6) Addition of Chemicals/Dispersing Agents

Sometimes, chemicals/dispersing agents are added during well development to disperse the clay particles in the mud cake or in the formation to avoid their sticking to sand grains and to speed up the well development process. Several polyphosphates are used for this purpose such as tetrasodium pyrophosphate, sodium tripolyphosphate, and sodium hexametaphosphate and sodium septaphosphate (Raghunath, 2007). Sometimes, blocks of solid carbon dioxide (dry ice) are added to a well after aciditizing and surging with compressed air. The accumulation of gaseous carbon dioxide released by sublimation creates a pressure within the well and upon release this causes a burst of muddy water from the well, thereby helping in well development.

For developing open-hole wells in limestone or dolomite formations, hydrochloric acid is added to water, which removes fine particles and widens fractures/fissures leading into the well bore (Todd, 1980).

Recuperation Test of Well

After completion of well development process, the well should be tested to determine its yield and drawdown. First of all, static water level is measured. The well is then pumped at the maximum possible rate until the water levels in the well stabilize. The depth of water is then noted. The difference in depth is drawdown. This information provides a basis for selecting the capacity and specifications of the pump.

3. IRRIGATION PUMPS

3.1 INTRODUCTION TO PUMPING SYSTEM

Basic Mechanisms of Water Lifting

When the source of water is at a lower than the area to be irrigated and when free gravity flow is not available to drain surface or subsurface water, the water lifting devices are used. Water may be moved by the application of any one (or any combination) of the six following mechanical principles, which are mostly independent:

1. Direct lift: This involves physically lifting water in a container i.e. Rope and bucket.
2. Positive Displacement: This involves utilizing the fact that water is effectively incompressible and hence it can be 'pushed' or displaced.
3. Velocity head creation: When water is propelled to a high speed, the momentum can be used either to create a flow or to create a pressure.
4. Buoyancy of a gas: Compressed air or other gases passed and bubbled through water will cause movement of columns of water due to difference in specific gravity.
5. Impulse: Water hammer phenomenon creates impulse due to which a small portion of the water supply is lifted to a considerably high level.
6. Atmospheric Pressure: Water is lifted by atmospheric pressure by creating a vacuum in a chamber which sucks water up to a maximum pressure head of one atmospheric pressure (Approx. 10 m.).

Indigenous Water Lifting Devices

Several types of indigenous water lifts are in use in small-scale irrigation. These families of lifting or propelling devices and pumps may be classified according to which of the above principles they depend on following Table. It is an attempt to classify pumps under the categories given above.

Performance and adaptability of common type of indigenous water lifts

Pump	Kind of power	Optimum lift (m)	Average Discharge (litre/hr)	Remarks
Swing bucket	Two men	0.9 – 1.2	14000-19000	Eastern and south India in Rice crop.
Don	Single man	0.5 - 1	9000-13000	eastern region of India
Archemedian screw	Single man	0.5 – 1.2	14000-19000	Some regions of Andhra Pradesh
Water wheel	One pair of bullocks or buffaloes and one man	1 – 1.2	40000-60000	North India to lift water from canal to field.
Persian wheel	One pair of bullocks or buffaloes or single camel and one man	5 - 10	14000-18000	Northern India during first half of 20th century.

Chain pump	One pair of bullocks or buffaloes and one man	3 - 6	15000-20000	Some part of Uttar Pradesh.
Self-emptying type rope and bucket lift	One pair of bullocks or buffaloes and one man	4 – 6	10000 - 15000	Some part of south India and Rajasthan
Circular two bucket lift	Single bullock or buffalo and one man	4 - 5	12000-14000	Some part of Tamilnadu
Counterpoise bucket lift	Single man	1.2 - 4	8000 - 11000	Some parts of southern India and Bihar
Rope and bucket lift	Two pair of bullocks or buffaloes	10 to 30	6000-1000	Some part of Rajasthan, Maharashtra and other areas of deep water table.

Fig. 3.1. Two swing baskets in operation.
Note the farmer couple on the stream bank. The operators on the other side are not visible in the picture.
(Photo: Ministry of Information and Broadcasting, Govt. of India).

Fig. 3.2. *Don* used to lift water from a shallow stream.
Dons are commonly used in West Bengal and parts of Bihar and Orissa as a manually operated water lifting device.

Fig. 3.3. An Archemedian screw in operation on a farm in the Godavari delta of Andhra Pradesh.

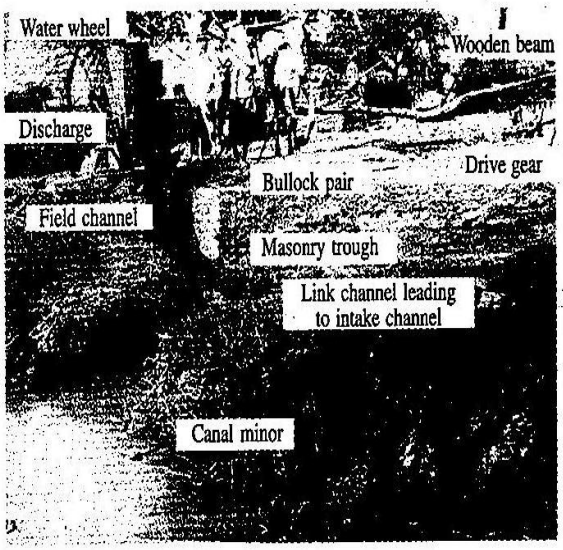

Fig. 3.4 (a). A bullock operated water wheel (*Jalaar*) lifting water from a canal minor near Rohtak, Haryana.