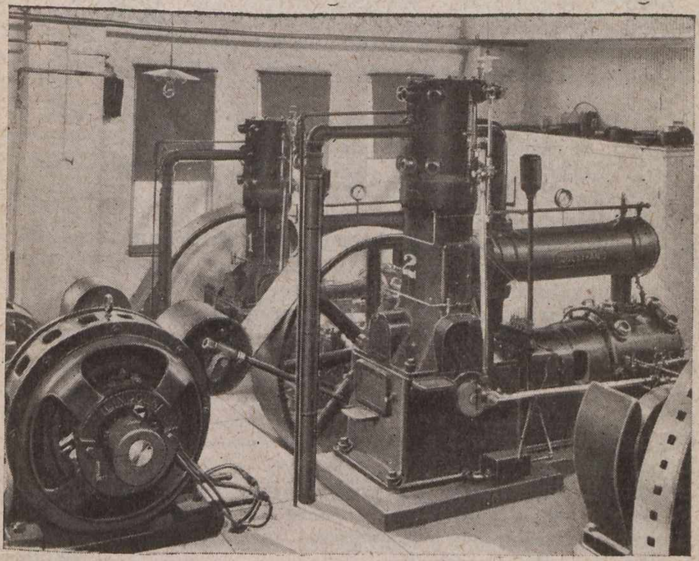
| | |
|---|---|
| Starting pressure with auxiliary | 129 lbs. |
| Gallons per minute pumped | 450 |
| Actual cu. ft. free air used per min. | .450 |
| Revolutions of compressor | 179 |
| Water h.p. (that is, ft. lbs. of work done) | 35.5 |
| Operating horse-power | 94 |
| Efficiency, per cent. | 37.5 |

The efficiency shown is considered excellent, and this result was made possible by careful proportioning of the sizes of air and water piping, proper location of the footpiece or pump in the well, and by the use of improved footpieces, providing a continuous flow of water. In this design the air is discharged from the footpiece into the water in the well casing in a multitude of fine jets, creating a very thorough mixture or emulsion of air and water. This action secures the maximum efficiency, as the chance of slippage is reduced to the minimum.



Compound Air Compressors, with Short-Belt Motor Drive, at Maywood Water Works

The figures on the second plant, known as the Bradley Well No. 2, are as follows and are taken from a test on March 8th, 1919:—

Depth of well, 1,245 ft.

Diameter, 360 ft. of 15-in., 250 ft. of 14¼-in., 635 ft. of 13½-in.

Water pipe in well, 204 ft. of 8-in., 213 ft. of 7-in., 190 ft. of 6-in.

Main air line, 600 ft. of 3-in.

Auxiliary line, 500 ft. of 1½-in.

*Conditions of operation:*—

| | |
|---|---|
| Static head from ground | 190 ft. |
| Drop | 157 ft. |
| Elevation above surface | 7 ft. |
| Total lift | 354 ft. |
| Operating submergence | 253 ft. |
| Percentage of submergence | 41.75 |
| Depth of pump in well | 600 ft. |
| Operating pressure | 115 lbs. |
| Shut-in pressure | 110 lbs. |
| Starting pressure with auxiliary | 135 lbs. |
| Gallons per minute pumped | 650 |
| Actual cu. ft. free air used per min. | 719 |
| Displacement | 883 |
| Revolutions of compressor | 214 |
| Water h.p. (that is, ft. lbs. of work done) | 58.2 |
| Operating air h.p. | 148 |
| Efficiency of air compressor compared to work done, percentage | 39.3 |
| Estimated in-put efficiency, percentage | 35.8 |
| Estimated motor efficiency, percentage | 91 |

Attention is called to the advantage of air-lift pumping in the case of wells, the waters from which, in order to make them suitable for domestic or other purposes, require treatment for the elimination of sulphates or carbonates of iron in solution, or other impurities which can be oxidized and precipitated by aeration and then removed by filtration.

In this method of pumping the compressed air is forced into and comingled with the water at the bottom, or at least deep in the well, by means of a multiplicity of fine streams or jets, ensuring the most intimate mixture of the air and water, every particle of the water being permeated with air as it rises in the eduction pipe. Oxidation and precipitation of the iron solution thus takes place with the greatest possible rapidity, and it is then a simple matter to remove it by filtration. Waters containing carbonate of iron are especially susceptible to treatment in this manner, the pumping operation at the same time serving the purpose of freeing the dissolved iron so that it may be removed by the filter without even intermediate sedimentation.

The treatment of waters containing sulphates of iron are more difficult, and the use of ample sedimentation tanks or basins ahead of the filter are advisable. In some cases aeration must be supplemented by the feeding of a very small quantity of lime into the water to accelerate sedimentation, but in any event the thorough aeration of the water in the pumping operation is a very important and vital adjunct to the purification process.

Combined air-lift pumping and purification plants can be arranged in many different ways, according to local conditions. In some cases the air-lift merely delivers the water to a sedimentation tank combined with a filter located at the surface and as close to the well as practical, the effluent from the filter flowing by gravity to a surface reservoir or sump, whence it is forced by piston or centrifugal pumps into the service system, or to a service tank or reservoir located at a suitable elevation.

In other cases, where the well or wells are deep enough to provide the necessary submergence, and other conditions are right to utilize the air-lift (by means of an air-lift booster and re-lift jet) to lift and force the water in one operation from the wells to the elevated storage reservoir, this reservoir or tank also acts as a sedimentation tank, and the water can pass from it through a pressure filter into the service pipes.

A third arrangement is where the pressure filter is placed in the line between the well and the elevated reservoir, and the water lifted and forced by the air-lift in one operation from the well through the filter and up to the elevated service reservoir.

I would like to call special attention to the two latter arrangements as it is my observation that the possibilities of the air-lift, as a means of forcing the lifted water to a point beyond the well-top, are not generally realized. While this method has its limitations, there are many situations where it can be used to advantage, eliminating the complication of a separate pump, with its incidental surface suction-basin for this service.

In the boosters generally used in these installations the discharge from the well is brought to a complete stop by striking an umbrella separator in the booster throwing the water to the bottom of the booster and allowing the air to escape from the top. Owing to the complete emulsion of the air and water, considerable of the air is carried over in the discharge from the booster, and, while this is of benefit where filtration is to be used as above described, it becomes detrimental where this class of booster is discharged into long horizontal lines, on account of the air pocketing in the high points, and also where the discharge is to be carried directly to pumps or condensers.

In order to overcome the difficulties above mentioned, and to ensure perfect separation of the air and water, a separator has been designed which consists of a simple shell, or cylinder, with top and bottom. The combined air and water is discharged into the top and at one side, at a tangent to the periphery, under high velocity from the well, causing it to swirl, and effecting a perfect separation of