Ramachandra Water-lift.

In the above wood-cut showing an illustration of the eastern bucket and rope drawn by the help of the western iron horse is an example of the east and west working together for the common good of India, where water-lifting is the greatest problem of the day.

In tracing the history of the water-lift in India the first inventor was the one that invented the palmyra leaf bucket that is now used in the Tinnevelly and the Godavari Districts. The next inventor was the man that stripped the bark of the tree and used it as a rope. Leaving aside the various inventors that made the wooden, leather, and metallic buckets, pulleys &c., we come to the greatest and most ingenious of our ancients namely, those that used the live-weight of men and animals on a see-saw and on inclines. Our Piccottah and the country Kavalai arethe only two water-lifts that stood the test of time. It is therefore evident

that all other attempts to invent water-lifts without utilising our ancient method of applying the animal power have all proved futile. The Piccottah is the simplest, cheapest and the most efficient. The weight of the moving parts of the machine (i. e.) the wooden see-saw bucket etc. is not more than three hundred or four hundred pounds. And the friction is therefore very low. But it has its own defects. First, it cannot be safely used for depths more than twenty feet. Secondly the number of men required to lift a large bucket with this lift is too very great, that it not only becomes very costly but also difficult to procure during the cultivating season. Thirdly one man is entirely wasted in guiding the bucket. Thus Piccottah cannot be an universal lift. The country Kavalai is only universal for want of another better, and it is so unpopular that people call it ಕವಲು (anxiety). It has a costly and troublesome water bucket though very ingenious. It costs a great strain on the animals that they very soon deteriorate. It was in view of solving this difficulty, that one of the greatest, and oldest of our Madras Agricultural College Students nearly a quarter of century ago struggled hard for years to substitute the live-weight of animals on a see-saw in place of men over a Piccottah. He did succeed in making a wonderful machine. But still it had two great defects. Firstly, it was found not safe to work to great depths with a long wooden platform that carry heavy weight of animals. Secondly, the weight of such a moving cattle platform was over three hundred pounds. Though the platform was carefully balanced on an axle still the friction of the moving parts was so great that it absorbed enormous power. Though this great intellect, Rao Bahadur C. K. Subba Rao, did not succeed in making a popular lift, yet he did go a great step in water-lift inventing, leaving his students to proceed further. Many did know that he lost his life and all that he earned in his life, in this noble enterprise for the sake of the ryot population. With the inspiration of this great personage at whose feet I had the honour

and privilege of sitting for education and enlightenment, I am trying to carry out his idea a step further by removing the two defects in his ingenious machine. Unlike Mr. Subba Rao, I took the permanent incline over which our country Kavalai is worked for utilising the maximum effect of the live weight of animals. Thus the difficulty of lifiting water from any depth is solved. Secondly, the weight of the moving parts of the machine such as the trolly, bucket, and the ropes etc. is reduced to such a low figure as 60 to 120 pounds. So much so, that it is even lighter than the see-saw of a bamboo Piccottah. As for the frictiou I have given four cast iron wheels to the four legs of the animal, and made it skate down a railed incline, thus avoiding the pulling and backing action of the animal which costs a great strain and deterioration in their health. And the water bucket too has been made the simplest and the cheapest having the minimum wear and tear.

In making this machine, every care has been taken to avoid any of the troublesome parts of other machines such as toothed wheels valves, springs, hinges, washers, plugs, closed pipes, foot-valves, water joint, etc.

Owing to the low friction in the moving parts, the cost of ropes required per year is not more than one rupee. After one months working this machine has been found to work very smoothly lifting not less than hundred buckets per hour from an average depth of 20 ft. at the rate of three gallons for every hundred pounds live-weight or in other words a hundred pound animal easily lifts three hundred gallons per hour, while in a Kavalai a hundred pounds weight of an animal does not lift more than hundred to hundred and twenty gallons per hour, thus one old animal easily does the work of three young animals. Every one that is using this machine in different parts of the Presidency says that their animals have improved in condition so much so that they want bigger buckets. Dr. Nanjunda Rao of Madras

says that he is now irrigating two hundred and fifty mango plants over four and half acres in about to hours time with an eighteen gallon bucket and an old animal weighing five-hundred pounds, for the last seven months. In another two hours time, half an acre of ragi crop is easily irrigated by the same lift. This machine is superior to a piccottah also. A man and a small *rekla* bull weighing about three hundred pounds can easily lift 1200 gallons per hour while three men on a Piccottah are not able to lift more than 1000 gallons per hour. The cost for maintaining a man and a small bull is certainly much cheaper than that of three men. The lift in the Central Farm Coimbatore has a water bucket of twenty gallon capacity and the animal that worked it weighed about six-hundred and fifty pounds. The animal was estimated to cost about forty rupees as it is very old. On the 2nd day of the trial, the animal was able to lift sixty buckets of twenty gallon capacity per hour. After a month's use the machine will easily work hundred buckets or two-thousand gallons per hour. The gradient of the incline is 1 : 3·5 while Mr. Chatterton C. I. E. in his bullettin No. 35 of 1912 says that even 1 : 3 is a good slope for animals to walk up. In Bellary a gradient of 1 : 2·5 is given to Kavalai animals. Thus in every way this machine must be efficient and very cheap.

The energy of an animal is directly proportional to its weight under similar conditions of climate, feeding and previous training. It is possible to train a small bull to do more work than its weight can do. But this is irrational, unscientific and cruel. The best way to judge of the capacity of an animal to work is to work it in its natural form and then to observe how it feels the strain on his muscles in working the machine. In the Live Weight Trolly Lift one animal can easily do more work than that of two animals without breathing hard, or frothing.

In judging the merit of the machine by its efficiency, I calculate as follows :—

Energy spent :—

700 lbs. weight of animal walking up a gradient of 1 : 3·5 over 20 feet length-height to which water is lifted.

i. e. 700 x 20/3·5 equal to 4000 foot pounds.

Work turned out :—

20 gallons of water lifted to 20 ft. height.

Or 200 pound lifted to 20 ft. height.

i. e. 22 x 20 or 4000 foot pounds.

Here the work of the driver is not calculated as was done by Mr. Chatterton C. I. E. in his bullettin No. 35 of 1912 on Water-lifts.

The efficiency of Kavalai as per above bullettin is 33%. The above calculations will speak for themselves.

S. RAMACHANDRA IYER.

Notes.

Prickly-Pear for fodder purposes :—An interesting machine called the "B and H Pear-burner," obtained from Texas U. S. A., is now under trial by the Department of Agriculture, Bombay. It consists of a 2 gallon vessel to which is fixed an air pump and from which a metal lance tube leads to a vaporizer 4 feet away. The tank is filled two-thirds with petrol and the air is pumped in. A strong flame easily adjustable and capable of being turned in all directions is obtained at the vaporizer end and this easily burns off the spines. The next thing is to teach cattle to feed on such treated bushes. The machine costs Rs. 68—2—0 landed in Poona. The cost of working is not yet known. T. S. V.

Destruction of field Rats :—Mr. Jhaveri of the Bombay Agricultural Department is said to have successfully used the " White-Ant Exterminator " for the purpose of killing field rats in their