Reamers types and uses

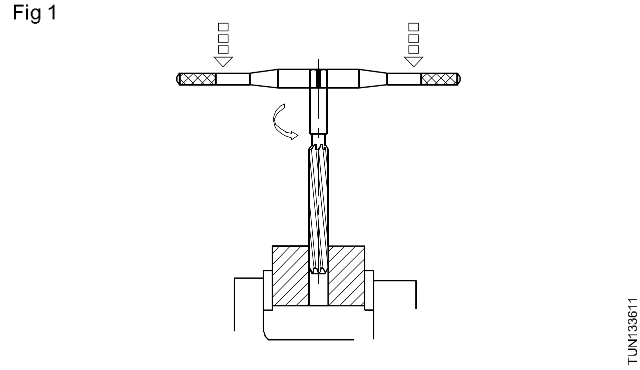
Objectives : At the end of this lesson you shall be able to

- **state the use of reamers**
- **state the advantages of reaming**
- **distinguish between hand and machine reaming**
- **name the elements of a reamer and state their functions.**

What is a reamer?

A reamer is a multi-point cutting tool used for enlarging by finishing previously drilled holes to accurate sizes.(Fig 1)

Fig 1



Advantages of 'reaming'

Reaming produces

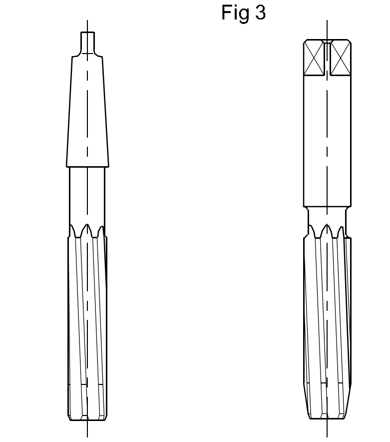
- high quality surface finish
- dimensional accuracy to close limits.

Also small holes which cannot be finished by other processes can be finished.

Classification of reamers

Reamers are classified as hand reamers and machine reamers. (Figs 2 and 3)

Fig 2 Fig 3



MACHINE REAMER HAND REAMER

Reaming by using hand reamers is done manually for which great skill is needed.

Machine reamers are fitted on spindles of machine tools and rotated for reaming.

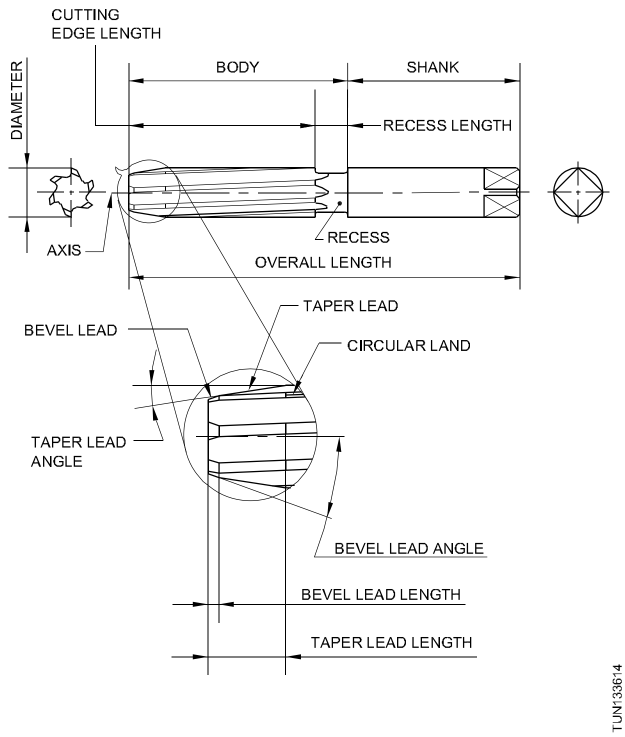
Machine reamers are provided with morse taper shanks for holding on machine spindles.

Hand reamers have straight shanks with 'square' at the end, for holding with tap wrenches. (Figs 2 & 3)

Parts of a hand reamer

The parts of a hand reamer are listed hereunder. Refer to Fig 4.

Fig 4



Axis

The longitudinal centre line of the reamer.

Body

The portion of the reamer extending from the entering end of the reamer to the commencement.

Recess

The portion of the body which is reduced in diameter below the cutting edges, pilot or guide diameters.

Shank

The portion of the reamer which is held and driven. It can be parallel or tapered.

Circular land

The cylindrically ground surface adjacent to the cutting edge on the leading edge of the land.

Bevel lead

The bevel lead cutting portion at the entering end of the reamer cutting its way into the hold. It is not provided with a circular land.

Taper lead

The tapered cutting portion at the entering end to facilitate cutting and finishing of the hole. It is not provided with a circular land.

Bevel lead angle

The angle formed by the cutting edges of the bevel lead and the reamer axis.

Taper lead angle

The angle formed by the cutting edges of the taper and the reamer axis.

Terms relating to cutting geometry flutes

The grooves in the body of the reamer to provide cutting edges, to permit the removal of chips, and to allow the cutting fluid to reach the cutting edges. (Fig 5)

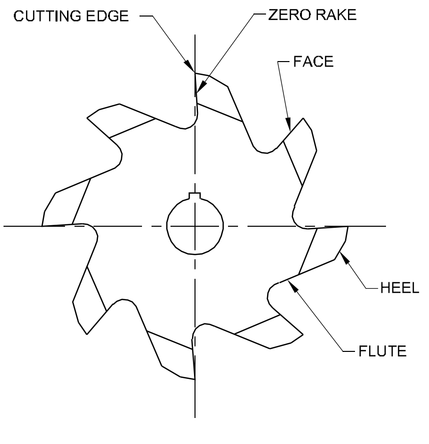
Heel

The edge formed by the intersection of the surface left by the provision of a secondary clearance and the flute. (Fig 5)

Cutting edge

The edge formed by the intersection of the face and the circular land or the surface left by the provision of primary clearance. (Fig 5)

Fig 5



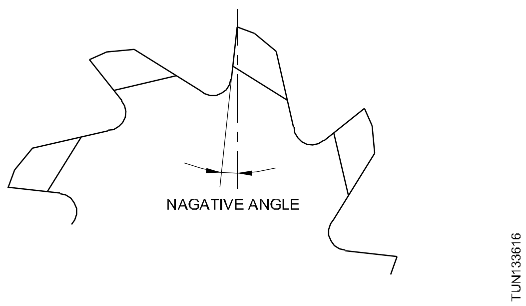
Face

The portion of the flute surface adjacent to the cutting edge on which the chip impinges as it is cut from the work. (Fig 5)

Rake angles

The angles in a diametral plane formed by the face and a radial line from the cutting edge. (Fig 6)

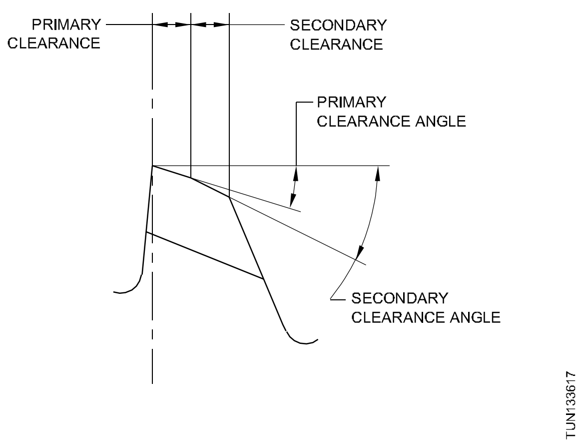
Fig 6



Clearance angle

The angles formed by the primary or secondary clearances and the tangent to the periphery of the reamer at the cutting edge. They are called primary clearance angle and secondary clearance angle respectively. (Fig 7)

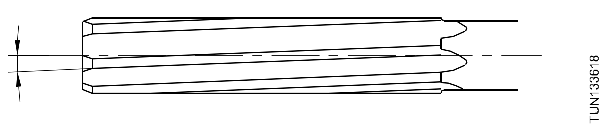
Fig 7



Helix angle

The angle between the edge and the reamer axis. (Fig 8)

Fig 8

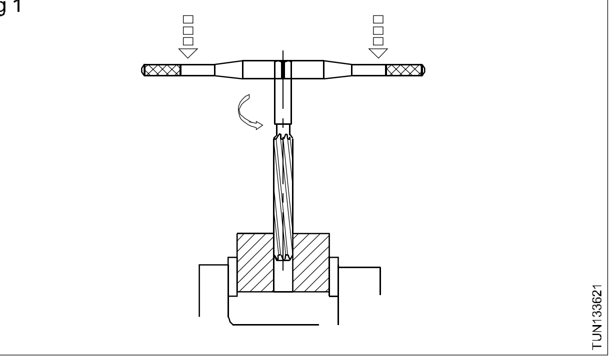


Hand reamers

Objectives : At the end of this lesson you shall be able to
- **state the general features of hand reamers**
- **identify the types of hand reamers**
- **distinguish between the uses of straight fluted and helical fluted reamers**
- **name the materials from which reamers are made and specify reamers.**

General features of hand reamers (Fig 1)

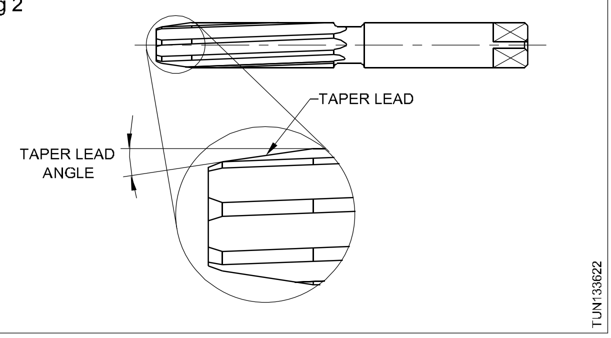
Fig 1



Hand reamers are used to ream holes manually using tap wrenches.

These reamers have a long taper lead.(Fig 2) This allows to start the reamer straight and in alignment with the hole being reamed.

Fig 2

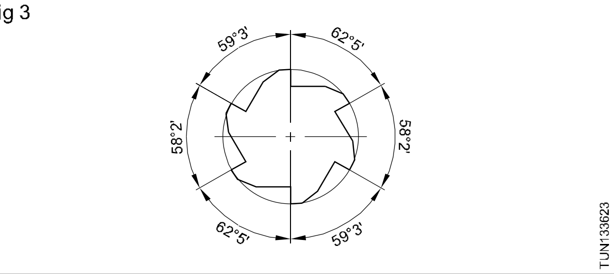


Most hand reamers are for right hand cutting.

Helical fluted hand reamers have left hand helix. The left hand helix will produce smooth cutting action and finish.

Most reamers, machine or hand, have uneven spacing of teeth. This feature of reamers helps to reduce chattering while reaming. (Fig 3)

Fig 3



Types, features and functions

Hand reamers with different features are available for meeting different reaming conditions. The commonly used types are listed here under.

Parallel hand reamer with parallel shank (Fig 4)

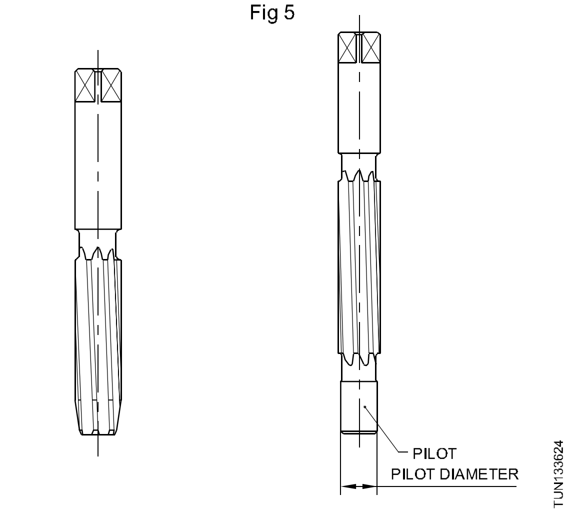
A reamer which has virtually parallel cutting edges with taper and bevel lead. The body of the reamer is integral with a shank. The shank has the nominal diameter of the cutting edges. One end of the shank is square shaped for tuning it with a tap wrench. Parallel reamers are available with straight and helical flutes. This is the commonly used hand reamer for reaming holes with parallel sides.

Reamers commonly used in workshop produce H8 holes.

Hand reamer with pilot (Fig 5)

For this type of reamer, a portion of the body is cylindrically ground to form a pilot at the entering end. The pilot keeps the reamer concentric with the hole being reamed.(Fig 3)

Fig 4 Fig 5



Socket reamer with parallel shank (Figs 6 and 7)

This reamer has tapered cutting edges to suit metric morse tapers. The shank is integral with the body, and is square shaped for driving. The flutes are either straight or helical. The socket reamer is used for reaming internal morse tapered holes.

Taper pin hand reamer (Fig 8)

This reamer has tapered cutting edges for reaming taper holes to suit taper pins. A taper pin reamer is made with a taper pin of 1 in 50. These reamers are available with straight or helical flutes.

Use of straight and helical fluted reamers (Fig 9)

Straight fluted reamers are useful for general reaming work. Helical fluted reamers are particularly suitable for reaming holes with keyway grooves or special lines cut into them. The helical flutes will bridge the gap and reduce binding and chattering.

Fig 6

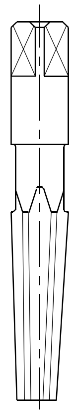
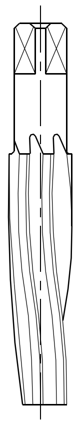
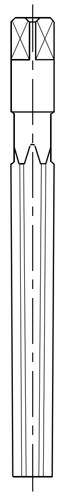


Fig 7



WITH HELICAL FLUTE

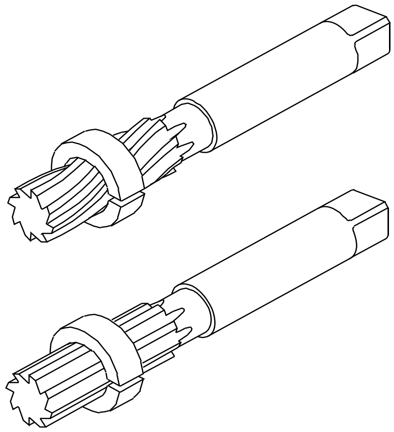
Fig 8



Material of hand reamers

When the reamers are made as a one-piece construction, high speed steel is used. When they are made as two-piece construction then the cutting portion is made of high speed steel while the shank portion is made of carbon steel. They are butt-welded together before manufacturing.

Fig 9



Specifications of a reamer

To specify a reamer the following data is to be given.

- Type
- Flute
- Shank end
- Size

Example

Hand reamer, straight flute, parallel shank of Ø 20 mm.

Drill size for reaming

Objectives : At the end of this lesson you shall be able to

- **determine the hole size for reaming.**

For reaming with a hand or a machine reamer, the hole drilled should be smaller than the reamer size.

The drilled hole should have sufficient metal for finishing with the reamer. Excessive metal will impose a strain on the cutting edge of the reamer and damage it.

Calculating drill size for reamer

A method generally practised in workshop is by applying the following formula.

Drill size = Reamed size – (Undersize + Oversize)

Finished size

Finished size is the diameter of the reamer.

Undersize

Undersize is the recommended reduction in size for different ranges of drill diameter. (See Table 1)

TABLE 1

Undersizes for reaming

Diameter of ready reamed hole (mm)	Undersize of rough bored hole (mm)
under 5	0.1.....0.2
5......20	0.2.....0.3
21....50	0.3.....0.5
over 50	0.5.....1

Oversize

It is generally considered that a twist drill will make a hole larger than its diameter. The oversize for calculation purposes is taken as 0.05 mm - for all diameters of drills. For light metals the undersize will be chosen 50% larger.

Example

A hole is to be reamed on mild steel with a 10 mm reamer. What will be the diameter of the drill for drilling the hole before reaming?

Drill size = Reamed size – (Undersize + Oversize)

(Reamed size)	=	10 mm
Undersize as per table	=	0.2 mm
Oversize	=	0.05 mm
Drill size	=	10 mm – 0.25 mm
	=	9.75 mm

Determine the drill hole sizes for the following reamers:

i 15 mm

ii 4 mm

iii 40 mm

iv 19 mm.

Answer

i ______________________________

ii ______________________________

iii ______________________________

iv ______________________________

Note

> **If the reamed hole is undersize, the cause is that the reamer is worn out.**

Always inspect the condition of the reamer before commencing reaming.

For obtaining good surface finish

> **Use a coolant while reaming. Remove metal chips from the reamer frequently. Advance the reamer slowly into the work.**

Defects in reaming - Causes and remedies

Reamed hole undersize

If a worn out reamer is used, it may result in the reamed hole being undersize. Do not use such reamers.

Always inspect the condition of the reamer before using.

Surface finish rough

The causes may be any one of the following or a combination thereof.

- Incorrect application
- Swarf accumulated in reamer flutes
- Inadequate flow of coolant
- Feed rate too fast

While reaming apply a steady and slow feed-rate.

Ensure a copious supply of the coolant.

Do not turn the reamer in the reverse direction.

Lubricant and coolant - types its necessity, system of lubrication, selection of coolant, handling & care

Objectives : At the end of this lesson you shall be able to
- **state what is cutting fluid**
- **state the function of cutting fluids & their advantages**
- **state the properties of a good cutting fluid**
- **list the different types of cutting fluids**
- **select appropriate cutting fluids for different materials.**

Cutting fluids and compounds are the substances used for efficient cutting while cutting operations take place.

Functions

The functions of cutting fluids are:

- to cool the tool as well as the workpiece
- to reduce the friction between the chip and the tool face by lubricating
- to prevent the chip from getting welded to the tool cutting edge
- to flush away the chips
- to prevent corrosion of the work and the machine.

Advantages

As the cutting fluid cools the tool, the tool will retain its hardness for a longer period; so the tool life is more.

Because of the lubricating function, the friction is reduced and the heat generated is less. A higher cutting speed can be selected.

As the coolant avoids the welding action of the chip to the tool-cutting edge, the built up edge is not formed. The tool is kept sharp and a good surface finish is obtained.

As the chips ar flushed away the cutting zone will be neat.

The machine or job will not get rusted because the coolant prevents corrosion.

Properties of a good cutting fluid

A good cutting fluid should be sufficiently viscous.

At cutting temperature, the coolant should not catch fire.

It should have a low evaporation rate.

It should not corrode the workpiece or machine.

It must be stable and should not foam or fume.

It should not create any skin problems to the operator.

Should not give off bad smell or cause itching etc. which are likely to irritate the operator, thus reducing his efficiency.

Should be transparent.

Types of cutting fluids

The following are the common cutting fluids.

- Straight mineral oil
- Chemical solution (synthetic fluids)
- Compounded or blended oil
- Fatty oils
- Soluble oil (Emulsified oil-suds)

Straight mineral oil

Straight mineral oils are the coolants which can be used undiluted. Use of straight mineral oil as a coolants has the following disadvantages.

It gives off a cloud of smoke.

It has little effect as a cutting fluid.

Hence straight mineral oils are poor coolants. But kerosene which is a straight mineral oil is widely used as a coolant for machining aluminium and its alloys.

Chemical solution (Synthetic oil)

These consist of carefully chosen chemicals in dilute solution with water. They possess a good flushing and a good cooling action, and are non-corrosive and non-clogging. Hence they are widely used for grinding and sawing. They do not cause infection and skin trouble. They are artificially coloured.

Compounded or blended oil

These oils are used in automatic lathes. These oils are much cheaper and have more fluidity than fatty oil.

Fatty oil

Lard oil and vegetable oil are fatty oils. They are used on heavy duty machines with less cutting speed. They are also used on bench-works for cutting threads by taps and dies.

Soluble oil (Emulsified oil)

Water is the cheapest coolant but it is not suitable because it causes rust to ferrous metals. An oil called soluble oil is added to water which gets a non-corrosive effect with water in the ratio of about 1:20. It dissolves in water giving a white milky solution. Soluble oil is an oil blend mixed with an emulsifier.

Other ingredients are mixed with the oil to give better protection against corrosion, and help in the prevention of skin irritations.

Soluble oil is generally used as a cutting fluid for centre lathes, drilling, milling and sawing.

Soft soap and caustic soda serve as emulsifying agents.

A chart showing coolants for different metals is given below.

Recommended Cutting Fluids for Various Metals and Different Operations

Material	Drilling	Reaming	Threading	Turning	Milling
Aluminium	Soluble oil Kerosene Kerosene and lard oil	Soluble oil Kerosene Mineral oil	Soluble oil Kerosene Lard oil	Soluble oil	Soluble oil Lard oil Mineral oil Dry
Brass	Dry Soluble oil Mineral oil Lard oil	Dry Soluble oil	Soluble oil Lard oil	Soluble oil	Dry Soluble oil Mineral oil Lard oil
Bronze	Dry Soluble oil Mineral oil Lard oil	Dry Soluble oil	Soluble oil Lard oil	Soluble oil	Dry Soluble oil Mineral oil Lard oil
Cast Iron	Dry Air jet	Dry Soluble oil	Dry Sulphurized oil	Dry Soluble oil	Dry Soluble oil
Copper	Dry Soluble oil	Soluble oil Lard oil	Soluble oil Lard oil	Soluble oil	Dry Soluble oil
Steel alloys	Soluble oil Sulphurized oil Mineral lard oil	Soluble oil Sulphurized oil Mineral lard oil	Sulphurized oil Lard oil	Soluble oil	Soluble oil Mineral
General purpose steel	Soluble oil Sulphurized oil Lard oil Mineral lard oil	soluble oil Sulphurized oil Lard oil	Sulphurized oil Lard oil	Soluble oil	Soluble oil Lard oil

Methods of applying lubricant

Objectives : At the end of this lesson you shall be able to
- **name the different methods of lubrication**
- **state the gravity feed methods of applying lubrication**
- **state the splash methods of applying lubrication**
- **name the different types of lubricators**
- **distinguish between the different methods of lubrication.**

The following methods are used for efficient lubrication

- Gravity feed method
- Force feed method
- Splash method

Gravity feed method

There are numerous ways of employing this principle, varying from the simple oil hole to the more elaborate wick and glass-sided drip feed lubricators in which the flow of the oil may be controlled and observed through the glass. A selection of these lubricators is shown in Fig 1.

Force (Pressure) feed method

There are various systems of lubrication employing a pressure feed to the lubricant, and the most important of such systems may be classified roughly into the following.

- Continuous feed of oil under pressure to each bearing concerned. In this method an oil pump driven by the machine delivers oil to the bearings and back to a sump from which it is drawn by the pump.
- Pressure feed by hand pump in which a charge of oil is delivered to each bearing at intervals (once or twice a day) by the machine operator. (Fig 2)
- Oil or grease gun method. The oil hole leading to each bearing is fitted with a nipple and by pressing the nose of the gun against this the lubricant is forced into the bearing. (Figs 3a, b, c & d)

Fig 1

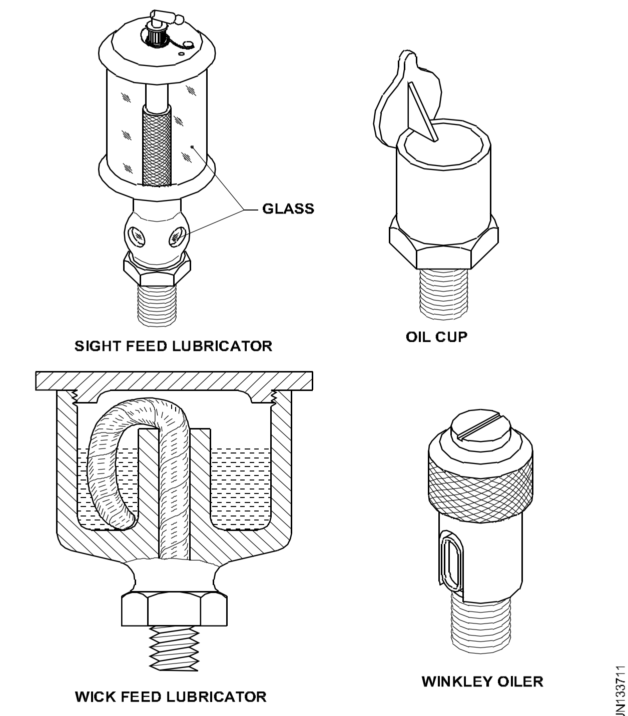
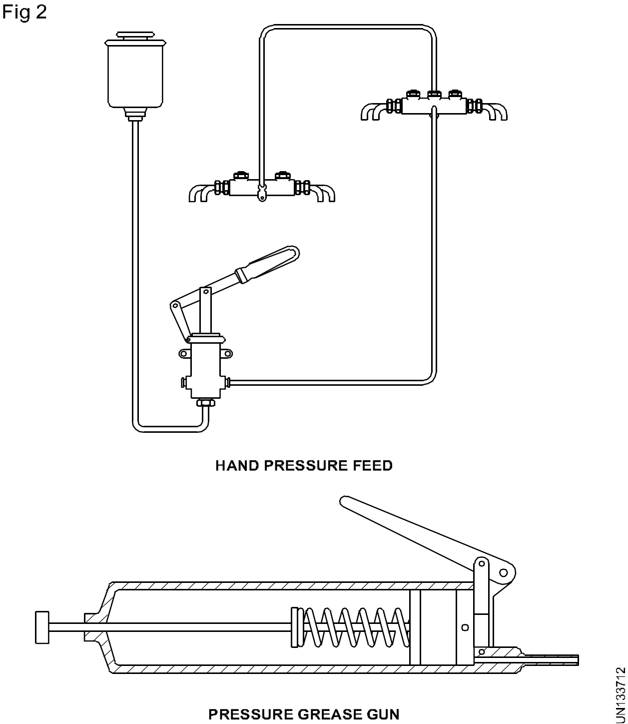


Fig 2



Splash method

In this method the shaft, or something attached to it, actually dips into the oil and a stream of lubricant is continually splashed round the parts requiring lubrication. This method is employed for the gears and bearings inside all gear drives, the lower parts of the gears actually dipping in the oil. (Figs 4a, b and c)

A common method of employing splash lubrication is known as 'ring oiling.'

Handling and Care:-

Fig 3

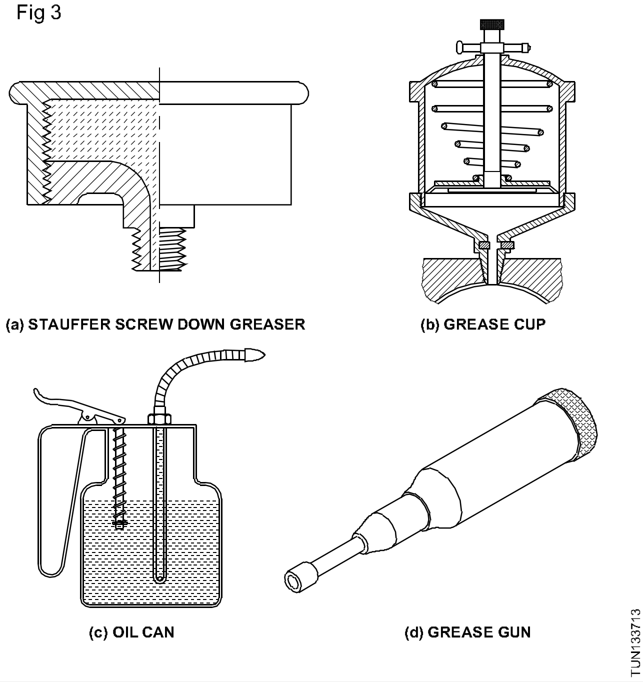
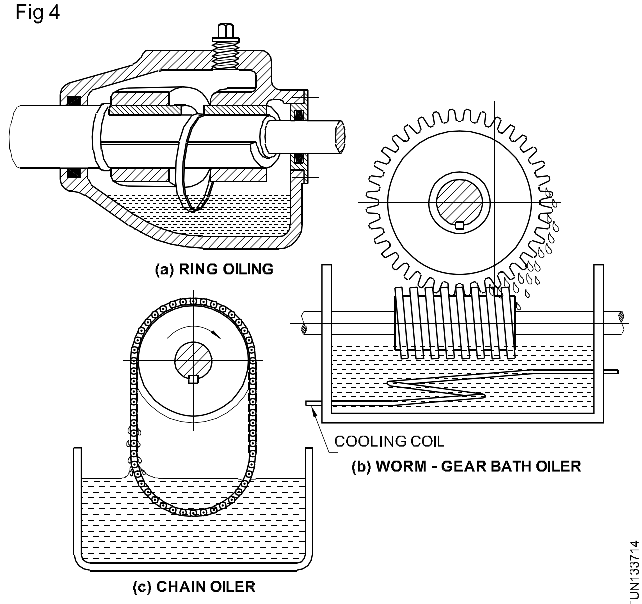


Fig 4



1. Stored in clean and dry location
2. Storage temperature should remain moderate at all times.
3. Lubricants in storage should be located away from all types of Industrial contamination including dust and humidity.
4. Brings must be kept tight at all times and drum covers should be used when ever drums are stored in the up right position.
5. Lubricants are stored in the horizontal position on proper storage racks allowing the containers to be rotate and used on as first - in first out basis.
6. Eliminate confusion with proper labeling.
7. Be sure that the proper transfer equipment and procedure are employed for that specific lubricants.