BASIC TIDE GAUGE

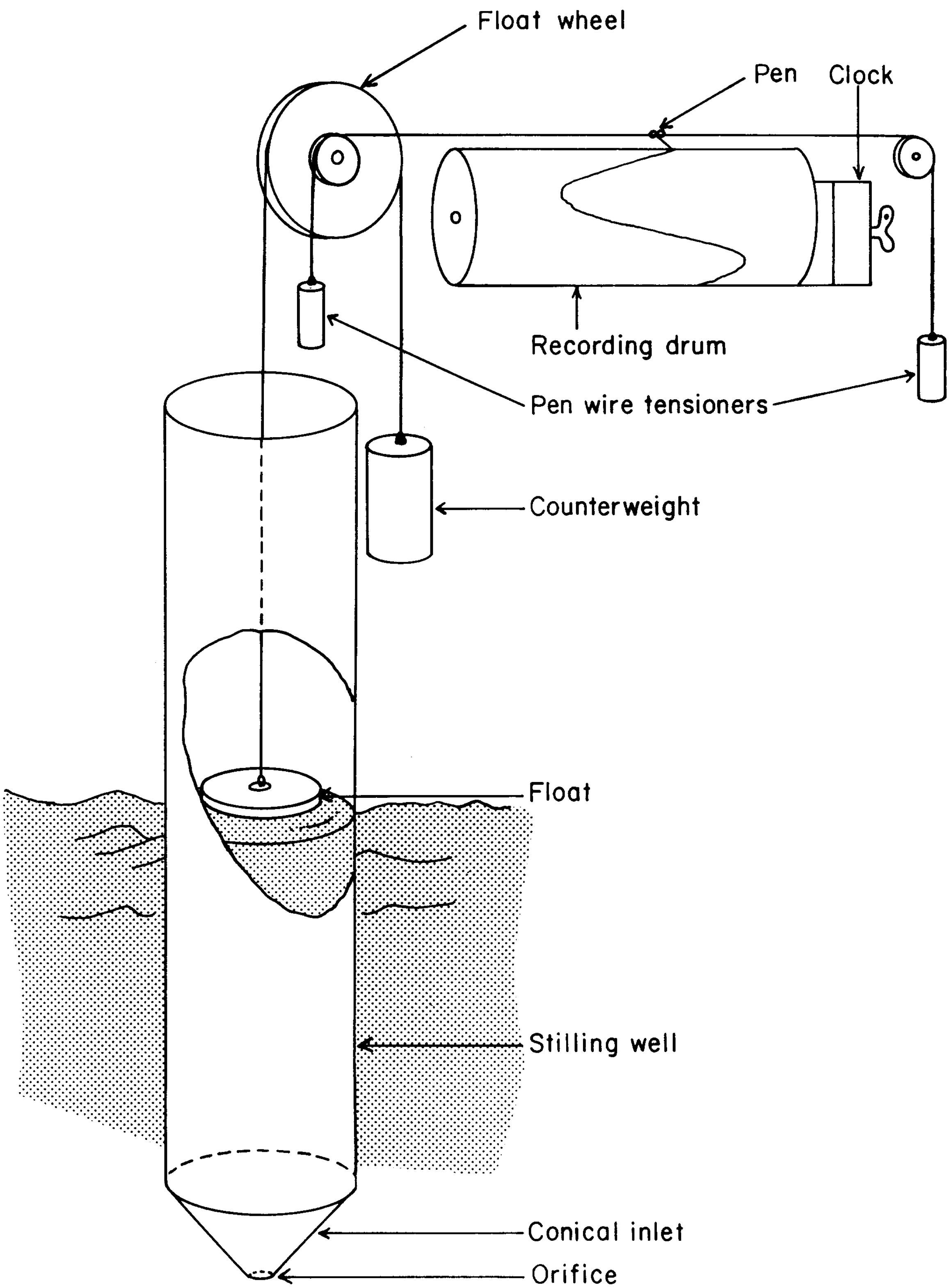

Figure 3.1

g) Proximity to outfalls can result in turbulence, currents, dilution and deposits, and should be avoided.

h) A study should be made of shipping passing or mooring close to the proposed site, since there will be a risk of collision and propeller turbulence causing silt movement.

i) Investigations should be made to determine if there is a possibility of construction work occurring in the area at some future time, which may affect the tidal regime at the site e.g. construction of new quays, breakwaters, locks or large factories having sluices or outfalls.

j) Where an appreciable amount of continuous power is required it will be necessary to lay in a mains electrical supply to the site. If this is not possible an alternative supply may be obtained from storage batteries and a generator. If power is required only for recording or telemetry purposes then batteries may suffice.

k) There must be adequate access to the site in the first instance to get materials on site during construction, and later for observation and maintenance visits.

3.2 THE FLOAT OPERATED TIDE GAUGE

(i) The Basic Tide Gauge

In its simplest form the installation for a float operated tide gauge could appear as shown in Figure 3.1. The float which sits on the surface of the water is connected by a cable passing over a pulley to a weight so that the position of the weight is determined by that of the float. As the float rises on rising water so the weight descends by the same amount and the cable passing over the pulley causes the pulley to rotate, the angle of rotation being directly proportional to the change in water level. The second pulley fastened to the same shaft will rotate through the same angle as the first pulley, but since its diameter is smaller the pen attached to the cord passing over this pulley will move through a smaller distance than the float although in exactly the same manner. The pen can be arranged to write on a chart and depict the movement of the float and hence the water surface although on a reduced scale. The ratio of the gauge is the relation between the pen movement and the actual water movement determined in this example by the relevant diameters of the two pulleys.

If the recording paper is arranged to pass normal to the path of the pen at a fixed speed a curve will be drawn to give a continuous record of water height against time.

The float is arranged to operate inside a stilling well which is necessary for satisfactory functioning. The well forms an enclosure to prevent the float from drifting in the presence of winds. By restricting the flow of water into and out of the well some damping of the water movement is achieved and eliminates the oscillations due to short period waves.

(ii) The Practical Tide Gauge

All analogue float operated tide gauges are based on the simple instrument already described. The designs of practical tide gauges differ from the basic model only by having features incorporated to improve accuracy and reliability.

(iii) Float System

A cable between the float and counterweight passing over a pulley is not normally employed since the cable is prone to slip on the pulley and at best can transmit little torque without slip occurring. The float wire is usually wound onto a drum having a spiral groove to locate the wire as it winds on and prevent overriding turns. The counterweight likewise is suspended from a similar drum. It is not normally convenient to have the counterweight operate through the same distance as the float since it will spend some time in water with consequent corrosion problems and reduced effect due to buoyancy. The weight is usually suspended from a much smaller diameter drum and hence travels through a much shorter distance than the float. The travel can be further reduced by passing the wire through a pulley or series of pulleys. As the range of the counterweight is less than that of the float so the mass of the counterweight must be increased in the same ratio to keep the system in balance. In several tide gauges the direct float counterweight link is employed: in these instances, either a perforated tape is used which registers with a sprocketed pulley, or a special pulley around which the wire is wrapped a number of turns. Modern floats are made from materials such as nylon or PVC which are little affected by the corrosive influence of seawater. Natural anti-fouling materials such as copper are also used. To be reliable a float must not leak and therefore should not be constructed from materials which are liable to corrode or split. The anti-fouling property is important since many forms of marine life seem to have a great affinity for items floating on the sea surface. The result is that the float grows as the marine life accumulates and gradually closes the gap between the float and walls of the well causing a sluggish response of the float. The float itself must not be allowed to come in contact with the wall of the well as this may cause the float to stick, particularly at joints in the well, and eventually wear away the float and cause leakage.

Float and counterweight wires should be selected from corrosion resistant and non stretching materials. Stainless steel and phosphor bronze wires are the most common. It is important that the correct gauge of wire is used on any particular tide gauge since a change in diameter of the wire will affect the ratio of the tide gauge. Counterweights can be made from any heavy material such as cast iron, steel, brass or lead. The mass of the counterweight is important since it must be sufficient to overcome any friction in the gauge mechanism but not be so excessive that it reduces the float effect so that it is insufficient to overcome friction in the opposite direction.

(iv) Gearing

The drive from the float pulley shaft to the pen mechanism can take a variety of forms; all of these are designed with the primary aim of minimising backlash. In some gauges this is achieved by loading the gear train in one direction, in some by use of sprung anti-backlash gears, and in others by precision manufacture of all parts.

(v) Pens

A great variety of pens and pencils have been used in tide gauges to produce a trace on the chart, some not very successfully. The pen is required to write very slowly on the chart, and to do this successfully must neither dry up nor flood. Most gauges now-a-days use either fibre tip pens or capillary pens with disposable ink capsules. Each type lasts on average about two