CHAPTER 4

NON-MOTORISED SPRAYERS

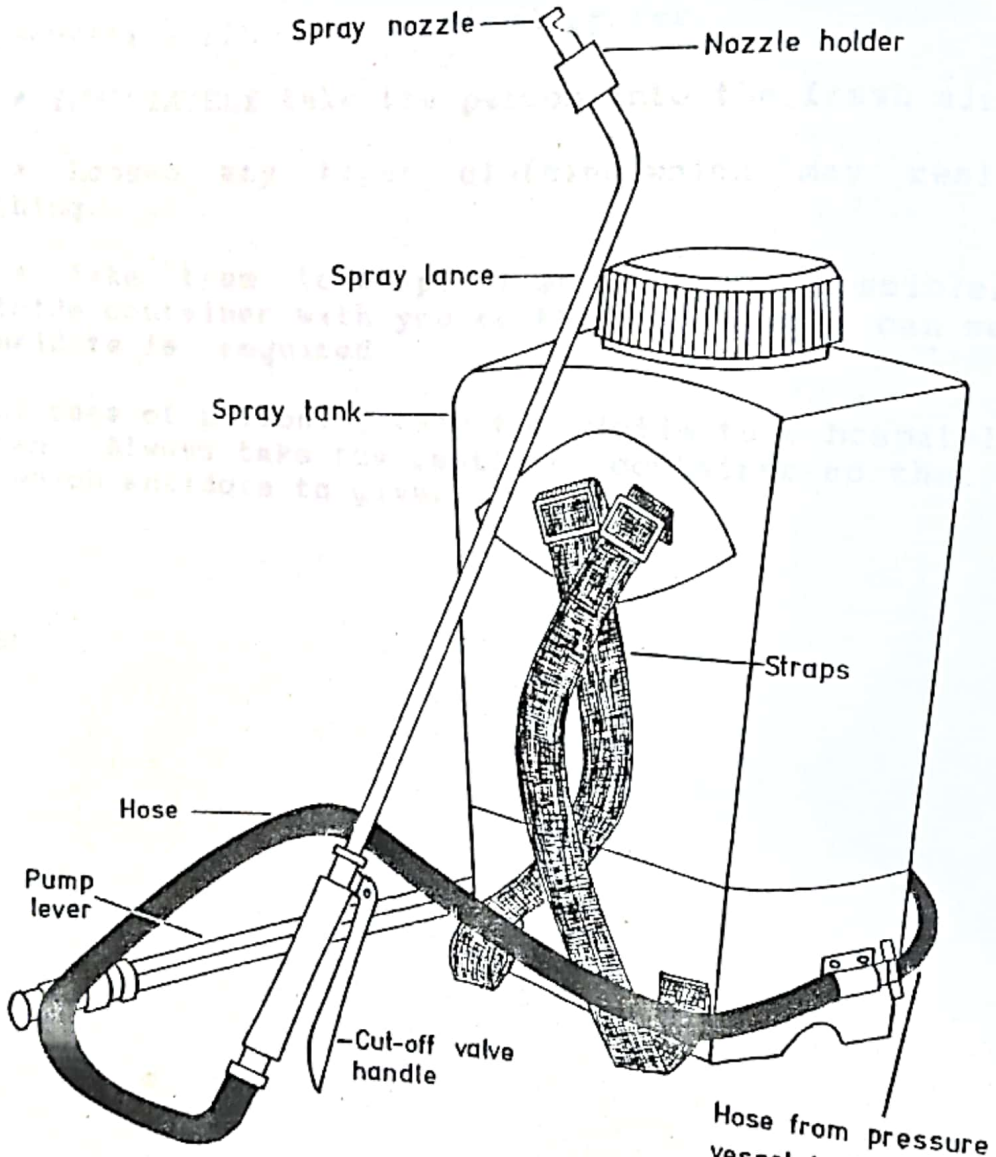

FIGURE 12 A GENERALISED LEVER-OPERATED SPRAYER

A sprayer is a piece of machinery which is used to spread mixed pesticide over a pest target. The target may be a weed, crop, insect or disease. It is the purpose of the sprayer to change the liquid in the tank into spray droplets so that the pesticide is spread evenly over the target area. In the following chapters different types of spraying equipment will be considerd. Non-motorised sprayers (this chapter), motorised knapsack sprayers (Chapter 5) and ultra low volume and electrostatic sprayers (Chapter 6).

The subjects discussed in this chapter are described more fully in the booklet "Non-motorised Hydraulic Energy Sprayers" (see book list page 148). The basic components of a typical knapsack sprayer are shown in Figure 12.

4.1 Nozzles

The nozzle of the sprayer is where the spray cloud is actually formed and is probably the most important part of the machine. The nozzle also regulates the rate at which the spray leaves the sprayer, this is known as the **FLOW RATE.**

There are three types of nozzle (see Figure 13). All three types need the pressure developed by the sprayer pump to make the spray cloud. The pressure is known as **HYDRAULIC PRESSURE** because it is liquid under pressure. The same types of nozzles are fitted to tractor sprayers and some knapsack and portable sprayers with engine driven pumps. **ANY** sprayer which has a system for **PRESSURISING** or **PUMPING** spray liquid uses **HYDRAULIC ENERGY NOZZLES.** They are the single most important type of agricultural nozzle.

The speed at which the pump of the sprayer is worked determines the pressure developed. **A HIGH PRESSURE** is made by **FAST** pumping and a **LOW PRESSURE** by **SLOW** pumping.

The higher the pressure:

- the smaller the spray droplets
- the higher the flow rate
- the wider the spray angle at the nozzle

The opposite occurs if the pressure is low. A slow pumping rate gives low pressure, larger droplets, lower flow rate and a smaller angle of spray at the nozzle.

This is a **VERY IMPORTANT** characteristic of knapsack sprayers and their nozzles, because **LARGE DROPLETS** are used for **HERBICIDES** and **SMALLER** droplets for **INSECTICIDES** and **FUNGICIDES.** When using knapsack sprayers and their nozzles it is important to maintain a steady pumping rate so that the flow rate, spray angle and droplet size remain fairly constant.

CONE NOZZLES - This type of nozzle is made up of two parts. The nozzle tip and a core (or swirl plate). They are usually separate but in some cases may be combined as a single part. In all cases droplet formation occurs in the same way.

Pressurised liquid from the sprayer tank approaches the core. Bored through the core, or around the thread at the nozzle tip if this is acting as the core, are slanted holes or a groove. There many be one or several. The core does not move, but the liquid is forced through the holes into a small chamber immediately behind the nozzle tip. This chamber is known as the **SWIRL CHAMBER.** The

angle of the holes in the core causes the water to move around the swirl chamber in a circular motion. As it comes out of the nozzle tip a cone-shaped pattern of spray is formed. There is no spray in the centre of the cone because of the circular motion which forms it. This type of nozzle is refered to as a **HOLLOW CONE** nozzle. If the core has a central hole so that the centre of the spray cone is filled with liquid, the nozzle is refered to as a **SOLID CONE** nozzle.

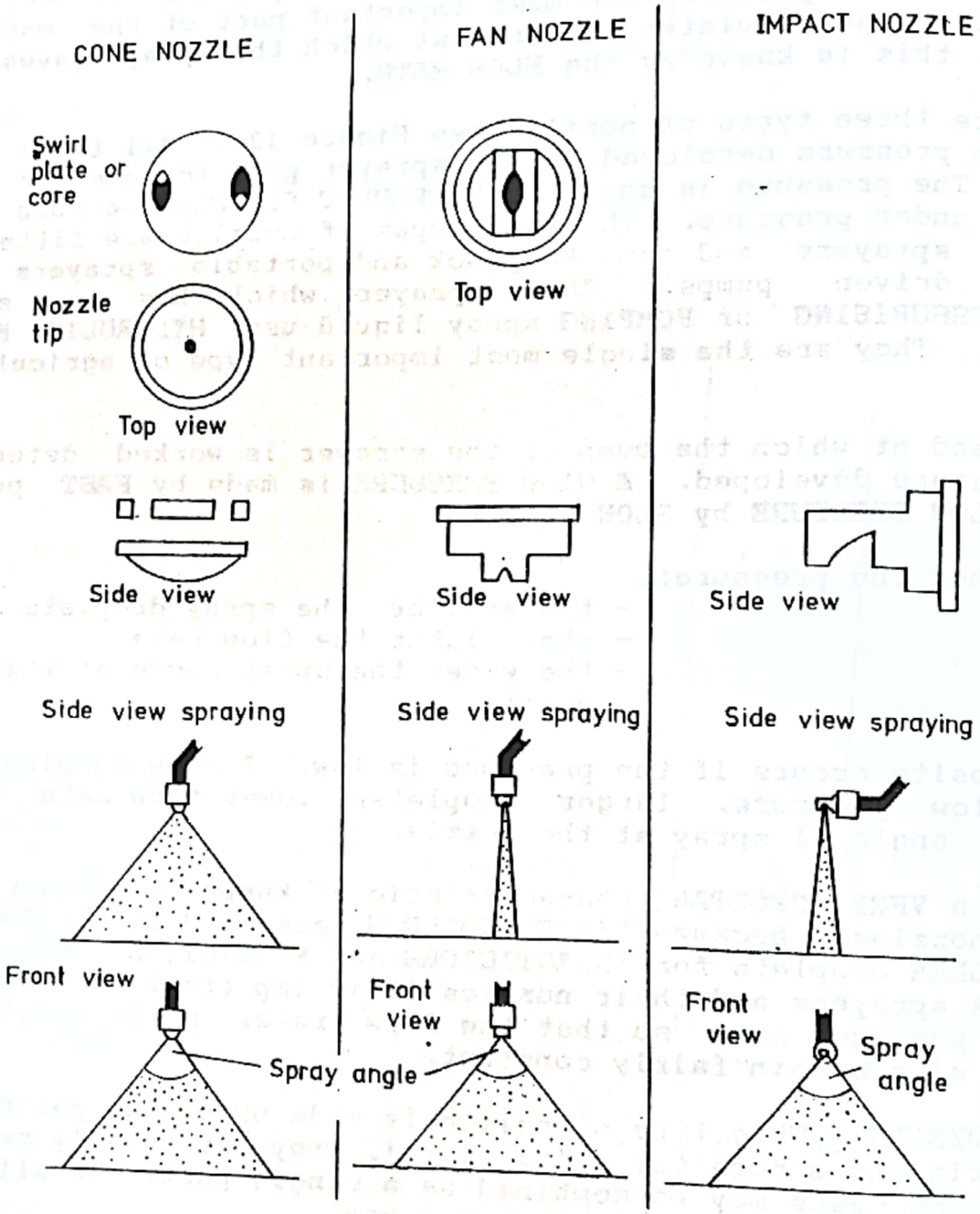

FIGURE 13 THREE TYPES OF SPRAY NOZZLE

The nozzle size controls the amount of liquid sprayed. Pressure also has an effect. For cone nozzles the flow may be adjusted by using a larger (or smaller) nozzle tip hole or by selecting a core with more (or fewer) holes in it. The angle of the cone also

varies with different types of cores and nozzle tips, and always increases with an increase in pressure (equal to an increase in the rate of pumping).

Cone nozzles operate at between 40-60 pound per square inch (psi). Cone nozzles, whether hollow or solid, are the type best suited for spraying crops because they produce a spray in which droplets approach the leaves from several angles, unlike the fan nozzles described below.

FAN NOZZLES - This type of nozzle is composed of a single element, the nozzle tip. The shape of the hole is responsible for the shape of the spray and the spray angle. The hole is rectangular or lens shaped and the pressurised liquid is forced through it giving a narrow lens shaped pattern. As with cone nozzles, the size of the nozzle hole affects the flow rate and the angle of spray. The most suitable size can be selected by referring to manufacturers' specifications. This type of nozzle is restricted to two uses. The application of **HERBICIDES** and the **SPECIAL** application of **INSECTICIDES** for obtaining a **RESIDUAL** deposit on walls, as in mosquito control programmes.

When used for herbicides, the pressure is low and the hole in the nozzle is large. This produces a spray with large droplets that are unlikely to drift onto non-target plants. Sometimes shields are placed on either side of the nozzle when spraying. This gives added protection to the crop if it has emerged. The low pressure is obtained by a lower pump rate combined with the larger hole in the nozzle.

When used for spraying walls to give a residual deposit, a higher pressure and smaller nozzle hole size, is used. The pressures under these conditions are similar to those for cone nozzles.

IMPACT NOZZLES - With these nozzles, the pressurised liquid passes through the nozzle hole, which is usually relatively large, and strikes the angled face. The spray formed has a fan-shaped pattern but because of the method of formation more spray is found at the outer edges of the fan and the pattern is more uneven than the fan nozzle.

As with the other types of nozzle, the flow rate and the angle of the spray are governed by the size of the hole in the nozzle and the slope of the angled impaction surface. This type of nozzle is used **ONLY** for **HERBICIDES**. Impact nozzles are used at low pressures to produced large droplets, which avoid the hazards of drift. Impact nozzles may be used with nozzle shields. They are sometimes refered to as anvil nozzles.

varies with different types of cores and nozzle tips, and always increases with an increase in pressure (equal to an increase in the rate of pumping).

Cone nozzles operate at between 40-60 pound per square inch (psi). Cone nozzles, whether hollow or solid, are the type best suited for spraying crops because they produce a spray in which droplets approach the leaves from several angles, unlike the fan nozzles described below.

FAN NOZZLES - This type of nozzle is composed of a single element, the nozzle tip. The shape of the hole is responsible for the shape of the spray and the spray angle. The hole is rectangular or lens shaped and the pressurised liquid is forced through it giving a narrow lens shaped pattern. As with cone nozzles, the size of the nozzle hole affects the flow rate and the angle of spray. The most suitable size can be selected by referring to manufacturers' specifications. This type of nozzle is restricted to two uses. The application of **HERBICIDES** and the **SPECIAL** application of **INSECTICIDES** for obtaining a **RESIDUAL** deposit on walls, as in mosquito control programmes.

When used for herbicides, the pressure is low and the hole in the nozzle is large. This produces a spray with large droplets that are unlikely to drift onto non-target plants. Sometimes shields are placed on either side of the nozzle when spraying. This gives added protection to the crop if it has emerged. The low pressure is obtained by a lower pump rate combined with the larger hole in the nozzle.

When used for spraying walls to give a residual deposit, a higher pressure and smaller nozzle hole size, is used. The pressures under these conditions are similar to those for cone nozzles.

IMPACT NOZZLES - With these nozzles, the pressurised liquid passes through the nozzle hole, which is usually relatively large, and strikes the angled face. The spray formed has a fan-shaped pattern but because of the method of formation more spray is found at the outer edges of the fan and the pattern is more uneven than the fan nozzle.

As with the other types of nozzle, the flow rate and the angle of the spray are governed by the size of the hole in the nozzle and the slope of the angled impaction surface. This type of nozzle is used **ONLY** for **HERBICIDES**. Impact nozzles are used at low pressures to produced large droplets, which avoid the hazards of drift. Impact nozzles may be used with nozzle shields. They are sometimes refered to as anvil nozzles.

4.2 Types of Non-motorised Sprayers

There are four main types of non-motorised sprayers:

- SLIDE-ACTION or TROMBONE SPRAYERS
- COMPRESSION SPRAYERS
- SHOULDER PUMP SPRAYERS (a simple type of piston pump sprayer not found in Pakistan)
- KNAPSACK SPRAYERS

Of these four types the most common is the knapsack sprayer, also known as the lever-operated sprayer. The trombone sprayer is used by small scale farmers and vegetable growers. The compression sprayer is the type used by the health authorities to control mosquitoes and also by some vegetable growers. For further details on the working of non-motorised sprayers see the booklet mentioned in the reading list.

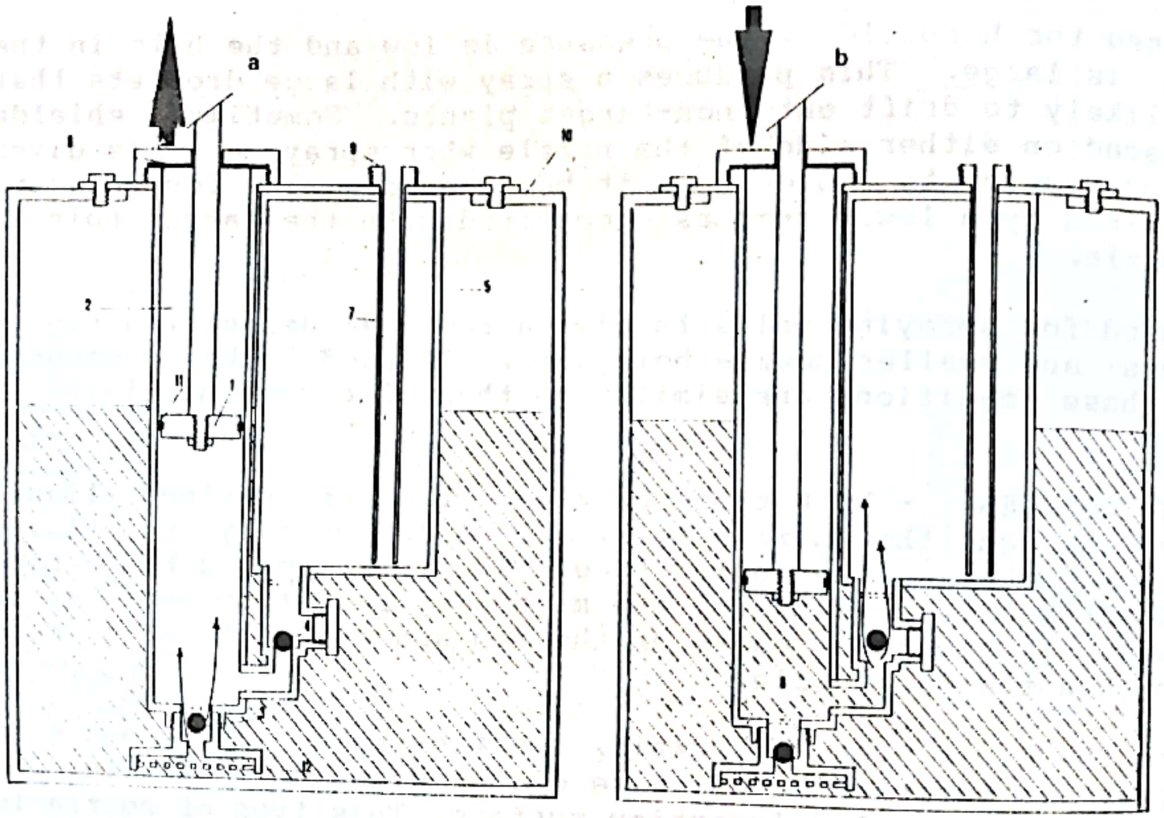

FIGURE 14 PUMP AND PRESSURE VESSEL OF A PISTON PUMP LEVER-OPERATED SPRAYER. 1=PISTON; 2=CYLINDER CHAMBER; 3=INLET BALL VALVE; 4=OUTLET BALL VALVE; 5=PRESSURE VESSEL; 6=PESTICIDE; 7=DIP TUBE; 8=SEALING WASHER; 9=HOSE ATTACHMENT; 10=TANK WALL; 11=PISTON O-RING; 12=STRAINER. (From Non-motorised Hydraulic Energy Sprayers see reading list).

LEVER-OPERATED SPRAYERS FITTED WITH PISTON PUMPS - There are several different designs of this type of sprayer. The lever action may be over-shoulder, or under-arm. The pump and the pressure vessel may be located inside or outside the sprayer tank.

LEVER-OPERATED SPRAYERS FITTED WITH DIAPHRAGM PUMPS - These types of sprayers usually have an under-arm action with the diaphragm and pressure vessel located inside the sprayer tank. The difference between a diaphragm pump sprayer and the piston pump, is the main component of a diaphragm pump which is the diaphragm. This is a cone-shaped piece of treated or synthetic rubber, with a flattened tip. It replaces the sliding piston of the other type. Diaphragm pumps generally produce lower pressures than piston pumps and are especially suited to the application of herbicides.

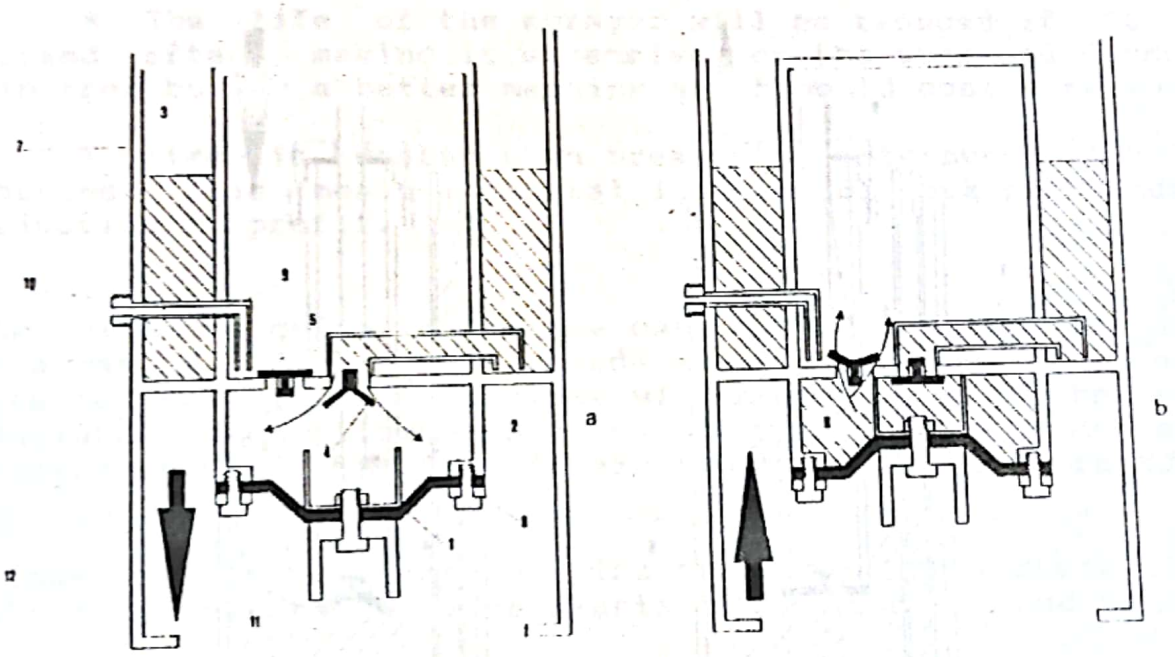

FIGURE 15 **LEVER-OPERATED SPRAYER FITTED WITH A DIAPHRAGM PUMP. 1=DIAPHRAGM; 2=DIAPHRAGM CHAMBER; 3=PRESSURE VESSEL; 4=INLET FLAP VALVE; 5=OUTLET FLAP VALVE; 6=PESTICIDE; 7=TANK WALL; 8=DIAPHRAGM FIXING RING; 9=DIP TUBE; 10=HOSE ATTACHMENT; 11=LEVER ATTACHMENT; 12=PUMP SKIRT.** (From **Non-motorised Hydraulic Energy Sprayers** see reading list).

The principle of operation is the same for both piston (Figure 14) and diaphragm pump sprayers (Figure 15).

Spray liquid is forced by the pump from the main sprayer tank into an air-filled chamber sealed by one-way valves. This chamber is called the **PRESSURE VESSEL** (Figure 14 and 15). As more liquid is forced into the vessel, the air becomes compressed and a

pressure develops. When the valve to the lance is opened the pressure in the pressure vessel forces the spray liquid out to the nozzle, where the spray is formed.

COMPRESSION SPRAYERS, which are cylindrical tanks, work the opposite way round. The sprayer tank acts as the pressure vessel in this instance. The tank is filled to about 75% capacity, and the lid sealed. The tank is airtight. The pump is then operated for a certain number of strokes. This introduces air into the tank, which creates a pressure (Figure 16). The sprayer is then put on the back of the operator and when the cut-off valve on the lance handle is opened the pressure forces the spray out of the nozzle. When the pressure in the tank is exhausted the operator must take the sprayer off his back and repressurise the tank. On well designed sprayers one tank pressurisation should be sufficient to discharge one tank load of chemical.

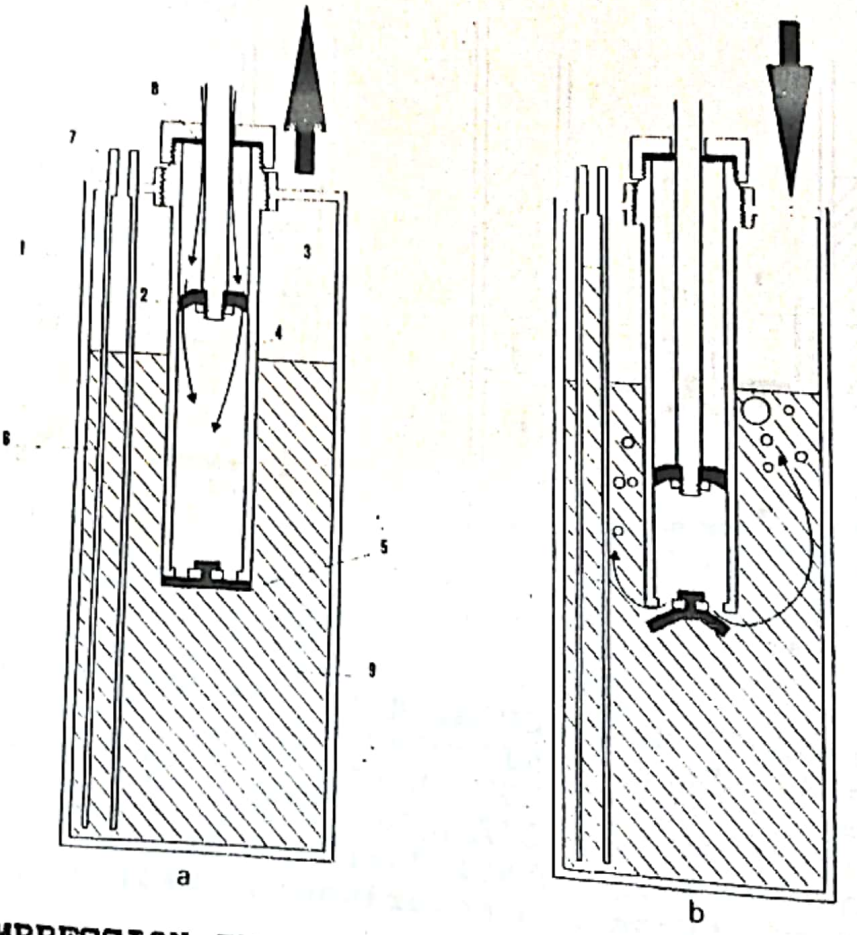

FIGURE 16 COMPRESSION SPRAYER. 1=SPRAYER TANK; 2=PISTON WASHER; 3=PUMP PISTON; 4=PUMP CYLINDER; 5=FLAP VALVE; 6=DIP TUBE; 7=HOSE ATTACHMENT; 8=SEALING WASHER; 9=PESTICIDE. (From Non-motorised Hydraulic Energy Sprayers, see book list).

SLIDE ACTION or **TROMBONE SPRAYERS** are the simplest type of sprayer. They have no pressure vessel and pumping must be continuous to supply spray to the nozzle.

4.3 Routine Care and Maintenance

The proper care of spraying machines is important for several reasons:

* The safety of the sprayman. Small leakages of poisonous chemical can accumulate and may cause illnes or death (see page 9).

* The successful control of insects and other pests relies on the chemical used, the knowledge of the user **AND** the condition of the sprayer.

* The life of the sprayer will be reduced if it is not looked after, making it expensive for the user and discouraging him from buying a better machine which would cost more money.

* Time is wasted when breakdowns interfere with a work routine. This means a general lowering of work standards and a reduction in profit.

The following guide to routine care and maintenance is suggested as a way of reducing the hazards amd problems mentioned above. It does not mean that no problems will occur, but if the procedures mentioned are followed sprayer life should be extended and work programmes should be less interupted by unforeseen breakdowns.

Before the spraying season - The purpose of this check list is to make sure that the sprayer starts the season in good condition.

* Check washers and gaskets are not damaged or worn. If there is any doubt about their condition then replace. These items are easy to renew at this stage, but if the change is delayed until a breakdown occurs, this can be both dangerous and time-consuming.

* Check ball-valves or flap valves on pressure vessels and pumps for signs of wear or damage and replace or repair as necessary.

* Fill the sprayer with clean water and operate the pump. Check the joints of hoses and pump are not leaking. Minor leaks can be repaired by wrapping plumbers' tape or twine around the threads. If major faults develop check the section on sprayer faults (page 56).

* If the spray produced is coarse or uneven, although the

sprayer is functioning normally, replace the nozzle with a new one (see page 47).

* Check that all filters are clean, replace any that are damaged.

* Check that the straps are well attached and not liable to break. Pay particular attention to where the straps loop over the strap hangers and strap clips.

* Check that hoses are not damaged and showing signs that they will soon break. Bend them and examine them for cracks. Replace as necessary.

* Check the lever linkages, pins and bearings on lever-operated sprayers. If they are badly worn repair them.

During the Spraying Season

The procedures here may be divided into three groups, **BEFORE, DURING** and **AFTER** spray application.

BEFORE SPRAYING

* Check that all connections are tight and the cut-off valve is closed.

* When adding the water to the tank. always use the filter provided with the sprayer. If none is provided (or it is damagaed or lost) pour chemical into the tank through a cloth or wire filter. These may be bought or made from a piece of mosquito wire. The sprayer will be pumping a large volume of water during the spraying season and problems with wear and blockage of valves will be greatly reduced if spray liquid is filtered.

DURING SPRAYING

* If the sprayer is a shoulder pump, trombone or lever-operated type, operate the pump at a steady rate which gives an even spray. Fast pumping means the pressures are too high and the droplets will be too small. Damage may occur to valves and seals if the pressure is too high. Over-pumping can cause seals to leak and place the spray operator in danger.

* If the sprayer is of the compression type, do not overfill the tank, as this will mean that extra re-pressurisation will be needed before it can be emptied. **DO NOT** over-pressurise the tank by pumping for too long as this may cause structural damage to the tank.

* If any faults or problems occur during operation, use the steps on page 56 to identify and treat them. Before carrying out

these operations, empty and clean the sprayer, to avoid poisoning.

AFTER SPRAYING

* Do NOT stop spraying until the tank is empty of chemical. Do not mix too much, the disposal of this unused mixture is potentially harmful and wasteful.

* Remove the nozzle and rinse in clean water. Clear away any dirt or deposits that may have accumulated.

* For trombone, shoulder pump and lever-operated sprayers, fill the tank with clean water (do not replace the nozzle), and pump until the tank is empty. The mixture of spray and clean water should be directed onto **WASTE** vegetation or into a hole at least 1 metre deep. Ensure that the tank and the pressure vessel are empty.

* For compression sprayer, remove the nozzle and clean it, fill the tank with water and rinse out the remaining chemical. Pour the contents onto waste vegetation or into a hole at least 1 metre deep. Rinse out the lance by adding 5 litres of water to the tank, pressurising it and spray without the nozzle in the usual way.

* Remove and clean any filters fitted to the sprayer.

* Clean the outside of the sprayer, including the straps.

* Replace the nozzle and remove the sprayer to storage. Leave the lid of the sprayer loose so that any moisture in the tank can evaporate.

After the Spraying Season

* Clean the sprayer thoroughly.

* For machines fitted with a piston pump remove the pump and pressure vessel (Figure 14). Dismantle the ball valves. Withdraw the piston from the pump cylinder and regrease it. Flush out the pressure vessel with clean water and allow it to dry. Reassemble the pump and fit.

* For machines fitted with a diaphragm pump, dismantle the pump and check the condition of the diaphragm. Replace if necessary. Clean out the pressure vessel and check all valves into and out of the diaphragm chamber (figure 15). Reassemble.

* Store in a dry place with the lid loosely fitted to allow excess moisture to evaporate.

To summarise, simple procedures are suggested for the care and maintenance of non-motorised sprayers. The main point to remember is **PREVENTION IS BETTER THAN CURE.** A breakdown could be costly and dangerous, try and prevent them.

4.4 Faults Occuring During Operation Causes and Remedies

If the procedures mentioned in the section above are followed, the chances of a major breakdown occuring in the field will be greatly reduced. It is still possible however that faults will occur.

In order to function properly, lever-operated sprayers rely on the development of pressure. Faults occur when something interferes with this process. The main problem areas are the pump seals, washers, diaphragm and valves. Four major faults are listed below and a fifth deals with minor problems. In describing the fault and its symptoms it has been assumed that the pumping rate is normal and the sprayer contains enough spray liquid for normal operation.

Before attempting any repairs or inspection it is **VERY IMPORTANT** to release any pressure within the machine. This will happen if the cut-off valve is left open and pumping is stopped. Alternatively the cut-off valve may be closed, the nozzle removed and the cut-off valve reopened. **DO NOT** attempt to investigate a pressurised sprayer and **NEVER** carry out major work on a machine unless it has been emptied of chemical and cleaned. The following instructions assume both these steps have been taken, but additional reminders are included!!!

When cleaning nozzles and valve parts **NEVER** use anything which will damage or enlarge the hole you are cleaning. Use **FINE** wire or a plant stalk. Rinse the part in clean water and **NEVER** attempt to clear a blockage by blowing with the mouth.

HIGH PRESSURE

This is indicated by the following symptoms:

* Resistance is felt during the pump stroke.
* An extremely fine spray is formed.
* Leaks come out of the top of the pump.
* Leaks from places which do not normally leak.

This may be because:

* The nozzle or cut-off valve is blocked. Release the pressure, remove and clean the cut-off valve and nozzle.

* The filter in the lance (when fitted) may be blocked by dirt. Remove and clean it. Do NOT use anything that is likely to damage it, rinse well in clean water.

* The ball valve into the pressure vessel may be blocked. Remove the pump and pressure vesel unit and clean the valve port by removing the ball retaining nut. Rinse well with water to ensure the passage is clear.

LOW OR ZERO PRESSURE

This is indicated by the following symptoms:

* No resistance in the pump stroke.

* No spray or coarse droplets.

* Increasing the pump rate has no effect.

The following faults may cause these symptoms:

* This may be because the pump washer has fallen apart. Check the pump and replace the washer as necessary.

* The diaphragm may be damaged or loose in its mounting. Inspect the diaphragm and replace or tighten the mounting, as necessary.

* Flap or ball valves may be blocked or damaged. Inspect and clean or replace.

PULSING SPRAY

This fault occurs with any sprayer fitted with a pressure vessel and may be more commmon if a simple pressure relief valve is also fitted. The following symptoms indicate pulsing spray:

* Alternate high and low pressure with pump strokes.

* Uneven spray.

* High pressure may be accompanied by the symptoms described above.

The pulsing spray is caused because the pressure vessel is not working. For it to work correctly it must have air inside. If for some reason the air comes out then the pressure vessel fills with water and spray comes out of the nozzle only when it is pumped into the pressure vessel. This is why sprayers with pressure relief valves can sometimes produce pulsing spray, even when they are otherwise normal. The pressure relief valve lets the extra air (pressure) out of the pressure vessel and this is replaced by water. Other causes are listed below:

* The inlet ball valve is badly worn and is no longer effective. Eventually the air in the pressure vessel is removed and without it the pulsing spray occurs. The remedy in this situation is to drain and clean the sprayer, remove the pump and pressure vessel and clean and repair the ball valve.

* Leaks in the pressure vessel. This is a more serious fault than the others, and is potentially dangerous. Inspect the pressure vessel seams for signs of a leak, especially at the top of the pressure vessel. On some sprayers the dip tube (the tube coming out of the pressure vessel and connected to the hose and nozzle) is threaded into the pressure vessel. Make sure that this is not leaking. Structural damage to the pressure vessel may be repaired by an experienced engineer in a workshop, but **DO NOT** attempt this type of repair yourself. If the damage is severe or there are signs of corrosion, then the sprayer will have to be replaced.

STRUCTURAL DAMAGE

If the sprayer is badly damaged by accident or old age it can be repaired, but the following points should be remembered:

* It is unwise to attempt to mend vessels designed to hold liquid under pressure, unless the leak is small, the material around it is good and the work can be done by an expert.

* A sprayer showing signs of old age is likely to breakdown more and more frequently. These breakdowns may be both time consuming and dangerous.

* Hints on what to look for when buying a new sprayer are given below (Section 4.5).

NORMAL SPRAY BUT MINOR FAULTS

* Leaking Joints - If the spray is normal but the joints are leaking, this may be caused by loose or ill-fitting threads. If tightening the connections does not stop the leaks, check the washers on the joints. Replace these if they are damaged. Wrap fine pieces of twine or plumber's tape around the threads and reassemble the connections.

* Stiff pump - This may be the first indication that the pump washer is breaking up. Remove the piston, inspect, and if necessary replace. Greasing the old washer will improve the seal and remove the stiffnes. Check also that the lever linkage to the pump has not been bent or damaged.

* Uneven spray - If none of the other remedies listed cures the fault it is probably because the uneven spray is caused by a worn nozzle. Replace the nozzle with a new one of the correct

type (see page 47).

To summarise, before attempting any repairs the sprayer should be depressurised, drained and cleaned. Major faults are in most cases caused by defective pump parts. Regular checks and maintenance will help to prevent these faults from developing. Sprayers with structural damage should only be mended if this can be done without reducing the machine's effectiveness or safety. Sprayers should be relaced as soon as they present a threat to safety.

4.5 Points to Consider when Buying a New Sprayer

Once it has become necessary to buy a new sprayer, there are two important things to consider. The first is what type of machine and the second is which make of a particular type. As this section deals only with non-motorised sprayers, we will deal with the four types mentioned on page 50.

General Points - Consider the following general points when selecting a particular machine type:

* How much money will be available for the sprayer?

* What will be the main crop/target sprayed?

* How large an area will be sprayed?

* How often will spraying be carried out?

* How much time will be available for spraying?

If only a small area (1 or 2 acres) is going to be sprayed infrequently then a trombone (slide action) sprayer is probably the most sensible type to buy. These are cheap but can only spray slowly and are not suitable for applying herbicides as they do not have the correct nozzles. The most likely choice for general purpose spraying and herbicide application is the lever-operated sprayer. These are the most effective type of non-motorised sprayer. When selecting a lever-operated knapsack sprayer or any other sprayer type, use the following guidelines. It is unlikely that you will find a machine that has all the features mentioned, but by selecting the one with the largest number, at the price you are prepared to pay, you should be obtaining the best machine in the group.

* **HOSES** - Check that there is sufficient length of hose with the sprayer for the work you have in mind. Ideally the hose should be attached to the connectors with screw-driven clips which can be easily detached. It should be possible to make the hose connections leak-proof without using special tools.

* **STRAPS** - The straps and strap clips are usually the first

things that break on sprayers. Make sure the strap hangers which hold the straps to the tank are not riveted through the tank. The straps should be adjustable in length and wide enough to be comfortable. Narrow straps are acceptable if wide shoulder pads are fitted. The best material for straps is reinforced plastic, as this will not absorb pesticides and is easy to wash.

* **FILLER HOLE** - The filler hole should be large enough to allow easy cleaning of the tank, and should be fitted with a filter.

* **NOZZLE** - For general agricultural work a cone type nozzle should be used. For herbicide applications either an impact or a fan type, (see page 47). Check that replacement nozzles are available, as well as the type you will require.

* **SPARE PARTS** - Check that a good supply of spare parts are available. It is no good buying an expensive sprayer for which there are no spare parts.

The following points apply to lever-operated knapsack sprayers:

* **LEVER SYSTEM** - The lever action may be either over-shoulder or under-arm. The advantage of the over-shoulder type is that they can be used for either right or left handed operation, with no adjustment or fuss. Some under-arm pump actions have this feature but require some undoing of bolts to change the side of operation. A machine that can be used with either hand is better.

* **PUMP VALVES** - Check that the pump valves are easy to reach and service. Make sure that spare parts are available!

* **PUMP LOCATION** - Some sprayers have pumps on the outside of the tank. This type of sprayer should be avoided since the pump is easily damaged by accidental dropping.

* **NOZZLE HOLDER** - Check that the nozzle holder will take a range of nozzles, of the type you will be needing.

The following points apply to compression sprayers:

* **TANK** - Ideally the tank should be made from either high density plastic or stainless steel. Galvanised tanks rust easily and this is dangerous because the tank acts as a pressure vessel.

* **DIP-TUBE** - This is the tube inside the tank, through which the spray is forced to the nozzle (Figure 16). Make sure that it comes as close to the bottom of the tank as possible as this will make sure that the tank is emptied of spray liquid.

* **PUMP** - Make sure the pump has a long threaded connection with the top of the tank, to prevent leaks.

The following points apply to slide-action or trombone sprayers:

* **SIZE** - Make sure the sprayer is not too long. If it is very long it is more likely to be accidentally damaged.

* **VALVES** - If possible the valves should be easy to replace and clean.

NOTES: