need hardly be pointed out that there is a great loss of efficiency when the motor is running under a light load, as the pressure energy which is not required to drive the machine is all absorbed without useful effect in the resistance of the partially closed valve

An idea of the actual efficiency reached can be gained from a consideration of the foregoing results, obtained for the small nozzle, for the range of heads from 120 to 300 feet. In calculating the efficiencies previously given, the available work was calculated on the assumption that the pressure under which the test was made was the total pressure available. But if that pressure is not the total available pressure as when the pressure is reduced by throttling from 125 to 100 or 75 lbs. per square in., then the total available work must be considered to be the product of the weight of water used and the head equivalent to the total available pressure before any throttling took place.

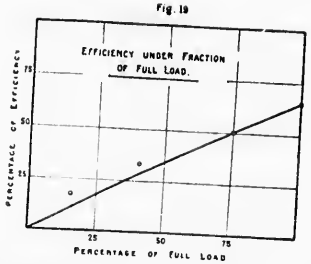
Proceeding in this way, and using the amounts of work done obtained in the trials for the various heads, but considering the energy available in every case to be that due to a pressure of 125 lbs. per square in., gives result as follows:

TABLE VII.

| Pressure. | Load. | Efficiency. |
|---|---|---|
| 125 | Full | 65% |
| 100 | .75 | 50% |
| 75 | .40 | 33% |
| 50 | .17 | about 18% |

This is illustrated in fig. 19.

Fig. 19




Besides the fact that a large amount of energy is wasted in the throttling in the pipe, a further cause of loss of efficiency under a light load exists in the fact that the motor is probably working under unfavorable conditions of pressure and velocity. In general it is desirable to keep the velocity constant, although the work done may vary. This means that if the motor is designed to run at the most efficient speed under full pressure, it will exceed the best speed for lower heads.

It will thus be seen that the efficiency obtained on the total expenditure of water will be considerably less than that indicated by the previous tables if there is any considerable variation in the load put on the motor.

In the preceding remarks an attempt has been made to describe and discuss the action of impulse water wheels, and more particularly of the wheel on which the experiments described were carried out; the question of efficiency has been illustrated and examined, and the advantages and disadvantages connected with the use of such a system have been pointed out. It is hoped that these notes may throw some light on this interesting and important subject.

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