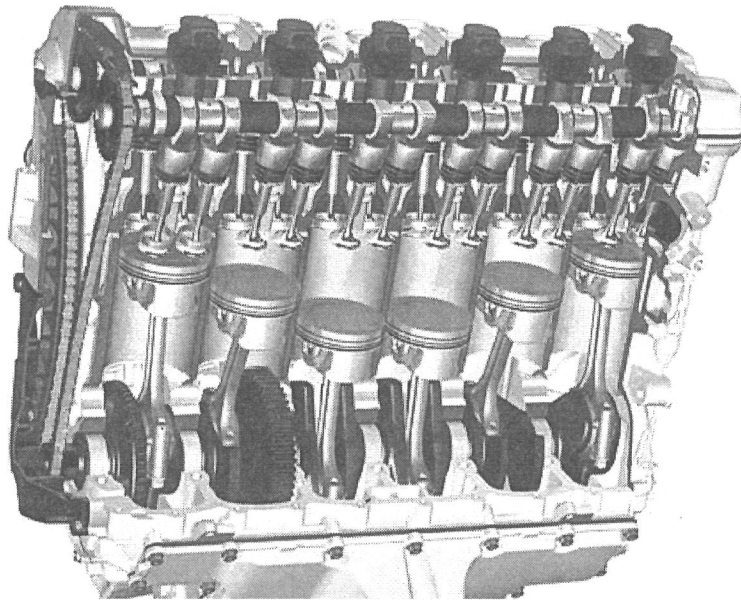


زبان فنی - کارمانی



## Technical Language Notes-۱

For Automotive Mechanical Engineering Students



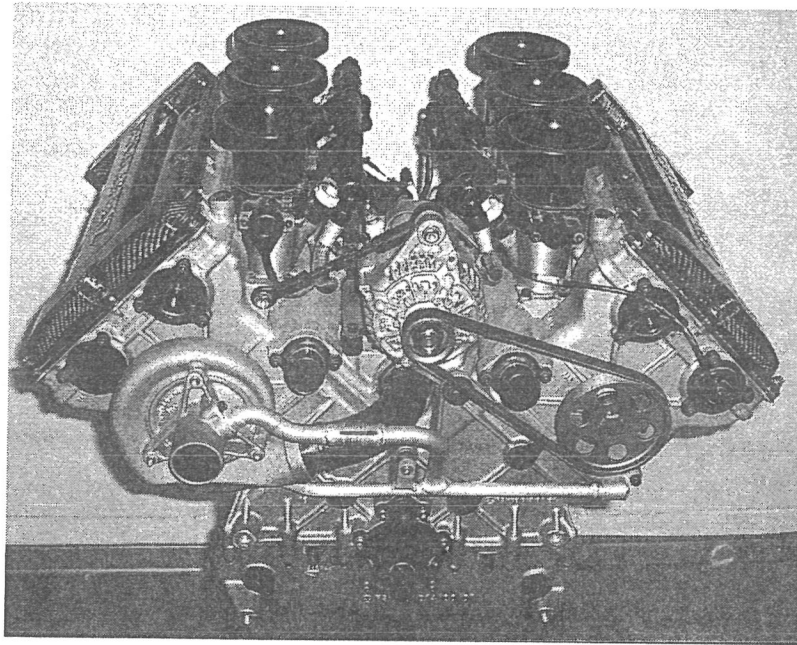
Dr. Farzin Azimpour shishevan





This article is about a machine to convert energy into useful mechanical motion.

An engine or motor is a machine designed to convert energy into useful mechanical motion. Heat engines, including internal combustion engines and external combustion engines (such as steam engines) burn a fuel to create heat which is then used to create motion. Electric motors convert electrical energy in mechanical motion, pneumatic motors use compressed air and others, such as wind-up toys use elastic energy. In biological systems molecular motors like myosins in muscles use chemical energy to create motion.



**Mercedes V6 DTM Rennmotor 1996**

### **Terminology:**

Originally an engine was a mechanical device that converted force into motion. Military devices such as catapults, battering rams are referred to as siege engines. The term "gin" as in cotton gin is recognized as a short form of the Old French word engine.

In modern usage, the term is used to describe devices capable of performing mechanical work, as in the original steam engine.

In most cases the work is produced by exerting a torque or linear force, which is used to operate other machinery which can generate electricity, pump water, or compress gas.

In common usage, an engine burns or otherwise consumes fuel, and is differentiated from an electric machine (i.e., electric motor) that derives power without changing the composition of matter

A heat engine may also serve as a prime mover, a component that transforms changes in pressure of a fluid into mechanical energy.

An automobile powered by an internal combustion engine may make use of various motors and pumps, but ultimately all such devices derive their power from the engine.

The term motor was originally used to distinguish the new internal combustion engine-powered vehicles from earlier vehicles powered by steam engines, such as the steam roller and motor roller, but may be used to refer to any engine

**Automobiles:**

The first commercially successful automobile, created by Karl Benz, added to the interest in light and powerful engines. The lightweight petrol internal combustion engine, operating on a four-stroke Otto cycle, has been the most successful for light automobiles, while the more efficient Diesel engine is used for trucks and buses.

**Increasing power:**

The first half of the 20th century saw a trend to increasing engine power, particularly in the American models. Design changes incorporated all known methods of raising engine capacity, including increasing the pressure in the cylinders to improve efficiency, increasing the size of the engine, and increasing the speed at which power is generated. The higher forces and pressures created by these changes created engine vibration and size problems that led to stiffer, more compact engines with V and opposed cylinder layouts replacing longer straight-line arrangements.

**Combustion efficiency:**

The design principles favored in Europe. Because of economic and other restraints such as smaller and twistier roads, leant toward smaller cars and corresponding to the design principles that concentrated on increasing the combustion efficiency of smaller engines. This produced more economical engines with earlier four-cylinder designs rated at 40 horsepower (30 kW) and six-cylinder designs rated as low as 80 horsepower (60 kW), compared with the large volume V-8 American engines with power ratings in the range from 250 to 350 hp (190 to 260 kW).

### **Engine configuration:**

Earlier automobile engine development produced a much larger range of engines than is in common use today. Engines have ranged from 1 to 16 cylinder designs with corresponding differences in overall size, weight, piston displacement, and cylinder bores. Four cylinders and power ratings from 19 to 120 hp (14 to 90 kW) were followed in a majority of the models. Several three-cylinder, two-stroke-cycle models were built while most engines had straight or in-line cylinders. There were several V-type models and horizontally opposed two- and four-cylinder makes too. Overhead camshafts were frequently employed. The smaller engines were commonly air-cooled and located at the rear of the vehicle; compression ratios were relatively low. The 1970s and '80s saw an increased interest in improved fuel economy which brought in a return to smaller V-6 and four-cylinder layouts, with as many as five valves per cylinder to improve efficiency. The Bugatti Veyron 16.4 operates with a W16 engine meaning that two V8 cylinder layouts are positioned next to each other to create the W shape sharing the same crankshaft.

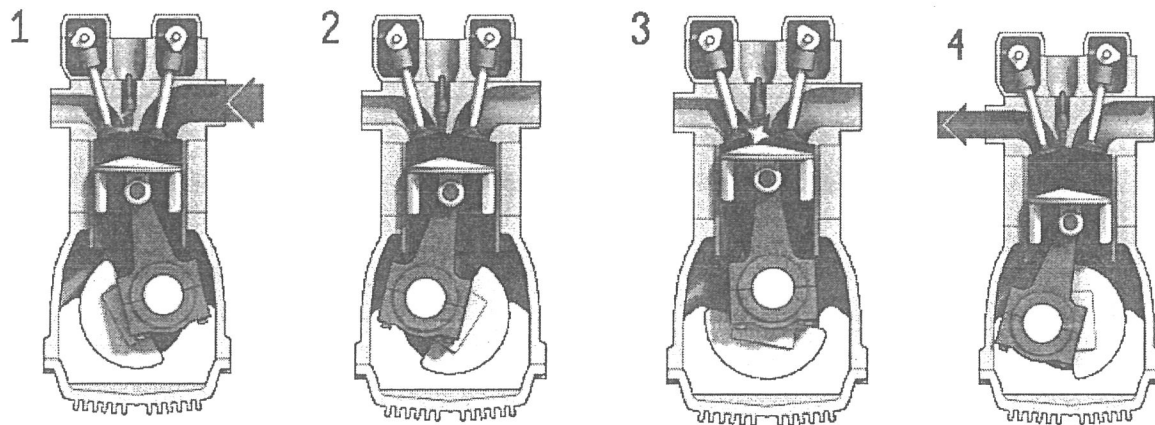
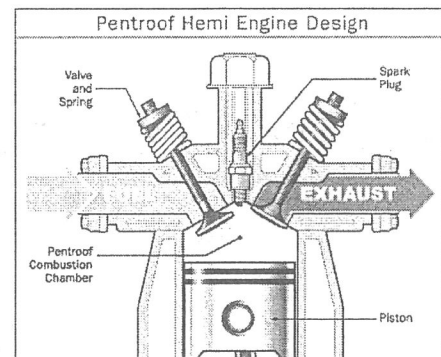
The largest internal combustion engine ever built is the Wärtsilä-Sulzer RTA96-C, a 14-cylinder, 2-stroke turbocharged diesel engine that was designed to power the Emma Maersk, the largest container ship in the world. This engine weighs 2300 tons, and when running at 102 RPM produces 109,000 bhp (80,080 kW) consuming some 13.7 tons of fuel each hour.

## Combustion engine:

### Internal combustion engine:

Combustion engines are heat engines driven by the heat of a combustion process.

The internal combustion engine is an engine in which the combustion of a fuel (generally, fossil fuel) occurs with an oxidizer (usually air) in a combustion chamber. In an internal combustion engine the expansion of the high temperature and high pressure gases, which are produced by the combustion, directly applies force to components of the engine, such as the pistons or turbine blades or a nozzle, and by moving it over a distance, generates useful mechanical energy.



### Four stages of the 4-stroke combustion engine cycle

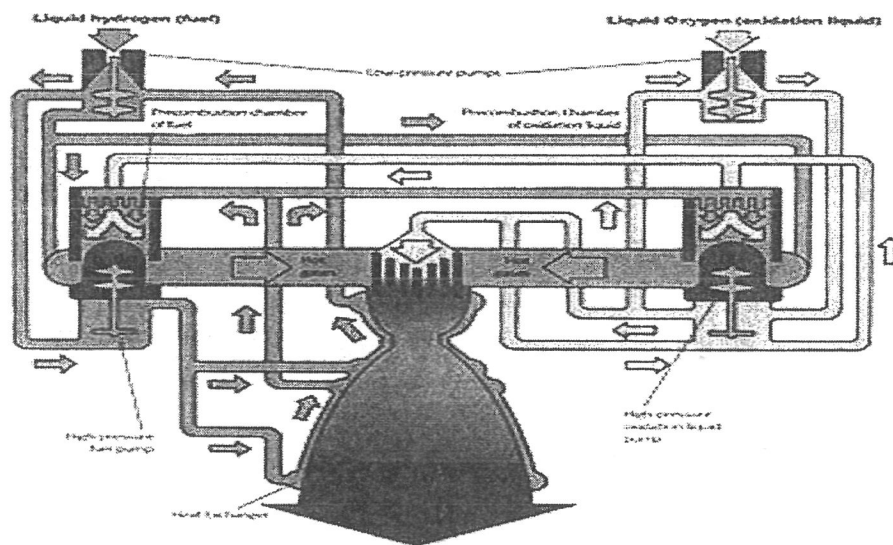
1. Induction (Fuel enters) 2. Compression 3. Ignition (Fuel is burnt) 4. Emission (Exhaust out)

## External combustion engine:

An external combustion engine (EC engine) is a heat engine where an internal working fluid is heated by combustion of an external source, through the engine wall or a heat exchanger. The fluid then, by expanding and acting on the mechanism of the engine produces motion and usable work. The fluid is then cooled, compressed and reused (closed cycle), or (less commonly) dumped, and cool fluid pulled in (open cycle air engine).

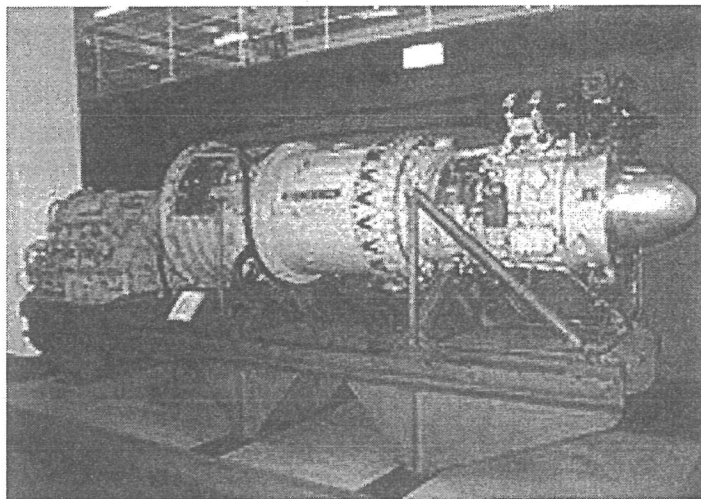
"Combustion" refers to burning fuel with an oxidizer, to supply the heat. Engines of similar (or even identical) configuration and operation may use a supply of heat from other sources such as nuclear, solar, geothermal or exothermic reactions not involving combustion; but are not then strictly classed as external combustion engines, but as external thermal engines.

The working fluid can be a gas as in a Stirling engine, or steam as in a steam engine or an organic liquid such as n-pentane in an Organic Rankine Cycle. The fluid can be of any composition; gas is by far the most common, although even single-phase liquid is sometimes used. In the case of the steam engine, the fluid changes phases between liquid and gas.

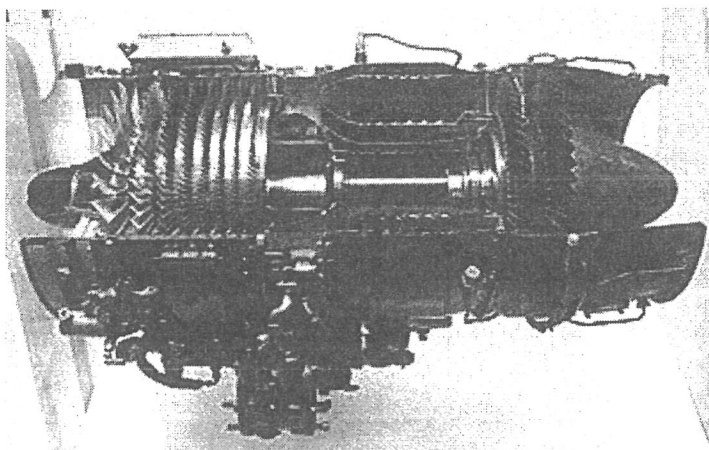


### **Gas turbine:**

A gas turbine is internal combustion in the sense that the combustion takes place in the working fluid, but external combustion in the sense that the combustion is not fully closed in and is outside the actual moving turbine section. Traditionally, "internal combustion" usually includes gas turbines, jets and rockets.



**The Gas turbine from MGB 2009**



A typical axial-flow gas turbine turbojet, the J85, sectioned for display. Flow is left to right, multistage compressor on left, combustion chambers center, two-stage turbine on right

### **Environmental effects:**

Operation of engines typically has a negative impact upon air quality and ambient sound levels. There has been a growing emphasis on the pollution producing features of automotive power systems. This has created new interest in alternate power sources and internal-combustion engine refinements. Although a few limited-production battery-powered electric vehicles have appeared, they have not proved to be competitive owing to costs and operating characteristics. In the 21st century the diesel engine has been increasing in popularity with automobile owners. However, the gasoline engine, with its new emission-control devices to improve emission performance, has not yet been significantly challenged.

### **Air quality:**

Exhaust from a spark ignition engine consists of the following: nitrogen 70 to 75% (by volume), water vapor 10 to 12%, carbon dioxide 10 to 13.5%, hydrogen 0.5 to 2%, oxygen 0.2 to 2%, carbon monoxide: 0.1 to 6%, unburnt hydrocarbons and partial oxidation products (e.g. aldehydes) 0.5 to 1%, nitrogen monoxide 0.01 to 0.4%, nitrous oxide <100 ppm, sulfur dioxide 15 to 60 ppm, traces of other compounds such as fuel additives and lubricants, also halogen and metallic compounds, and other particles. Carbon monoxide is highly toxic, and can cause carbon monoxide poisoning, so it is important to avoid any build-up of the gas in a confined space. Catalytic converters can reduce toxic emissions, but not completely eliminate them. Also, resulting greenhouse gas emissions, chiefly carbon dioxide, from the widespread use of engines in the modern industrialized world is contributing to the global greenhouse effect – a primary concern regarding global warming.



Name \_\_\_\_\_

Date \_\_\_\_\_

## Car Parts

**Directions:** Draw a line from words to their definitions.

A) steering wheel

B) accelerator

C) brake

D) gear shift

E) battery

F) muffler

G) speedometer

H) odometer

I) dashboard

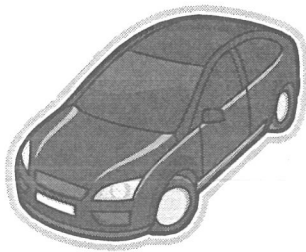
J) exhaust pipe

K) spark plugs

L) trunk

M) axle

N) radiator



1) a compartment in the back of the car, used for storage

2) an instrument on the dashboard that steers the car

3) cools the engine and disperses heat

4) provides electricity to start the car

5) the pedal used to increase speed

6) houses the steering wheel and instruments – radio, odometer, gas and oil levels, et cetera, in the front of the car

7) controls the gear in which the car is driving – driving forward/reverse/neutral/2<sup>nd</sup> or other gear

8) reduces the noise produced by the car

9) indicates the total miles driven

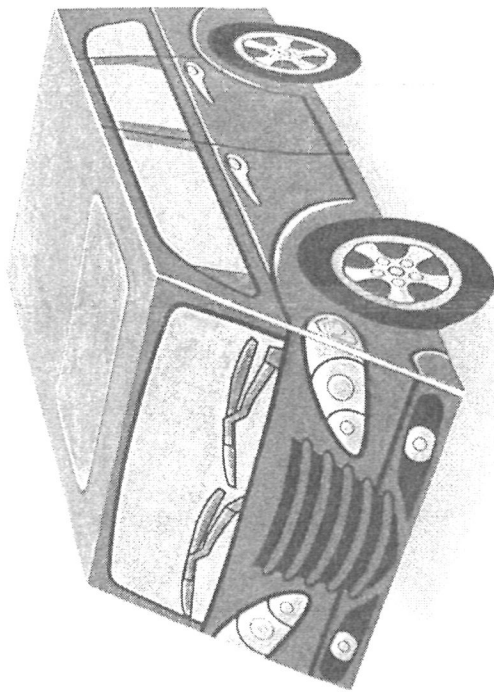
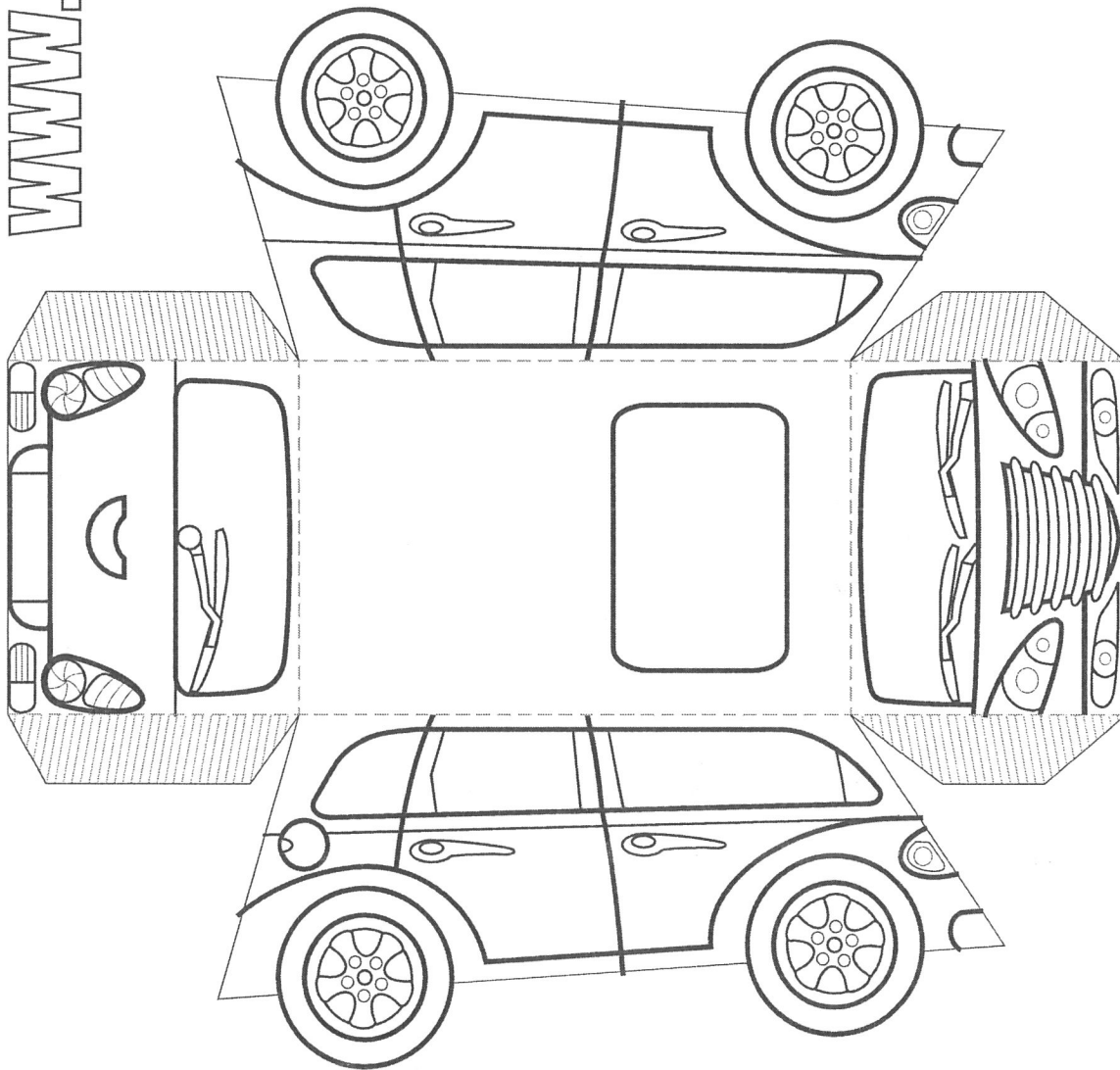
10) a shaft on which a wheel rotates

11) ignites the gasoline in the engine

12) the pedal used to slow and stop the car

13) releases smoke produced by the engine

14) indicates the speed at which one is driving



## Instructions

**1. Colour**

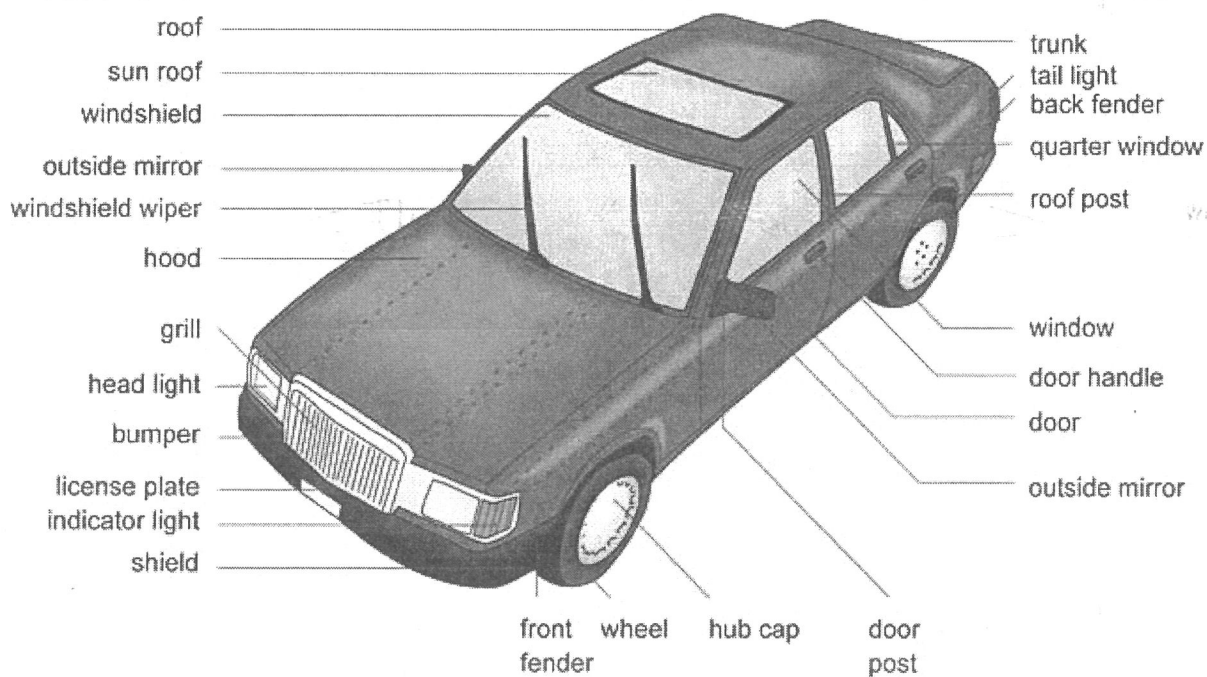
**2. Cut around**  
the outside

**3. Fold here**

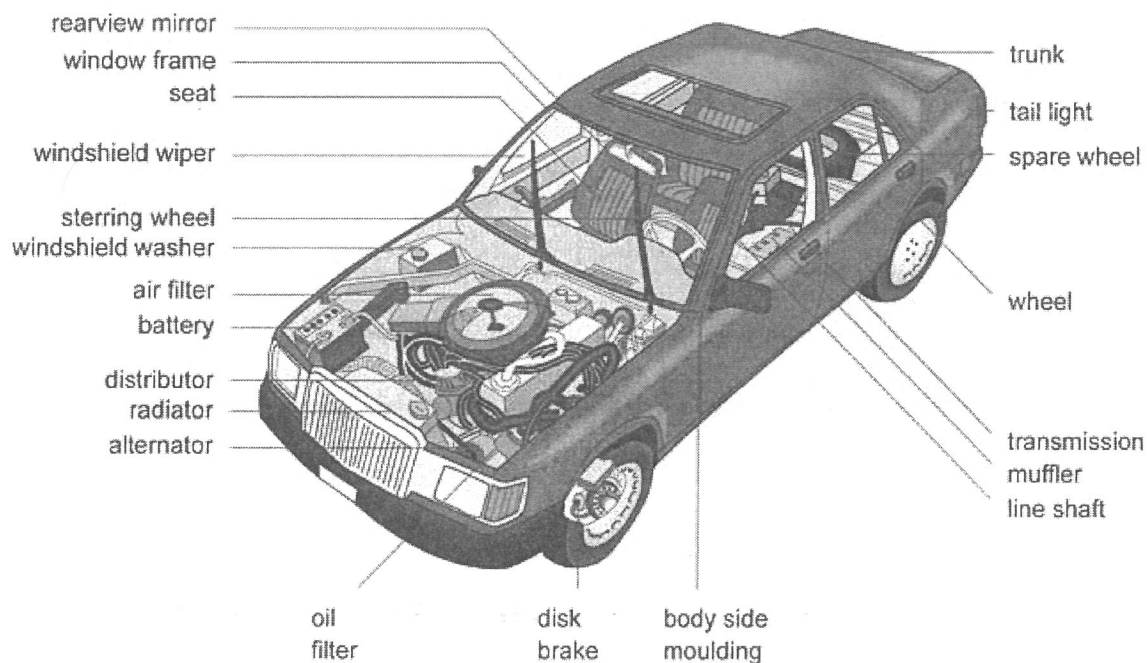
**4. Paste here**  
(do not colour)



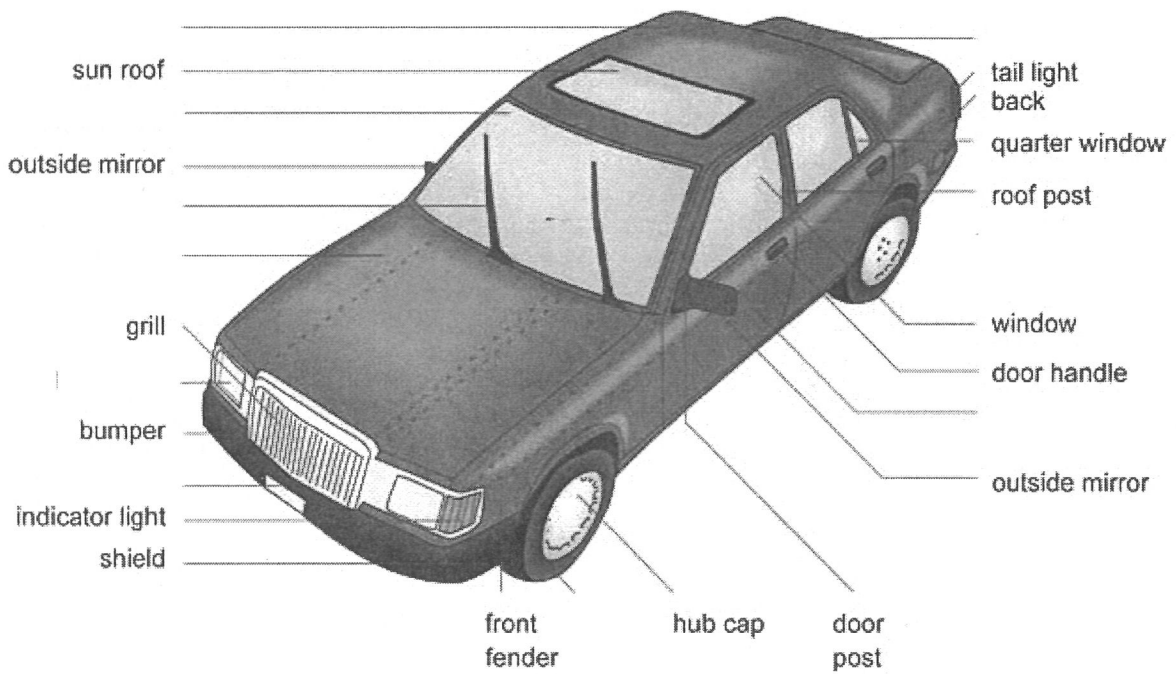
## AUTOMOBILE



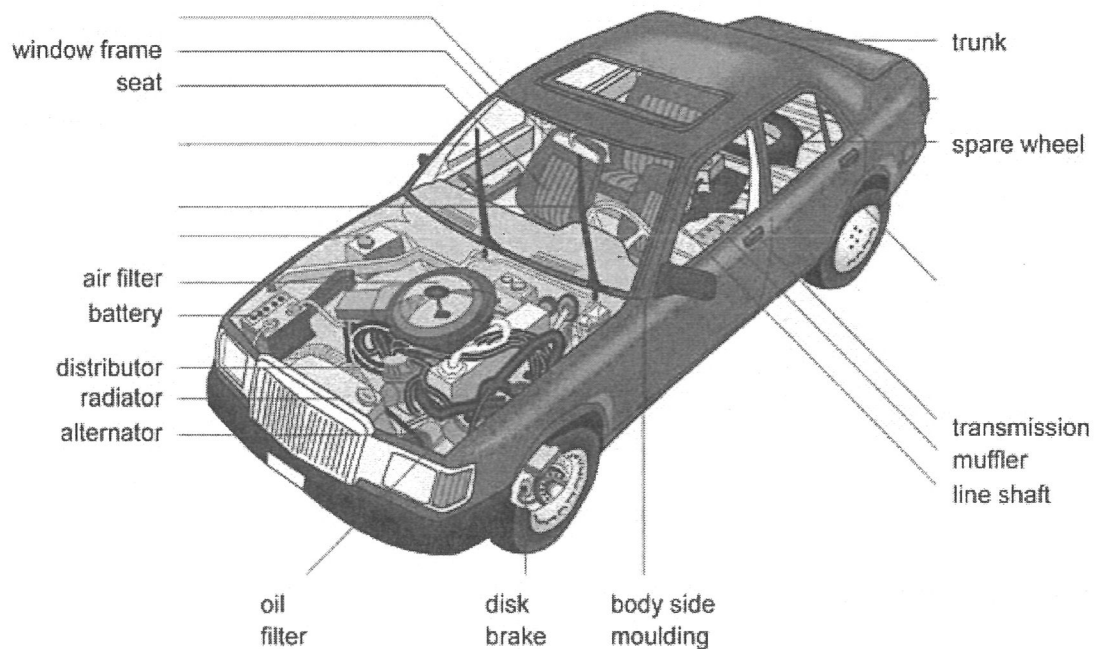
## ANATOMY OF AN AUTOMOBILE

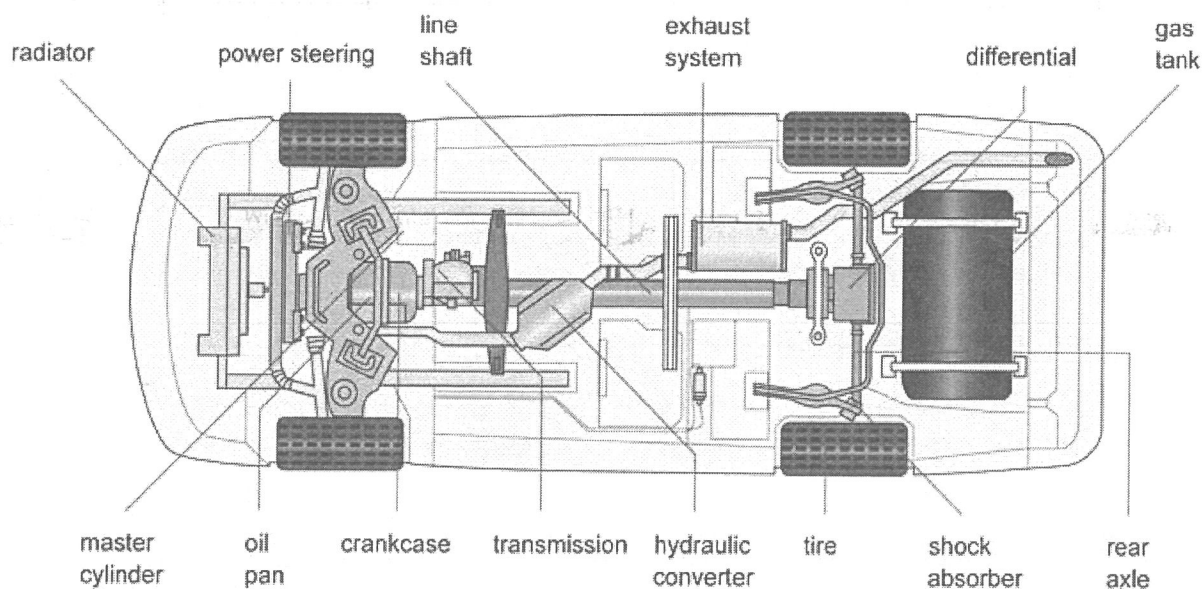
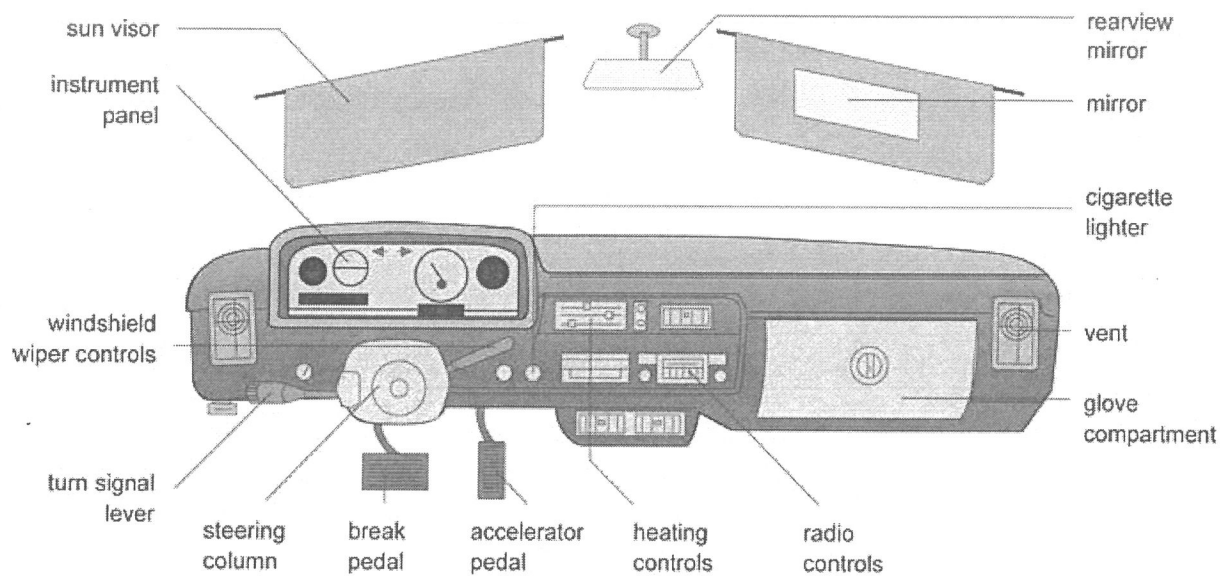


## AUTOMOBILE

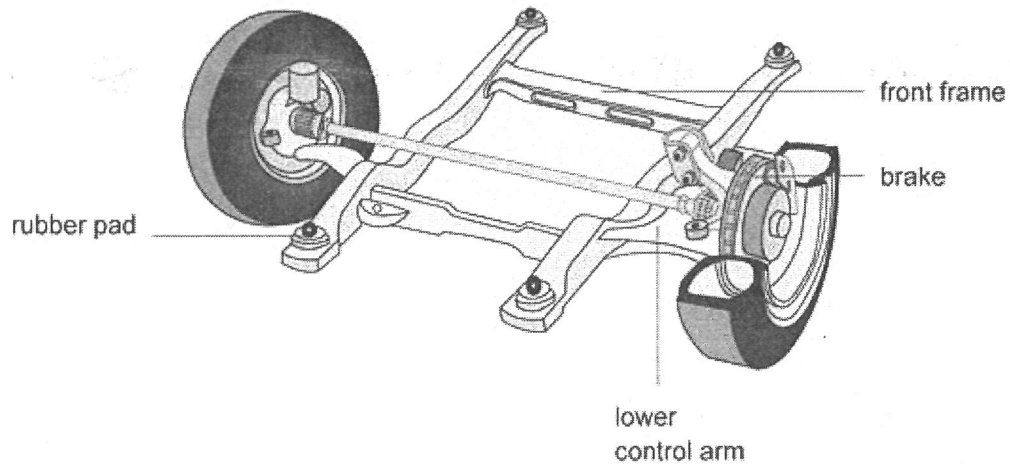


## ANATOMY OF AN AUTOMOBILE

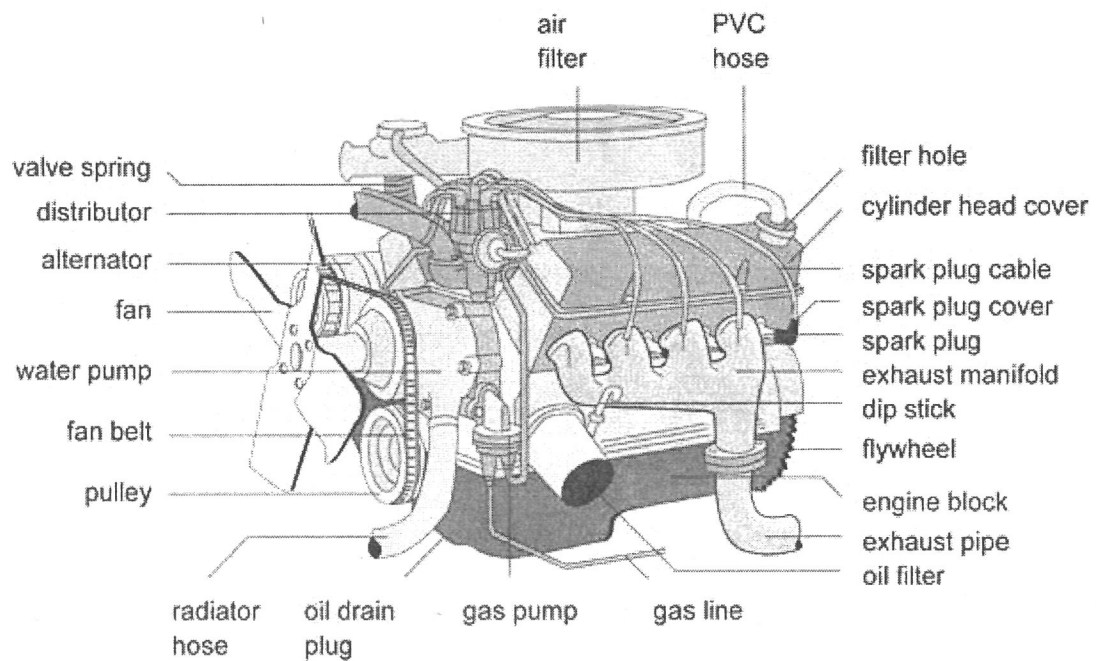


**AUTOMOBILE (view from below)****AUTOMOBILE DASHBOARD**

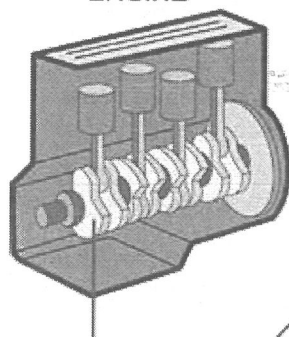
## FRONT FRAME OF AN AUTOMOBILE



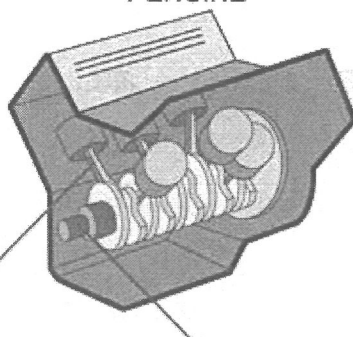
## AUTOMOBILE ENGINE



## TYPES OF MOTORS

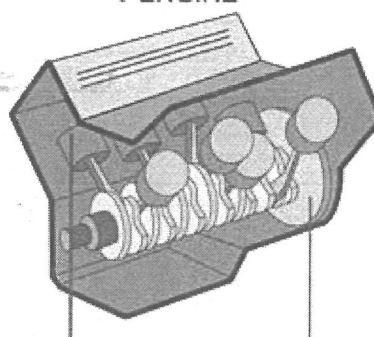
IN LINE  
4 CYLINDER  
ENGINE

counterweight

6 CYLINDER  
V-ENGINE

piston rod

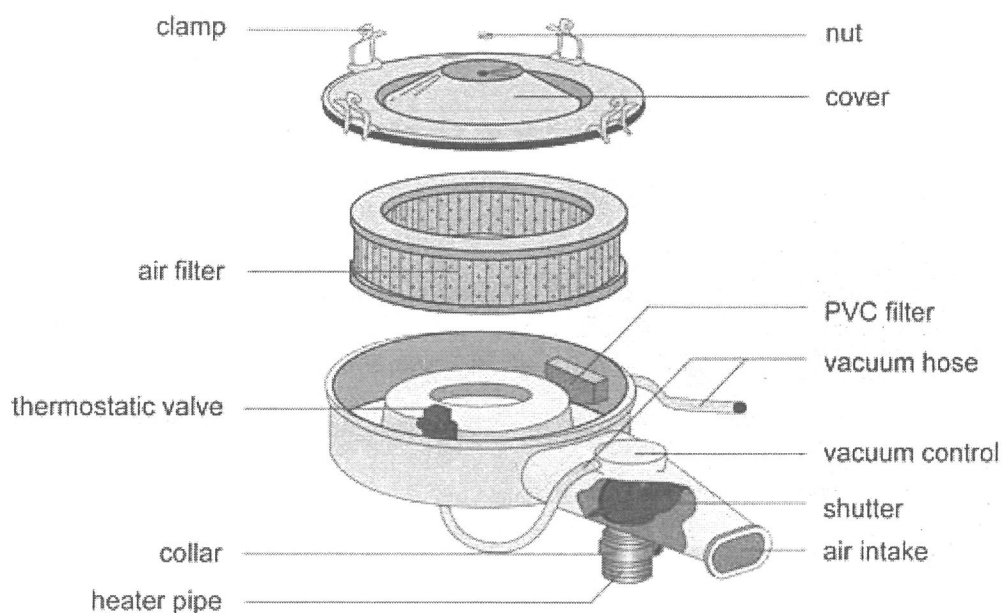
crankshaft

8 CYLINDER  
V-ENGINE

piston

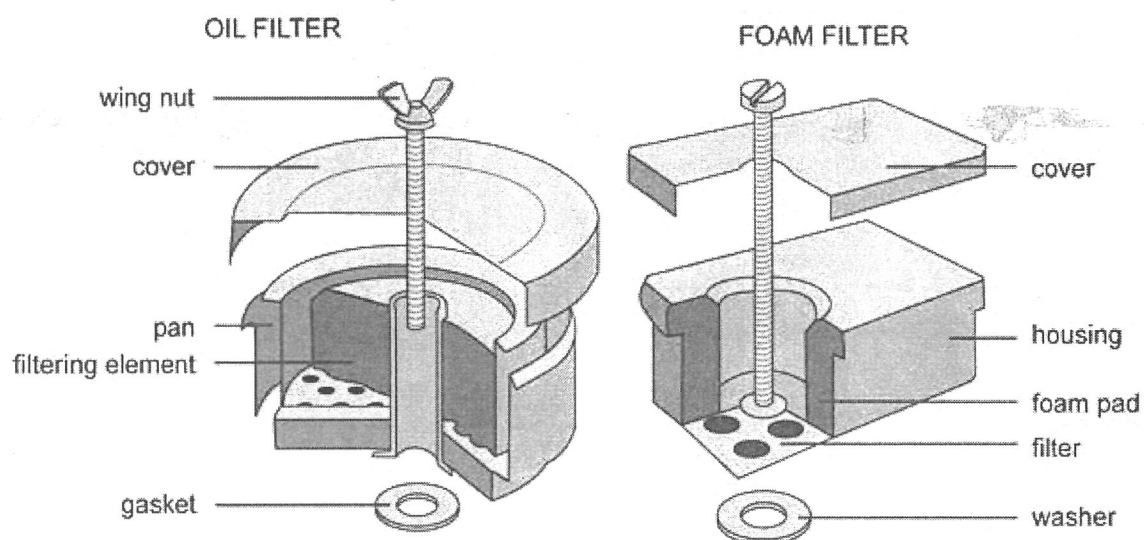
flywheel

## AIR FILTER

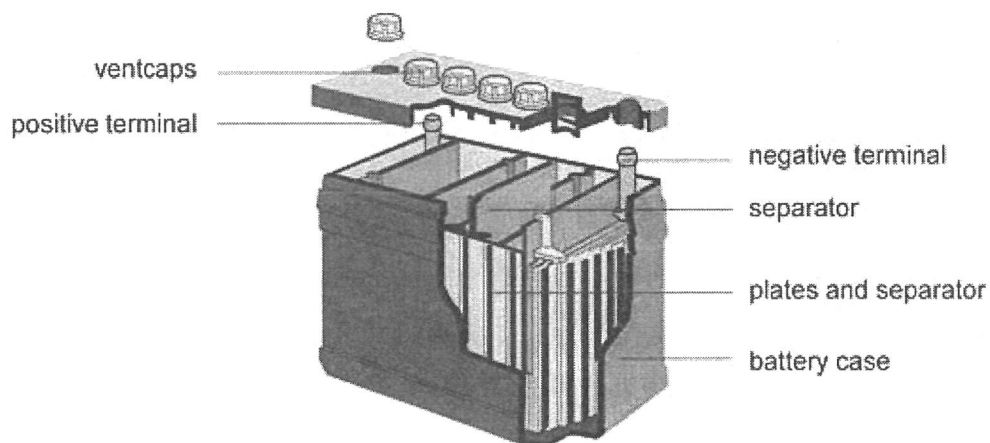




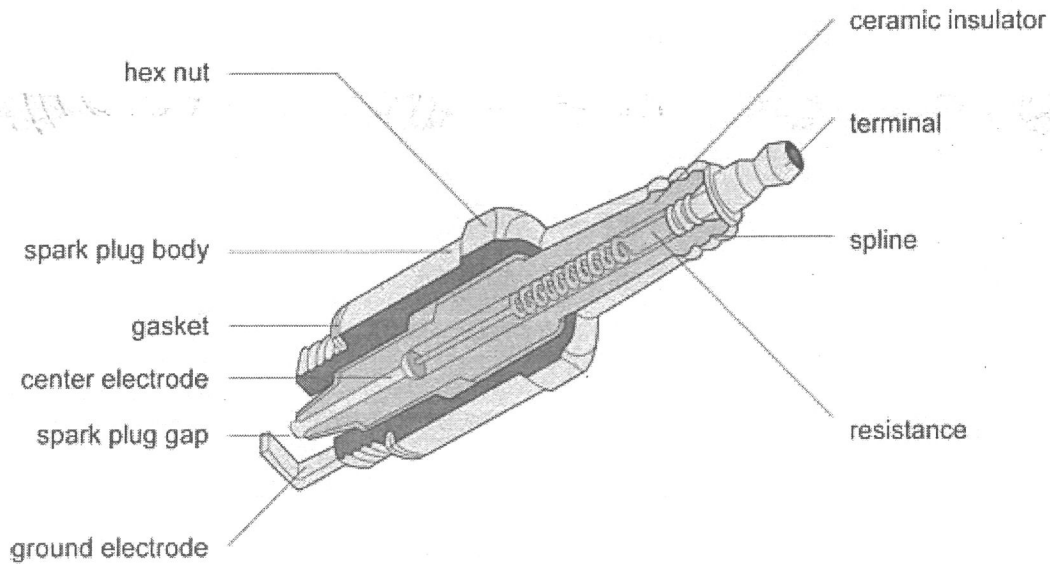
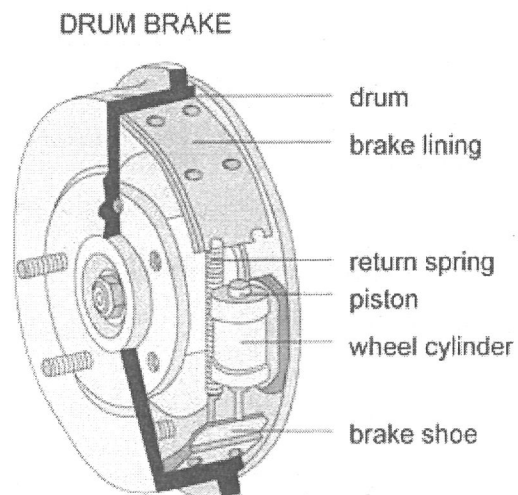
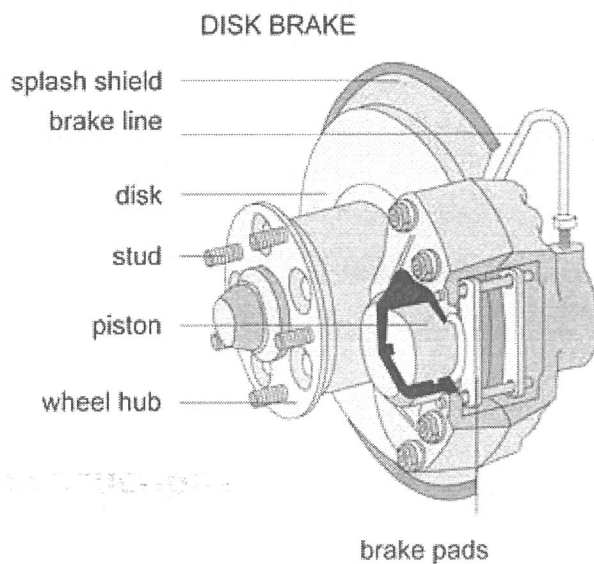
## FILTERS FOR SMALL MOTORS



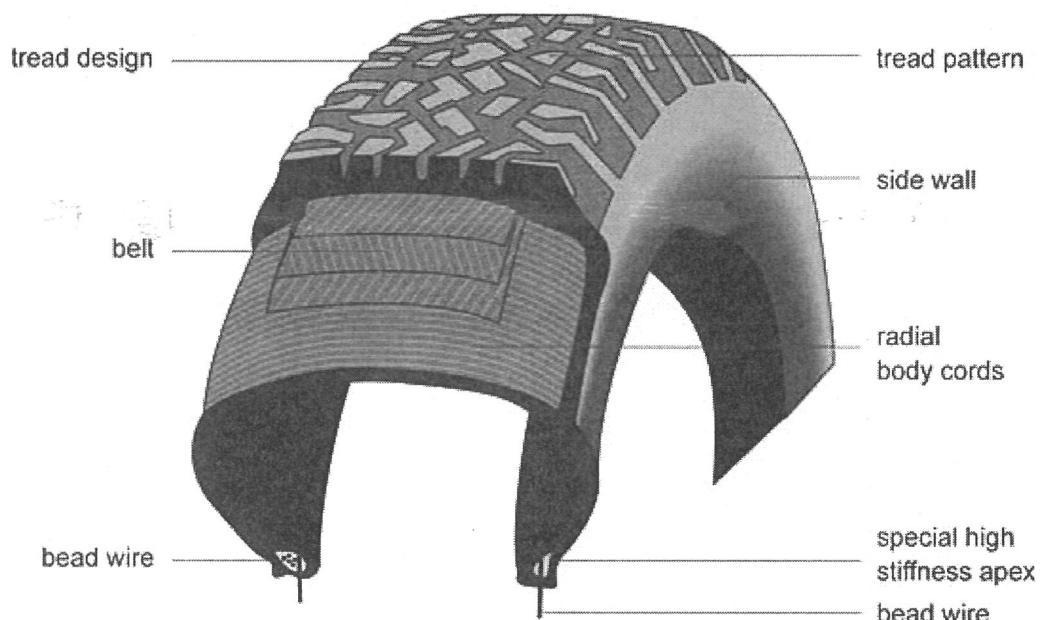
## AUTOMOBILE BATTERY



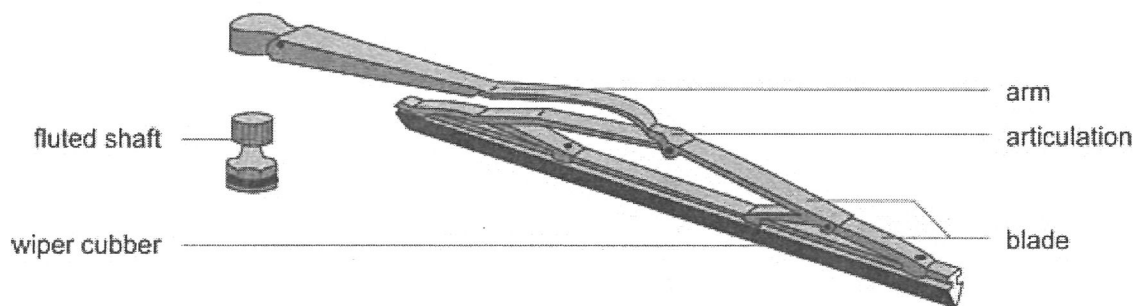


**AUTOMOBILE SPARK PLUG****TYPES OF BRAKES**

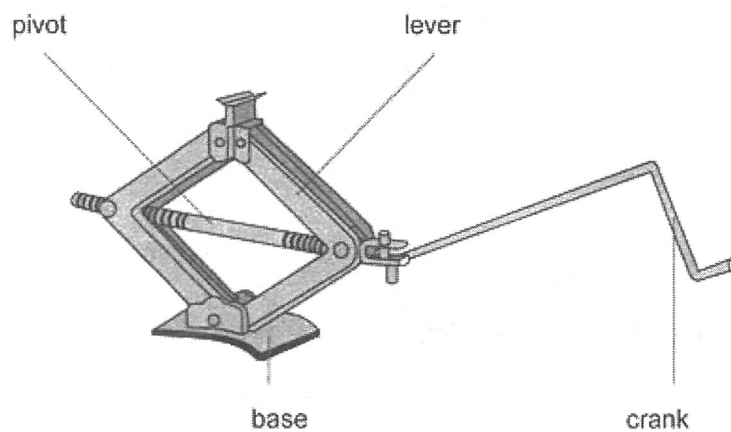
## TIRE

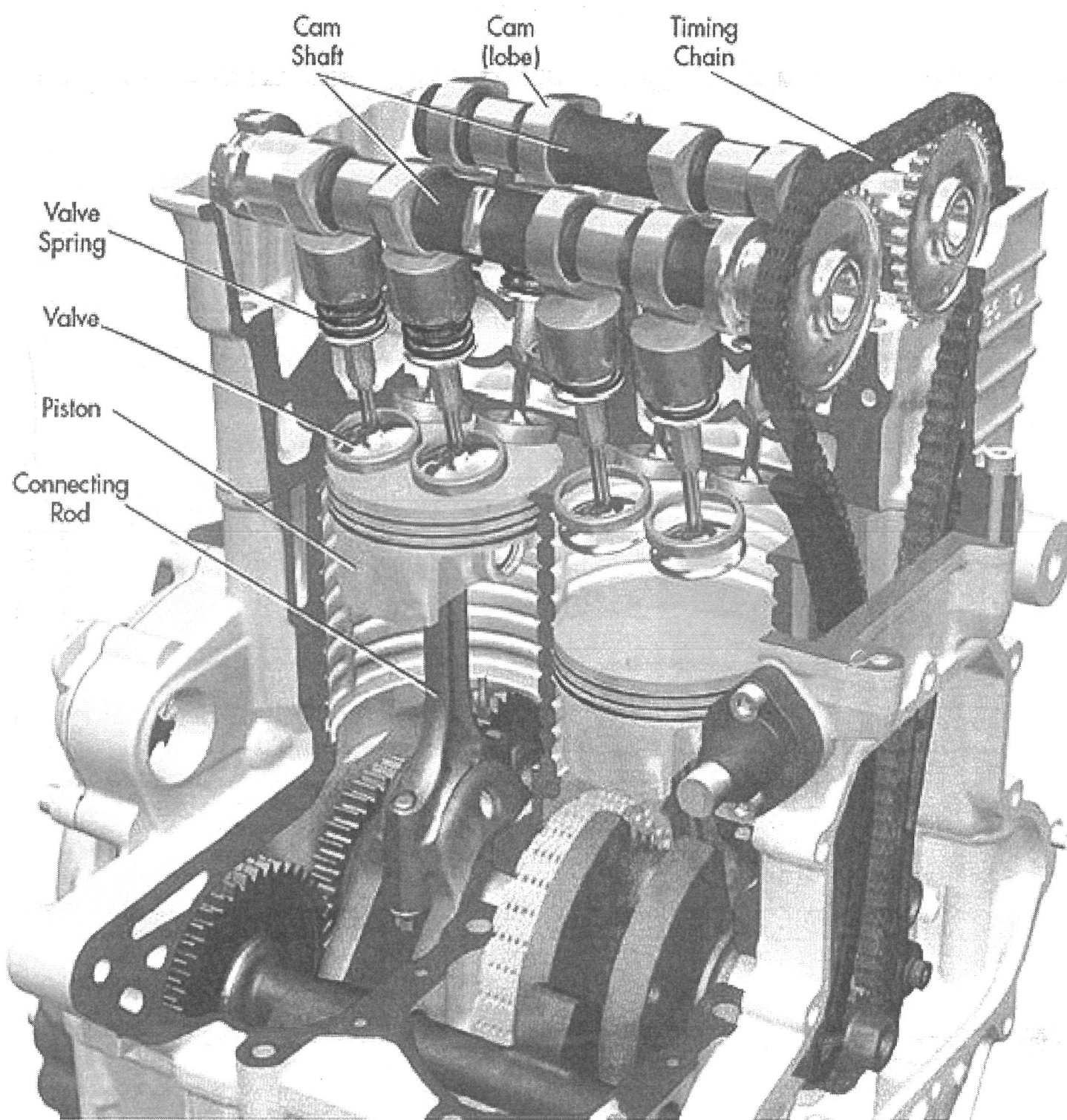


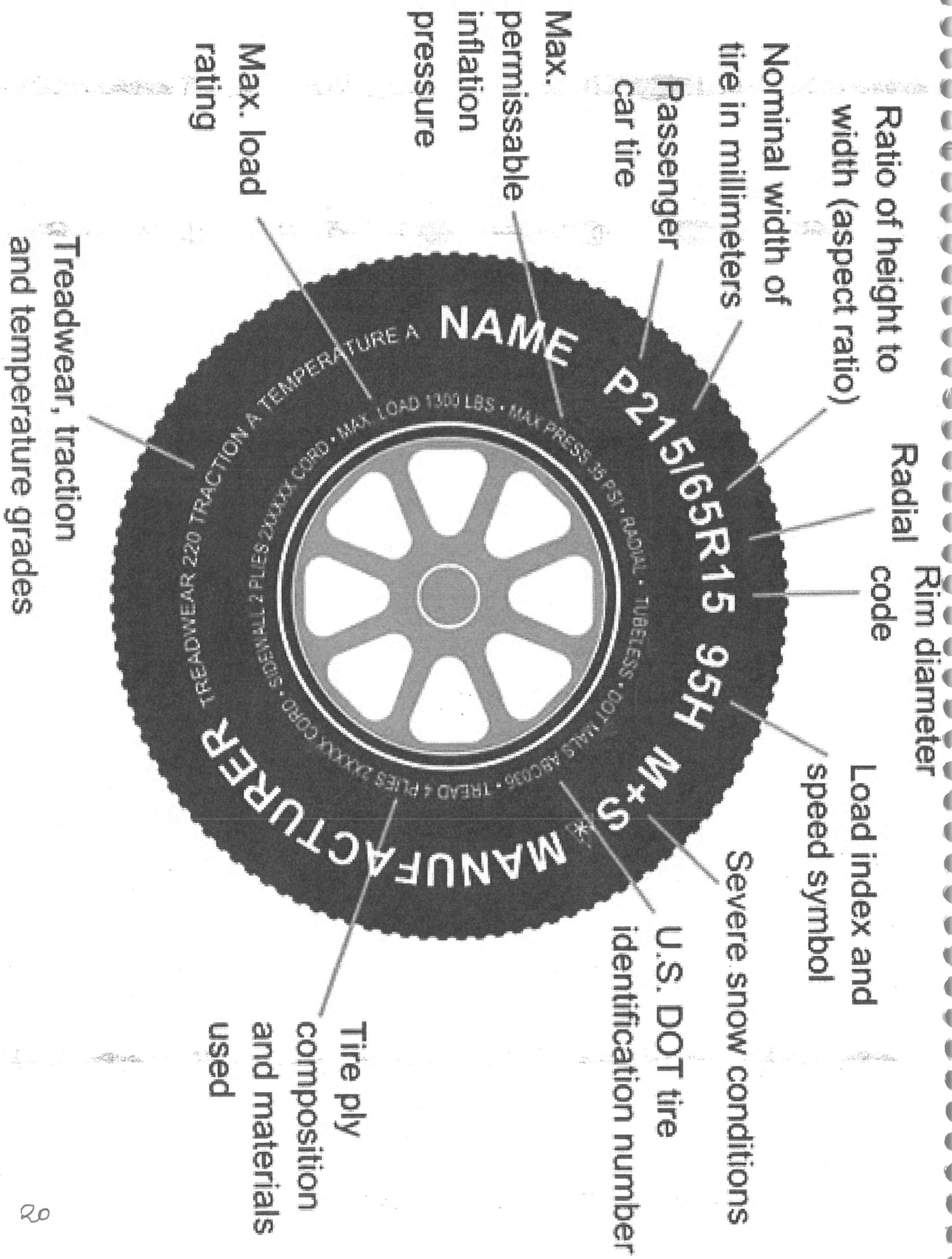
## WINDSHIELD WIPER

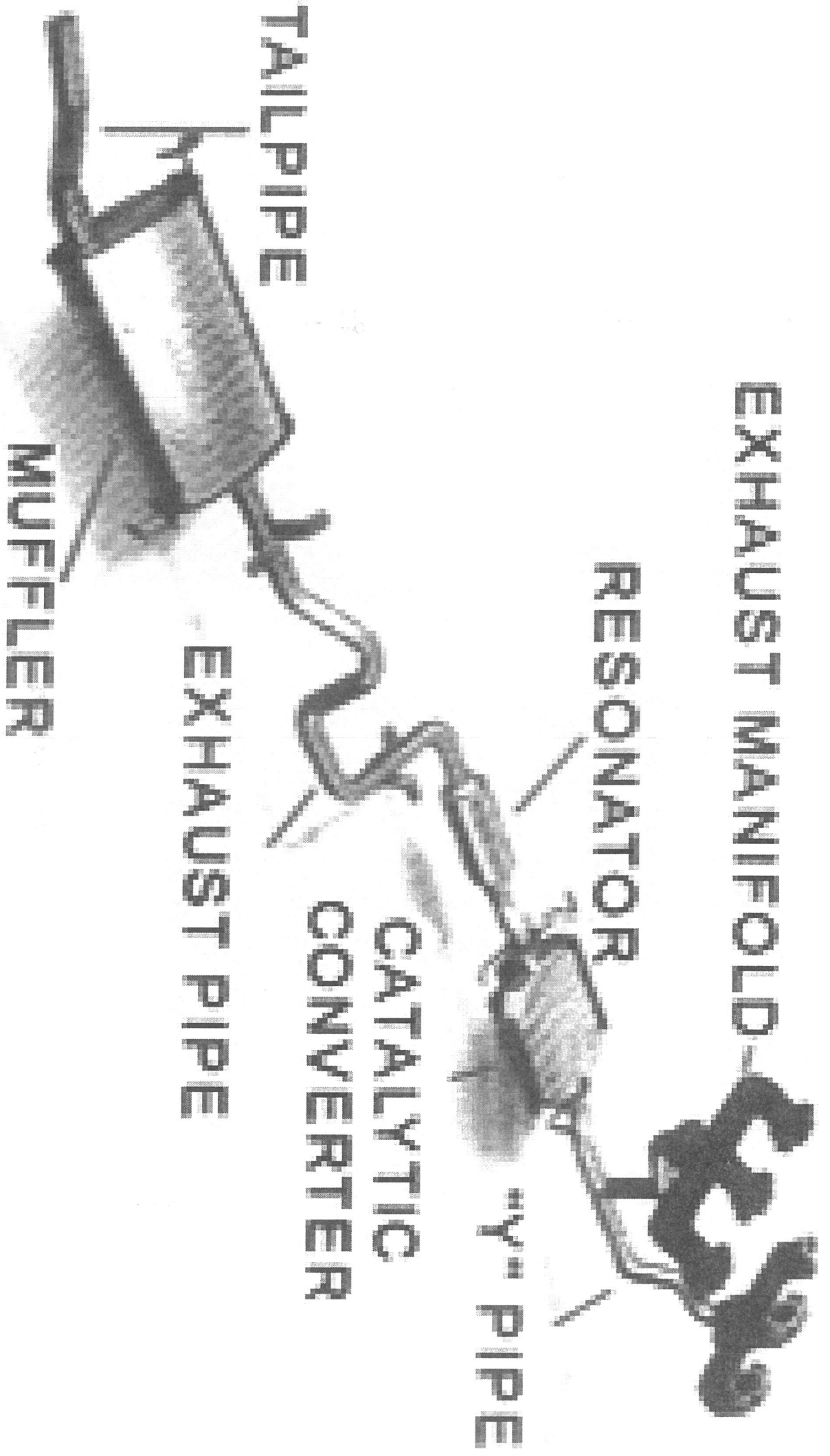


## AUTOMOBILE JACK

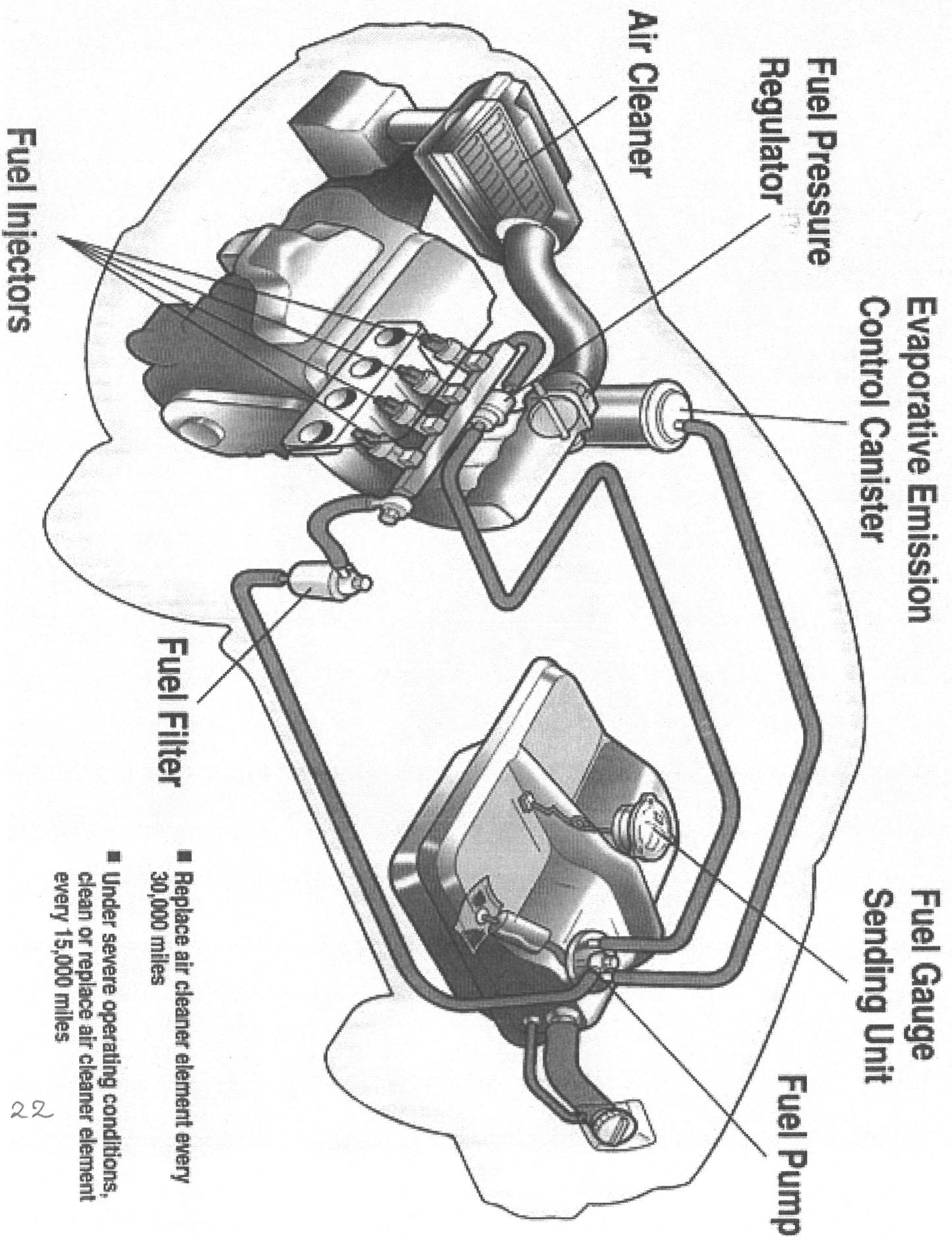






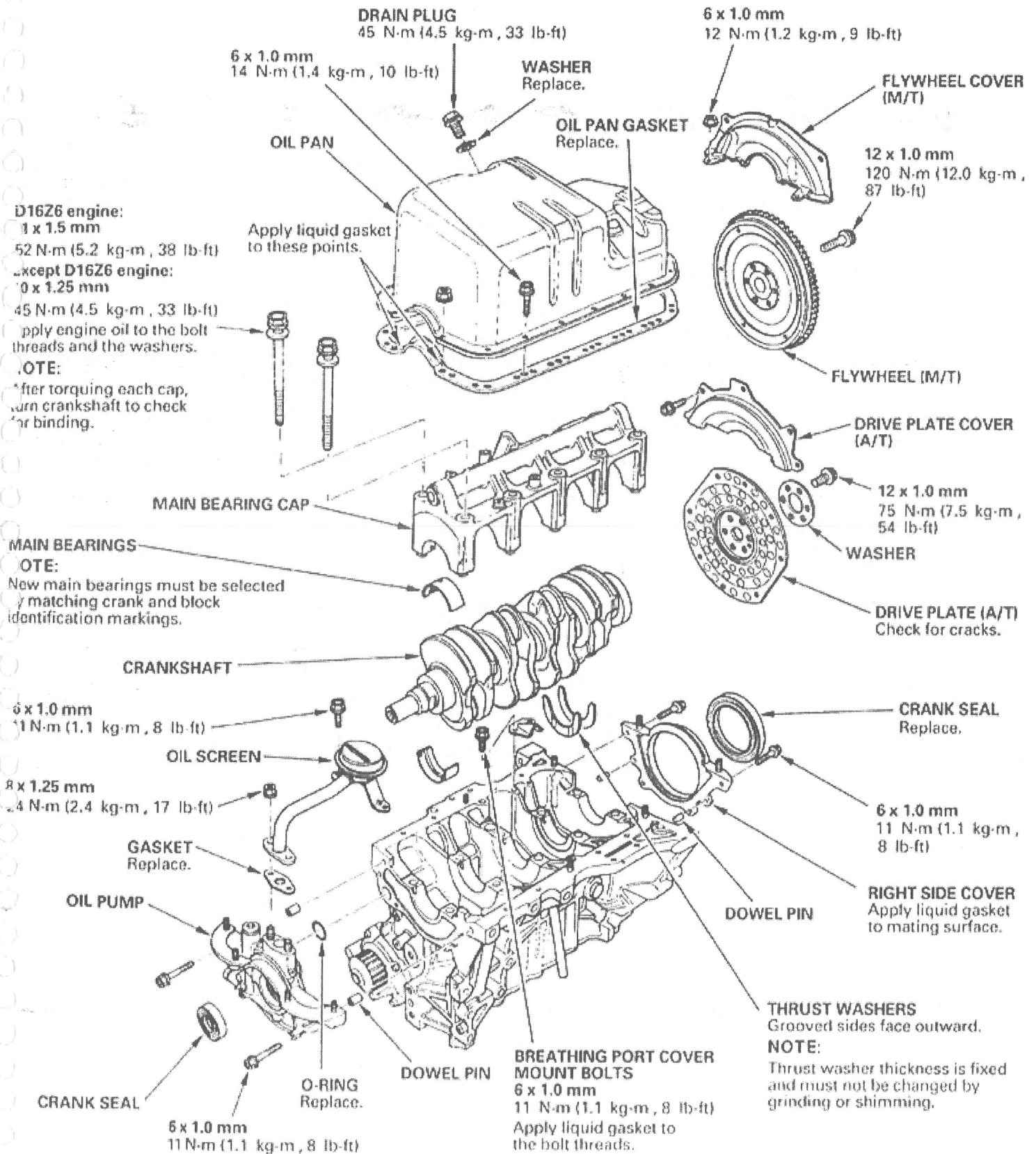




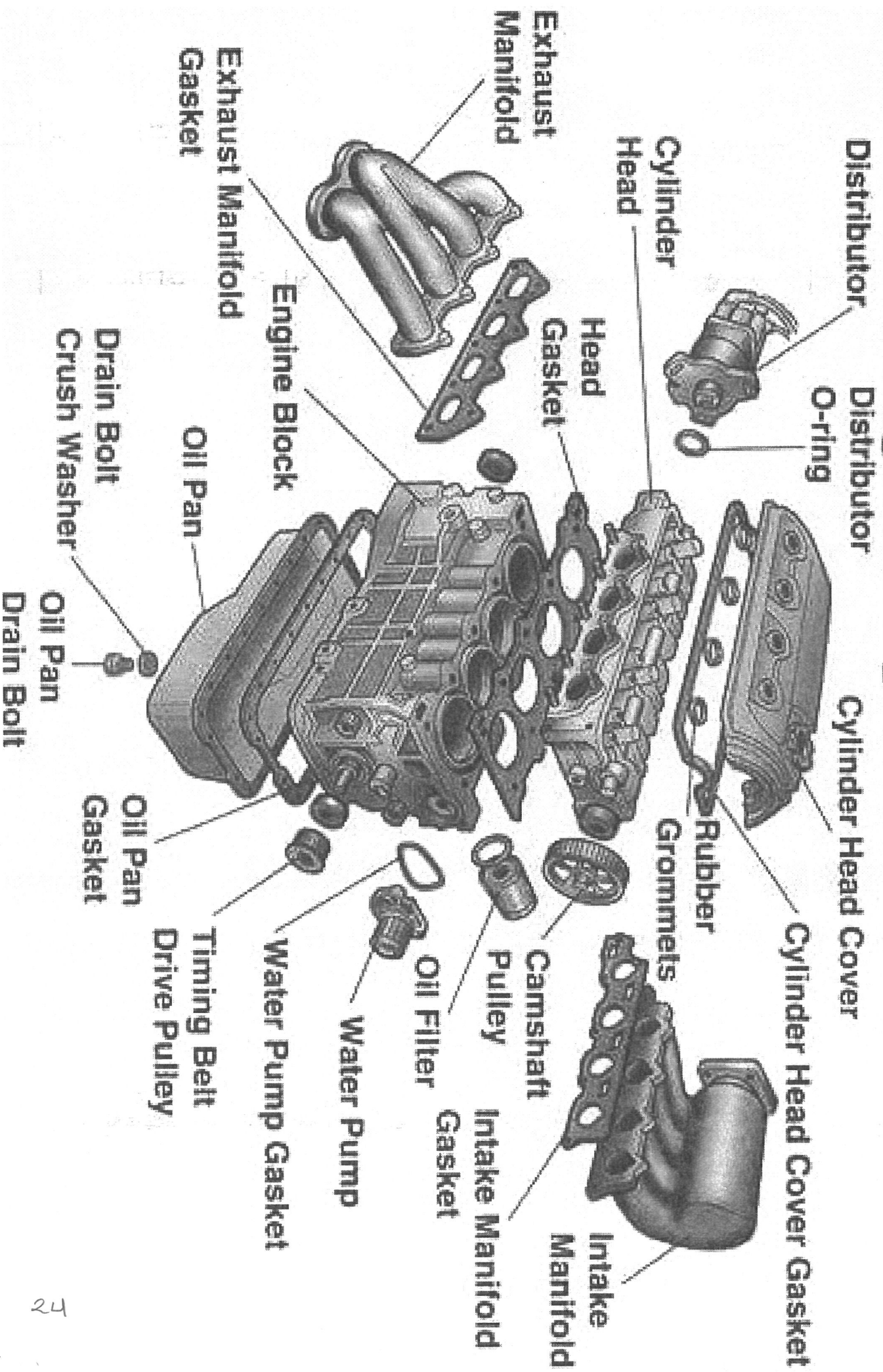


**NOTE:**

- Apply liquid gasket to the mating surfaces of the right side cover and the oil pump before installing them.

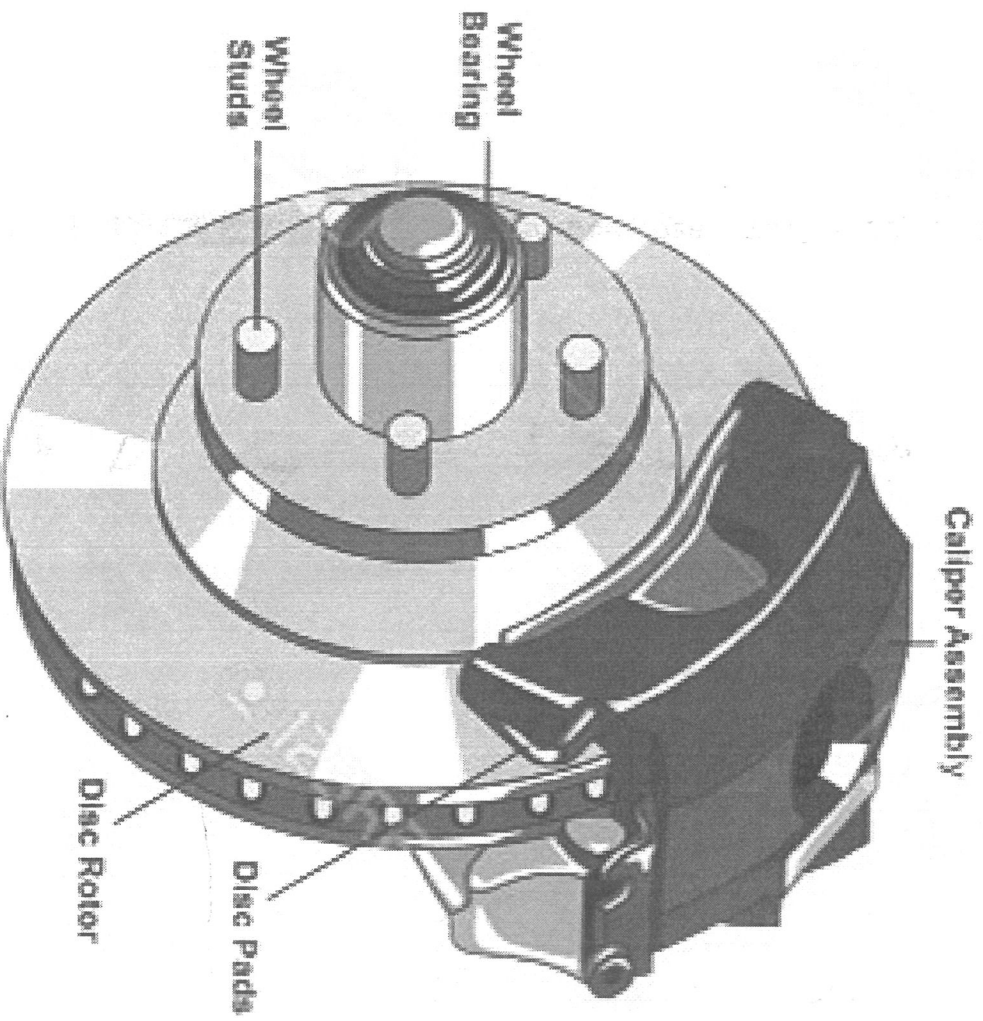


# Engine (Exploded View)

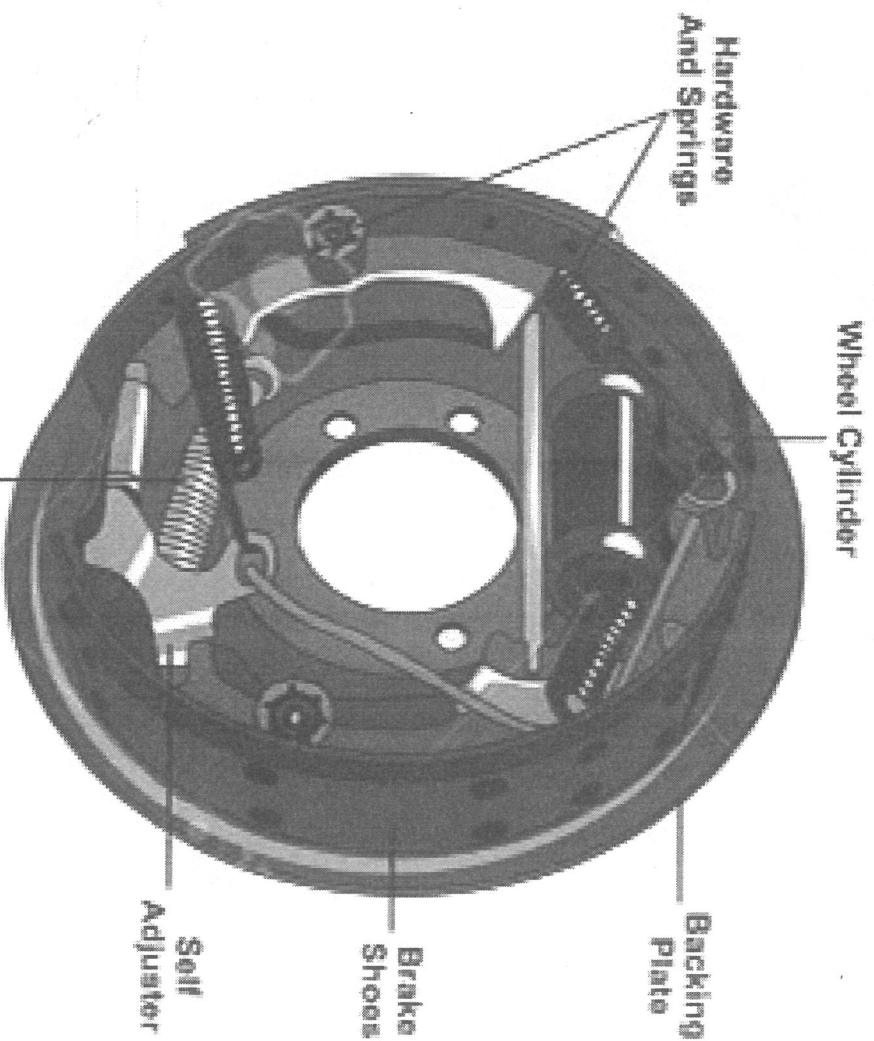




# Automotive Braking

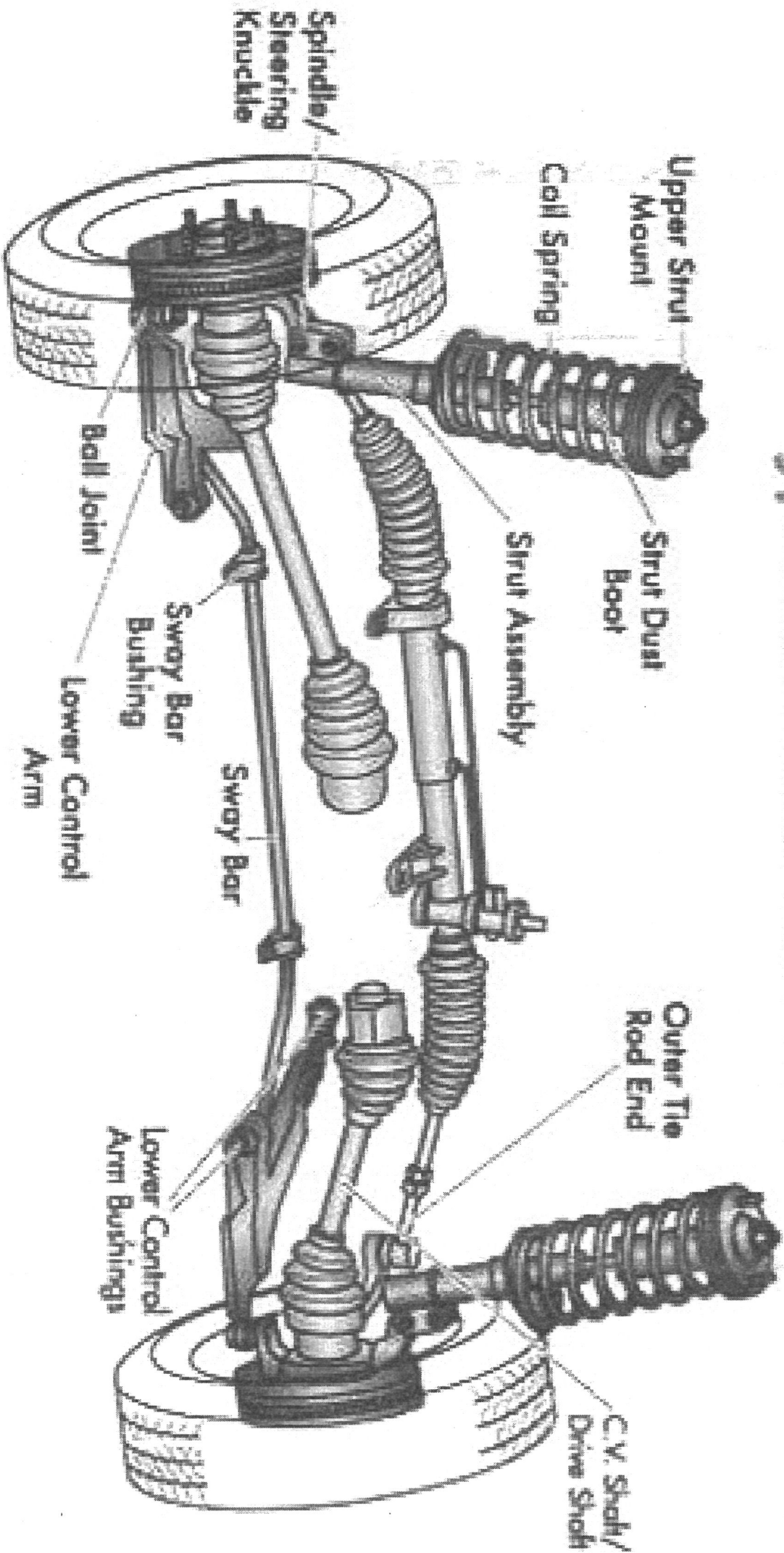


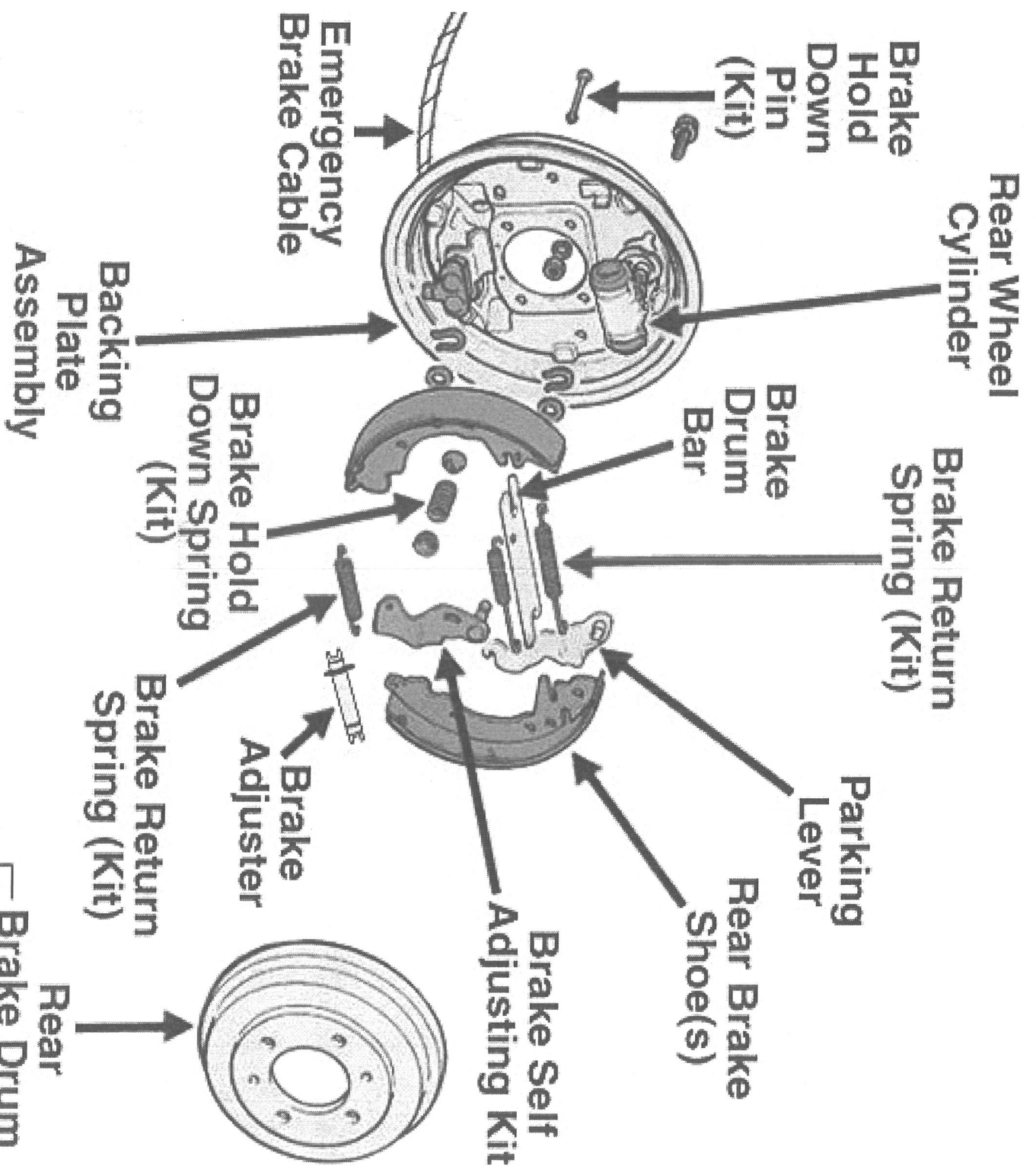
Disk Brake

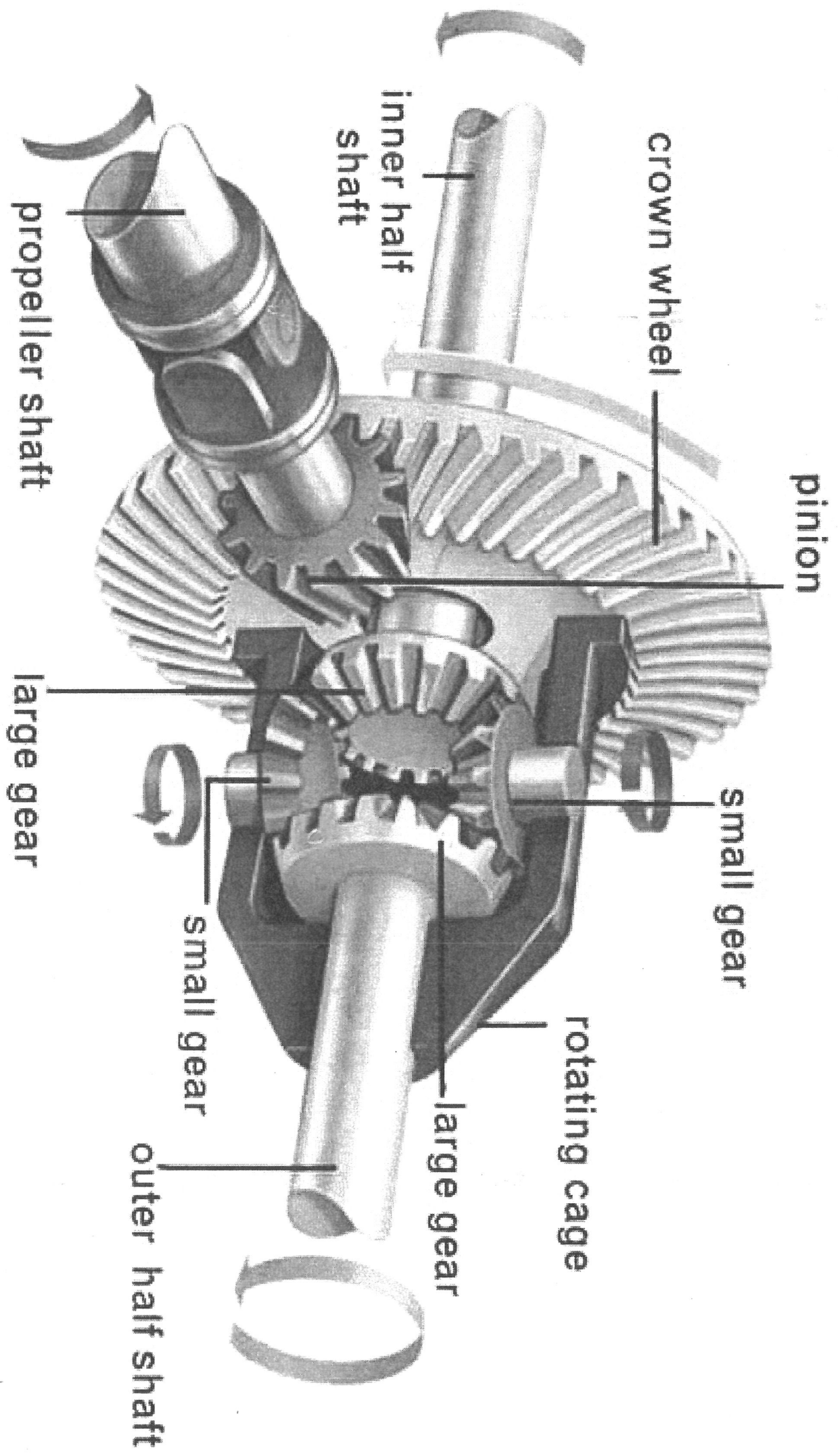


Drum Brake

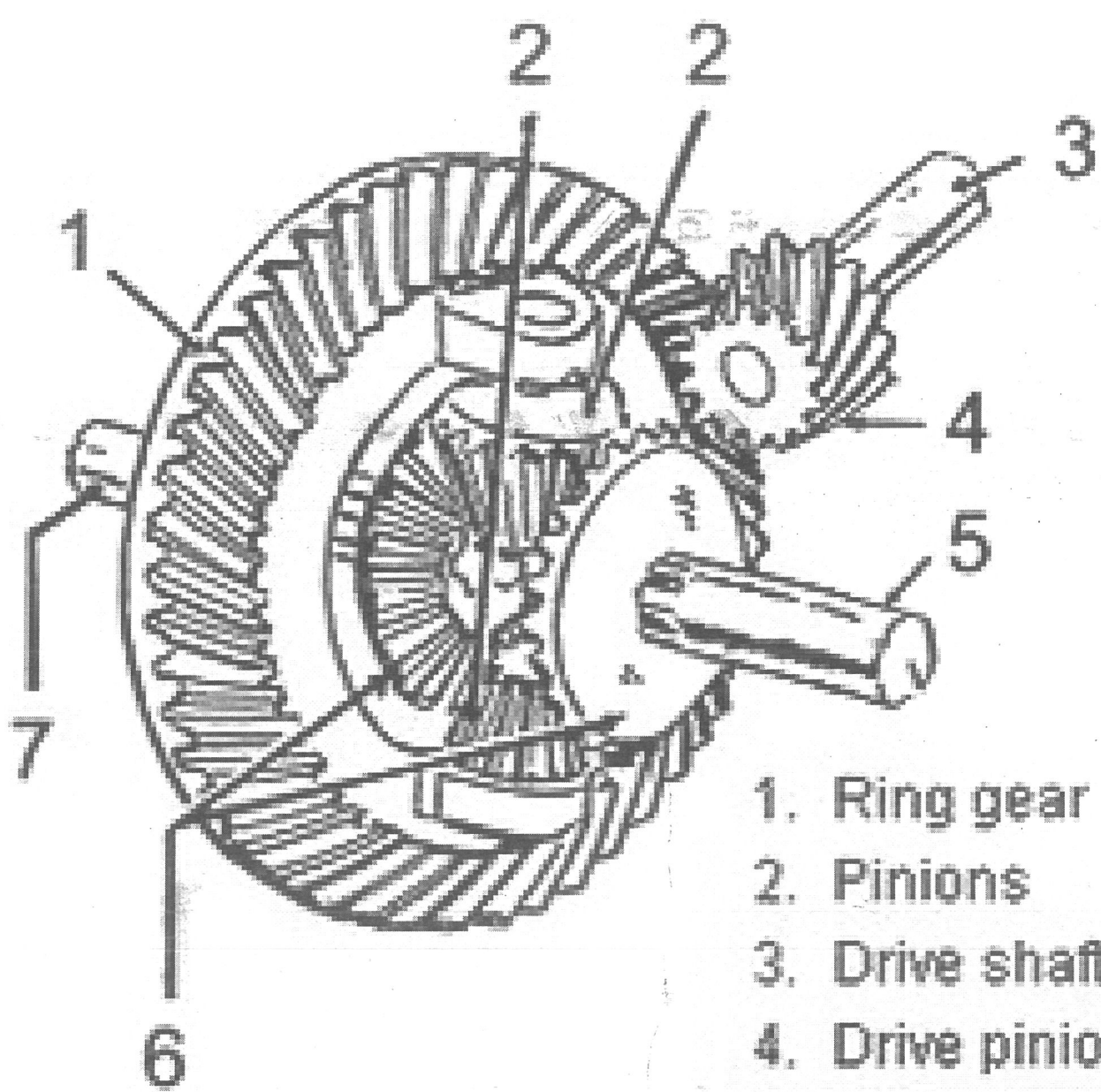
# Typical Front Wheel Drive



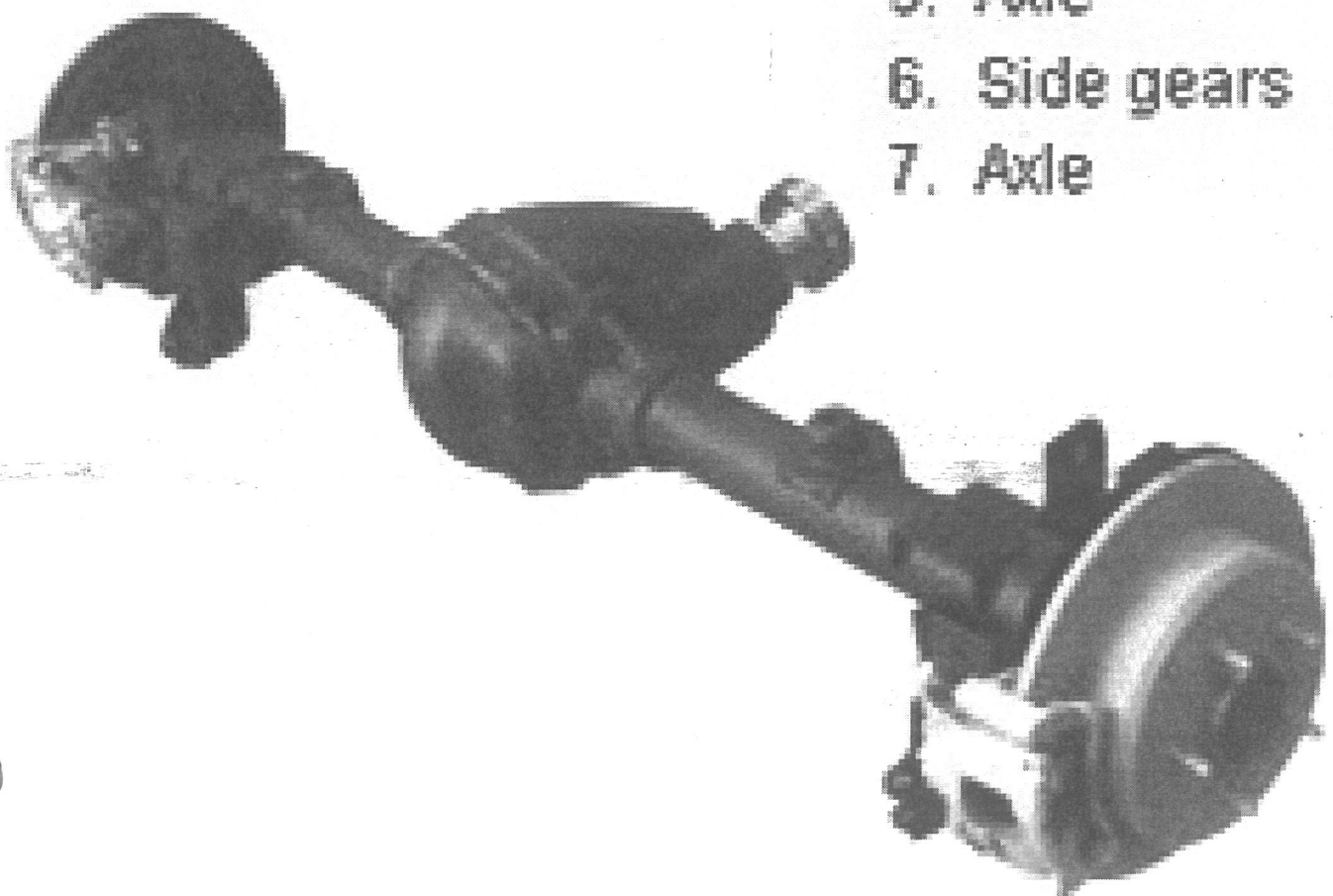




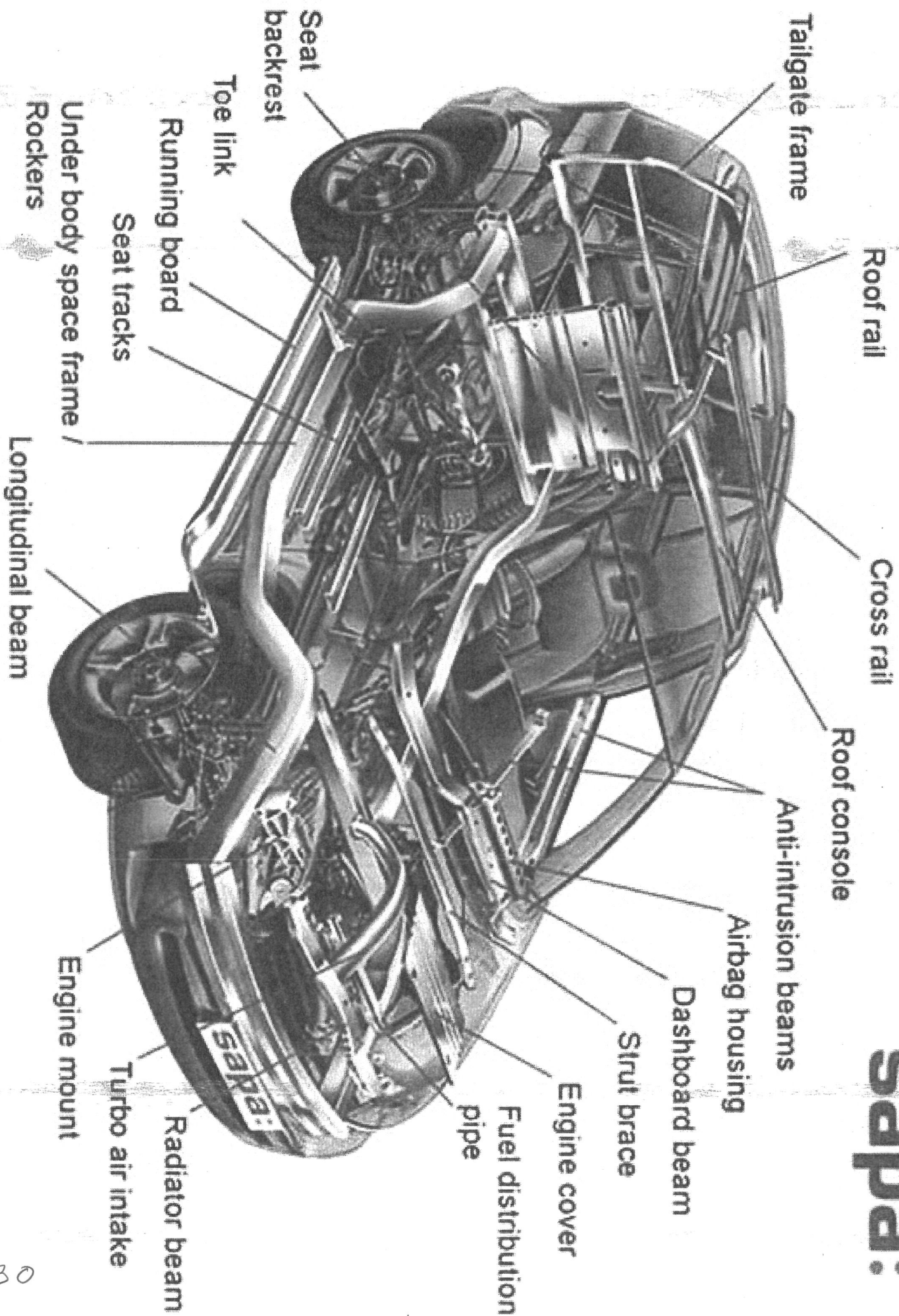




1. Ring gear
2. Pinions
3. Drive shaft
4. Drive pinion
5. Axle
6. Side gears
7. Axle



# sapa:



- |                           |                                       |
|---------------------------|---------------------------------------|
| 1) Abnormal combustion    | 1) احتراق غیر عادی، احتراق غیر معمولی |
| 2) Accessory drive pulley | 2) پولی سر میل لنگ                    |
| 3) Alternator bushing     | 3) بوش دینام                          |
| 4) Antifriction bearing   | 4) یاتاقان ضد اصطکاک                  |
| 5) Axis                   | 5) خط تقارن                           |
| 6) Aluminum piston        | 6) پیستون آلومینیمی                   |
| 7) Adjusting screw        | 7) پیچ تنظیم                          |
| 8) All season oil         | 8) روغن چهار فصل                      |
| 9) Anti corrosion         | 9) ضد خوردگی (از افزودنی های روغن)    |
| 10) Anti wear             | 10) ضد سایش (از افزودنی های روغن)     |
| 11) Armature              | 11) آرمیچر                            |
| 12) Anti freeze           | 12) ضد یخ                             |
| 13) Atmospheric pressure  | 13) فشار جو، فشار هوا                 |
| 14) Air flow              | 14) جریان هوا                         |
| 15) Anti rust             | 15) ضد زنگ                            |
| 16) Anti boil             | 16) ضد جوش                            |
| 17) Anticorrosion         | 17) ضد خوردگی                         |
| 18) Air mix door          | 18) دریچه ی تنظیم هوای ورودی          |
| 19) Air-fuel mixture      | 19) مخلوط سوخت و هوا                  |
| 20) Air                   | 20) هوا                               |
| 21) Air cleaner           | 21) فیلتر هوا                         |
| 22) Absolute pressure     | 22) فشار مطلق                         |
| 23) Air filter            | 23) فیلتر هوا                         |

- |                             |                                    |
|-----------------------------|------------------------------------|
| 24) Actuator                | 24) عملگر، عمل کننده               |
| 25) Accelerator pedal       | 25) پدال گاز                       |
| 26) Anti knock agent        | 26) ماده ی ضد کوبش (افزودنی بنزین) |
| 27) Accelerator pump system | 27) مدار پمپ شتاب دهنده            |
| 28) Auto ignition           | 28) خود سوزی                       |
| 29) Air flow sensor         | 29) سنسور هوای ورودی               |
| 30) Air temperature sensor  | 30) سنسور دمای هوا                 |
| 31) Actuator                | 31) عمل کننده، عمل گر              |
| 32) Accumulator             | 32) انباره                         |
| 33) Air-fuel ratio          | 33) نسبت اختلاط سوخت و هوا         |
| 34) Annular groove          | 34) شیار حلقوی                     |
| 35) Agglomeration           | 35) هم جوشی، گرد آمدگی             |
| 36) Amplifier               | 36) تقویت کننده                    |
| 37) Ammeter                 | 37) آمپر سنج                       |
| 38) Alternator              | 38) دینام، مولد برق                |
| 39) Advance                 | 39) آوانس                          |
| 40) Anti seize compound     | 40) مواد ضد گریپاژ                 |
| 41) Advanced spring         | 41) فنر وزنه ی آوانس               |
| 42) Advanced weights        | 42) وزنه های آوانس                 |
| 43) Asbestos fibers         | 43) الیاف آزبست، پنبه نسوز         |
| 44) Axle shaft              | 44) میل پلوس                       |
| 45) Absorber                | 45) کمک فنر، ضربه گیر              |
| 46) Axle                    | 46) پلوس                           |



- 47) Anti roll bar (stabilizer bar) میله ی ضد غلتش
- 48) Air spring فنر آبی
- 49) Adjusting sleeve میله ی تنظیم (زاویه هم گرایی، واگرایی)
- 50) Abrasion فرسودگی
- 51) Aspect ratio نسبت منظر
- 52) Air bag کیسه ی هوا
- 53) Bulb حباب
- 54) Barrel بارل، بوش
- 55) Ball valve سوپاپ ساچمه
- 56) Beam selector switch کلید نور بالا و پایین
- 57) Brush زغال
- 58) Blocker ring دنده برنجی
- 59) Brake cone مخروطی ترمز
- 60) Bevel gear چرخ دنده مخروطی
- 61) Baffle صفحه منعکس کننده
- 62) Ball joint (tuber) سیبک
- 63) Bias لایه مورب
- 64) Bead طوقه، لبه ی تایر
- 65) Balance تعادل، بالانس
- 66) Brake ترمز
- 67) Bleeding هوا گیری
- 68) Booster تقویت کننده
- 69) Bore قطر



70) Belt tensioner	(70) تسمه سفت کن
71) Bucket tappet	(71) تایپت، استکانی سوپاپ
72) Bearing	(72) یاتاقان
73) Bolt	(73) پیچ
74) Balance weight	(74) وزنه ی تعادل میل لنگ
75) Bearing diameter	(75) قطر یاتاقان
76) Bearing lubrication	(76) روغن کاری یاتاقان
77) Bearing wear	(77) ساییدگی یاتاقان
78) Bottom dead center	(78) نقطه ی مرگ پایین
79) Bronze bushing	(79) بوش برنزی
80) Ball pivot	(80) نشیمنگاه کروی
81) Base circle	(81) دایره ی مبنا
82) Bypass tube	(82) لوله ی فرعی
83) Battery	(83) باتری
84) By pass	(84) لوله ی فرعی
85) Boiling point	(85) نقطه ی جوش
86) Bimetal	(86) بی متال، دو فلزی
87) Blower motor	(87) الکترو موتور، دمنده
88) Bleed valve	(88) سوپاپ خلأی
89) Back pressure	(89) پس فشار
90) Boost control valve	(90) سوپاپ تنظیم فشار
91) Baffle	(91) صفحه ی موج گیر
92) Bellows	(92) فانوسی، دیافراگم فانوسی



93) Brake drum	93) کاسه ی ترمز
94) Crankshaft sprocket	94) چرخ تسمه ی میل لنگ
95) Cylinder	95) سیلندر
96) Camshaft	96) میل سوپاپ
97) Camshaft sprocket	97) چرخ تسمه ی میل سوپاپ
98) Compressing stroke	98) مرحله ی تراکم
99) Compressing ignition engine	99) موتور دیزلی
100) Cylinder block	100) بدنه ی موتور، بلوک سیلندر
101) Crankshaft	101) میل لنگ
102) Cylinder head	102) سر سیلندر
103) Cylinder head gasket	103) واشر سرسیلندر
104) Crankcase ventilation regulator valve	104) سوپاپ تنظیم کننده ی تهویه ی کارتر
105) Crankcase ventilation oil separator	105) روغن گیر، جذب کننده ی روغن
106) Cam bearing	106) یاتاقان میل سوپاپ
107) Coolant inlet	107) لوله ی ورود مایع خنک کننده
108) Clutch disc	108) دیسک کلاچ
109) Clutch plate	109) صفحه کلاچ
110) Connecting rod bearing	110) یاتاقان متحرک، یاتاقان شاتون
111) Clutch pilot bushing	111) بوش فلاپویل
112) Camshaft thrust plate	112) صفحه ی نگه دارنده میل سوپاپ
113) Connection rod	113) شاتون، دسته پیستون
114) Connection rod journal	114) محور لنگ میل لنگ (یاتاقان متحرک)



115) Compressing ring	115) رینگ کمپرسی
116) Concave piston	116) پیستون با سطح مقعر
117) Cup depth	117) عمق گودی سر پیستون
118) Compression ring groove	118) شیار رینگ کمپرسی
119) Compression distance	119) قسمت فشاری پیستون
120) Centerline	120) خط مرکزی
121) Chrome rail	121) تیغه ی کرمی
122) Coolant	122) مایع خنک کننده
123) Cam	123) بادامک
124) Cam lobe	124) شیب جانبی بادامک
125) Cylinder wall	125) دیواره ی سیلندر
126) Conical spring	126) فنر مخروطی
127) Coolant passages	127) مجراهای عبور مایع خنک کننده
128) Chain tensioner	128) زنجیر سفت کن
129) Cotter pin	129) اشیپیل
130) Crude oil	130) نفت خام
131) Core clean-out holes	131) محل های نصب پولکی
132) Conduction	132) رسانایی
133) Convection	133) جابجایی
134) Cooling fins	134) پره های رادیاتور
135) Combustion leak detector	135) وسیله ی نشت یابی
136) Coefficient of conductivity	136) ضریب هدایت

- |                                 |  |
|---------------------------------|--|
| 137) Coil                       | (137) سیم پیچ                          |
| 138) Carburetor                 | (138) کاربراتور                        |
| 139) Cast iron                  | (139) چدن                              |
| 140) Catalytic convertor        | (140) مبدل کاتالیزوری، تصفیه کننده دود |
| 141) Coated ceramic beads       | (141) لایه های سرامیکی                 |
| 142) Convertor shell            | (142) پوسته ی مبدل                     |
| 143) Carbon soot                | (143) دوده ی کربن                      |
| 144) Complete combustion        | (144) احتراق کامل                      |
| 145) Carbon monoxide            | (145) مونواکسید کربن                   |
| 146) Carbon dioxide             | (146) دی اکسید کربن                    |
| 147) Cup seal                   | (147) لاستیک تشتکی                     |
| 148) Choke system               | (148) مدار ساسات                       |
| 149) Charcoal canister          | (149) جذب کننده ی بخار بنزین           |
| 150) Camshaft position sensor   | (150) سنسور وضعیت میل بادامک           |
| 151) Crankshaft position sensor | (151) سنسور وضعیت میل لنگ              |
| 152) Control relay              | (152) رله ی کنترل                      |
| 153) Closing spring             | (153) فنر برگرداننده ی سوزن            |
| 154) Compressing ratio          | (154) نسبت تراکم                       |
| 155) Compression ignition       | (155) موتور احتراق تراکمی              |
| 156) Control sleeve gear        | (156) کمر بند دندانه دار               |
| 157) Control rack               | (157) شانه ی گاز                       |
| 158) Control sleeve             | (158) بوش راهنما، بوش کنترل سوخت       |



159) Cir clip  
 160) Cell divider  
 161) Condenser  
 162) Capacitor  
 163) Conductors  
 164) Coil tower  
 165) Coil wire  
 166) Collopison  
 167) Ceramic  
 168) Couple  
 169) Cushion spring  
 170) Cone clutch  
 171) Carrier bearing  
 172) Counter shaft  
 173) Clutch shaft  
 174) Cone surface  
 175) Coupling sleeve  
 176) Case  
 177) Constant mesh gear  
 178) Converter  
 179) Control valve  
 180) Chain  
 181) Cage

159) خار فنری  
 160) جدا کننده ی خانه های باتری  
 161) خازن، فیوز  
 162) خازن  
 163) سیم پیچ های آرمیچر  
 164) برجک کوئل  
 165) وایر بین دلكو و كویل  
 166) سقوط میدان مغناطیسی  
 167) سرامیک  
 168) درگیر شدن  
 169) فنر ضربه گیر  
 170) كلاچ مخروطی  
 171) رولر برینگ  
 172) محور دنده واسط  
 173) محور ورودی جعبه دنده  
 174) سطح مخروطی  
 175) کشویی  
 176) محفظه، پوسته  
 177) دنده های همیشه درگیر  
 178) مبدل گشتاور  
 179) سوپاپ های کنترل  
 180) زنجیر  
 181) قفسه ساچمه





182) Crossmember	182) رام شاسی، شاسی عرضی
183) Cantilever	183) سگ دست
184) Column	184) ستون فرمان
185) Constant ratio	185) نسبت ثابت
186) Carcass	186) منجید، منجیت
187) Cetane number	187) عدد ستان
188) Coil spring	188) فنر مارپیچی
189) Counterweight	189) وزنه ی تعادل میل لنگ
190) Detent spring	190) فنر ماهک، فنر ضامن
191) Detent	191) خار موشکی
192) Downshift	192) دنده معکوس
193) Drive sprocket	193) چرخ زنجیر محرک
194) Dowel	194) پین راهنما
195) Disengage	195) آزاد شدن
196) Drum	196) کاسه، طبلیک
197) Driving axle	197) محور محرک
198) Drier	198) رطوبت گیر، خشک کن
199) Damping force	199) نیروی میرا کنندگی
200) Dive	200) کله زدن (هنگام ترمز گیری)
201) Diagonal	201) مورب الزاویه، لایه مورب
202) Dynamic balance	202) تعادل پویایی، بالانس دینامیکی
203) Dual system brake	203) ترمز دو مداری
204) Dehumidification	204) رطوبت زدایی



205) Dampener	(205) ضربه گیر
206) Driven plate	(206) صفحه ی خلاص کننده ی دنده (کلاچ)
207) Distributor bushing upper	(207) بوش بالایی محور دلکو
208) Distributor bushing lower	(208) بوش پایینی محور دلکو
209) Distributor thrust plate	(209) صفحه ی نگه دارنده محور دلکو
210) Dome piston	(210) پیستون محدب
211) Dome height	(211) ارتفاع بر آمدگی پیستون
212) Direction of rotation	(212) جهت چرخش
213) Dowel hole	(213) محل نصب پین راهنما
214) Double overhead camshaft	(214) موتور دو میل سوپاپ رو
215) Decarbonizing	(215) کربن زدایی
216) Drilled crankshaft passages	(216) مجراهای روغن میل لنگ
217) Drain plug	(217) پیچ تخلیه روغن
218) Drain	(218) محل تخلیه روغن
219) Dipstick	(219) میله ی اندازه گیری روغن
220) Drive shaft	(220) محور محرک
221) Driven gear	(221) دنده متحرک
222) Drive gear	(222) دنده محرک
223) Detergents	(223) مواد پاک کننده
224) Dispersants	(224) مواد معلق کننده
225) Diesel engine oil	(225) روغن موتور دیزل



- 226) Dowel pin (226) پین راهنما
- 227) Dual exhaust system (227) دستگاه خروج دود دو تایی
- 228) Dual bed catalytic convertor (228) تصفیه کننده دو تایی
- 229) Discharge air (229) هوای فشرده
- 230) Detonation (spark knock) (230) انفجار ناگهانی، انفجار با ضربه
- 231) Diaphragm spring (231) فنر دیافراگمی
- 232) Diaphragm (232) دیافراگم
- 233) De-choke tab (233) زبانه ی باز کننده ی دزیچه ی ساسات
- 234) Digital fuel gauge (234) سوخت سنج دیجیتالی (عددی)
- 235) Detonation sensor (235) سنسور کوبش
- 236) Dust seal (236) گردگیر
- 237) Duty cycle (237) پهنای پالس انژکتور
- 238) Distributor type pump (238) پمپ انژکتوری دوار
- 239) Direct injection (239) تزریق مستقیم
- 240) Diesel engine (240) موتور دیزلی
- 241) Delivery valve (241) سوپاپ تحویل (یک طرفه)
- 242) Diagnostic connector (242) فیش عیب یابی
- 243) Dwell angle (243) زاویه ی داول
- 244) Diode (244) دیود، یکسو کننده
- 245) Dual coil (245) کوئل دوبل
- 246) Delta winding (246) سیم پیچ مثلثی
- 247) Differential (247) دیفرانسیل



248) Drive shaft	248) شیر تخلیه
249) Drain valve	249) ذوب کن یخ، یخ زدا
250) Defroster (de-icer)	250) میل گاردان
251) Efficiency	251) بازده، راندمان
252) Eddy current	252) جریان گردآبی
253) Electrode	253) الکتروود
254) Engage	254) درگیر شدن
255) External spline	255) هزار خار بیرونی
256) Eyebolt nut	256) مهره ی شش گوش تنظیم
257) External teeth	257) دندانه های بیرونی
258) External splines	258) هزار خار بیرونی
259) Emergency	259) اضطراری
260) Engage	260) درگیر شدن
261) End plate	261) صفحه ی انتهایی
262) Eared disc	262) صفحه ی گوشواره ای
263) Even wear	263) سایش یکنواخت
264) Equalizer	264) بازوی متعادل کننده



265) Exhaust stroke	(265) مرحله ی تخلیه
266) Exhaust manifold	(266) مانیفولد دود
267) Engine life hood	(267) قلاب بالا بر موتور
268) Expansion slot	(268) شیار انبساط
269) Expansion	(269) انبساط
270) Exhaust valve	(270) سوپاپ دود
271) Electrical terminals	(271) محل اتصال سیم برق
272) Engine oil additives	(272) افزودنی های روغن موتور
273) Eccentric	(273) دایره ی خارج از مرکز
274) Expansion tank	(274) مخزن انبساط
275) Electric fan motor	(275) الکترو موتور پروانه
276) Engine warm-up	(276) گرم شدن موتور
277) Ethylene glycol	(277) ماده ترکیبی ضد یخ (پایه روغنی)
278) Electric throttle control	(278) کنترل الکترونیکی دریچه گاز
279) Electronic muffler	(279) انباره ی آگزوز الکترونیکی
280) Exhaust turbine	(280) توربین دود
281) Emulsion well	(281) مجرای ریز کننده ی سوخت
282) Electronic control unit (ECU)	(282) واحد کنترل الکترونیکی
283) Engine speed sensor	(283) سنسور دور موتور
284) Epoxy filter	(284) ماده پر کننده درز گیر
285) Excess fuel botton	(285) دکمه ی ارسال سوخت اضافی (در روشن کردن موتور)
286) Effective plunger stroke	(286) کورس موثر پلانجر
287) Eccentric shaft	(287) محور خارج از مرکز



289) Fuel rail	289) ریل سوخت، مجرای سوخت
290) Flywheel	290) چرخ لنگر، چرخ طیار
291) Front oil pan seal	291) کاسه نمد جلو کارتر
292) Flat engine	292) موتور تخت، موتور خوابیده
293) Front cover (timing cover)	293) سینی جلو موتور (قاب زنجیر)
294) Flanged main bearing	294) یاتاقان اصلی لبه دار
295) Fan thrust plate	295) صفحه ی نگه دارنده ی پروانه
296) Front oil seal	296) کاسه نمد سر میل لنگ
297) Fillet	297) گردی میل لنگ
298) Flat piston	298) پیستون تخت
299) Full floating piston pin	299) گژنپین شناور
300) Flat top piston	300) پیستون سر تخت
301) Face (valve face)	301) نشیمنگاه سوپاپ
302) Fulcrum seat	302) تکیه گاه کروی شکل
303) Fulcrum	303) تکیه گاه
304) F-head	304) سوپاپ ترکیبی
305) Flash point	305) نقطه ی اشتعال
306) Foam inhibitor	306) ضد کف (از افزودنی های روغن)
307) Filter bypass	307) سوپاپ فرعی فیلتر
308) Force feed lubrication	308) روغن کاری تحت فشار
309) Fins	309) پره
310) Folded paper element	310) کاغذ چین دار صافی
311) Fuse	





312) Fan belt	(312) تسمه پروانه
313) Flat belt	(313) تسمه با مقطع مستطیلی
314) Fan shroud (fan cowling)	(314) بادگیر رادیاتور (تونل هوا)
315) Filler neck	(315) گلوپی رادیاتور
316) Fan	(316) پروانه، پنکه
317) Finned cylinder	(317) سیلندر پره دار (موتورهای هوا خنک)
318) Filler cap	(318) در پوش رادیاتور
319) Flow	(319) جریان
320) Flexible hose	(320) لوله ی انعطاف پذیر، شیلنگ
321) Float	(321) شناور
322) Fuel	(322) سوخت
323) Filter element	(323) فیلتر کاغذی
324) Fuel injector	(324) انژکتور سوخت پاش
325) Fuel supply hose	(325) لوله ی لاستیکی بنزین
326) Fuel filter	(326) فیلتر بنزین
327) Fuel tank	(327) باک بنزین
328) Fuel return hose	(328) لوله ی برگشت بنزین
329) Fuel system	(329) دستگاه سوخت رسانی
330) Fuel vapor line	(330) لوله ی انتقال بخار بنزین
331) Fossil fuels	(331) سوخت های فسیلی
332) Float level adjusting lip	(332) زبانه ی تنظیم شناور
333) Fast idle cam rod	(333) میله ی بادامک دور تند
334) Float bowl	(334) پیاله ی بنزین



335) Fast idle screw	(335) پیچ تنظیم دور تند
336) Fuel cut off valve	(336) شیر قطع کننده ی سوخت
337) Fuel distributor	(337) تقسیم کننده ی سوخت
338) Fly weight	(338) وزنه های رگلاتور
339) Fully transistorized regulator	(339) آفتامات تمام ترانزیستوری
340) Field coils	(340) بالشتک ها
341) Friction ring	(341) حلقه اصطکاکی
342) Fork	(342) چنگک
343) Free travel	(343) لقی، خلاصی
344) Free play	(344) لقی، خلاصی
345) Fourth gear	(345) دنده ی چهارم
346) First gear	(346) دنده ی اول
347) Front pump	(347) پمپ جلو
348) Front suspension	(348) تعلیق جلو
349) Force	(349) نیرو
350) Fiberglass	(350) فایبرگلاس
351) Frame	(351) شاسی، بدنه
352) Forward	(352) جلو، سمت جلو
353) Foot print width	(353) سطح تماس
354) Floating	(354) شناور
355) Flasher	(355) چشمک زن
356) Freezing point	(356) نقطه ی انجماد



357) Grommet	(357) واشر لاستیکی، واشر حلقوی
358) Gasket	(358) واشر
359) Gear	(359) چرخ دنده
360) Groove clearance	(360) خلاصی شیار
361) Groove width	(361) عرض شیار
362) Guide	(362) راهنما
363) Gear type oil pump	(363) اویل پمپ دنده ای
364) Ground	(364) اتصال بدنه
365) Gas flow	(365) وجریان گاز
366) Gasoline vapor	(366) بخار بنزین
367) Graphite seal	(367) درز گیر گرافیتی
368) Governor vent screw	(368) پیچ هوا گیری محفظه ی رگلاتور
369) Gear pump	(369) پمپ دنده ای
370) Governor	(370) رگلاتور
371) Generator	(371) تولید کننده ی برق
372) Gap	(372) فاصله ی دهانه ی شمع
373) Ground	(373) اتصال بدنه
374) Gear teeth	(374) دندانه های چرخ دنده
375) Gear shift	(375) تعویض دنده
376) Gear ratio	(376) نسبت دنده ها
377) Governor	(377) تنظیم کننده
378) Gas	(378) گاز
379) Gasoline	(379) بنزین

380) Ground clearance	(380) فاصله ی بین شاسی و زمین
381) Glazing	(381) شیشه ای شدن، آینه ای شدن
382) Glass	(382) شیشه
383) Helix	(383) شیار مارپیچ
384) Horn system	(384) مدار بوق
385) Horns	(385) بوق
386) Hex nut	(386) مهره ی شش گوش
387) Hazard flasher	(387) اتوماتیک راهنما
388) Helical spring	(388) فنر مارپیچی
389) Hydraulic line	(389) لوله ی روغن
390) High gear	(390) دنده سبک
391) Hydraulic pump	(391) پمپ هیدرولیکی
392) Height sensor	(392) سنسور ارتفاع
393) Hanger bracket	(393) تکیه گاه فنر به شاسی
394) Housing	(394) پوسته، محفظه
395) Humidity control	(395) کنترل رطوبت



23/01/2017

## Experiment no. 1

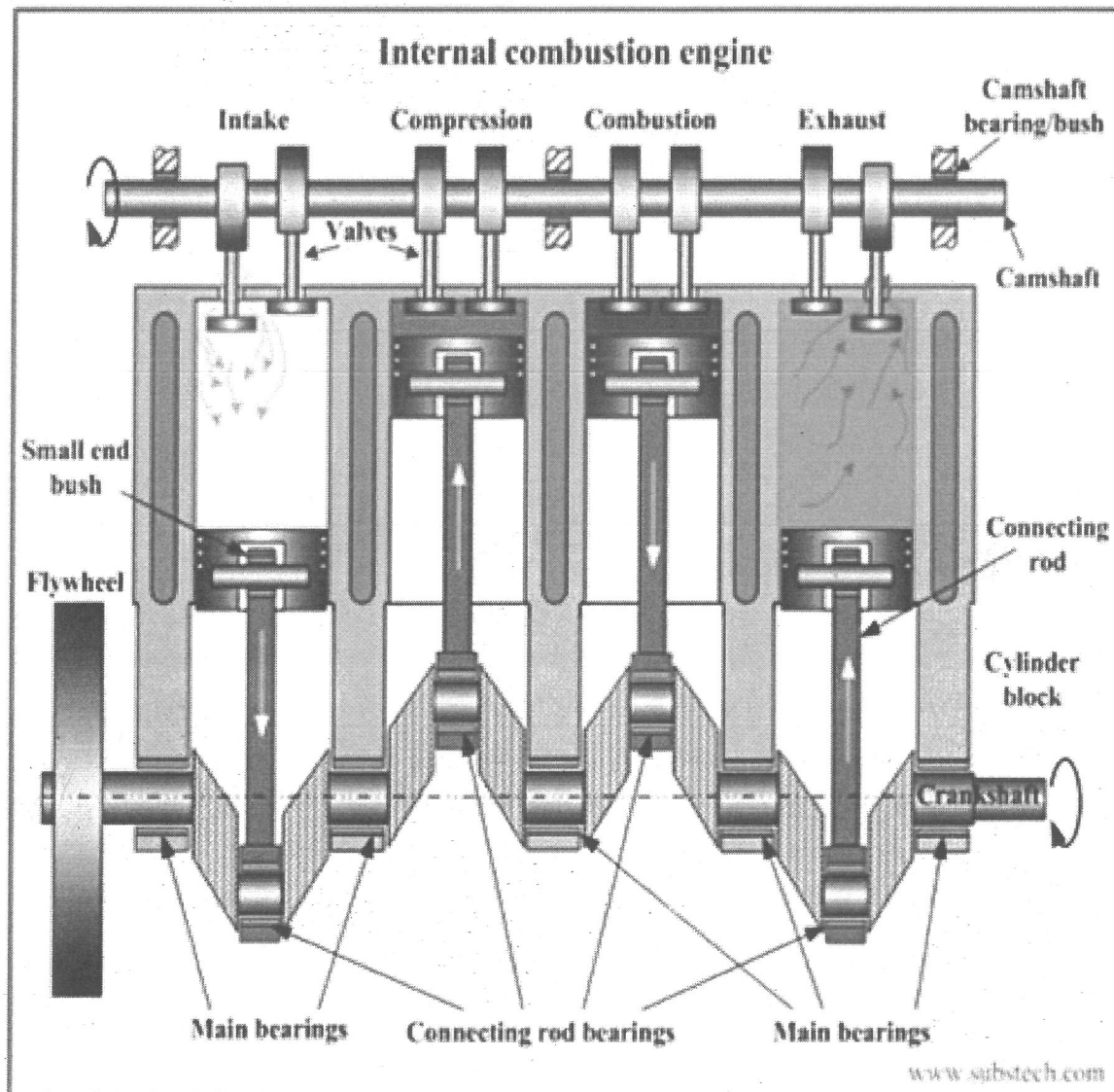
Date: - 23/01/2017

### Objective: -

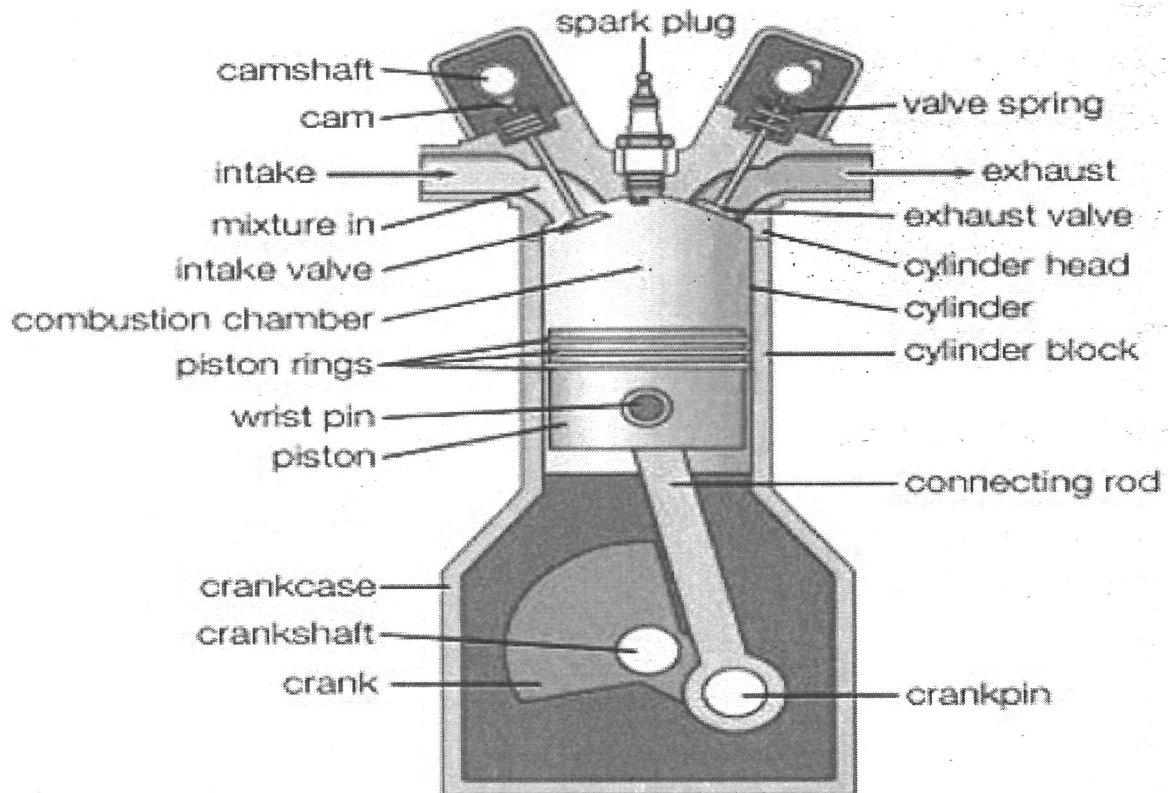
To study the different component of Internal Combustion Engine.

### Apparatus Required: -

Model of Internal Combustion Engine



P.I.T.

**Theory: -****COMPONENTS OF INTERNAL COMBUSTION ENGINE**

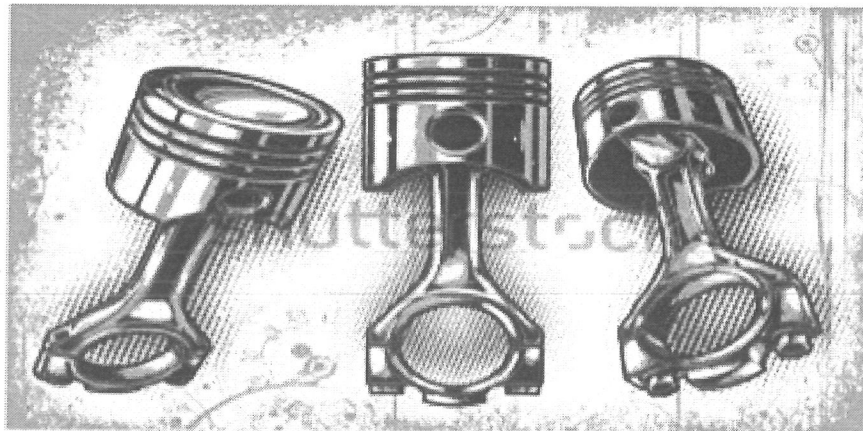
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**Engine Cylinder:-** Cylinder is the main body of IC engine. Cylinder is a part in which the intake of fuel, compression of fuel and burning of fuel take place. The main function of cylinder is to guide the piston. It is in direct contact with the products of combustion so it must be cooled. For cooling of cylinder a water jacket (for liquid cooling used in most of cars) or fin (for air cooling used in most of bikes) are situated at the outer side of cylinder. At the upper end of cylinder, cylinder head and at the bottom end crank case is bolted. The upper side of cylinder consists of a combustion chamber where fuel burns. To handle all this pressure( $50 \text{ kg/cm}^2$ ) and temperature(more than  $2000^\circ\text{C}$ ) generated by

P.I.T.



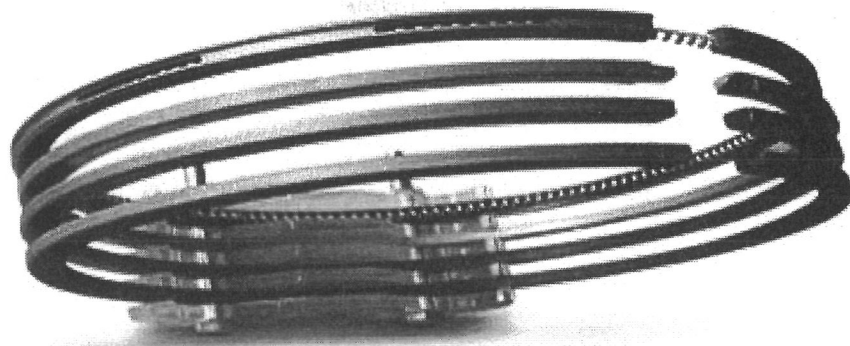
**Piston:** - Piston is considered as the heart of an I.C. Engine. It is fitted to each cylinder as a face to receive gas pressure and transmit the thrust to the connecting rod. It is the prime mover in the engine. The main function of piston is to give tight seal to the cylinder through bore and slide freely inside of cylinder. Piston should be light and sufficient strong to handle the gas pressure generated by combustion of fuel. So the piston is made by aluminum alloy and sometimes it is made by cast iron because light alloy piston expands more than cast iron so they need more clearances to the bore.



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**Piston Rings:** - A piston must be a fairly loose fit in the cylinder so it can move freely inside the cylinder. If the piston is too tight fit, it would expand as it got hot and might stick tight in the cylinder and if it is too loose it would leak the vapor pressure. To provide a good sealing fit and less friction resistance between the piston and cylinder, pistons are equipped with piston rings. These rings are fitted in grooves which have been cut in the piston. They are split at one end so they can expand or slipped over the end of piston. A small two stroke engine has two piston rings to provide good sealing but in a four stroke engine has an extra ring which is known as oil ring. Piston rings are made of cast iron of fine grain and high elastic material which is not affected by the working heat. Sometimes it is made by alloy spring steel.

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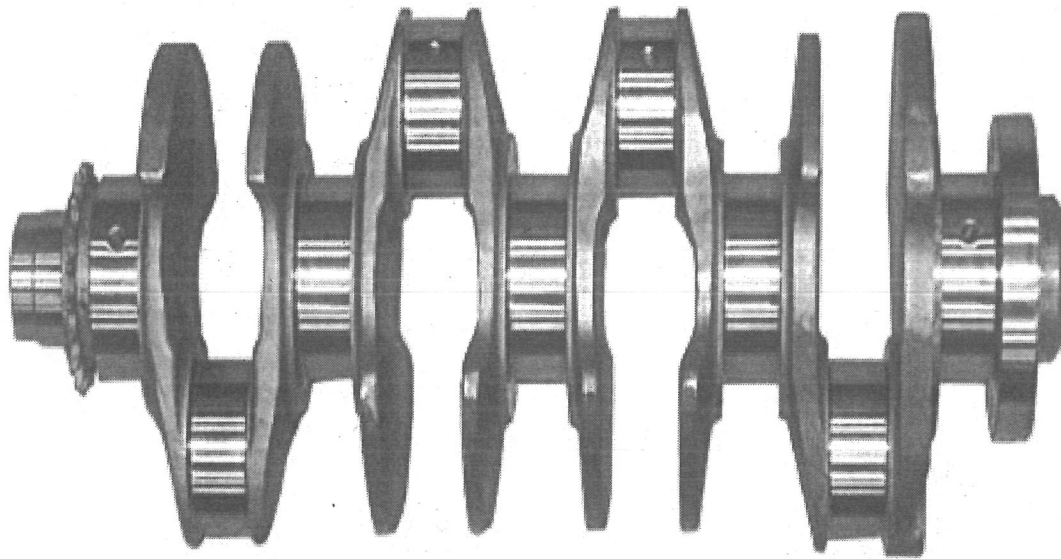


**Connecting Rod:** - Connecting rod connects the piston to crankshaft and transmits the motion and thrust of piston to crankshaft. It converts the reciprocating motion of the piston into rotary motion of crankshaft. There are two end of connecting rod one is known as big end and other as small end. Big end is connected to the crankshaft and the small end is connected to the piston by use of piston pin. The connecting rods are made of nickel, chrome, and chrome vanadium steels. For small engines the material may be aluminum.



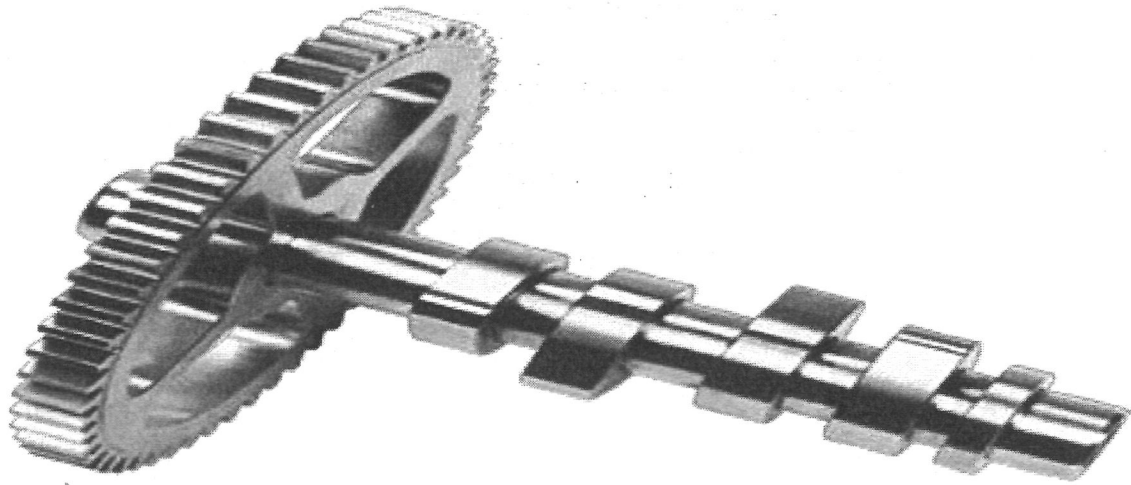
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**Crank Shaft:** - The crankshaft of an internal combustion engine receives the efforts or thrust supplied by piston to the connecting rod and converts the reciprocating motion of piston into rotary motion of crankshaft. The crankshaft mounts in bearing so it can rotate freely. The shape and size of crankshaft depends on the number and arrangement of cylinders. It is usually made by steel forging, but some makers use special types of cast-iron such as spheroidal graphitic or nickel alloy castings which are cheaper to produce and have good service life.

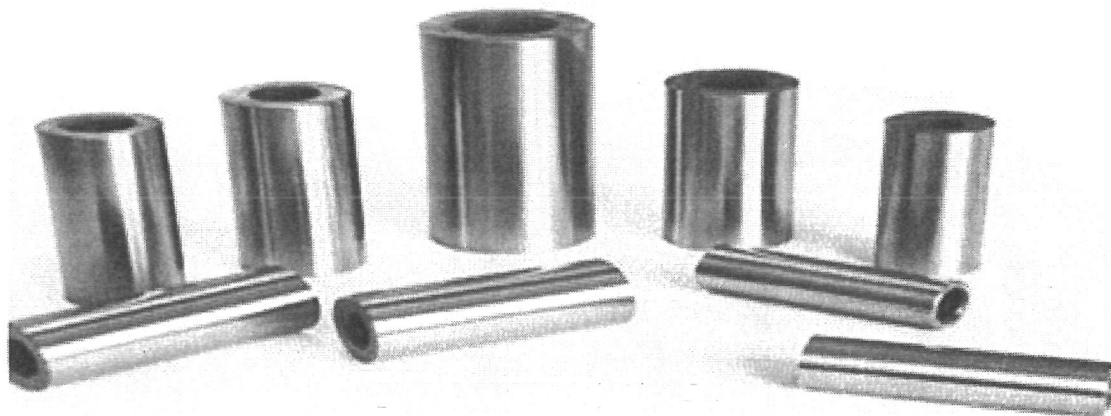


**Cam Shaft:** - Camshaft is used in IC engine to control the opening and closing of valves at proper timing. For proper engine output inlet valve should open at the end of exhaust stroke and closed at the end of intake stroke. So to regulate its timing, a cam is use which is oval in shape and it exerts a pressure on the valve to open and release to close. It is driven by the timing belt which drives by crankshaft. It is placed at the top or at the bottom of cylinder. It takes driving force from crankshaft through gear train or chain and operates the inlet valve as well as exhaust valve with the help of cam followers, push rods and rocker arms.

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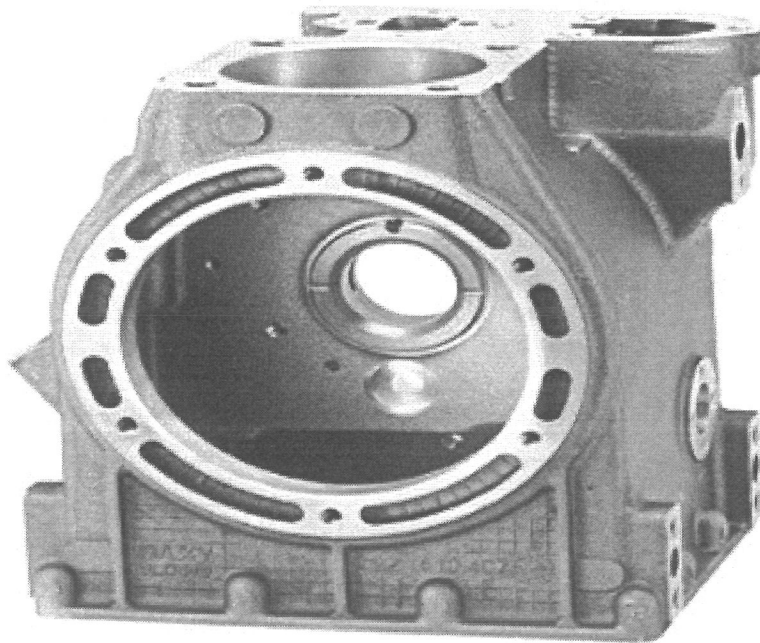


**Gudgeon Pin:** - These are hardened steel parallel spindles fitted through the piston bosses and the small end bushes or eyes to allow the connecting rods to swivel. It connects the piston to connecting rod. It is made hollow for lightness. It is made of steel.



**Crank Case:** - The main body of the engine to which the cylinder are attached and which contains the crankshaft and crankshaft bearing is called crankcase. It serves as the lubricating system too and sometime it is called oil sump. All the oil for lubrication is placed in it.

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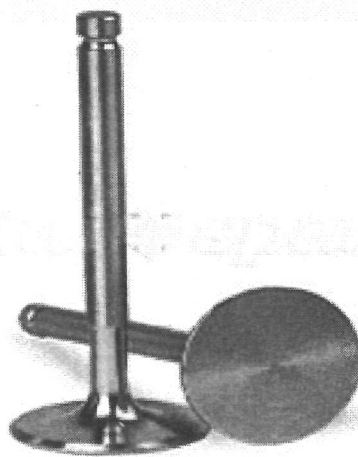


**Fly wheel:** - Fly wheel is a rotating mass used as an energy storing device. A flywheel is secured on the crankshaft. The main function of flywheel is to rotate the shaft during preparatory stroke. It also makes crankshaft rotation more uniform. It is done by storing excess energy during the power strokes, which is returned during other strokes.

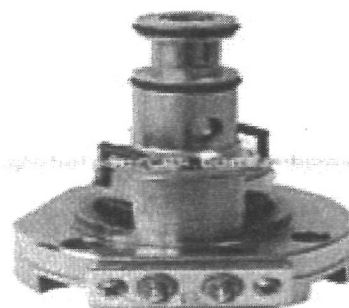


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**Intake & Exhaust valves:** - To control the inlet and exhaust of internal combustion engine, valves are used. The number of valves in an engine depends on the number of cylinders. Two valves are used for each cylinder one for inlet of air-fuel mixture inside the cylinder and other for exhaust of combustion gases. The valves are fitted in the port at the cylinder head by use of strong spring. This spring keep them closed. Both valves usually open inwards.

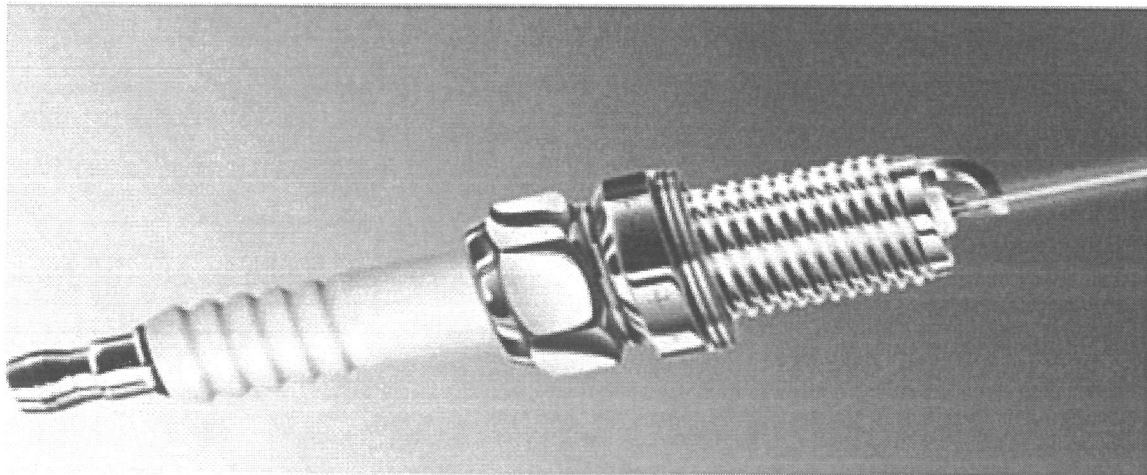


**Governor:** - As the name indicates, it controls the speed of engine by controlling the fuel supply. It controls the speed of engine at a different load by regulating fuel supply in diesel engines. In petrol engines, supplying the mixture of air-petrol and controlling the speed at different load conditions.

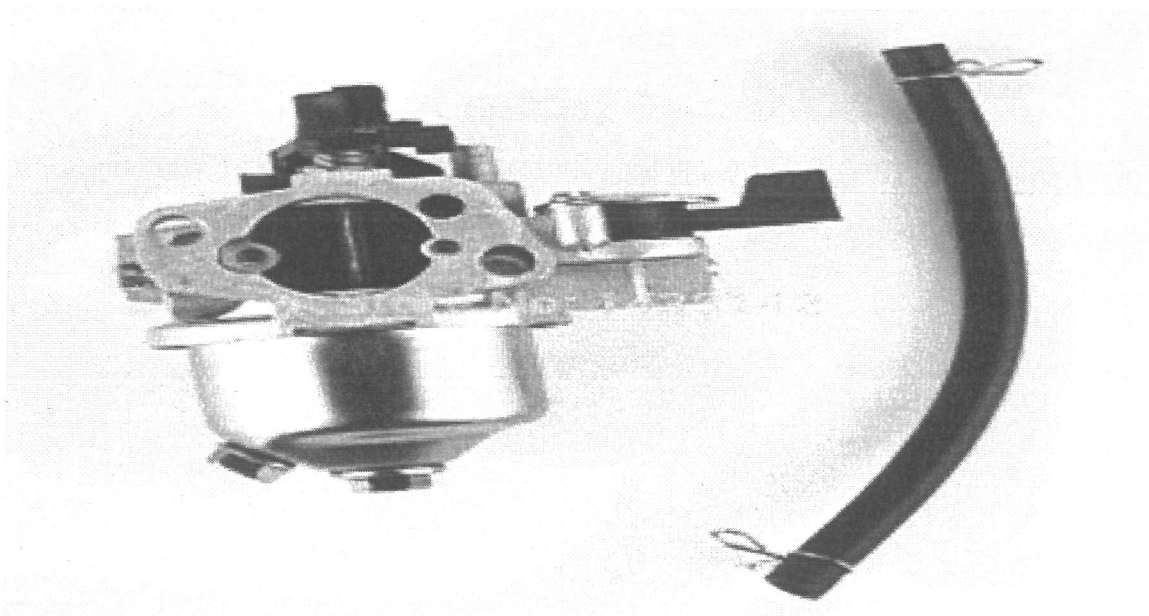




**Spark plug:** - It is used in petrol engine only. The main function of a spark plug is to ignite the compressed air fuel mixture. It is fitted on cylinder head. The spark plug consists of a metal shell having two electrodes which are insulated from each other with an air gap.

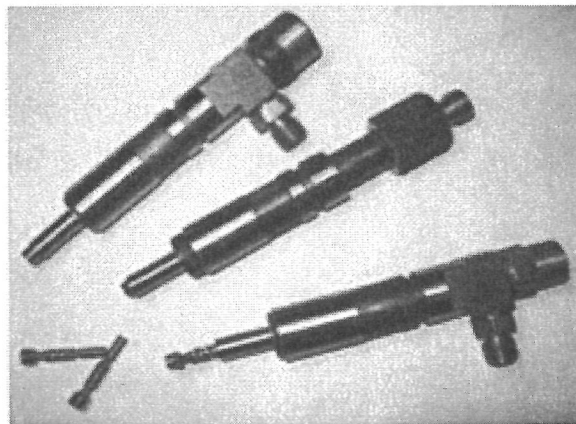


**Carburetor:** - It is a small but the important part of engine. It converts petrol in fine spray and mixes with air in proper ratio as per requirement of engine. The working life and performance of engine is mostly dependent on the carburetor.

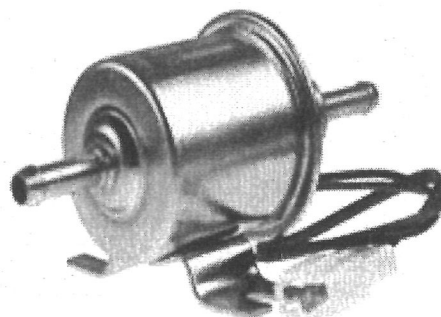


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**Fuel Injector:** - Injector is usually used in compression ignition engine. It sprays the fuel into combustion chamber at the end of compression stroke. It is fitted on cylinder head. Fuel injection is a system for mixing fuel with air in an internal combustion engine. It has become the primary fuel delivery system, which is used in automotive petrol engines. The primary difference between carburetors and fuel injection is that fuel injection atomizes the fuel by forcibly pumping it through a small nozzle under high pressure, while a carburetor relies on low pressure created by intake air rushing through it to add the fuel to the airstream. The fuel injector is only a nozzle and a valve: the power to inject the fuel comes from a pump or a pressure container farther back in the fuel supply.



**Fuel Pump:** - It is an important part of fuel supply system, which supplies petrol to the carburetor by sucking from the fuel tank.



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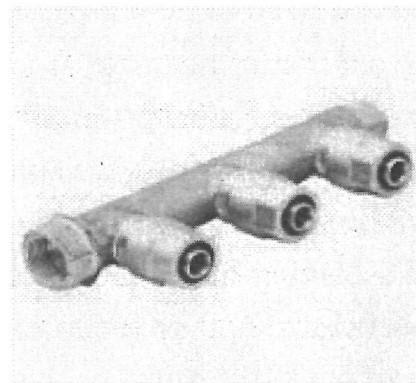
**Engine bearing:** - Everywhere there is rotary action in the engine, bearings need. Bearings are used to support the moving parts. The crankshaft is supported by bearing. The connecting rod big end is attached to the crank pin on the crank of the crankshaft by a bearing. A piston pin at the rod small end is used to attach the rod to the piston, also rides in bearings. The main function of bearings is to reduce friction between these moving parts. In an IC engine sliding and rolling types of bearing used. The sliding type bearing which are sometime called bush is use to attach the connecting rod to the piston and crankshaft. They are split in order to permit their assembly into the engine. The rolling and ball bearing is used to support crankshaft so it can rotate freely. The typical bearing half is made of steel or bronze back to which a lining of relatively soft bearing material is applied.



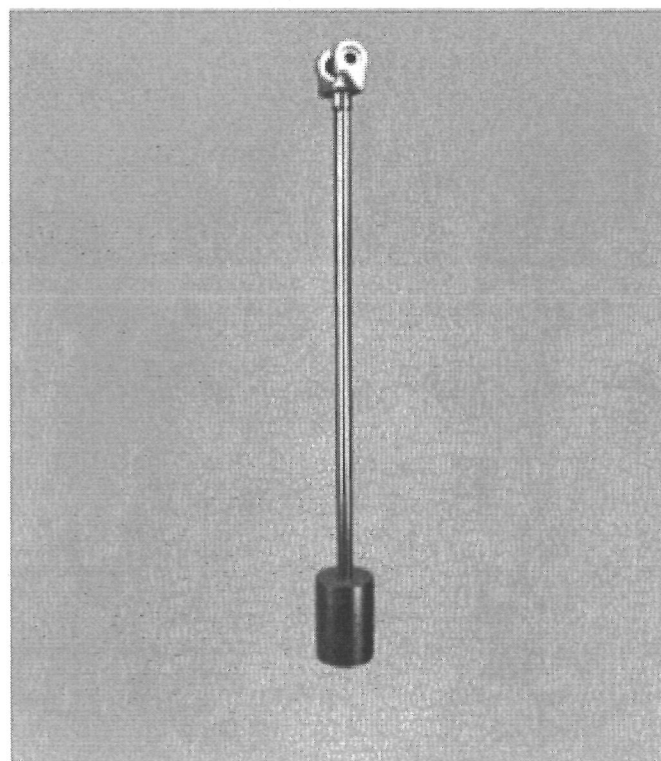
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**Manifold:** - The main function of manifold is to supply the air fuel mixture and collects the exhaust gases equally form all cylinder. In an internal combustion engine two manifold are used, one for intake and other for exhaust. They are usually made by aluminum alloy.

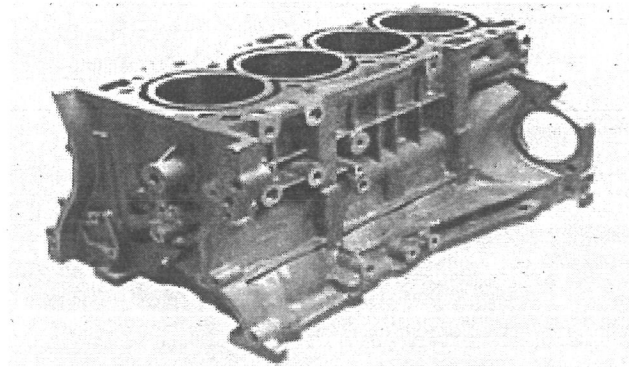


**Pushrod:** - Pushrod is used when the camshaft is situated at the bottom end of cylinder. It carries the camshaft motion to the valves which are situated at the cylinder head.

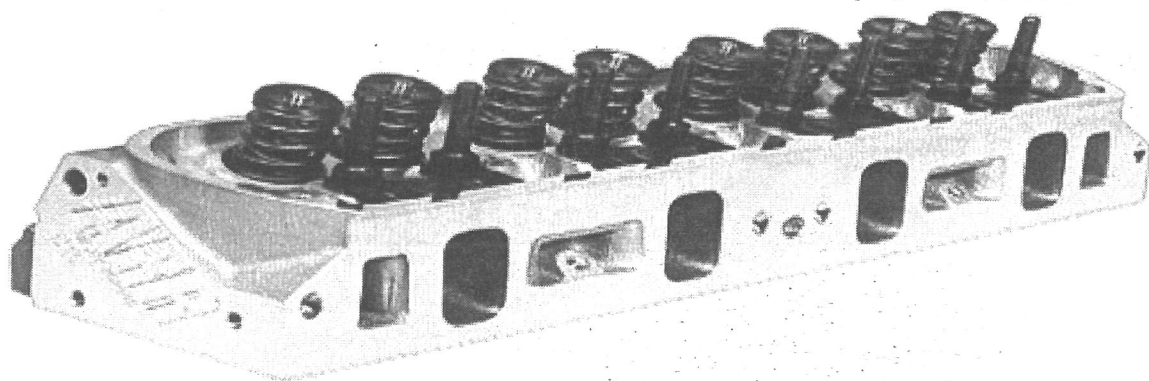


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combustion of fuel, cylinder material should have high compressive strength. So it is made by high grade cast iron. It is made by casting and usually cast in one piece.



**Cylinder Head:** - The top end of cylinder is closed by means of removable cylinder head. There are two holes or ports at the cylinder head, one for intake of fuel and other for exhaust. Both the intake and exhaust ports are closed by the two valves known as inlet and exhaust valve. The inlet valve, exhaust valve, spark plug, injector etc. are bolted on the cylinder head. The main function of cylinder head is to seal the cylinder block and not to permit entry and exit of gases on cover head valve engine. Cylinder head is usually made by cast iron or aluminum. It is made by casting or forging and usually in one piece.





## I.C. ENGINE

### Engine (Exploded View)

