APPENDIX XIV: FEEDING DEVICES

The feeding of fish and shrimp is done by hand in most farms and there are advantages in doing so. The main one is that it enables the operator to inspect his stock regularly and to judge whether they are eating properly. It also enables him to check the other parameters of the pond/tank/cage at the same time.

There are, however, a number of mechanical aids to hand feeding and many types of automatic feeders on the market. Automatic feeders are particularly appropriate to intensive systems and the feeding of nursery fry tanks which require frequent, small doses of feed.

This appendix lists and illustrates some of the major types of feeding device. Automatic feeders are available for dry diets. Moist diets are difficult to dispense automatically because of their texture. The exact operational details of each feeder are not illustrated, only the principle involved. Details of devices for fry feeding are given in another FAO publication (Berka, 1973). Commercially available feeders are marketed by aquaculture equipment supply companies in each country. The names of some can be found in the annual Buyers Guide of the American journal, 'Aquaculture Magazine'; advertisements for them are often to be found in 'Fish Farming International'.

Some feeders, particularly demand feeders, are relatively easy to construct using simple materials like oil drums or plastic containers.

1. MOBILE DEVICES FOR DRY FEEDS

Feed does not necessarily have to be carried round a pond. It can be pushed round in a wheelbarrow or, if the ponds are large or many, and the bunds are wide and strong enough to take a vehicle, the feed can be towed in a truck or a tractor driven trailer. The feed can then be shovelled or thrown into the pond by the operators.

Feed can be more efficiently distributed in this manner with mechanical help. Nearly all equipment of this type depends upon a blowing device powered by the truck or tractor engine. Feed is released into the turbo blower by the operator who controls the time (and therefore the amount of feed) and the direction in which it is ejected. This then is still a form, albeit mechanically aided, of manual feeding. Hoppers in this type of equipment can contain up to 3-4 tons of feed at a time and blowers will distribute feed over an area of up to 6 x 3 m on each occasion or up to a distance of 20 m from the pond bank.

Blower feeders are obviously designed for very large farm units and are not appropriate for small-scale aquaculture: they are mentioned here for completeness.

Similarly, while feed is often transported by boat and fed by hand or by shovel, devices have been used in large farms to aid this operation. These include mobile boat mounted blowers, as above, and longitudinal slots in the bottom of boats through which different amounts of feed can be released by operating a lever.

2. STATIONARY DEVICES FOR DRY FEEDS

These devices can be grouped into a number of categories. Some require mains or battery electrical power. Some rely on water power, others on the weight of the feed and the action of the feeding fish.

2.1 Electrically Powered Feeders

These fall into two broad categories - those which operate mechanically and those which employ compressed air.

In both cases the control devices are electrical. The time and duration (thus the amount of feed) can be pre-set by the operator using an electrical timer. This may be mains or battery driven and it may operate a single feeder or a whole bank of feeders. Some sophisticated feeders are controlled not only by timers but also by sensors which detect when certain environmental factors are correct, such as temperature or light intensity.

2.1.1 Compressed Air Feeders

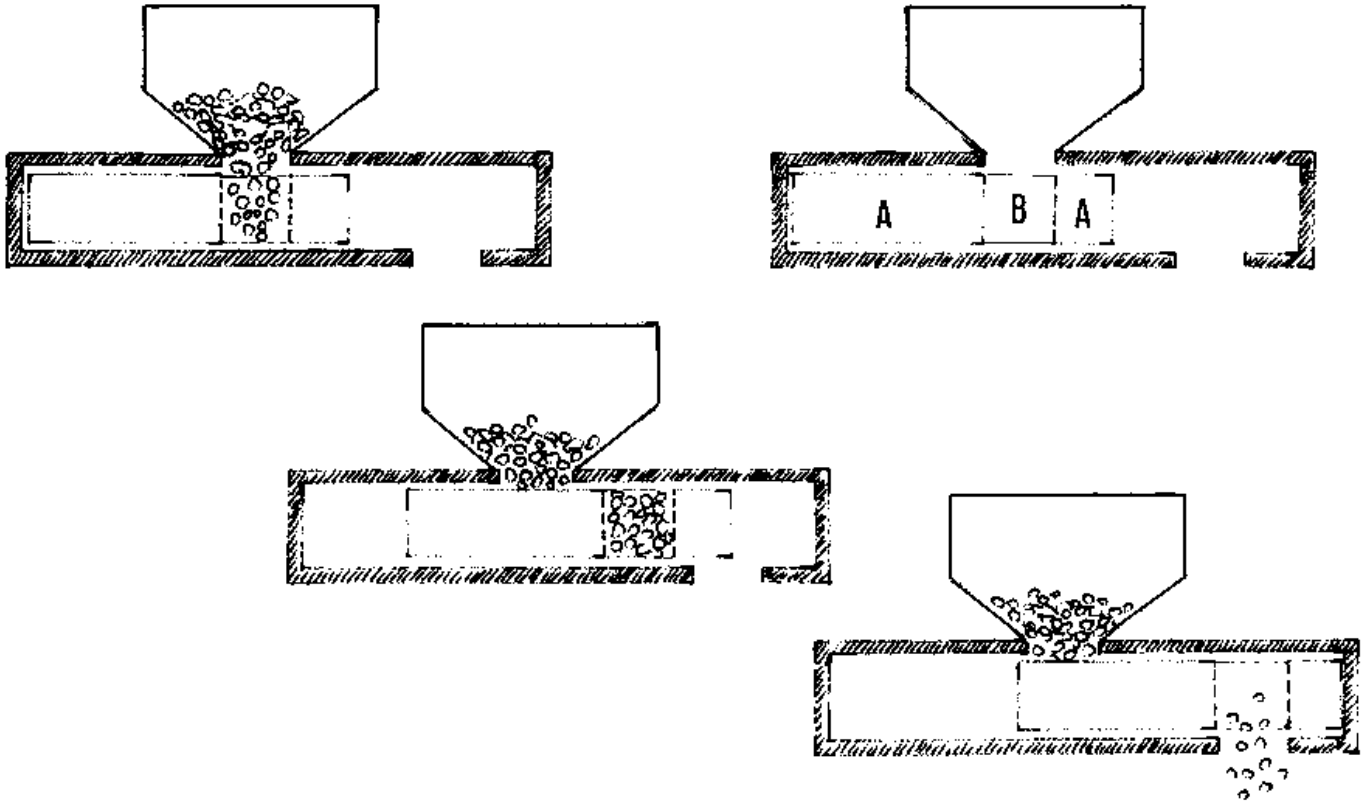
Basically, though there are many variants and patented examples of compressed air feeders, most are based on the same principle. A compressor supplies air to one or a number of feeders. The supply of air to each feeder is normally shut off. Each feeder has a supply of feed in a hopper mounted above a feed distribution pipe, in turn placed over the tank or pond. Feed is allowed to fall by gravity from the hopper into the distribution pipe. It ceases to flow when the orifice of the hopper becomes blocked by the fallen feed. A blast of air is introduced into the distribution pipe by the release of a valve controlled by a timer and the feed is ejected with considerable force. The amount of feed ejected on each occasion depends on the diameter of the distribution pipe and the hopper outlet and, principally, by the length of time that the blast of air is allowed to pass through the distribution pipe.

2.1.2 Mechanical Feeders

The operation of these types of feeders, which are also controlled by timers, depends on electro-magnets or electric motors. The principles of operation are best described by the following series of diagrams:

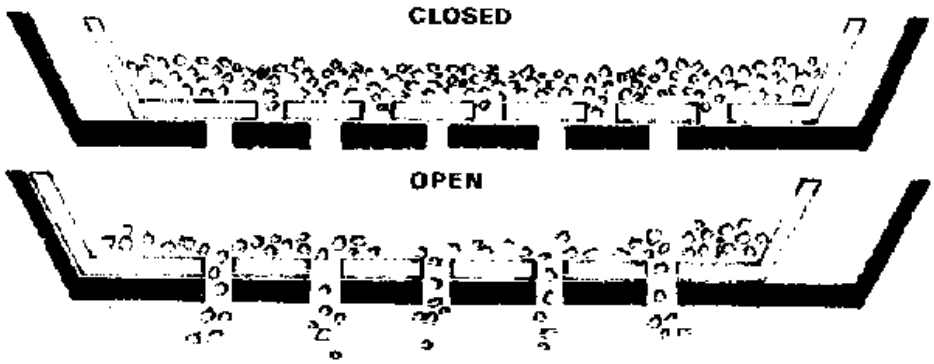
Type 1

Movement of the slug 'A' is controlled by an electro-magnet. The space 'B' governs the amount of feed released at each movement of 'A'.



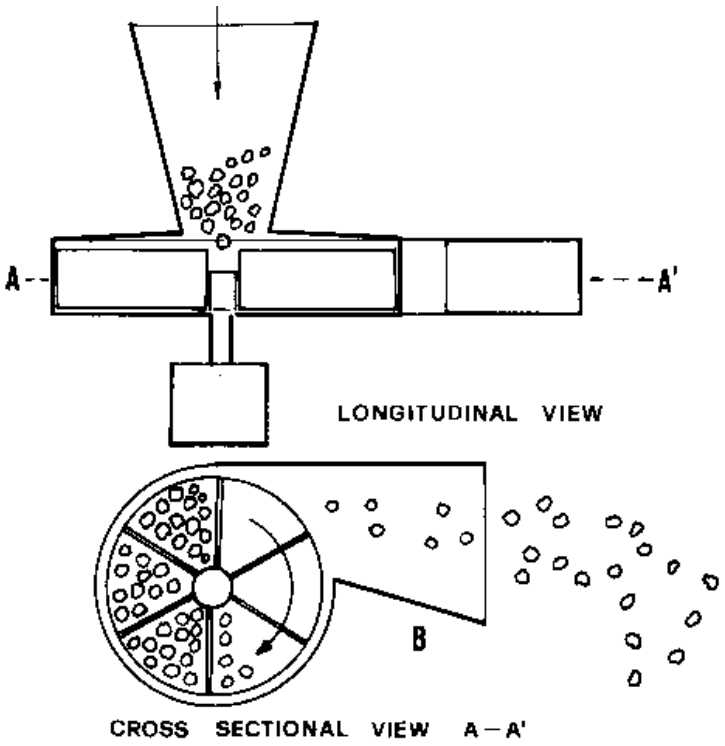
Type 2

Here the feed trough consists of two parts, one inside the other. The movement of the inner one is controlled by an electro-magnet. When the holes in the two parts of the feeder coincide, the feed falls through.



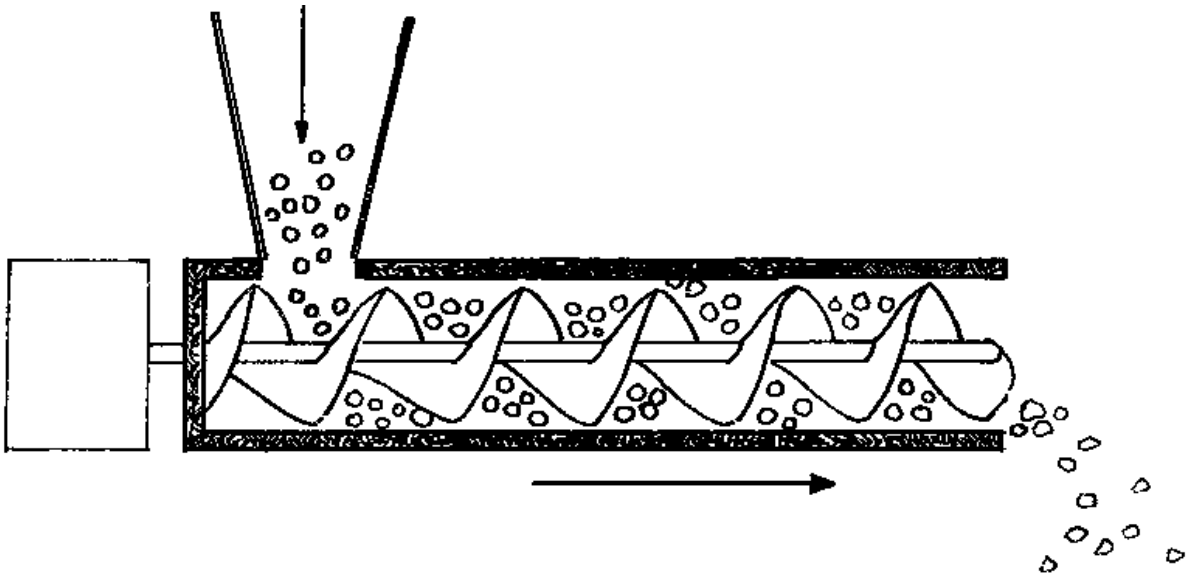
Type 3

In this version the feed falls from the hopper on to a disc which is rotated by an electrical motor at intervals to eject a portion of feed. The motor also releases the feed from the hopper on to the disc by operating a valve. The feed can either be released directionally, using the guide shield 'B' or, if the latter is removed, throughout a 360 angle.



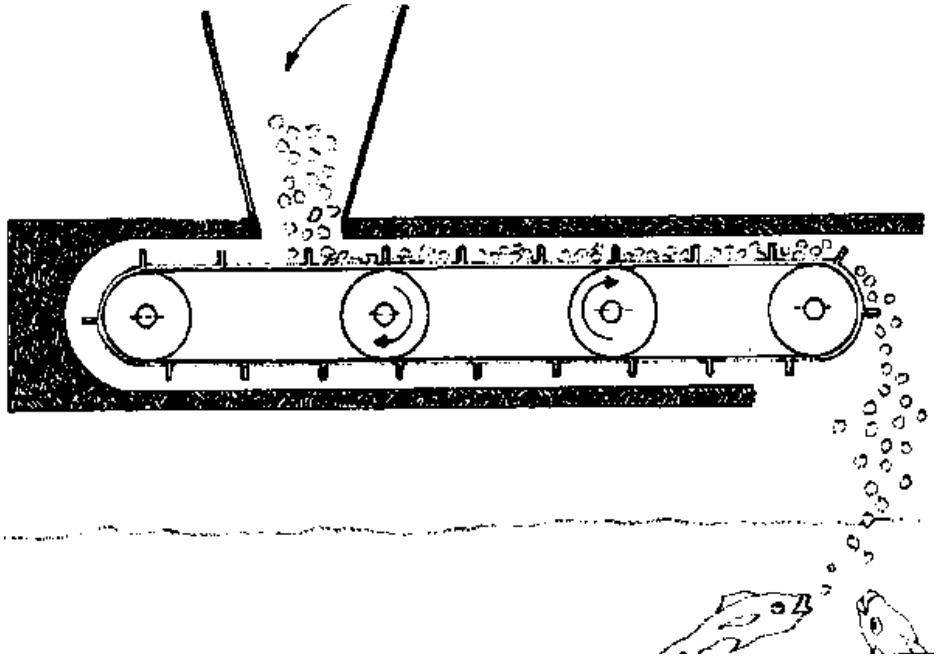
Type 4

In type 4, an endless screw mechanism transfers the feed from the hopper to the outlet. The amount of feed released depends on the number of revolutions of the motor drive screw, which is controlled by a timer as is the periodicity of feeding.



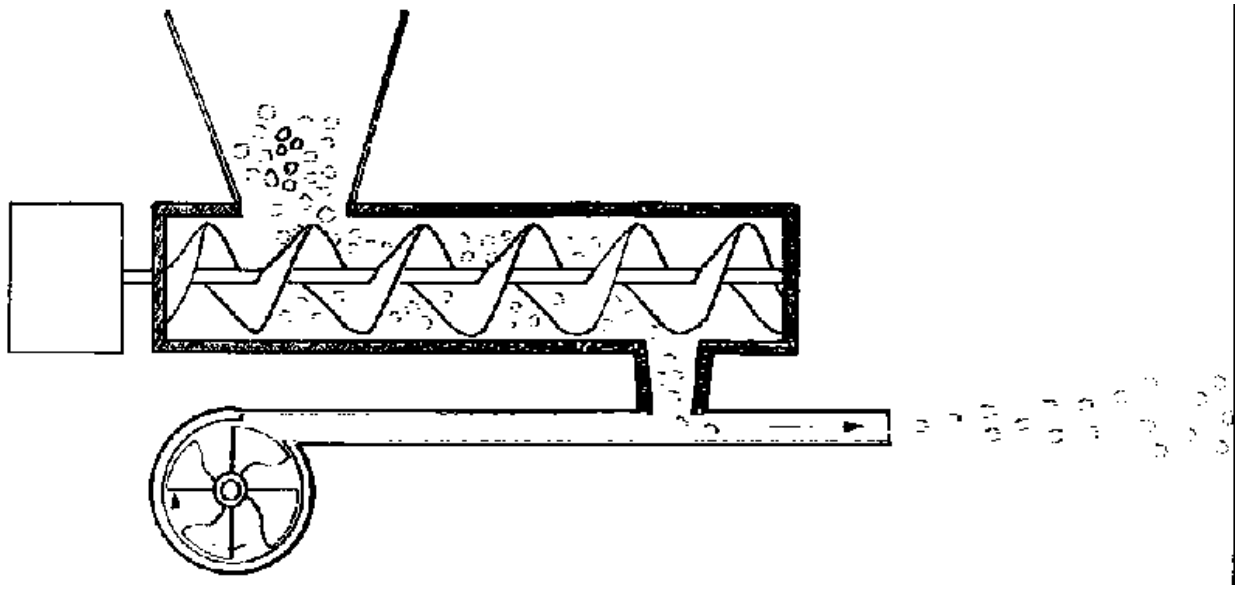
Type 5

Type 5 is similar to type 4 except that a blower is added, which distributes the feed over a greater distance.



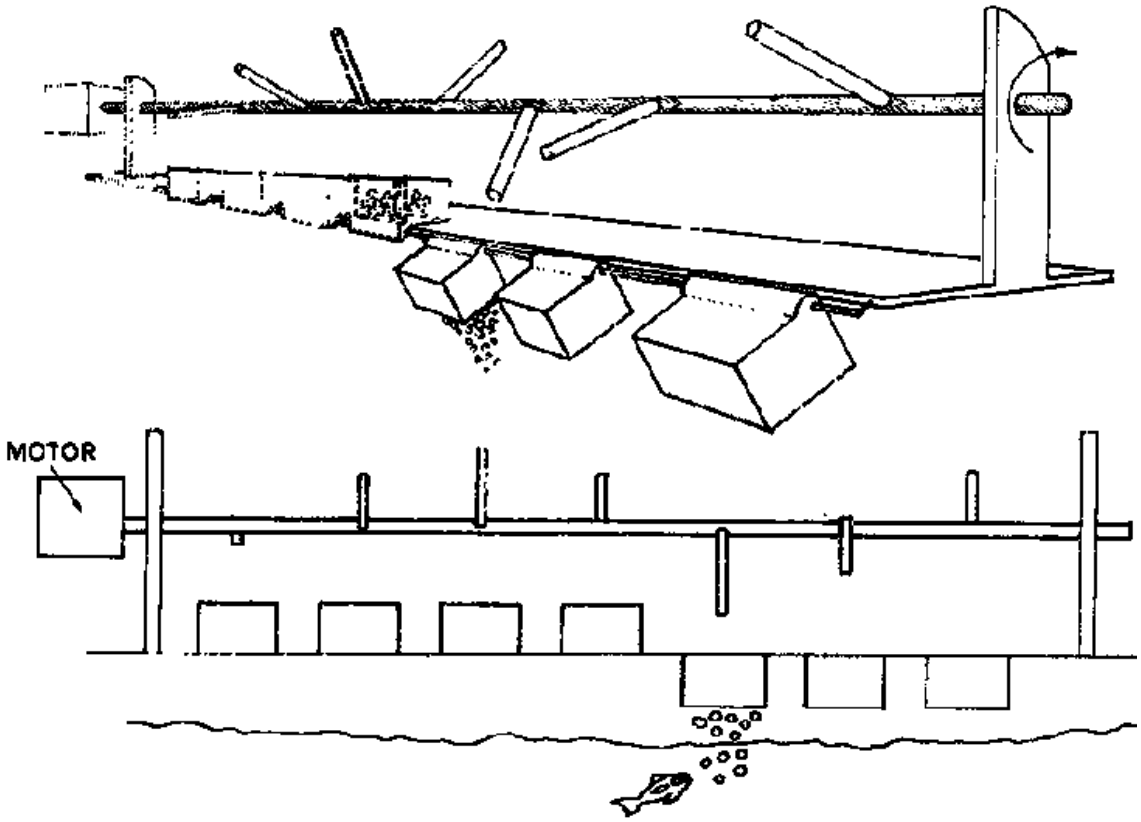
Type 6

In type 6, the feed is delivered on a conveyor belt driven, at selected intervals, by a motor controlled by a time switch.



Type 7

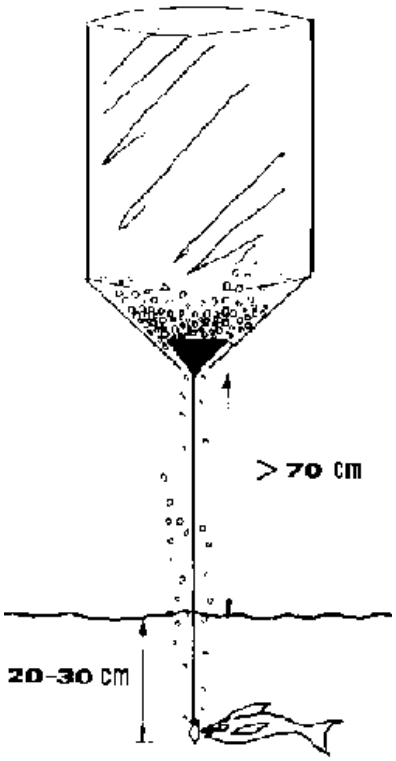
In type 7, a series of spikes on a revolving spindle overturn a row of feed containers in turn. The frequency depends on the speed of revolution of the spindle.



There are many commercial varieties of the feeders whose principles were described above.

2.2 Demand Feeders

There are also many different varieties of demand feeders but their general principle is the same. Some species of fish learn very rapidly to use demand feeders but they are usually unsuitable for small fish which are unable to operate them. The following diagram illustrates the principle. The advantages and disadvantages of demand feeding are discussed in some of the papers listed in 'further reading' at the end of this appendix.



In the demand type of feeder illustrated above, the fish touch the rod connected to a plug or plate in the bottom of the feed hopper. This plug normally closes the hopper so that feed does not fall out. When moved by the movement of the bait rod, a small quantity of feed is released. The quantity of feed released on each occasion can be controlled by the shape and design of the plug. The plug is usually ball shaped or an inverted cone. These feeders can easily be 'home-made' (see Hepher and Prugenin, 1981 and Meriwether, 1986).

Another type of feeder has advantages over the normal demand feeder; it relies on the WEIGHT of food consumed. Instead of the bait rod in the example shown above, there is a rod with a feed tray on the end. As the weight of feed on the tray decreases, more feed is released from the hopper.

2.3 Water Controlled Feeder

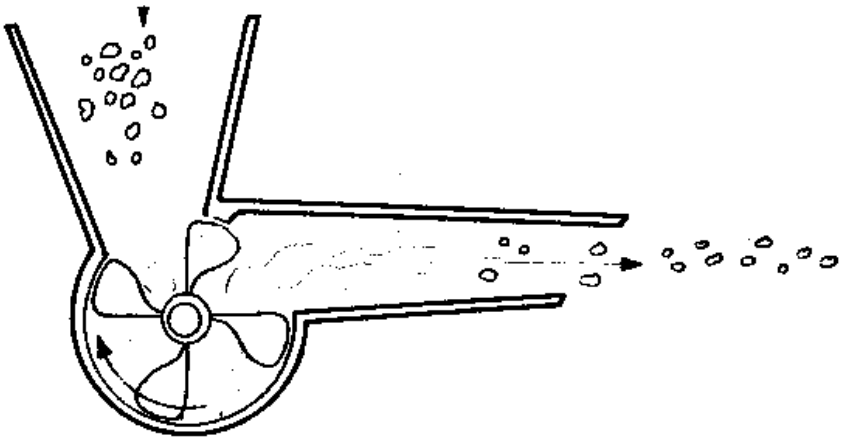
The operation of these feeders is similar to those diagrammed in section 2.1.2 of this appendix, except that the motive power is water instead of electricity. Either a water wheel is used or water is allowed to run into a container which empties on a syphon system, like a lavatory cistern, every time it becomes full. As the container empties (or the wheel moves) it triggers a valve on a feed hopper which releases a controlled amount of feed.

3. FEEDING DEVICES FOR WET OR MOIST FEEDS

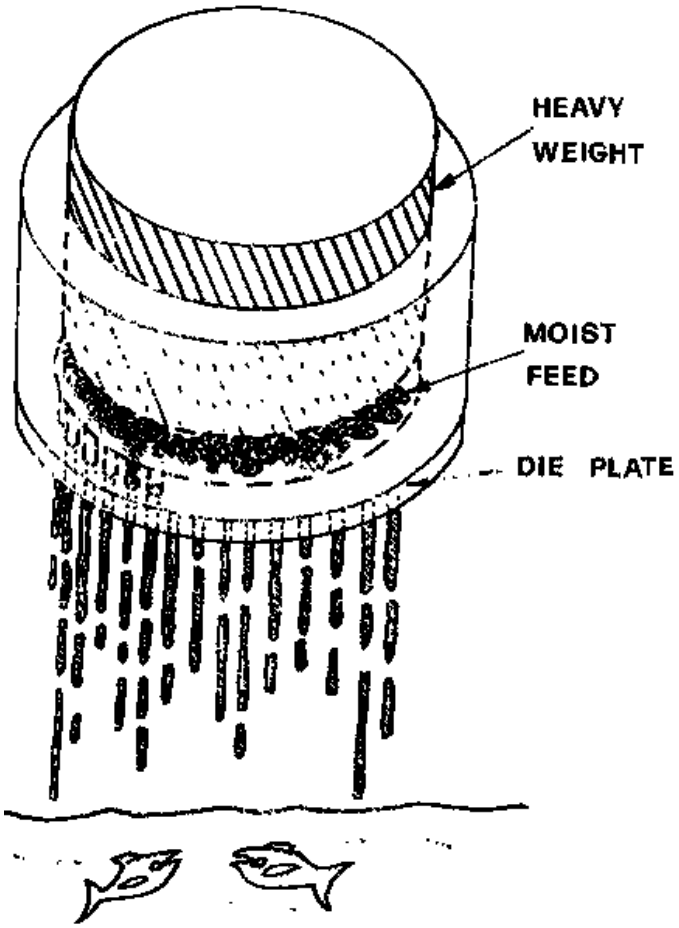
The non-manual distribution of high moisture feeds is much more difficult than that of dry feeds because of the formers' stickyness. However, the principles involved in some dry feeders can be adapted for use with moist feeds. The examples given in section 2.1.2 (Types 4 and 6) can be modified for this purpose but normally hoppers will need to be re-designed to prevent the feed sticking together.

In Japan, where small 'trash' fish is often used for feeding large aquaculture cages, feeding is done in the following way. A feeding boat moors alongside the cage. Alongside the feeding boat itself is a barge full of 'trash' fish. A suction hose is put into the barge and, using a pump on the feeding boat, the feed is sucked up into it. From there the feed is transferred to the centre of the cage using water pumped through a pipe mounted on a boom (see following page).

This type of feed and other moist feeds can also be transferred to large cages and ponds more effectively than it can be fed by hand, by using a mechanical 'thrower'. This is simply a centrifugal fan into which the feed is dropped.

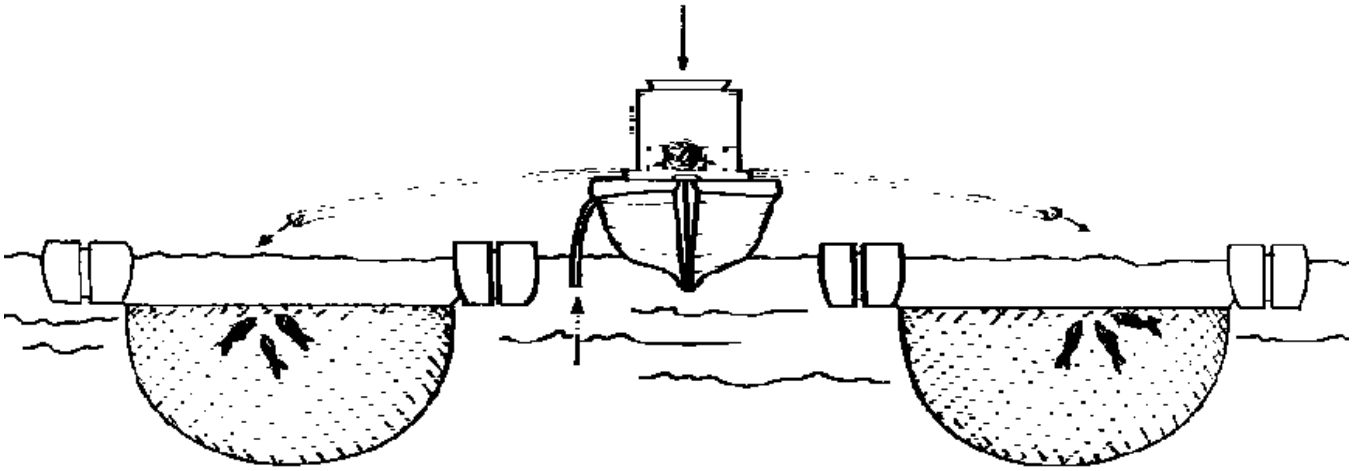


Another type of feeder used for dispensing moist minced feed is based on forcing the feed through a horizontally mounted die plate through the use of a heavy weight.



The weight type of minced feed dispenser runs continously; the system does not lend itself to operation at fixed intervals.

Flowing water is used to transfer freshly made moist pellets in another feeding technique. In this case the feed is made, in the pre-determined quantity for each cage, in a mixer/extruder mounted on board a boat. The mixer/extruder is driven mechanically or hydraulically from the boat engine. The extruded feed falls into a trough where a supply of water, provided from a small on-board pump, washes it through a pipe into one or more cages:



4. OTHER DEVICES

Floating feeds are sometimes put within a floating collar so that they do not float away all over the pond or tank. In this way the feeding activity of the fish can be concentrated in one place. Less feed is wasted and it is easier for the operator to observe the feeding behaviour of the fish.

Further reading for Appendix XIV:

Berka (1973), Coil Morales (1983), Lee (1981), Sedgwick (1982), Stevenson (1982), Hepher and Pruginin (1981), Meriwether (1986).