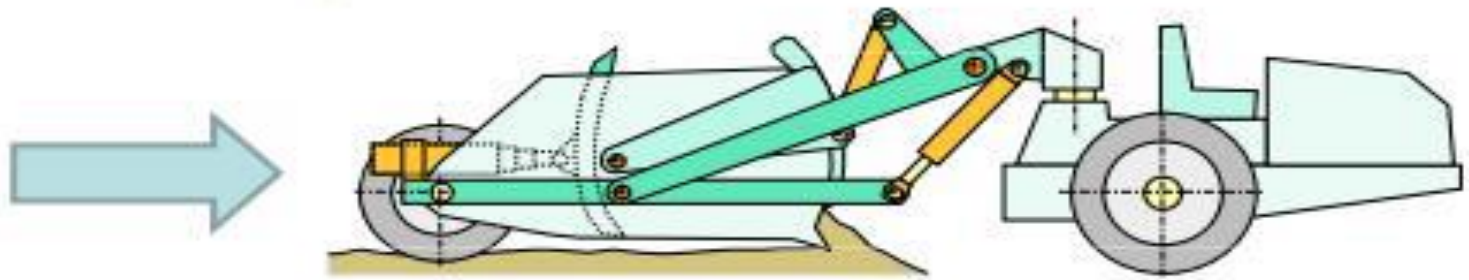
Phases of a cycle (turn)



Excavating (charging): apron up (open), bowl down (penetrating into the soil)

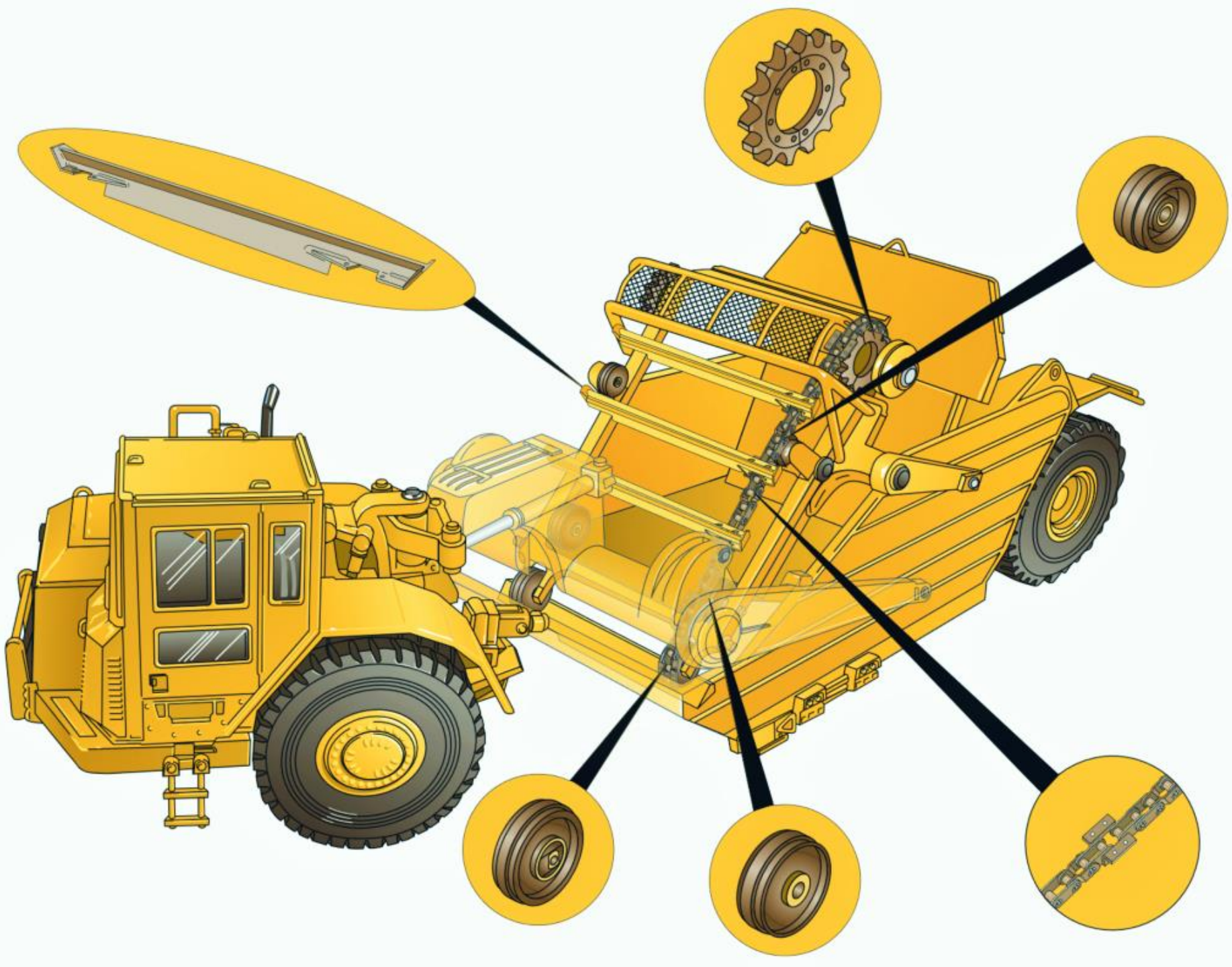


Hauling (and compacting): apron down (close), bowl up



Discharging (spreading and compacting): apron up (open), bowl up, ejector forward

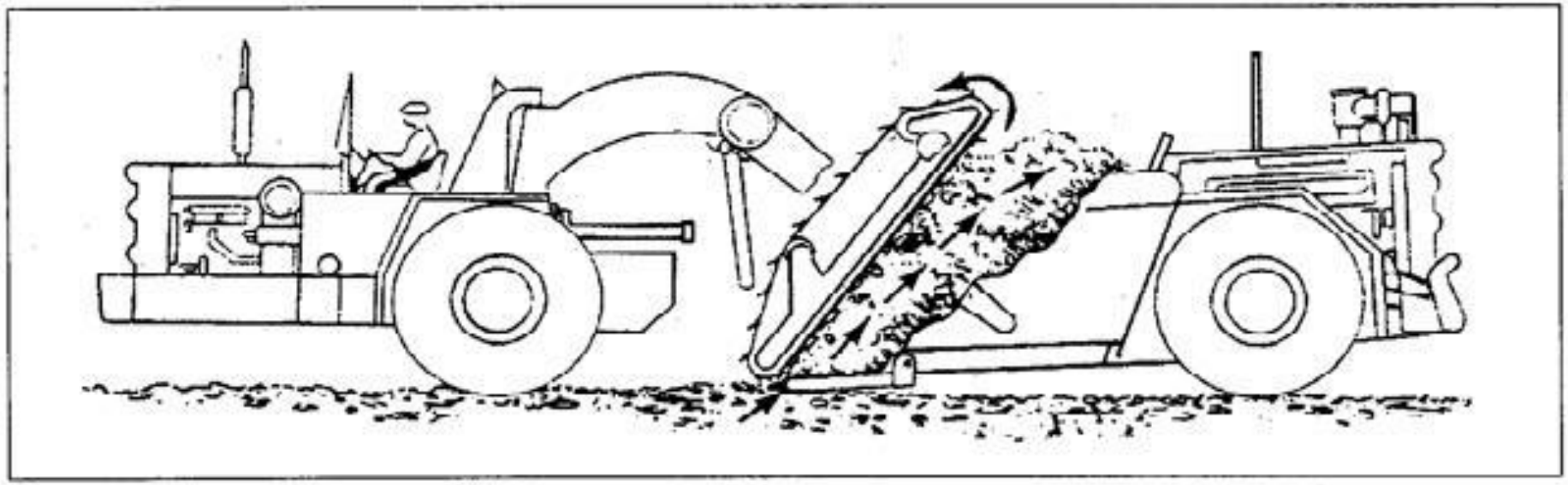

CATERPILLAR
CAT
623G



Loading of scrapers

Scrapers are loaded by the following methods:-

1. Self-loading in loose soils
2. Push loaded by crawler tractor
3. Elevating self-loading
4. Push pull
5. Top loaded by hydraulic excavator or front end loader



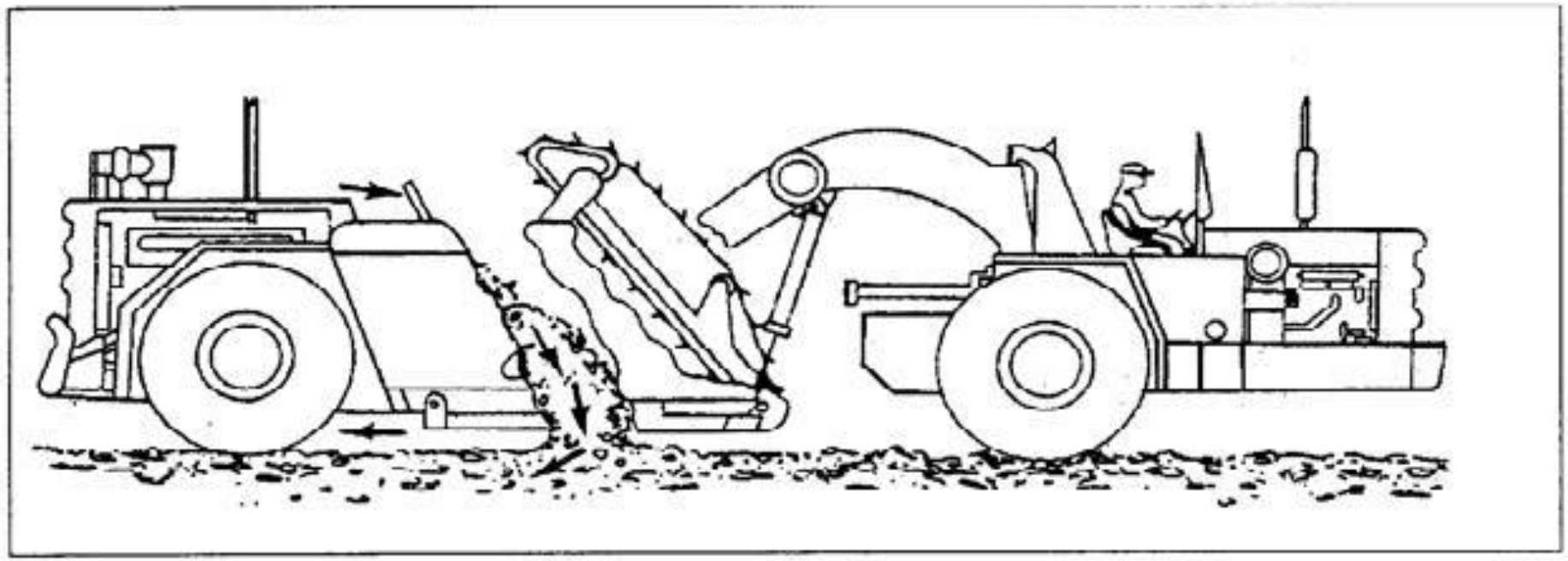


Figure- Typical Elevating Scraper

Scraper cutting blade

a. Standard Blade – used for fine grading and finishing and for general earthmoving operations where the soils are not too stiff or hard

b. Drop Centre Blade – Operates in broad range of soil and for stripping grass and root bound soils. The centre section is dropped so as to prevents the dam up of the materials inside the bowl when loading and unloading.

c. Double Drop Centre Blade – Used in heavy clay or where the material has a tendency to loosed in sheets.

d. Drop Centre Tooth Mounted Blade – operates efficiently on material which are hard or crusty.

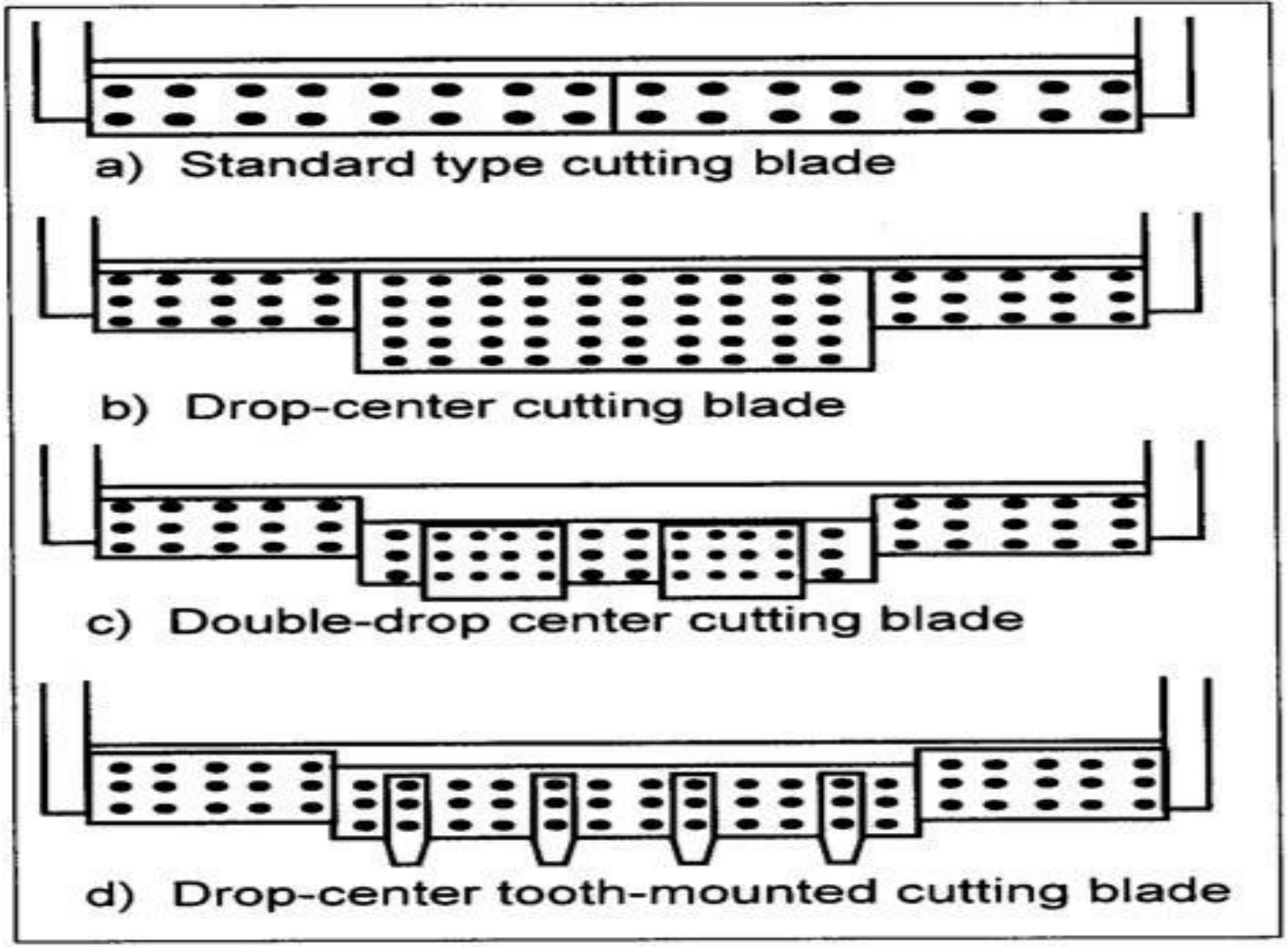


Figure – Cutting blade for Scraper

The basic operating parts of a scraper are these:

- Bowl. The bowl is the loading and carrying component. It has a cutting edge, which extends across the front bottom edge. Lower the bowl until the cutting edge enters the ground for loading, raise it for carrying, and lower it to the desired lift thickness for dumping and spreading.
- Apron. The apron is the front wall of the bowl. It is independent of the bowl and, when raised, it provides an opening for loading and spreading. Lower the apron during hauling to prevent spillage.
- Ejector. The ejector is the rear wall of the bowl. Keep the ejector in the rear position when loading and hauling materials. Activate the ejector to move forward during spreading to provide positive discharge of materials.

OPERATING RANGE

The optimum haul distance for the small- and medium-size scrapers is 300 to 3,000 feet. There are larger scrapers that are effective up to 5,000 feet.

SELECTION

A scraper is a compromise between a machine designed exclusively for either loading or hauling. For medium-distance movement of material, a scraper is better than a Bulldozer because of its travel-speed advantage and it is better than

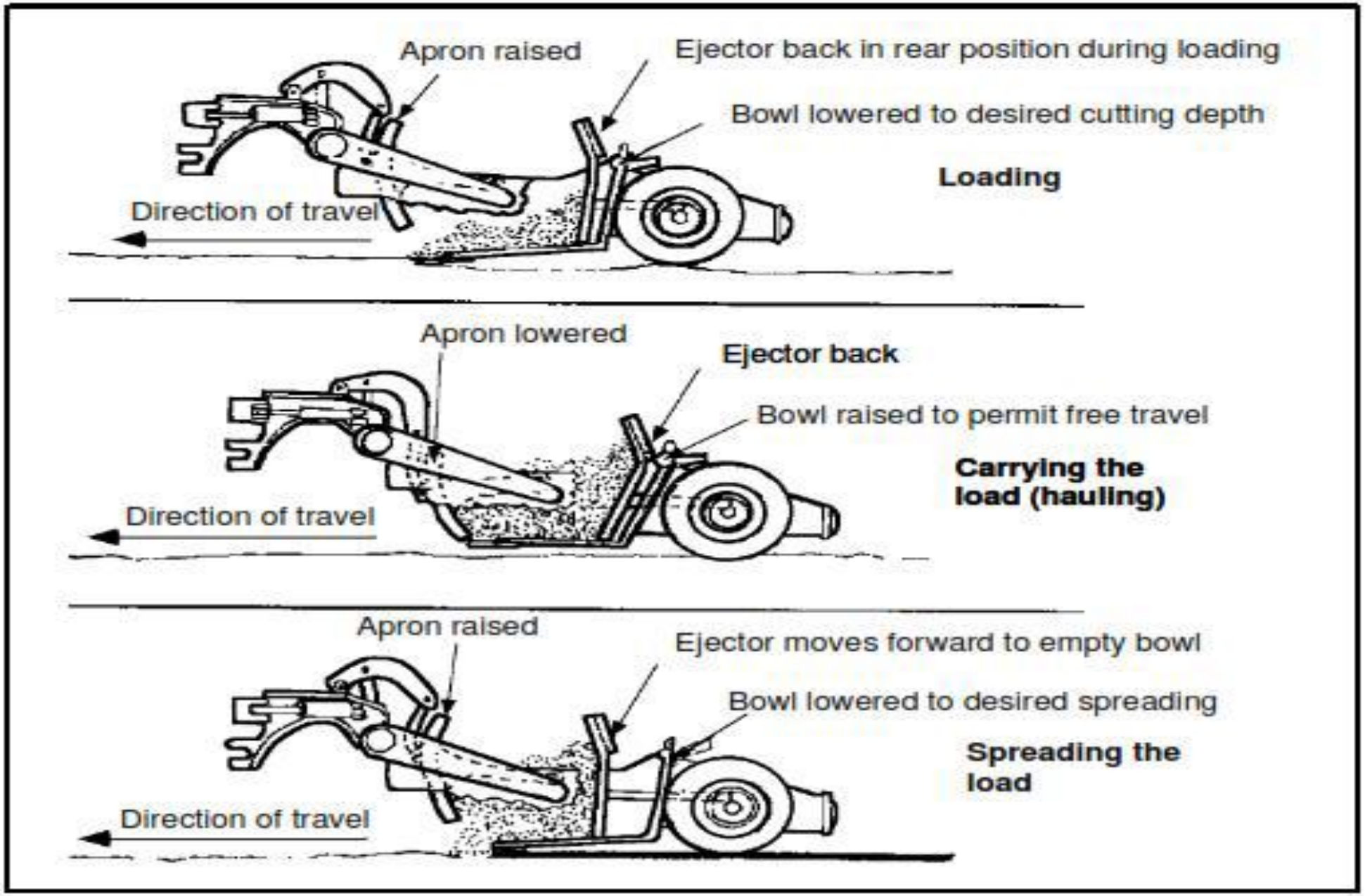
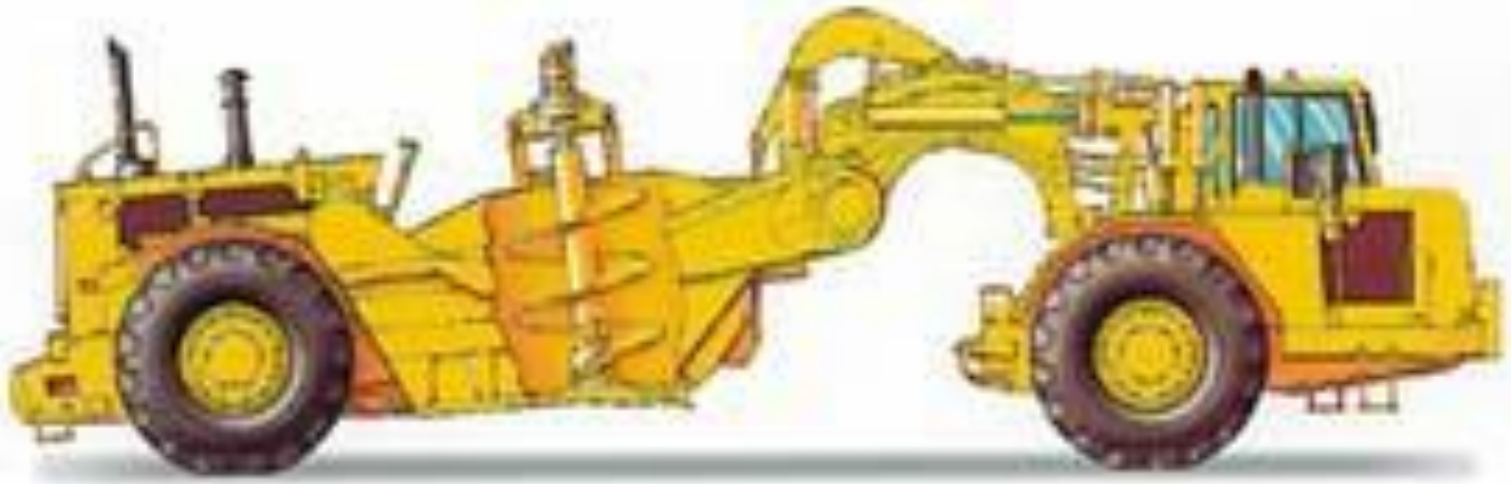


Figure - Functions of the Apron, Bowl, and Ejector

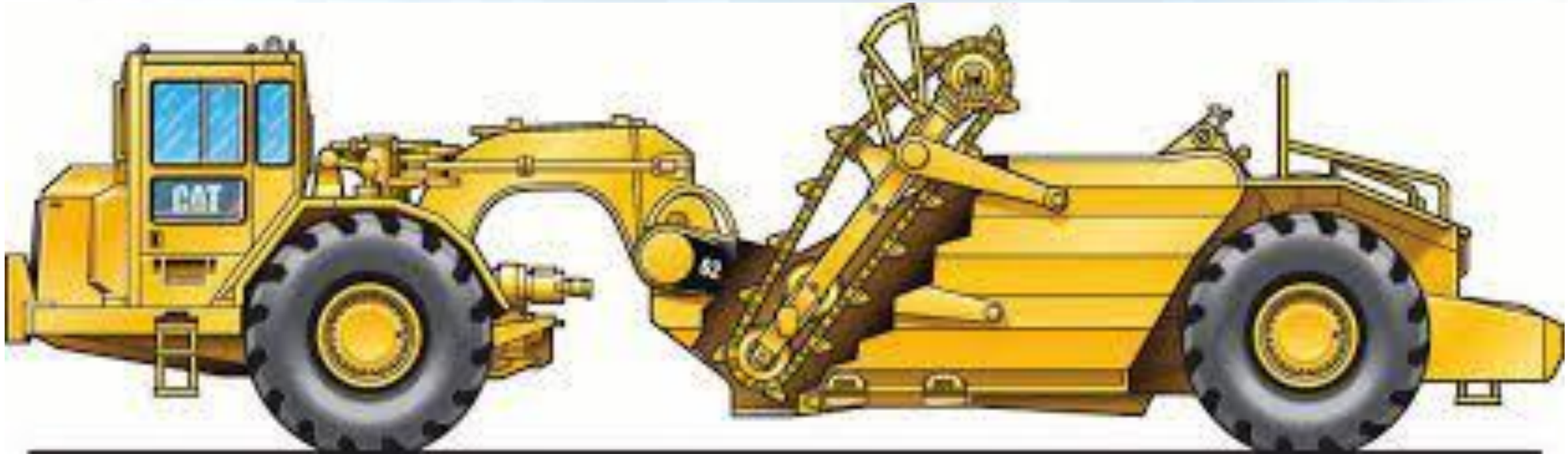
Types of scrapers

1. Push-Loaded: Single Powered Axle

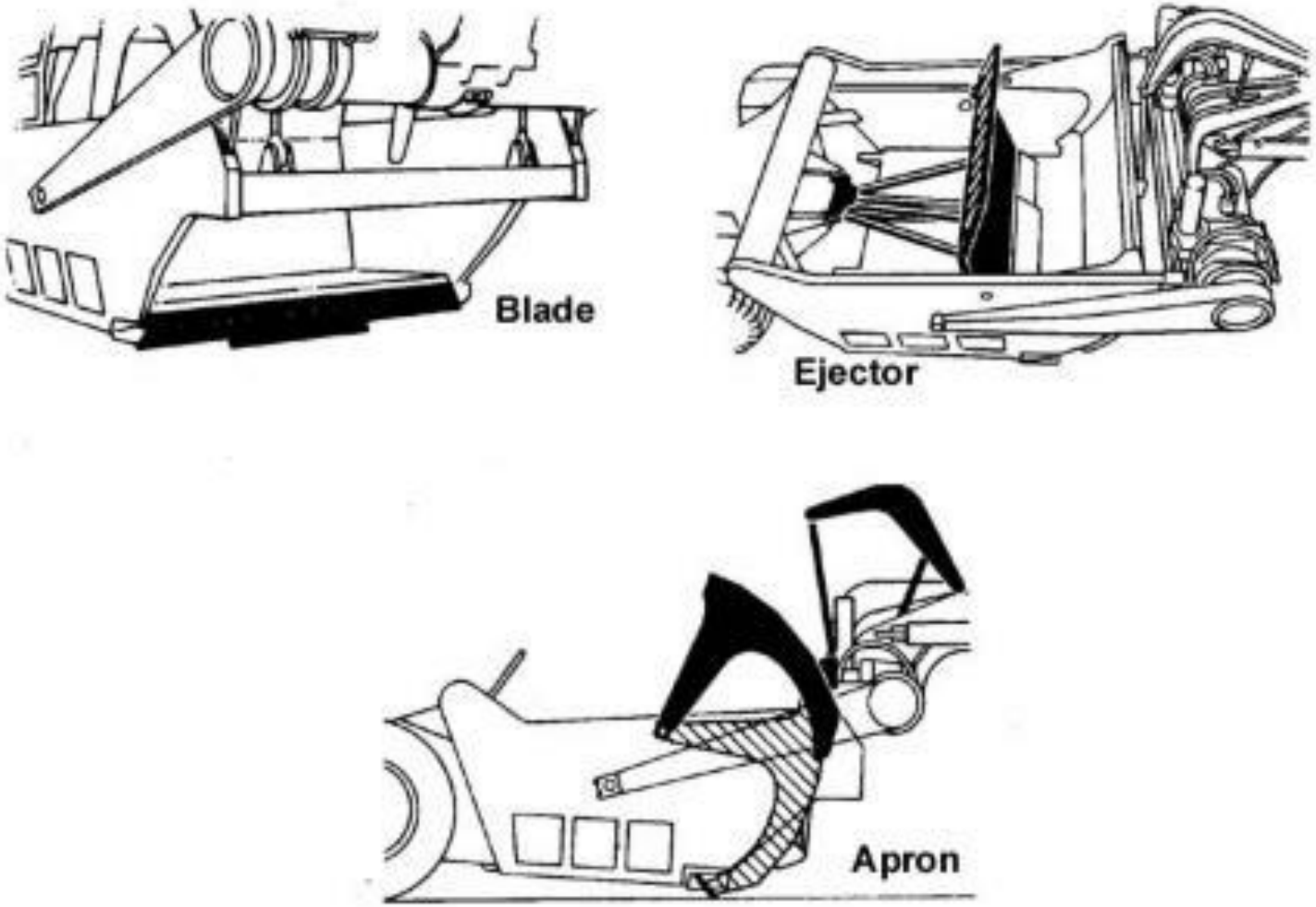
2. Push-Pull: Tandem- Powered Axle Elevating




627G
CAT


CAT
62

The ejector is a curved plate located at the back of the bucket. The ejector can be moved forwards to push material out of the bowl. Figure highlights the blade, apron, and ejector on a typical scraper bowl.



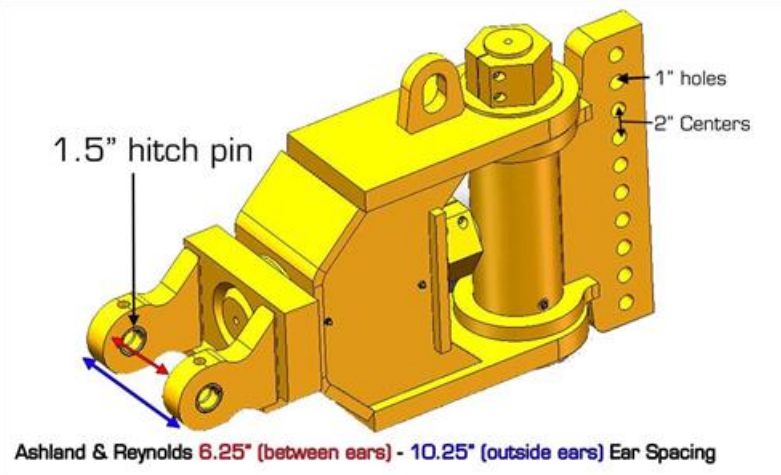
Parts of Scraper Bowl

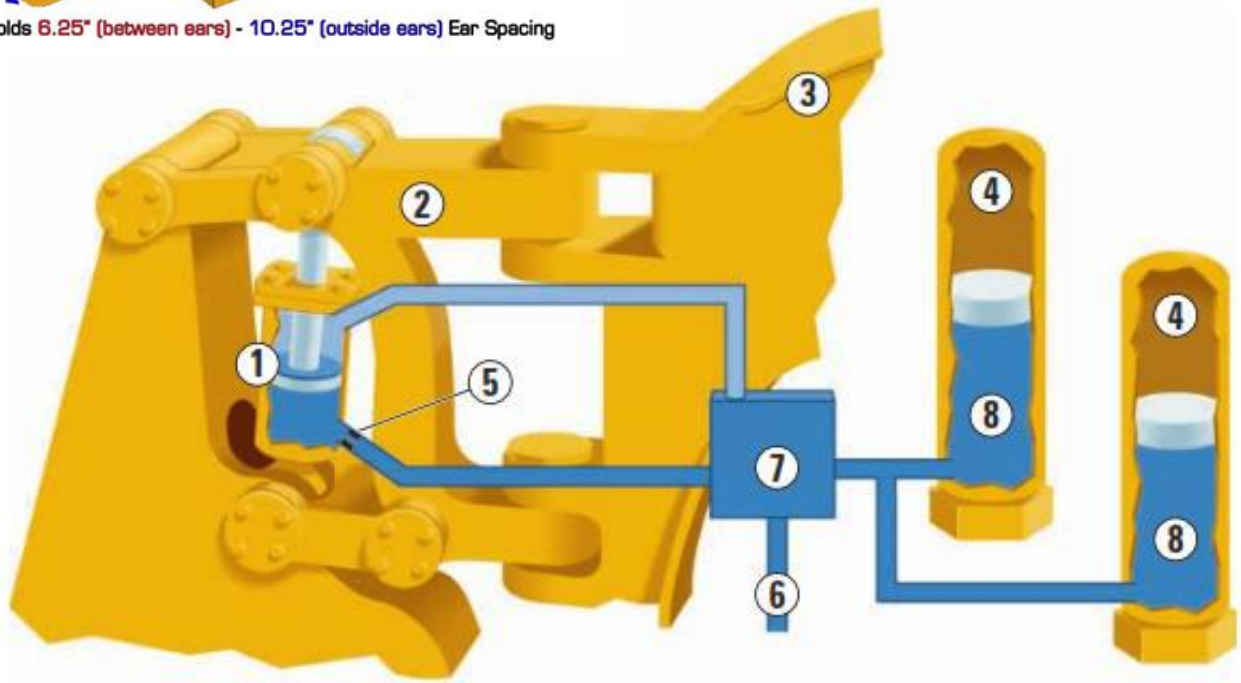
mph (45 km/h) while carrying a full load. This makes them economical, because they can move a large volume of soil over a considerable distance at a relatively high speed. The disadvantage to equipping scrapers with rubber tires is that they cannot generate the traction necessary to work on soft soils or to load themselves to capacity. Therefore, all scrapers are designed to have some type of assistance in loading. Scrapers are classified by their method of loading. Scrapers are either push-loaded, push-pull, or elevating.

Structures

Superior structural design and construction optimize performance and reliability.

1. Load cylinder
2. Hitch castings
3. Scraper gooseneck
4. Nitrogen accumulators
5. Orifice
6. Oil from tractor hydraulic system
7. Leveling valve
8. Free floating pistons



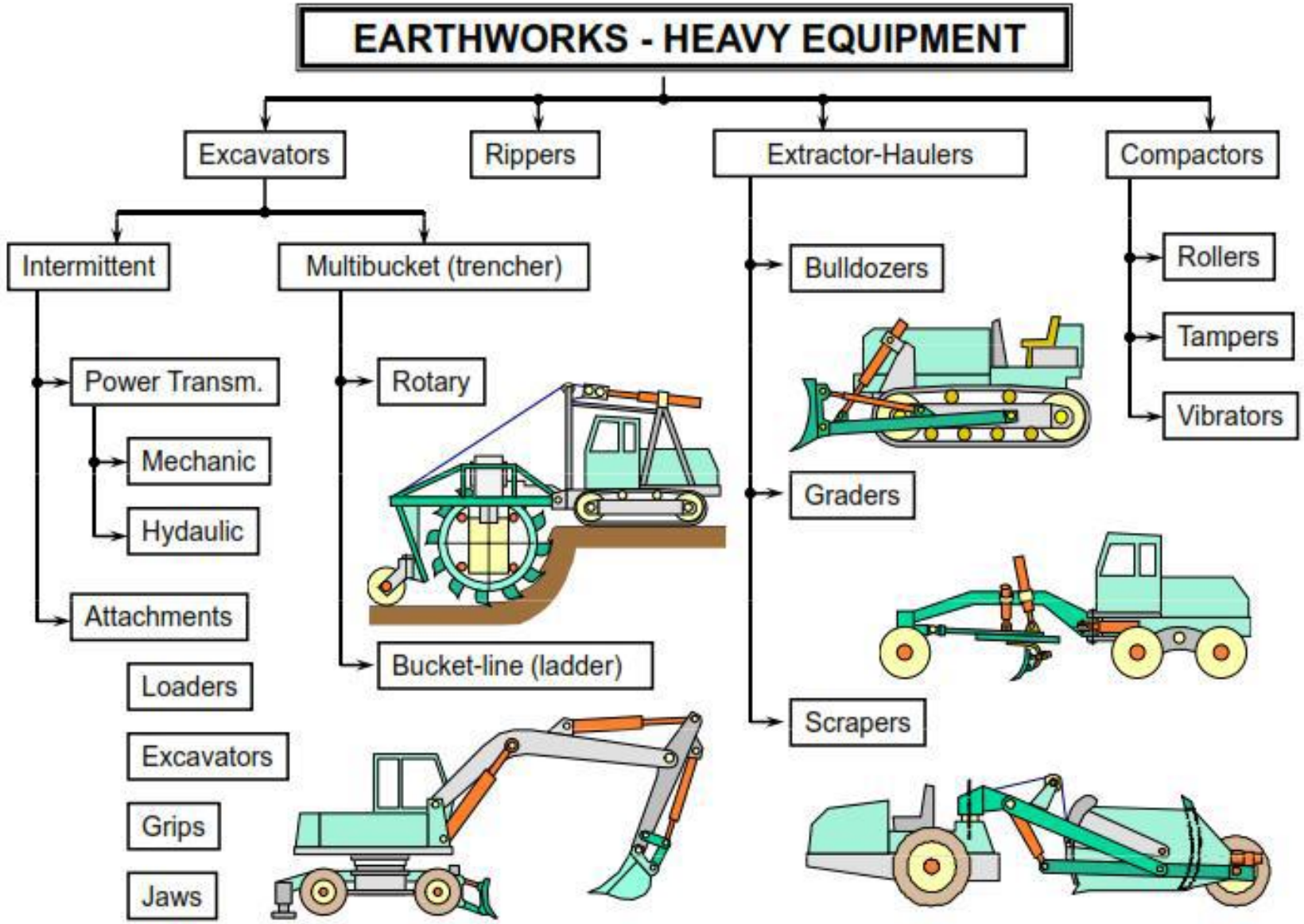


Reclamation Machine and Equipment

EXCAVATOR

Assist teacher: yahya younis Mohsen

EXCAVATOR


EARTHWORKS - HEAVY EQUIPMENT
Excavators
Rippers
Extractor-Haulers
Compactors
Intermittent
Multibucket (trencher)
Power Transm.
Mechanic
Hydaulic
Attachments
Loaders
Excavators
Grips
Jaws
Rotary
Bucket-line (ladder)
Bulldozers
Graders
Scrapers
Rollers
Tampers
Vibrators

Excavators

Excavators are heavy construction equipment consisting of a boom, stick, bucket and cab on a rotating platform (known as the "house"). The house sits atop an undercarriage with tracks or wheels. A cable-operated excavator uses winches and steel ropes to accomplish the movements.

They are a natural progression from the steam shovels and often called power shovels. All movement and functions of a hydraulic excavator are accomplished through the use of hydraulic fluid, with hydraulic cylinders and hydraulic motors. Due to the linear actuation of hydraulic cylinders, their mode of operation is fundamentally different from cable-operated excavators .

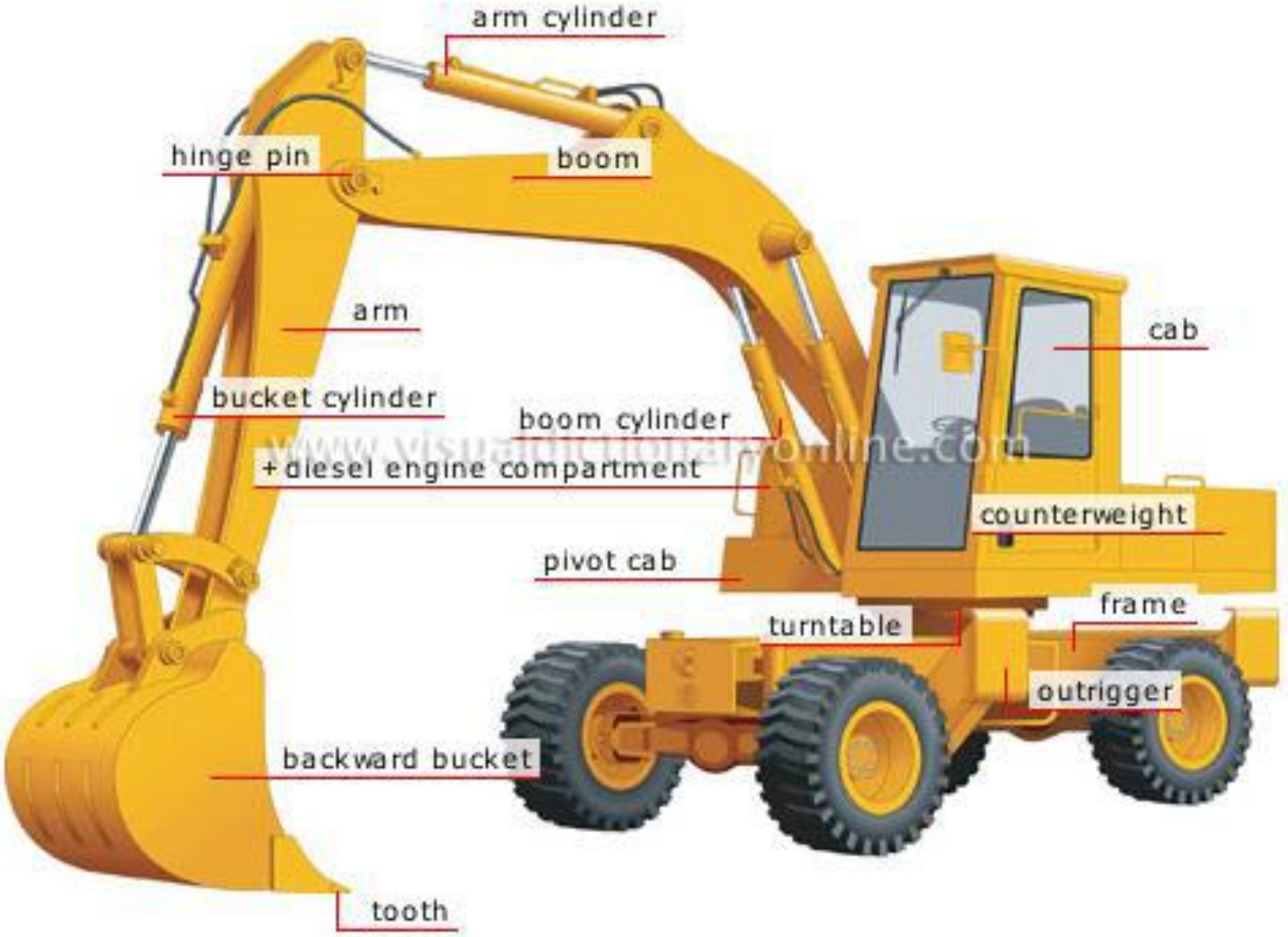
Excavators are also called **diggers**, **JCBs** (a proprietary name, in an example of a generic trademark), **mechanical shovels**, or **360-degree excavators** (sometimes abbreviated simply to **360**).

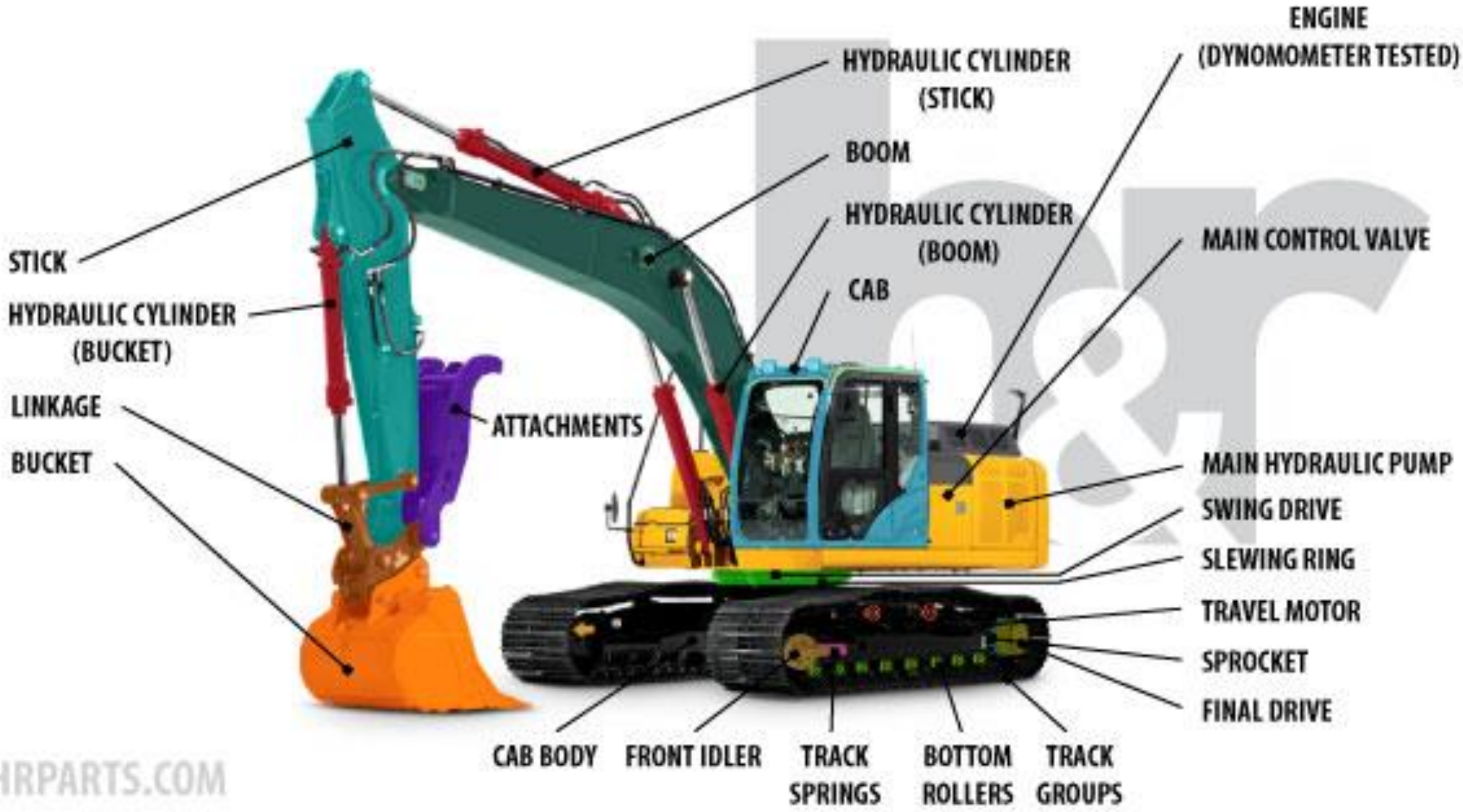
Excavators are used in many ways:

- Digging of trenches, holes, foundations
- Material handling
- Brush cutting with hydraulic attachments
- Forestry work
- Forestry mulching
- Demolition
- General grading/landscaping
- Heavy lift, e.g. lifting and placing of pipes
- Mining, especially, but not only open-pit mining
- River dredging
- Driving piles, in conjunction with a pile driver

Excavators compounded

Machine made up of a pivot cab with a bucket attached for moving various types of material.




ENGINE
(DYNOMOMETER TESTED)
HYDRAULIC CYLINDER
(STICK)
BOOM
HYDRAULIC CYLINDER
(BOOM)
CAB
MAIN CONTROL VALVE
STICK
HYDRAULIC CYLINDER
(BUCKET)
LINKAGE
BUCKET
ATTACHMENTS
MAIN HYDRAULIC PUMP
SWING DRIVE
SLEWING RING
TRAVEL MOTOR
SPROCKET
FINAL DRIVE
CAB BODY
FRONT IDLER
TRACK
SPRINGS
BOTTOM
ROLLERS
TRACK
GROUPS

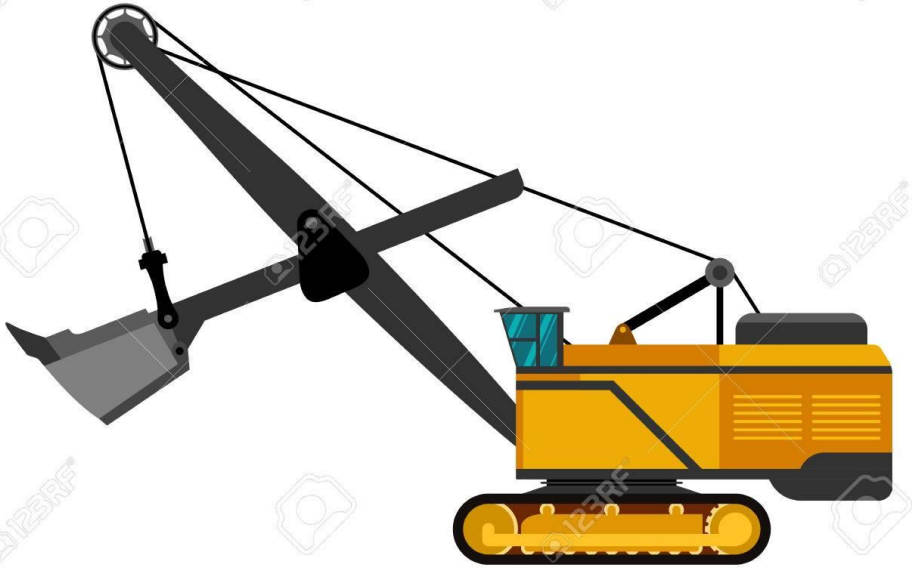
The two main sections of an excavator are the undercarriage and the house. The undercarriage includes the blade (if fitted), tracks, track frame, and final drives, which have a hydraulic and gearing providing the drive to the individual tracks,and the house includes the operator cab, counterweight, engine, fuel and hydraulic oil tanks. The house attaches to the undercarriage by way of a centerpin. High pressure oil is supplied to the tracks' hydraulic motors through a hydraulic swivel at the axis of the pin, allowing the machine to slew 360°
unhindered.

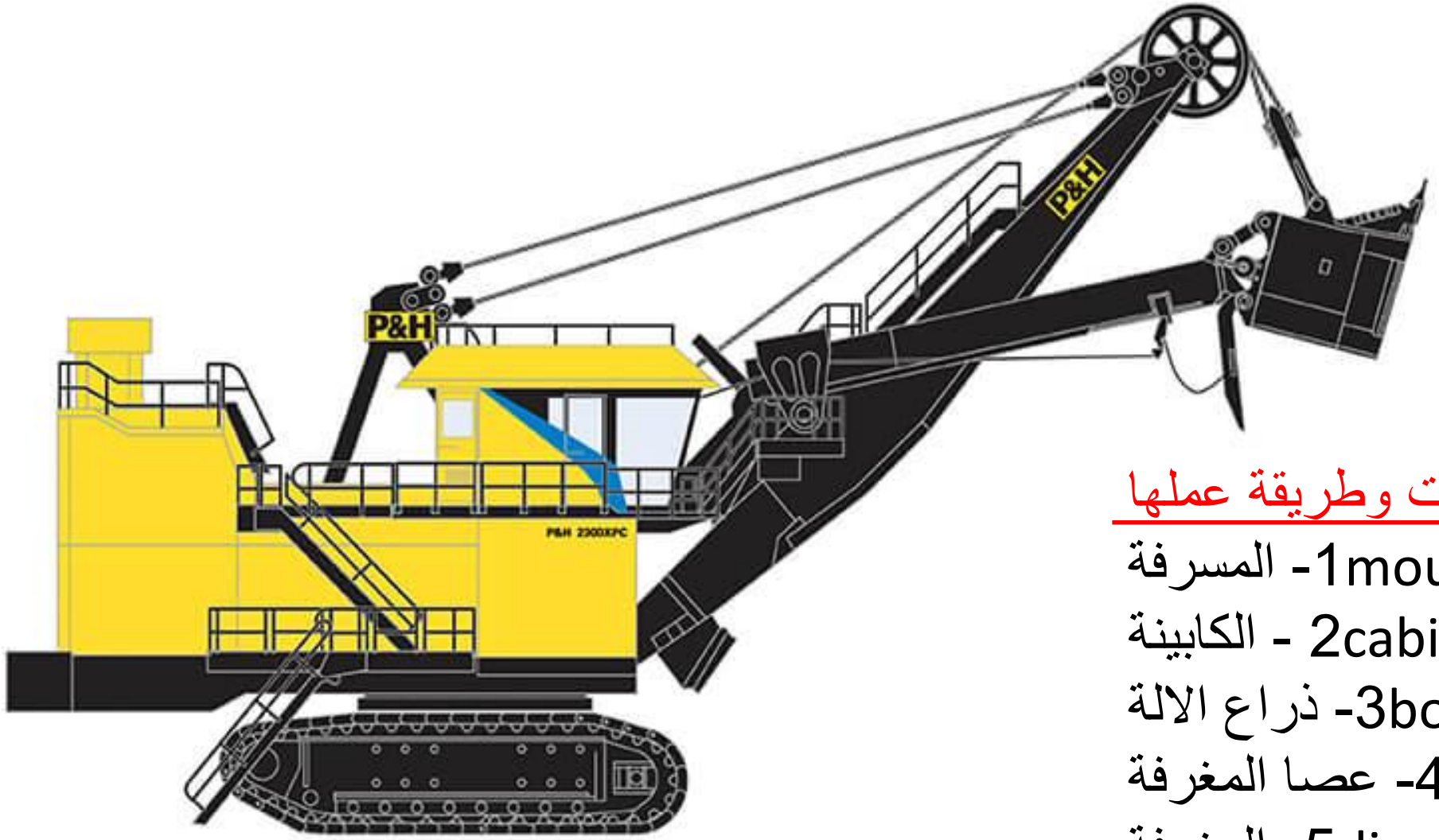
والجرافات تكون على نوعين :

1. 1- الجرافات المسرفة : تكون هذه الجرافات بطيئة الحركة وضغطها على التربة قليل ، لذلك تعمل في الاراضي الرخوة بسهولة
2. الجرافات المدولبة (ذات الاطارات المطاطية):تكون هذه الجرافات اسرع من الجرافات المسرفة وضغطها على التربة اكبر لذلك تستعمل في الاعمال البسيطة وحيث تقوم بعملية النقل ايضاً.

الجرافات الهيدروليكية

الجرافات السلكية





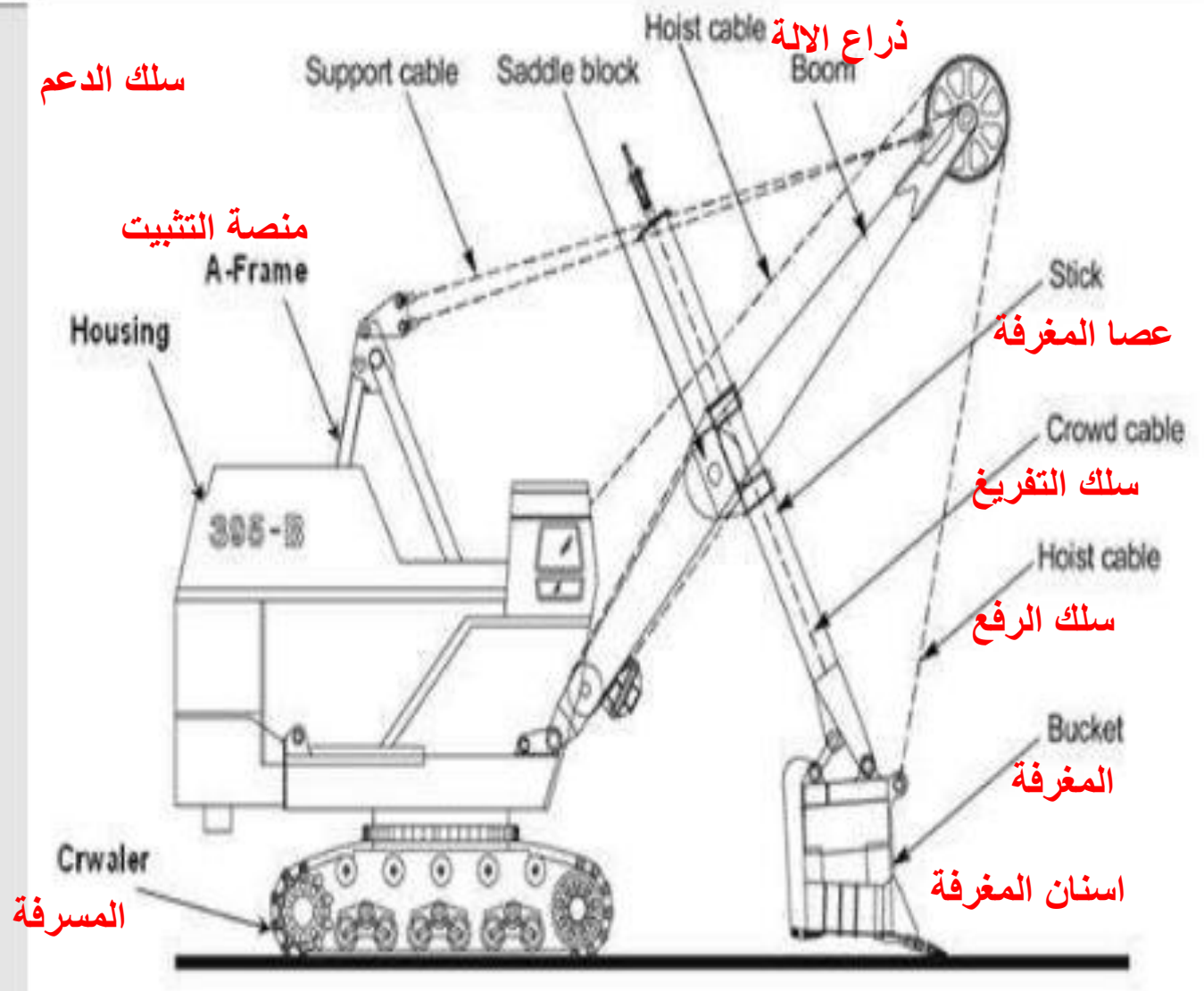
الاجزاء الرئيسية للجرافات وطريقة عملها

1- المسرفة mounting
2- الكابينة cabine
3- ذراع الالة boom
4- عصا المغرفة dipper stick
5- المغرفة dipper
6- سلك الرفع hoist

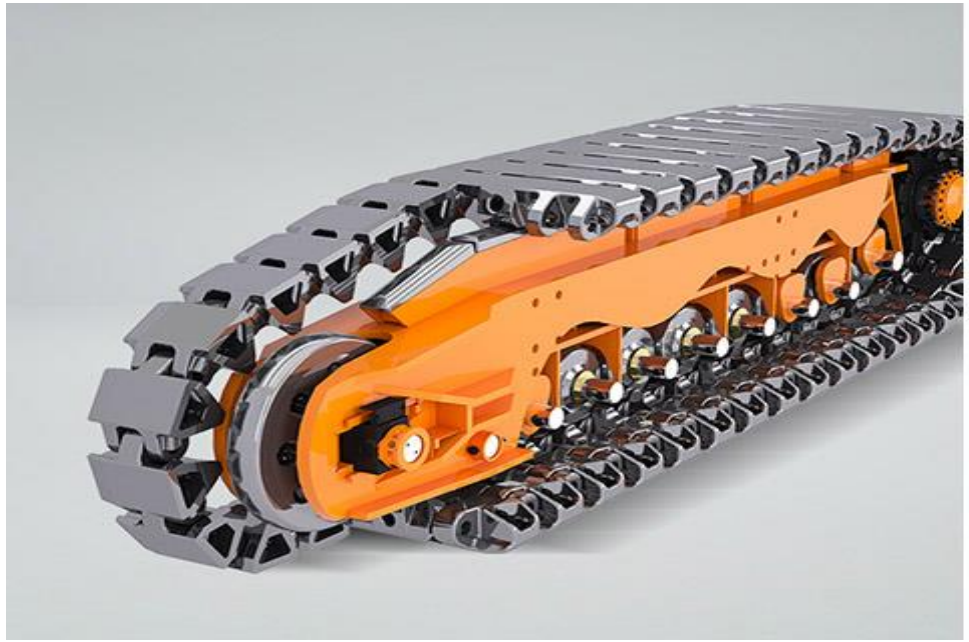
الاجزاء الرئيسية للجرافة

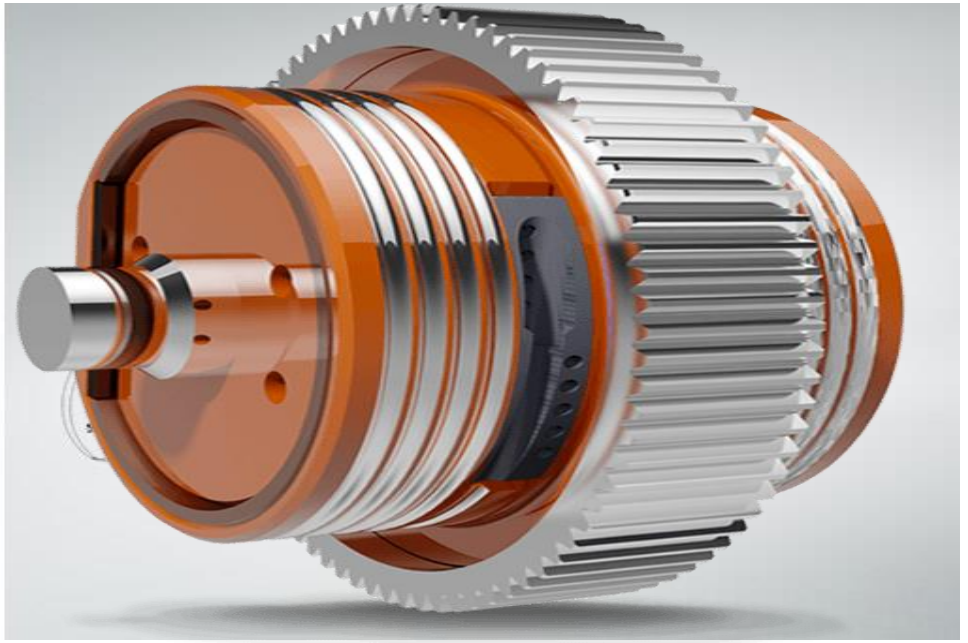
Basic parts

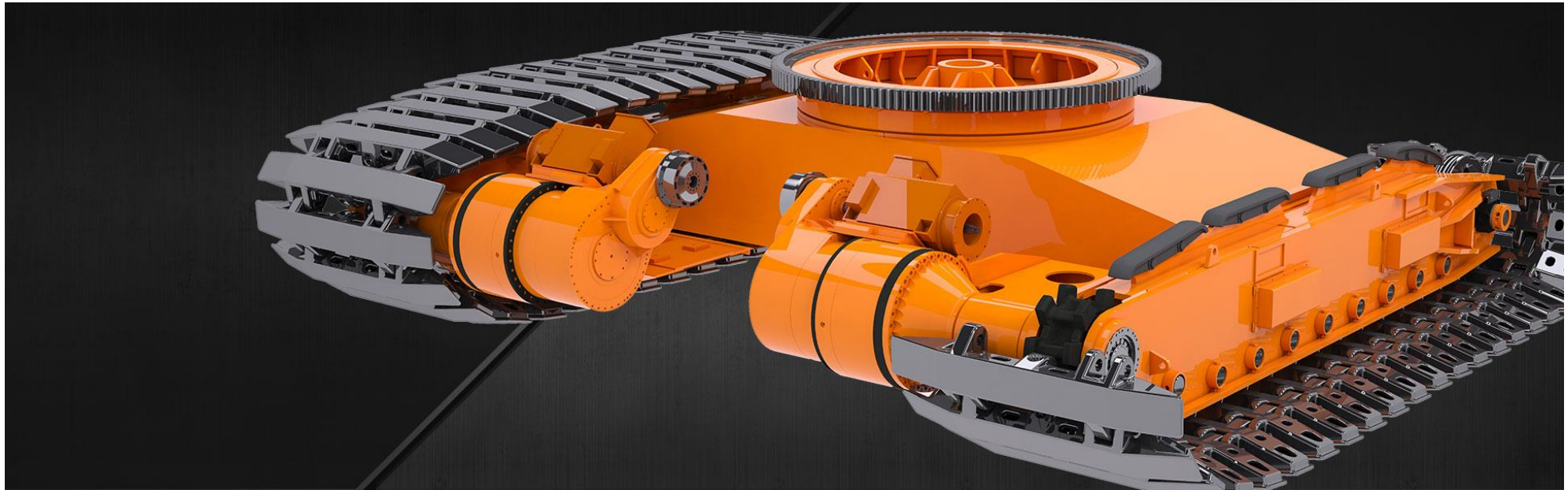
1. The mounting (crawler track or rubber tyred wheel)
2. Cab
3. Boom
4. Dipper stick
5. Dipper
6. Hoist line



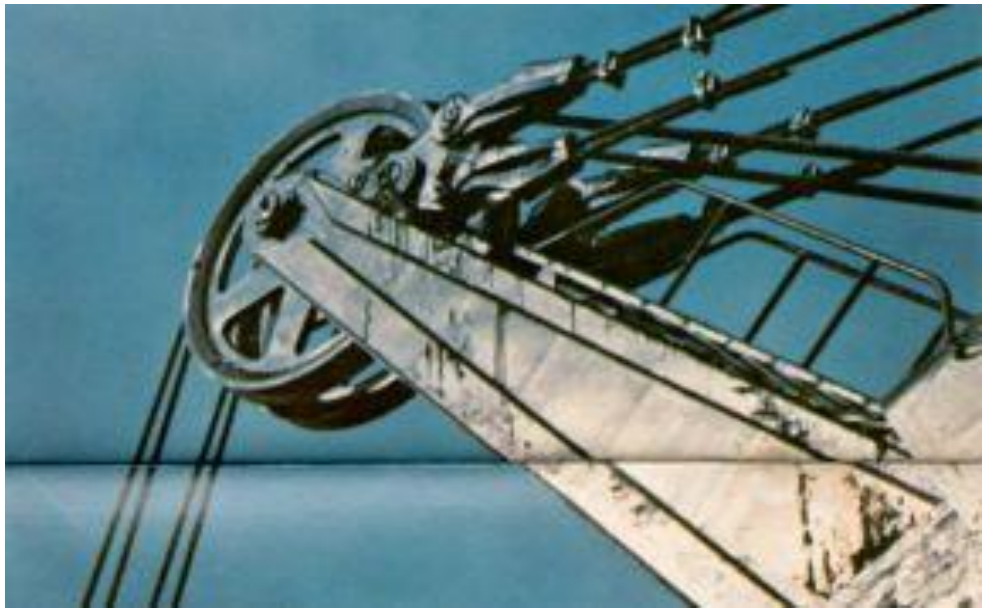
mountingالمسرفة

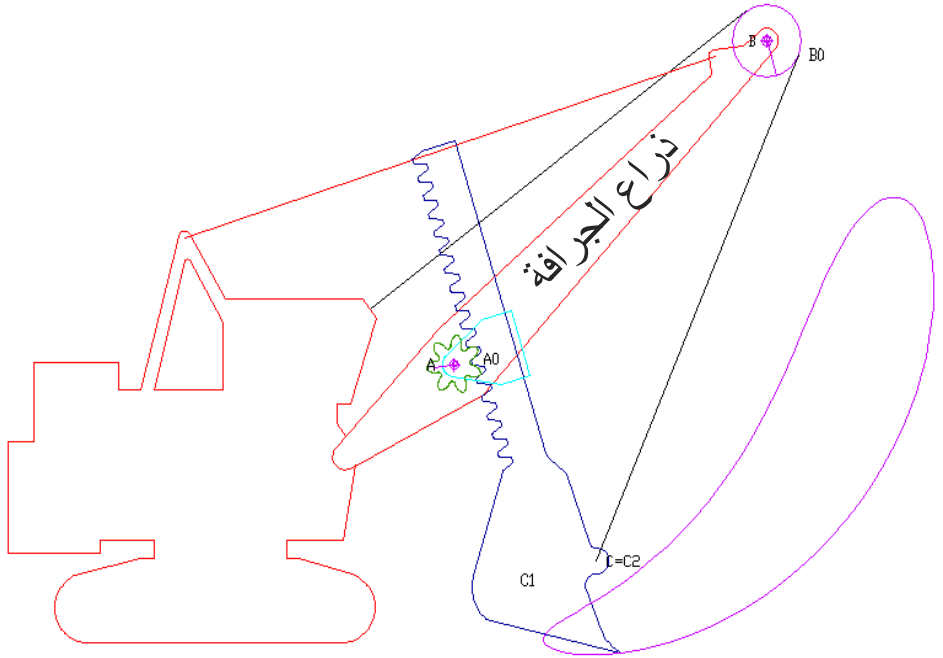


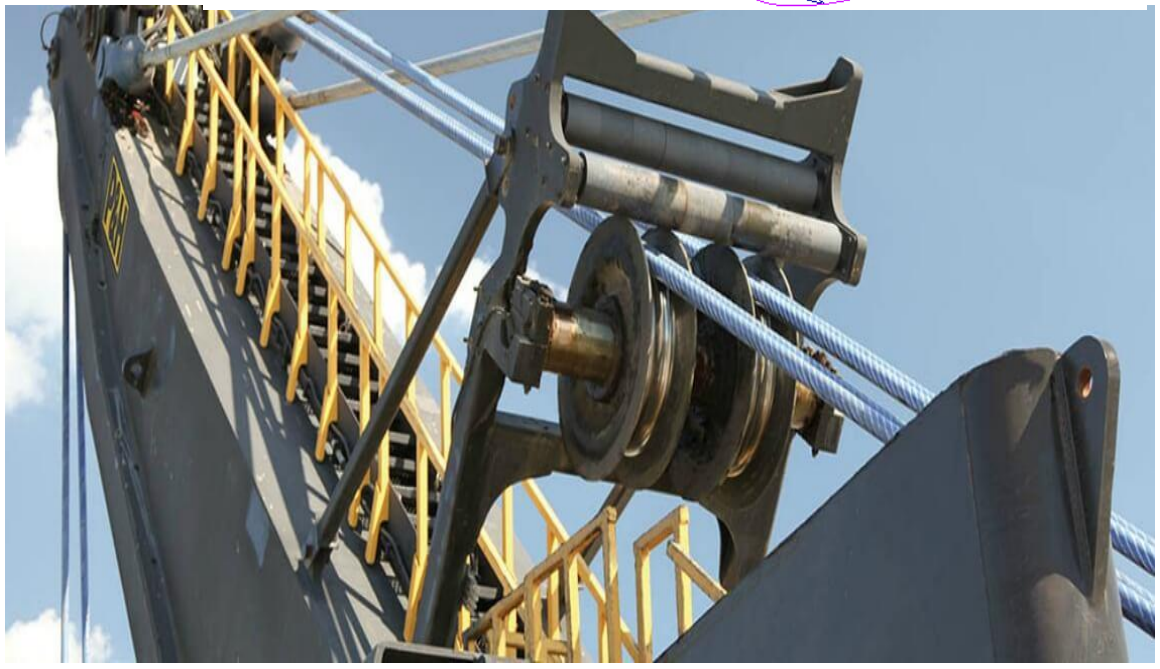




boomذراع الالة

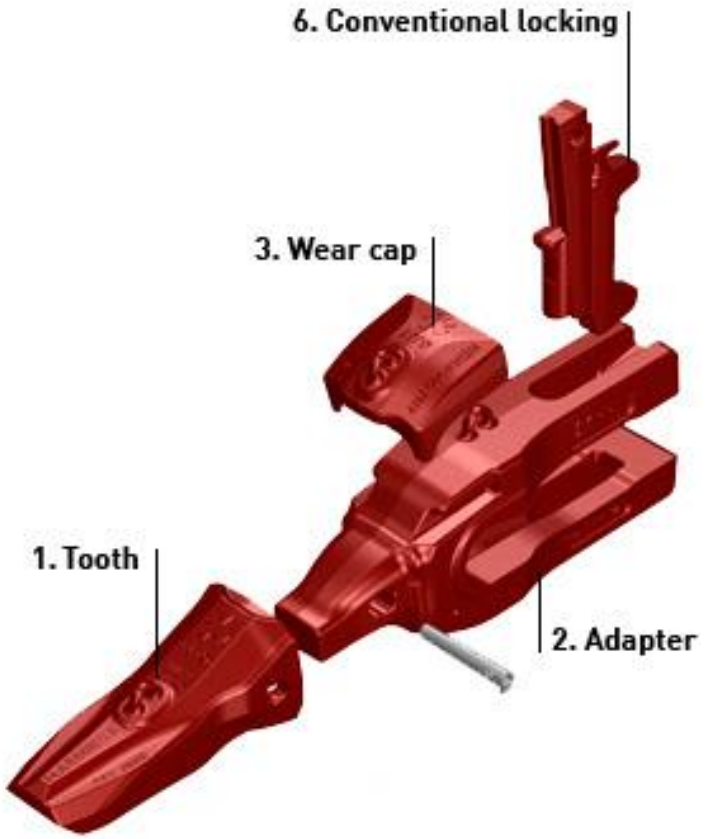


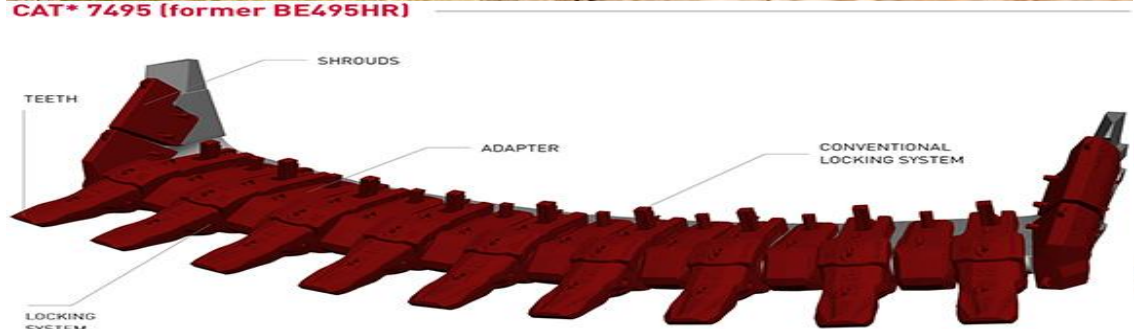




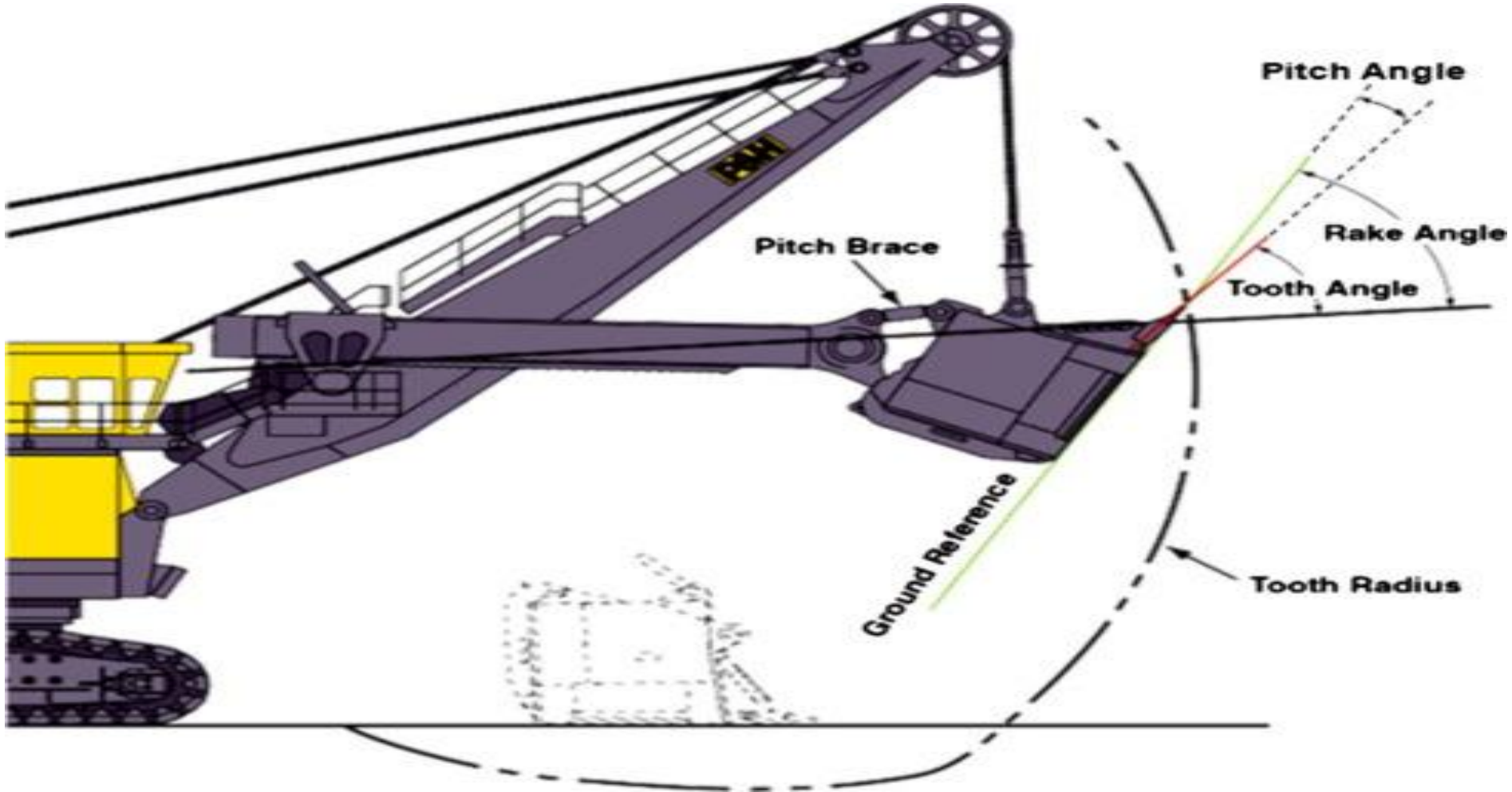
dipper stick عصا المغرفة

dipperالمغرفة





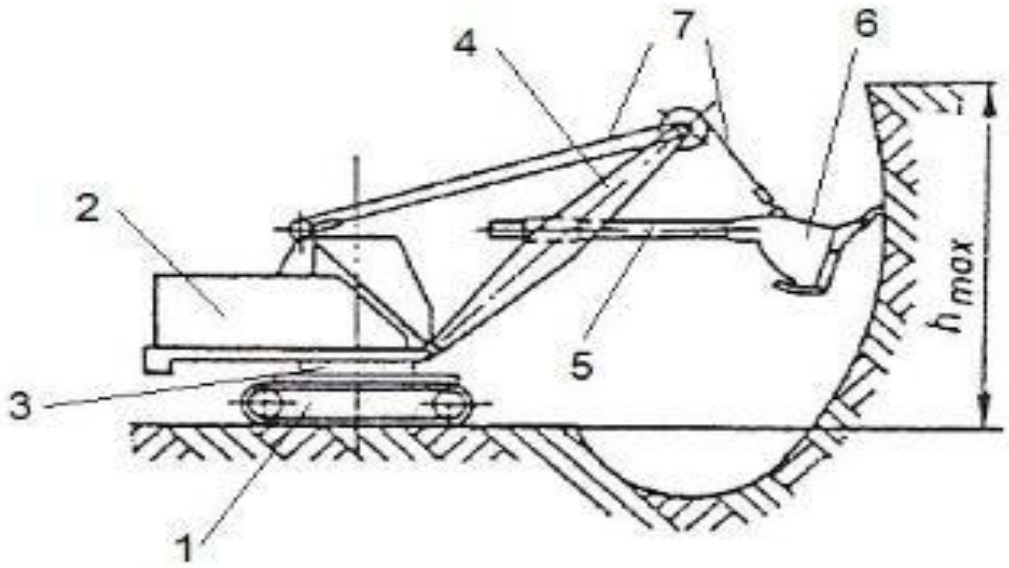
الوضع الصحيح للجرافة هو ان تكون واجهتها قريبة من سطح الارض المراد حفرها وبحيث تكون المغرفة عند اقل وضع لها على ارضية الحفرة ، وتكون مقدمة المغرفة للأمام .



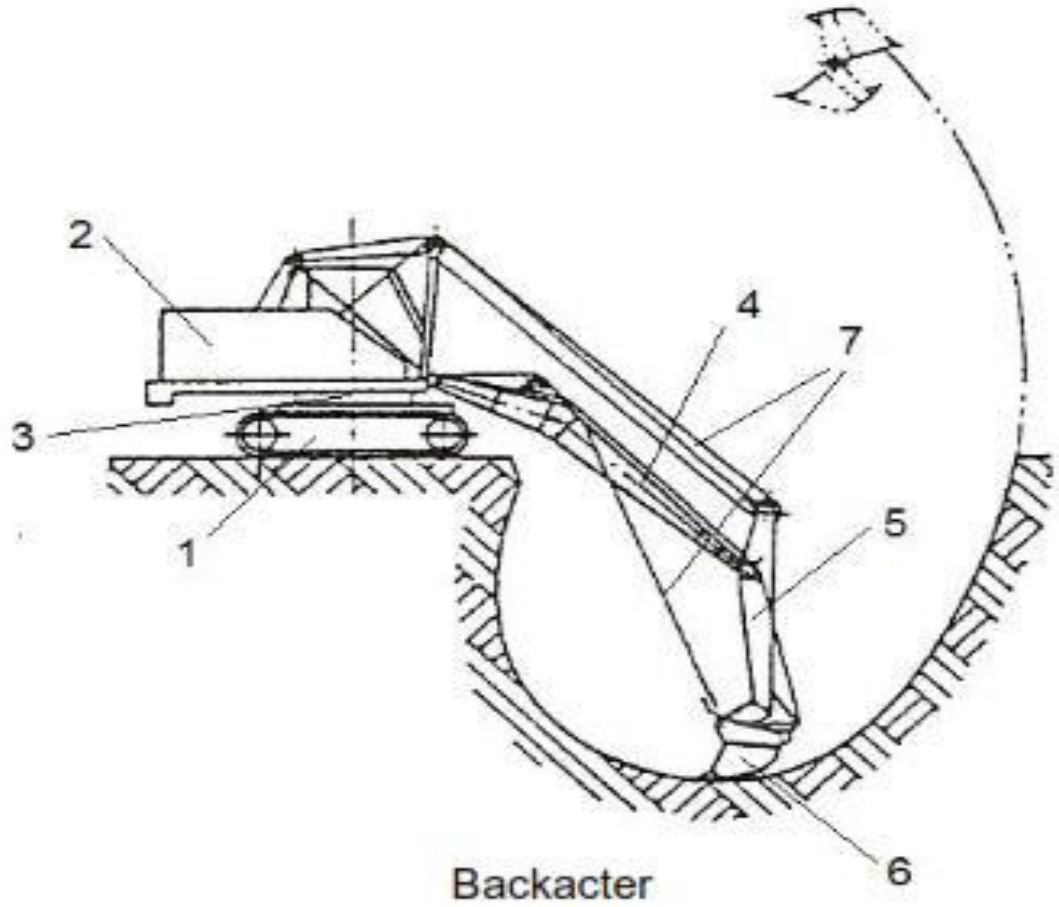
The main boom attaches to the house, and can be one of several different configurations:

1. Most are mono booms: these have no movement apart from straight up and down.
2. Some others have a knuckle boom which can also move left and right in line with the machine
3. Another option is a hinge at the base of the boom allowing it to hydraulically pivot up to 180° independent to the house; however, this is generally available only to compact excavators.
4. There are also triple-articulated booms (TAB).

Cable-operated excavators



Front shovel

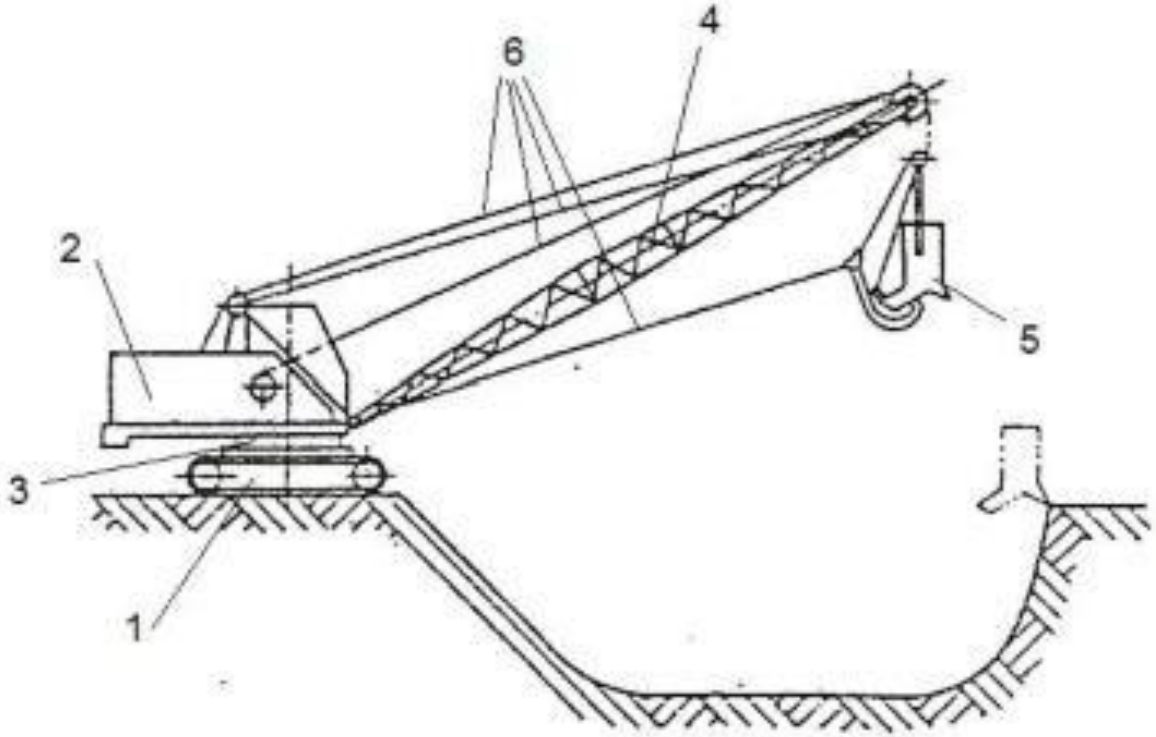


Backacter

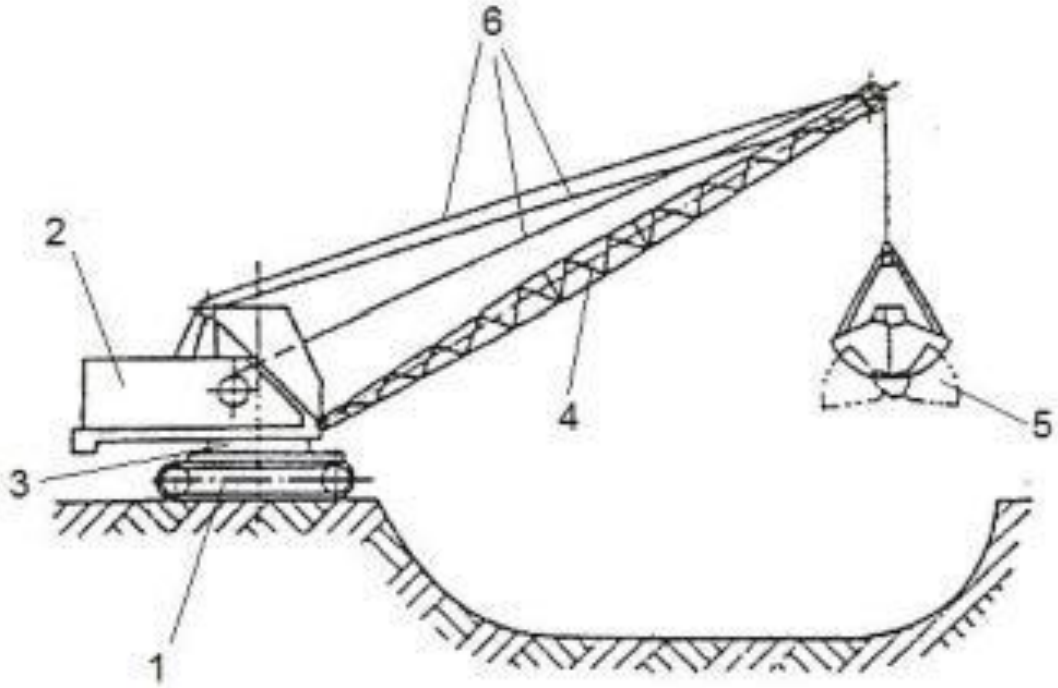
1. bogie undercarriage
2. slewing upper machinery (drive, operator's canopy, counter-weight)
3. turn mechanism
4. boom
5. arm
6. bucket
7. cable-lines

Features:

- complicated driving system
- many moving elements → manifold potential failures
- low working performance
- extensive maintenance requirements



Dragline



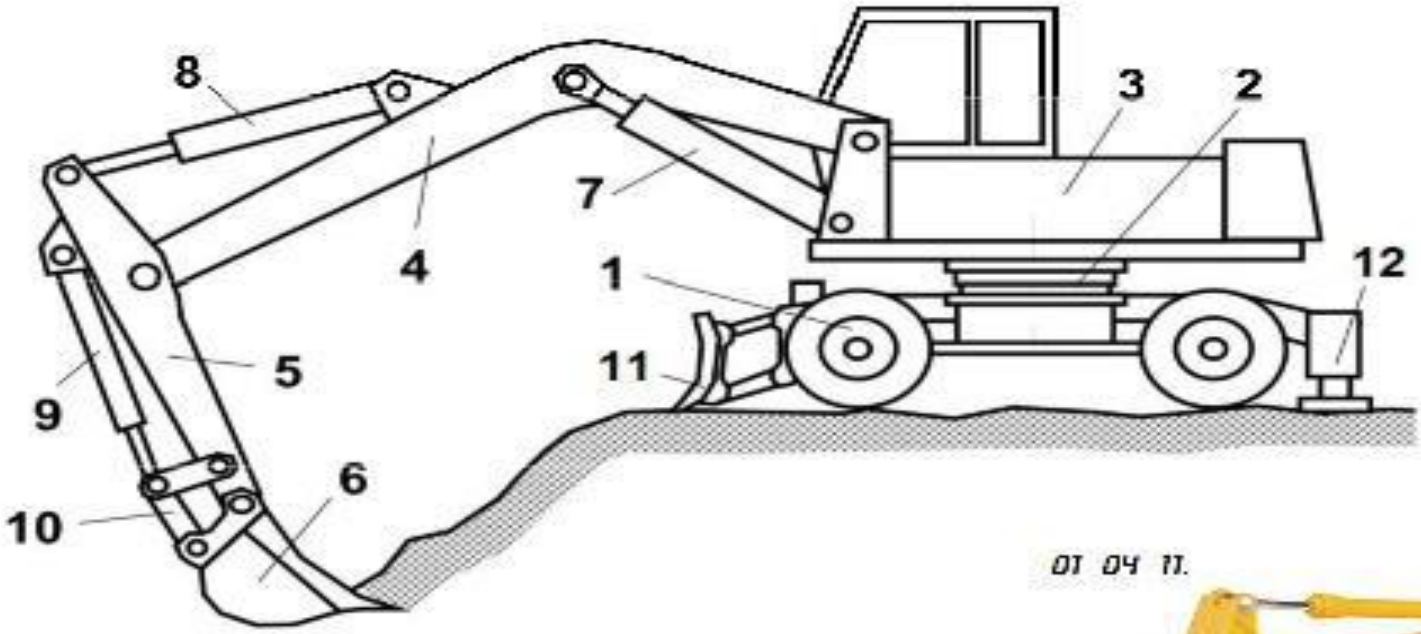
Clamshell

1. bogie undercarriage
2. slewing upper machinery (drive, operator's canopy, counter-weight)
3. turn mechanism
4. boom
5. bucket
6. cable-lines

<u>Features:</u>

- complicated driving system
- many moving elements → manifold potential failures
- low working performance
- extensive maintenance requirements

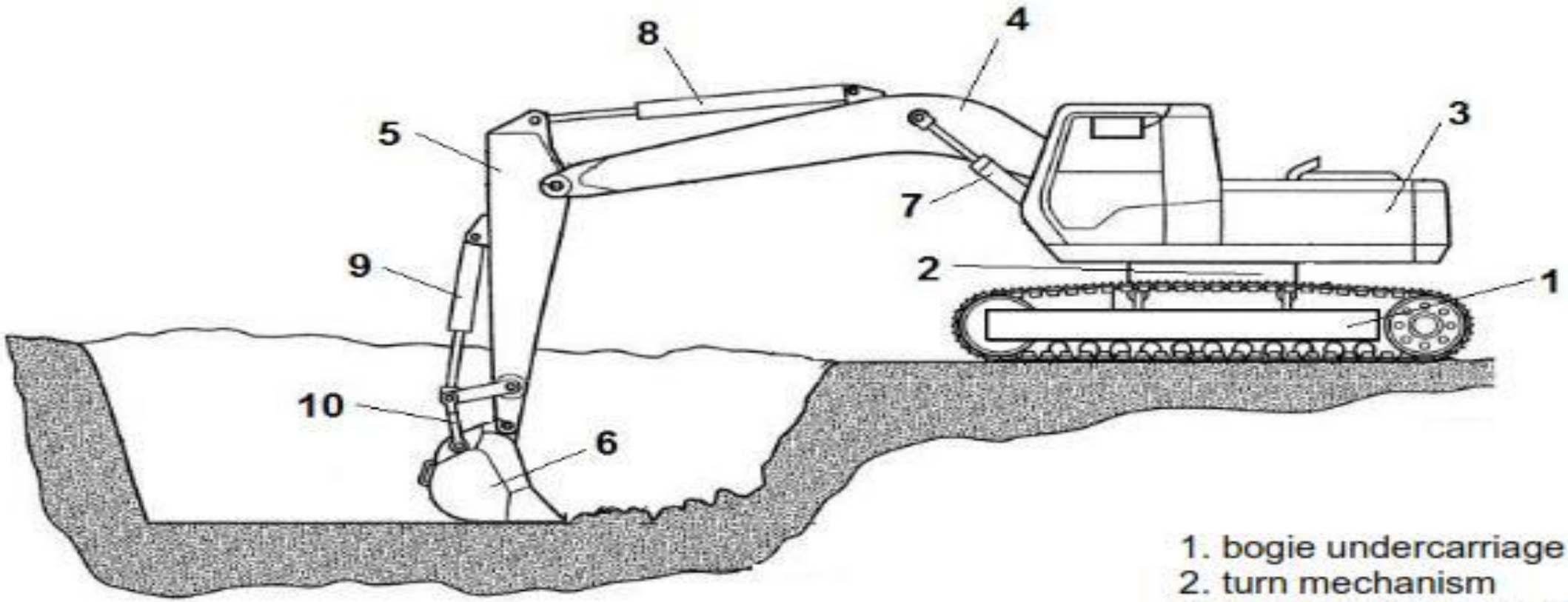
Hydraulic excavators
(slewing excavators)



1. wheel-bogie
2. turn mechanism
3. slewing upper machinery
4. boom
5. arm
6. backacter
7. boom cylinders
8. arm cylinder
9. bucket cylinder
10. bucket moving rods
11. auxiliary attachment
12. outrigger

Wheel-mounted backacter slewing excavator

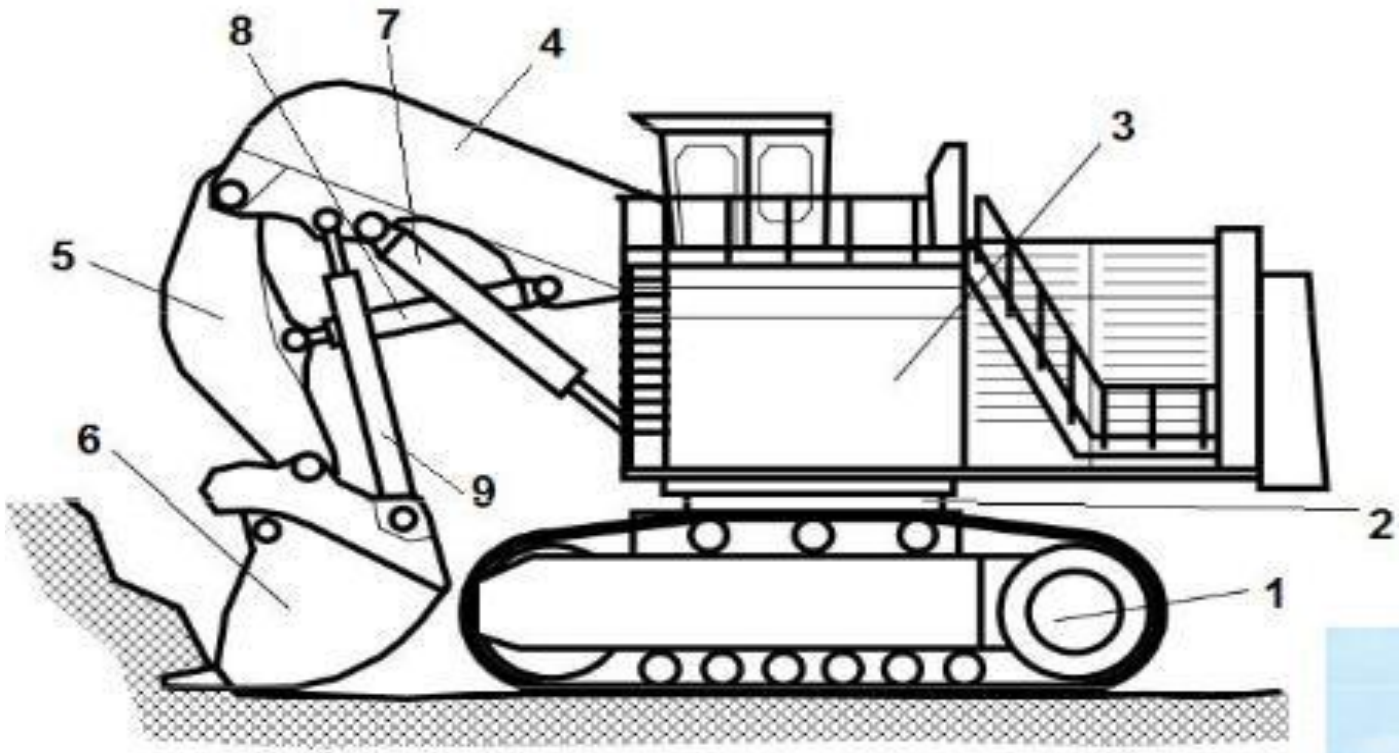
Hydraulic excavators
(slewing excavators)



Track-mounted backacter slewing excavator

1. bogie undercarriage
2. turn mechanism
3. slewing upper machinery
4. boom
5. arm
6. backacter
7. boom cylinders
8. arm cylinder
9. busket cylinder
10. Bucket moving rods

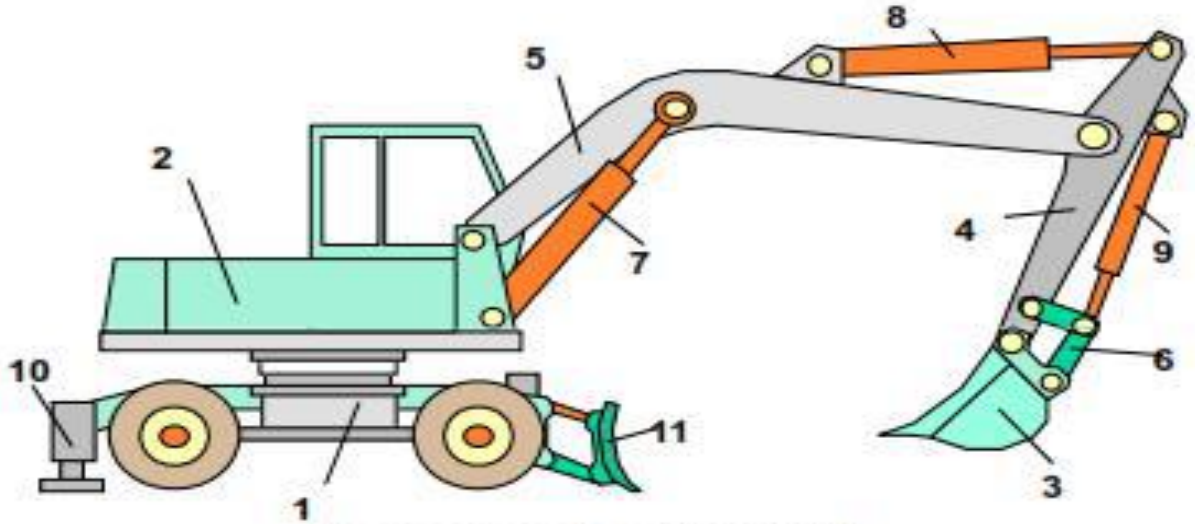
Hydraulic excavators
(slewing excavators)



1. bogie undercarriage
2. turn mechanism
3. slewing upper machinery
4. boom
5. arm
6. front shovel
7. boom cylinders
8. arm cylinder
9. shovel moving cylinders

Track-mounted front shovel slewing excavator

Hydraulic excavators
(slewing excavators)



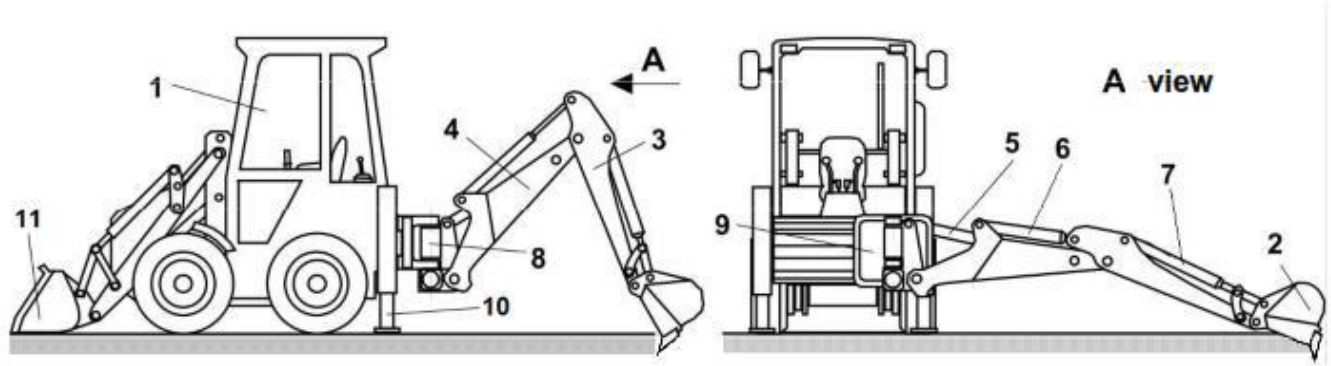
Backacter, wheel-mounted

1. frame (carriage)
2. slewing upper machinery (engine, operator's canopy, counter-weight)
3. hoe (showel or bucket)
4. arm
5. boom (monoblock or articulated)
6. hoe rods
7. boom lifting cylinder
8. arm moving cylinder
9. hoe moving cylinder
10. outrigger (strut, jack)
11. auxiliary attachment (blade)

Front shovel, track-mounted

Excavator (in action)

Backhoe excavators



1. wheel tractor
2. backacter
3. arm
4. slewing boom
5. boom cylinder
6. arm cylinder
7. bucket cylinder
8. slewing mechanism
9. suspension (base) plate
10. outrigger
11. front attachment (loader)

Hydraulic excavator attachments

Earthwork attachments

Backacter bucket

Auger

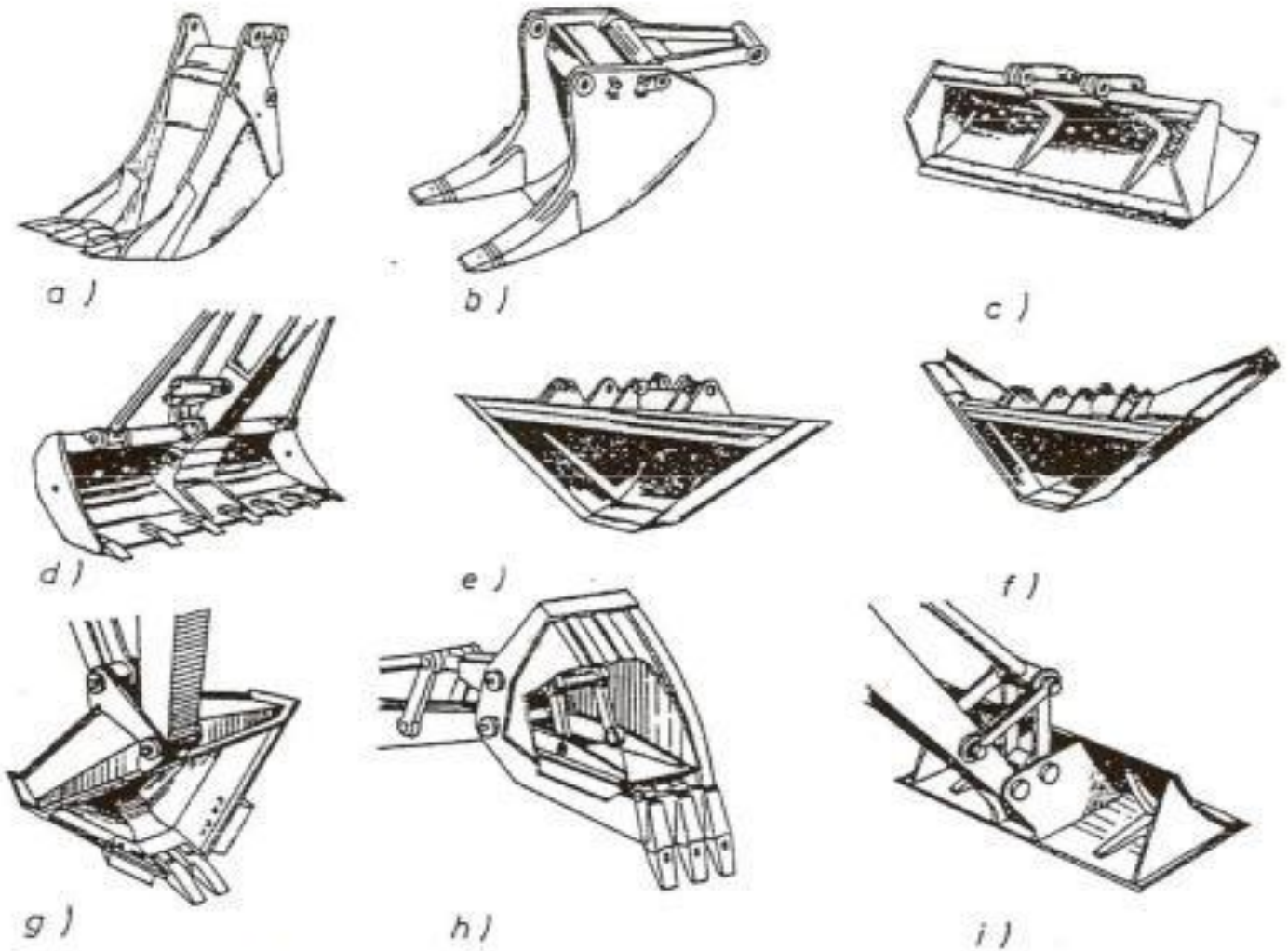
Ripper

Clamshell

Others: loading attachment; surface vibrator; roller compactor; bucket-lined or rotary terncher; profile buckets; sheet-wall driver; etc.

Hydraulic excavator attachments

Earthwork attachmenst



Special bucket-typed attachments

a. drainer; b. ripper; c. canal maintainer; d. ripper-cleaner; e. profile bucket;
f. extended cutter; g. ripper-profiler; h. ejector; i. tamper

Hydraulic excavator attachments

Demolisher and Recycler attachments

Screen drum

Crusher (mill)

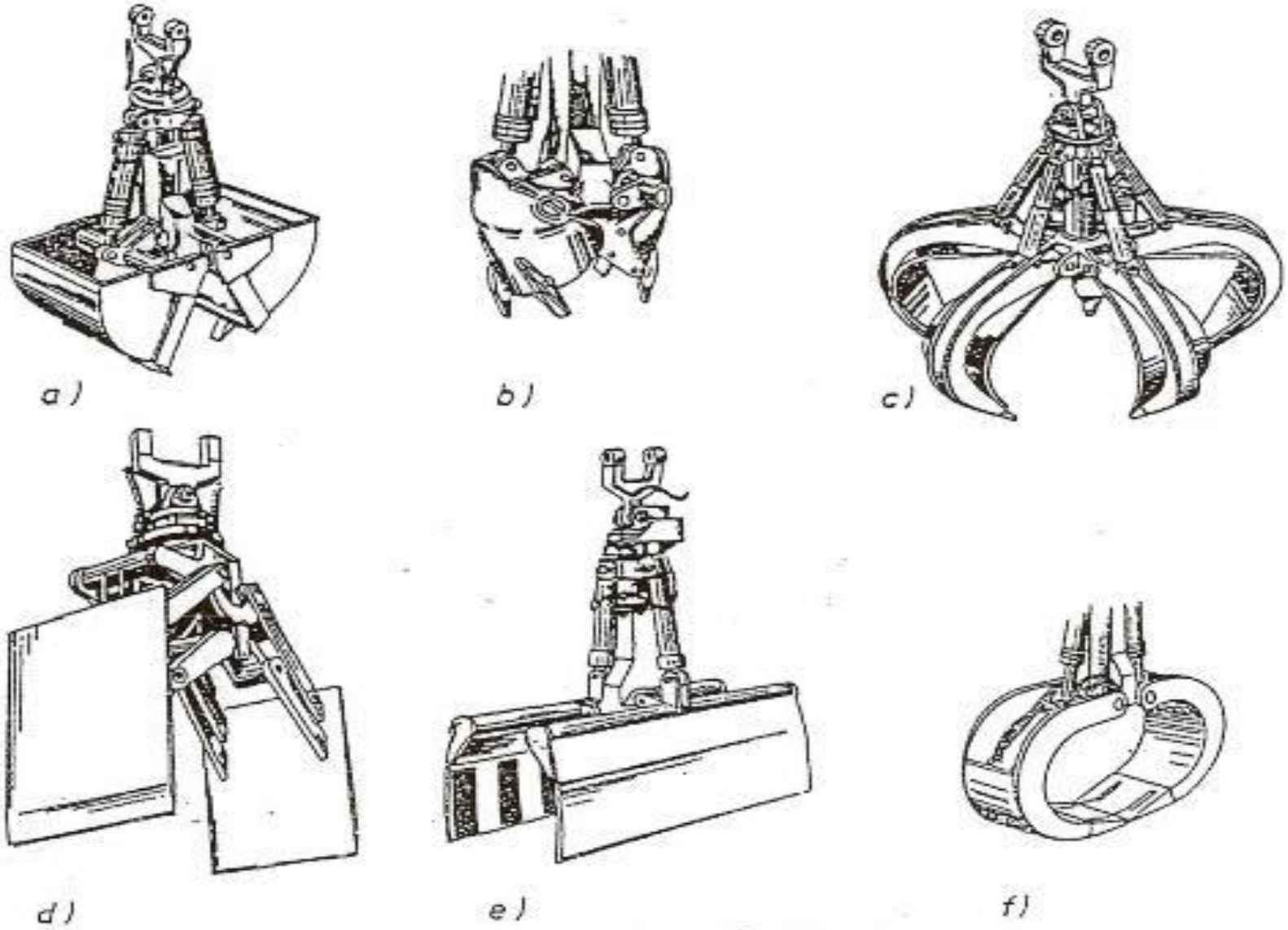
Breaker

Bucket-wheel

Snapper
(cutter/jaw)

Hydraulic excavator attachments

Grabs, grips and loaders



Grabbing and loading attachments

a. clamshell; b. boring; c. fingered; d. bale grip; e. barrel/pipe grip; f. logger

Attachments

Clamshell bucket (for granular material)

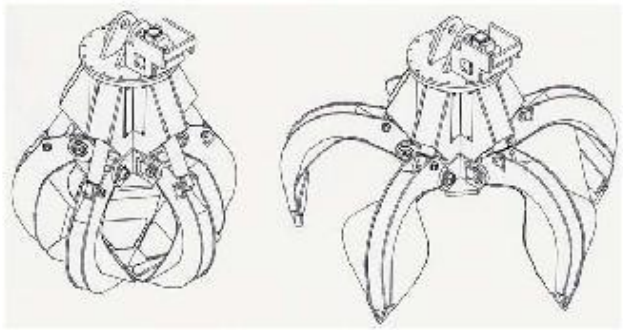
Screening adapter (for recycled material)

Breakers, Jaws
(for concrete, reinforced concrete and steel)

Others: loader bucket; drill; trunk-grip; cutter; trencher; fingered grips (for fibers or bars); crusher; vibro-plate; etc.

Sheet-wall piling equipment

Boring (auger) equipment



Fingered grip

Crusher adapter

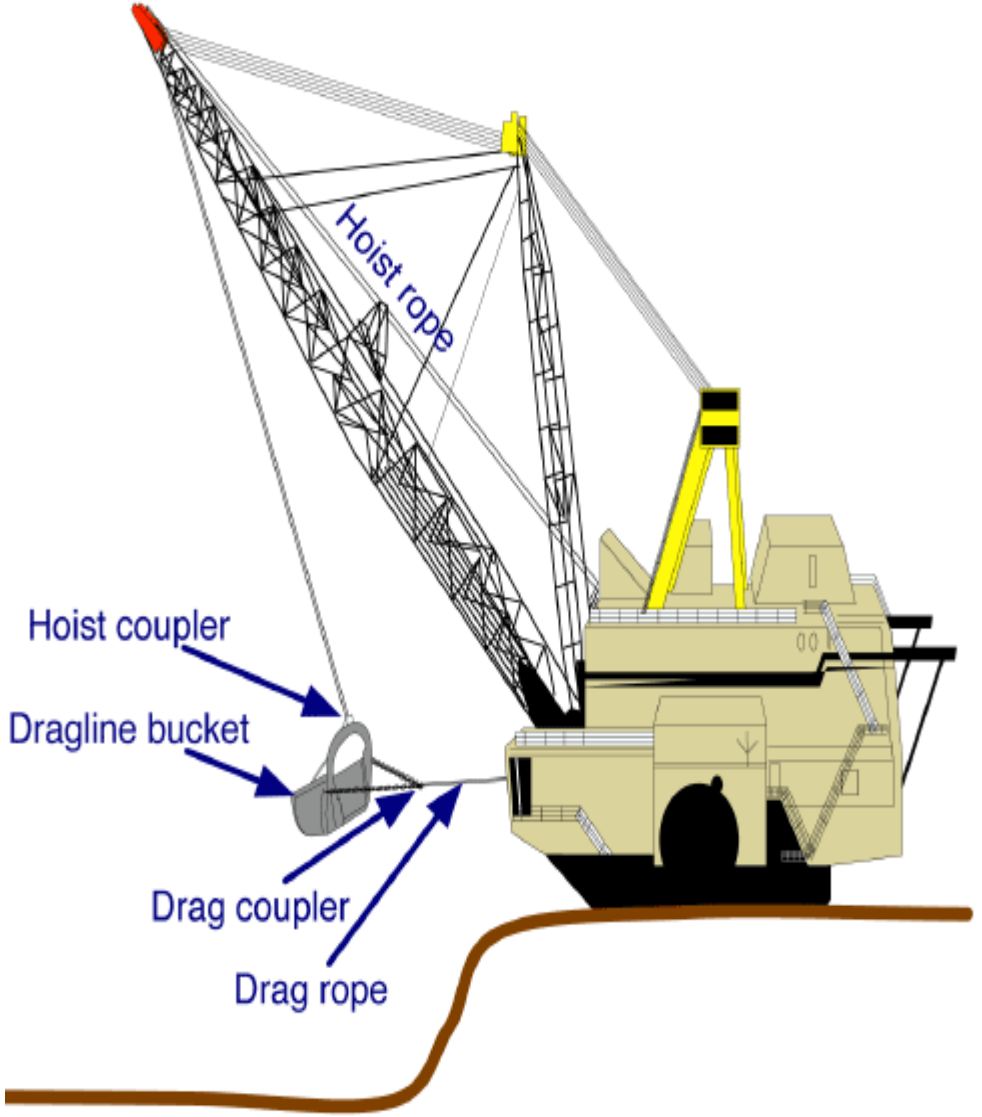
Backhoe excavators

Features:

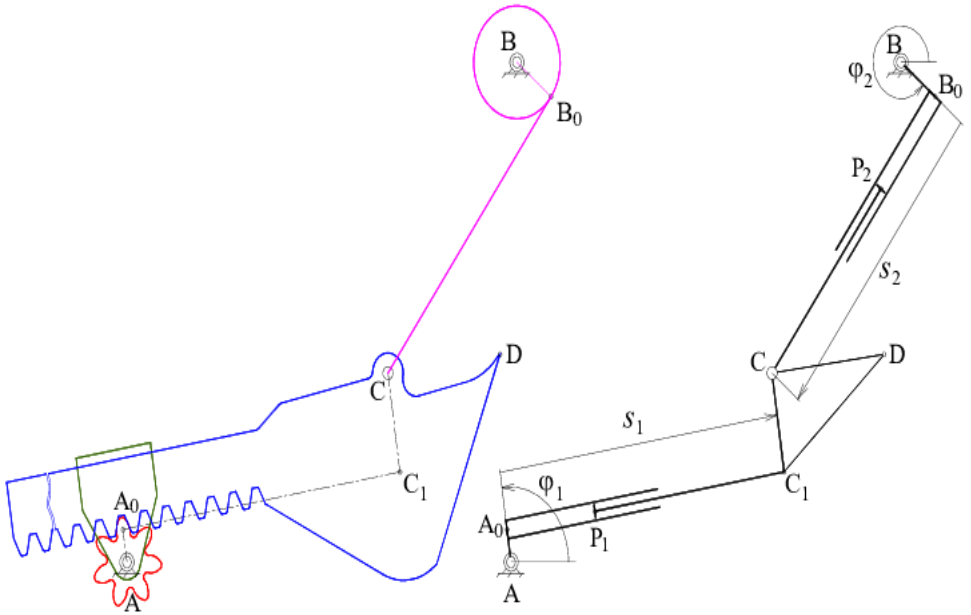
- Multifunctional front showel
- Draw beam (telescopic arm)
- Transversely slidable boom

الاسئلة ؟

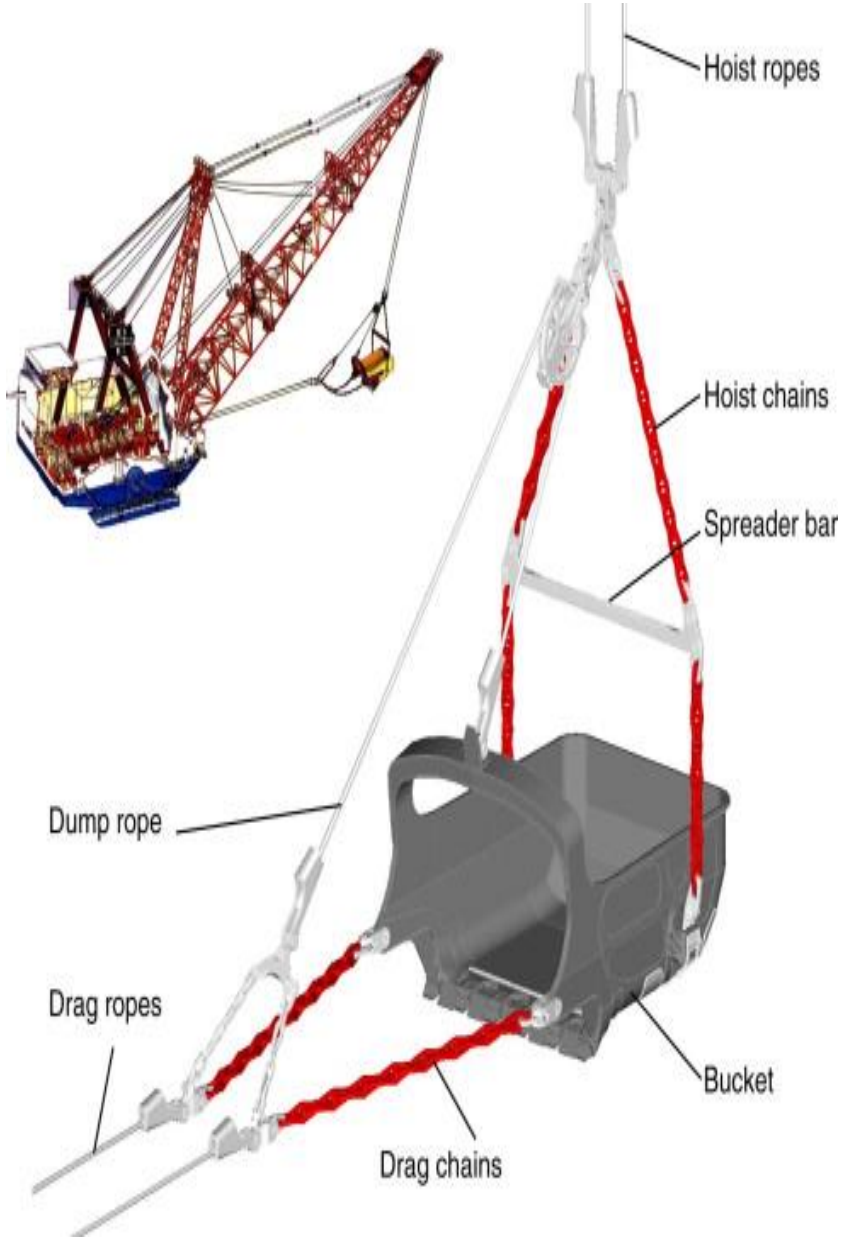
سؤال : ماهو الفرق بين الجرافات السلكية والحفارات السلكية ؟



الفرق في الدفع الاجباري لمغرفة الجرافة مما يؤمن عزم كافي لقطع التربة



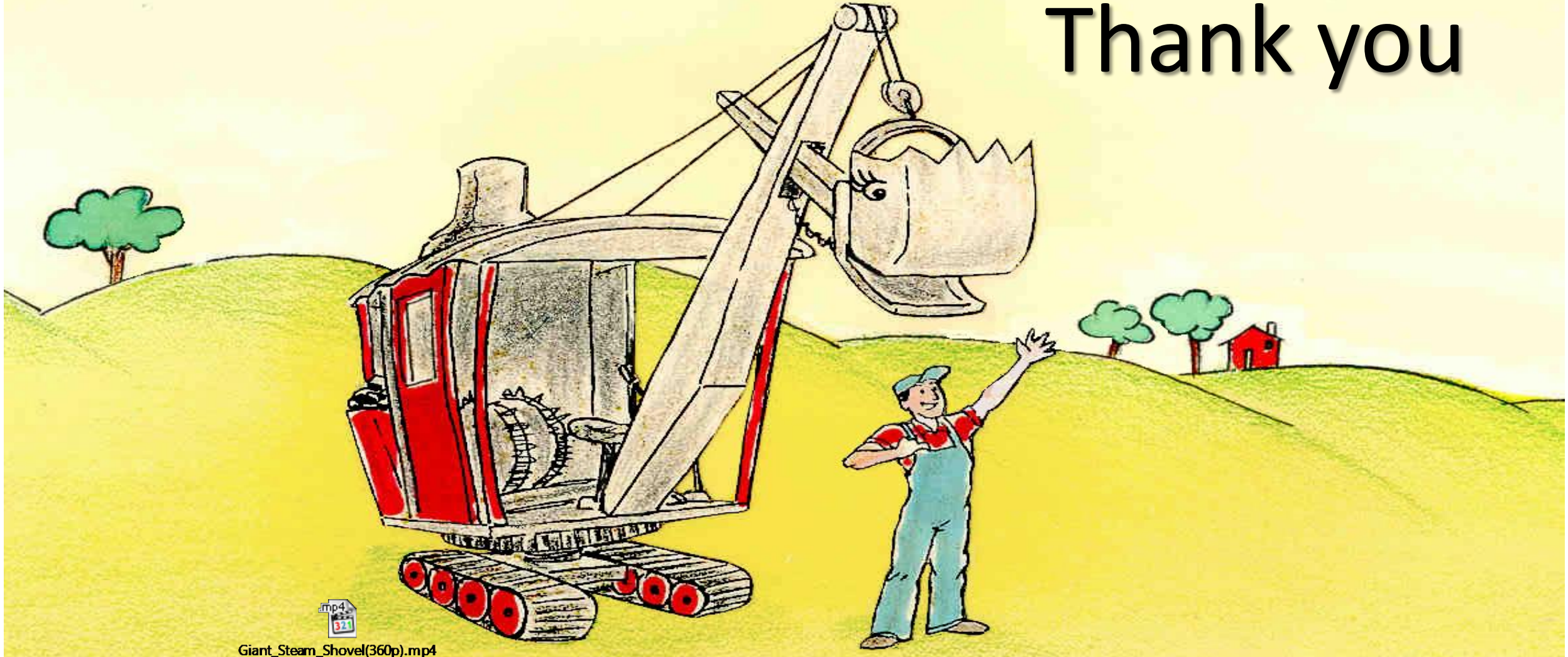
Source: See also animation *Rope Shovel*




المربد

سؤال : ماهو الفرق بين الجرافات والحفارات من ناحية القطع للتربة ؟

Thank you



Giant_Steam_Shovel(360p).mp4

Terex_RH170_Face_Shovel_Excavator_Loading_Dumpers(480p).mp4

Rebuilt_P&H_4100A_Electric_Rope_Shovel_-_Wyodak_Mine_-_Komatsu_Equipment_Company(360p).mp4

Reclamation Machine and Equipment

TRUCKS AND HAULING EQUIPMENT

Assist teacher: yahya younis Mohsen

TRUCKS AND HAULING EQUIPMENT

1. Trucks are hauling units

2. Trucks have high travel speeds when operating on suitable roads, provide relatively low hauling costs

3. Trucks provide a high degree of flexibility permitting modifications in the total hauling capacity of a fleet and adjustments for changing haul distances

4. Most trucks may be operated over any haul road for which the surface is sufficiently firm and smooth and on which the grades are not excessively steep.

TRUCKS CLASSIFICATION

Trucks may be classified according to a number of factors including:

1. The size and type of engine gasoline, diesel, butane, propane
2. The number of gears.
3. The kind of drive-two-wheel, four- wheel, six-wheel, etc
4. The number of wheels and axles and arrangement of driving wheels.
5. The method of dumping the load rear-clump, side-dump.
6. The class of material hauled-earth, rock, coal, ore, etc.
7. The capacity, in tons or cubic yards.

LIGHT

MEDIUM

HEAVY

CAPACITY OF DUMP TRUCKS

There are three methods of expressing the capacities of trucks and wagons:

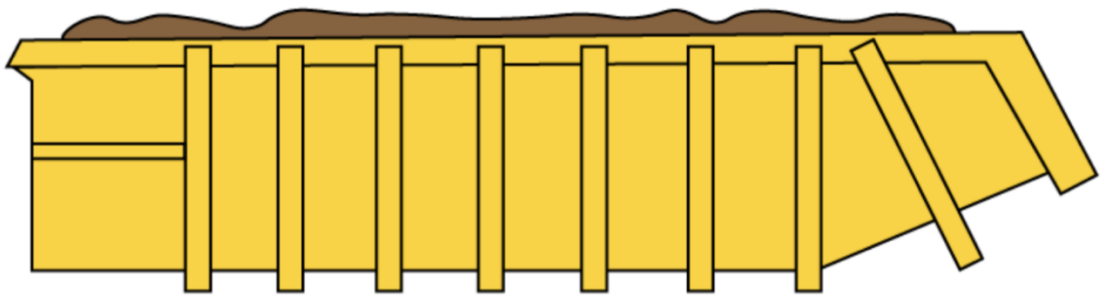
1) by the load which it will carry, expressed gravimetrically in tons.
2) by its struck volume (cu yd.).
3) by its heaped volume (cu yd.).

The **struck capacity** of a truck is the volume of material which it will haul when
it is filled level to the top of the sides of the body.

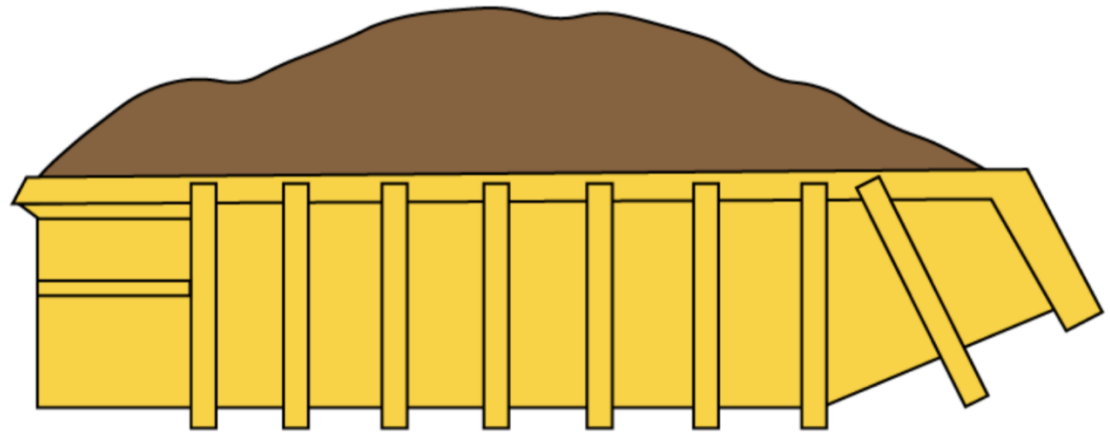
The **heaped capacity** is the volume of material, which it will haul when the
load is heaped above the sides.


通运重工
TYZG

Struck



Heaped



USING SMALL TRUCKS COMPARED WITH LARGE TRUCKS

Advantages:

1) They are more flexible in maneuvering, which may be an advantage on short hauls.
2) They may have higher speeds.
3) There is less loss in production when one truck in a fleet breaks down.
4) It is easier to balance the number of trucks with the output of the excavator, which will reduce the time lost by the trucks or the excavator.

Disadvantages:

1) A small truck is more difficult for the excavator to load owing to the small target for depositing the bucket load.
2) More total spotting time is lost in positioning the trucks because of the larger number required.
3) More drivers are required to haul a given output of material.
4) The greater number of trucks increases the danger of units bunching at the pit, along the haul road, or at the dump,
5) The greater number of trucks required may increase the total investment in hauling equipment, with more expensive maintenance and repairs, and more parts to stock.