

or plowed after a fashion with a wooden stick, and the crop immediately put in. So rapid is the growth that crops come to maturity before the moisture has been entirely exhausted from the sub-soil. It is not possible by this method of irrigation to give the ground any further supply during the season. Naturally, the harvesting of a good crop under these conditions is attended with considerable risk, and if the flow is insufficient or other conditions not wholly satisfactory, a loss ensues. To remedy this state of affairs the natives have resorted to crude methods of raising the water from the river after it falls to the lower level, and allowing it to flow upon the land in small quantities; this method of irrigation is still practiced throughout the valley of the Nile.

The second method of irrigation, which is superseding the old flood system as far as possible, is known as perennial irrigation. By this method the water is distributed as required over the land in a systematic way throughout the whole season from a network of canals which draw their supply from the river. In order to make these canals effective it is necessary to be able to control the level of the river at the point of entrance to the distribution system, and to provide these entrances with permanent works in the way of sluice gates and waste weirs so that the amount of water may be regulated.

*Native Water Lifts.*—The two principal machines used by the natives for raising water are the "Sakkia" and "Shaduf," and from a mechanical point of view these devices are very interesting.

The "Sakkia" is a mechanical device by which the water is elevated, through heights varying from 10 to 30 ft., by means of an endless chain of earthen jars, the motive power being a pair of oxen. The construction is of the most primitive kind, and is entirely without any ironwork. The materials of which it is made are Nile mud, palm trees, grass fiber and raw-hide. It is interesting as a development of the use of the materials at hand, by which a very serviceable and satisfactory machine is constructed with engineering skill of an unconscious kind. The oxen are made to travel in a circle and rotate a vertical shaft, to which is fixed a toothed wheel about 6 ft. in diameter. This wheel engages with a smaller one similarly toothed on the end of a horizontal shaft which is carried out beneath the road on which the oxen travel. These wheels thus act as bevel gearing, the teeth being merely wooden pegs in the rim, which after some use wear themselves to a bearing. On the end of the horizontal shaft is a sort of sprocket wheel or revolving cage over which are suspended two strands of fibrous rope, which dip down beneath the water surface, and to which are attached at intervals earthen jars holding a couple of gallons each. A trough formed of a hollowed palm tree receives the discharge from the earthen jars and conducts it away.