THE UTILIZATION OF SOLAR HEAT FOR THE ELEVATION OF WATER.

This article will treat of the combined application of two natural forces to the elevation of water. These forces are: first, the heat of the atmosphere; and second, the comparatively low temperature of the water to be raised.

The accompanying drawing shows the general arrangement of an apparatus worked on this principle. This apparatus has been built at Auteuil, where it operates very well, although our climate is not favorable to the operation of such a device.

F is a small building covered by a roof, E, which is exposed to the south, and this roof is formed of ten metallic plates, which are numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. Each of these plates consists of two sheets of iron riveted together on all their edges, and separated slightly by filling pieces. Each plate thus constitutes a water-tight receptacle, in which a volatile liquid can be held. Various liquids can be used, but I prefer a solution of ammonia. Under the influence of atmospheric heat, the solution emits vapors, and said vapors or gases escape through tubes, one of which is provided for each plate and are conducted to the receptacle, N. Any liquid which may have been carried along by the gas is taken back to the plates by a tube. By another tube the gas escapes from the vessel, N. This gas has a pressure of 1, 2, or 3 atmospheres, according to the work which is to be done. It is conducted through a tube to a hollow sphere, which is placed in the well or tank from which the water is to be elevated. This sphere contains a rubber diaphragm, which can attach itself to either half of the sphere.

Let us suppose, for instance, that the sphere is full of water; the rubber diaphragm, consequently, will rest against the upper half or hemisphere. If, now, the pressure of the ammonia gas is brought to bear on the diaphragm, it will be forced to rest on the lower hemisphere; but in order to do this, the diaphragm must eject the water which fills the sphere. This causes the formation of a jet of water, as shown above the tank, R, near the letter G. But the gas must be driven from the sphere after it has been emptied of water, so that the operation may be renewed.

This is accomplished in the following manner: In the center of the diaphragm a float is inserted, which carries a rod by which a slide is actuated. One of the apertures in this slide coincides with the gas inlet and the other with the outlet. When the diaphragm rests on the upper hemisphere the inlet is opened, and the water escapes; when it moves toward the lower hemisphere the inlet is closed, the outlet is opened, the sphere is filled with water again, and so on.

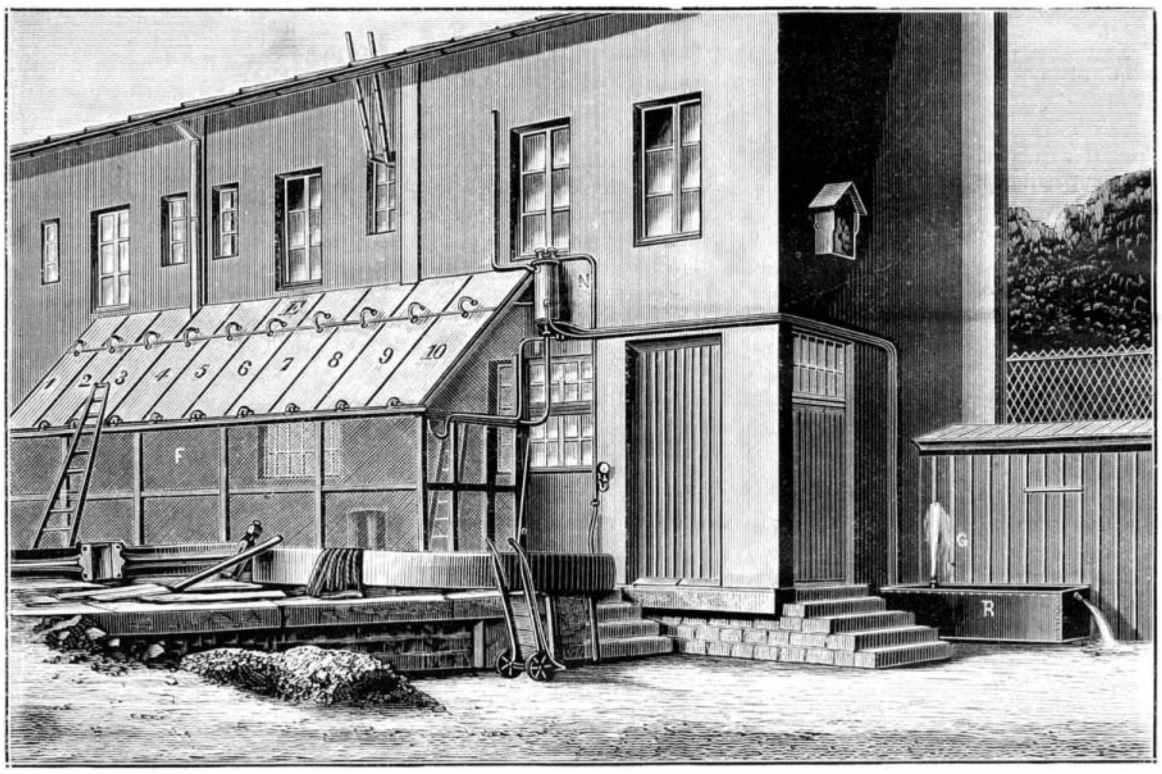
This would complete the operation if the ammonia gas did not cost anything, but as it is expensive it must be used over and over indefinitely. Here we are aided by the low temperature of the water, which is made to pass through a serpentine pipe contained in a water tight vessel containing part of the ammonia solution used. The solution is cooled by the water in the pipe, and is ready to absorb ammonia. Then, as soon as the outlet is opened, the ammonia gas conducted into it is absorbed, the pressure which was exerted in the sphere is removed, and water can again enter the sphere.

A final precaution is taken, which is to attach a little pump to the float, by means of which the ammonia solution can be pumped back into the roof, E.

The apparatus at Auteuil raises over 300 gallons of water per hour. In warm countries the same apparatus would raise 792 gallons a distance of 65 feet. The calculation of the results to be obtained by this apparatus is based on the following considerations:

A sheet of metal one yard square absorbs 11 calories for a difference of one degree. Each plate which has a surface of 4 square yards absorbs 44 calories per hour. If there is a difference of 6 degrees, 264 calories will be taken from the atmosphere every hour; and by combining this quantity of heat with the cooling action of the water, it is easy, by the difference of tension produced, to obtain an inexpensive force for raising water.

This apparatus differs from the numerous devices by which attempts have been made to utilize solar heat by means of the Archimedean mirror, by which only secondary heat is obtained. It is not necessary to concentrate the heat by metallic or other mirrors; the atmospheric heat is the basis of the operation, and all roofs exposed to the sun can be used for this purpose. In this manner a valuable motive power can be obtained in warm countries without loss of room. Generating plates, such as we have described, can be applied to any roof, and if we consider, that with only ten such plates 792 gallons can be raised 65 feet per hour, we can easily understand that a great elevating power can be obtained by increasing the number of plates.—*La Nature.*



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Increased Railway Loads.

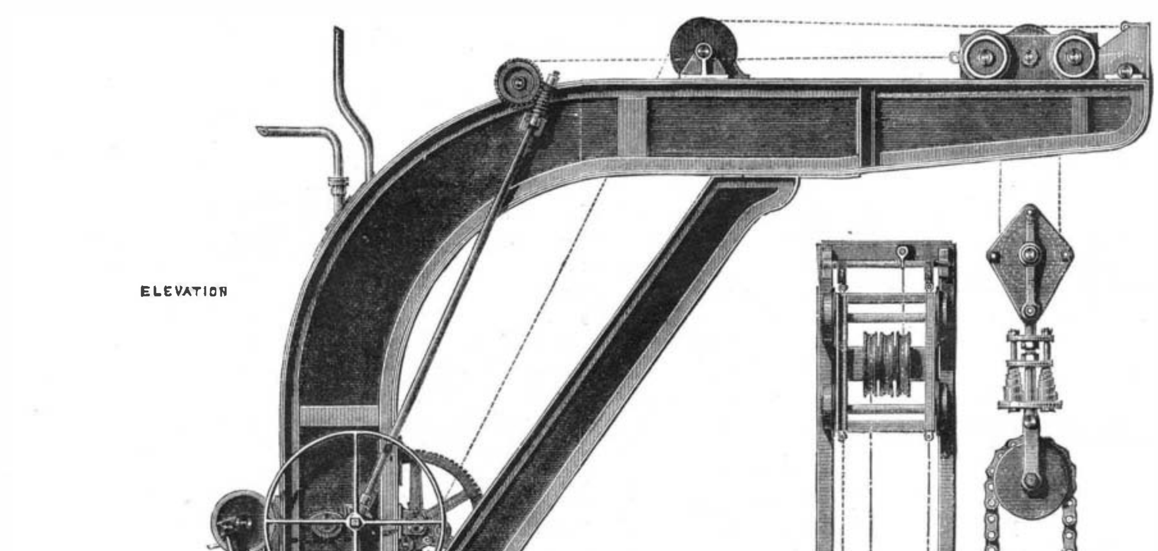
Ten years ago a standard car load on all first-class railroads was 20,000 pounds, the weight of the car being 20,500 pounds. In 1881 the load on most roads had increased to 40,000 pounds, but the weight of the car had increased to only 22,000 pounds. The master car builders of the Pennsylvania road have now adopted cars to carry 60,000 pounds, while the weight of the cars will be very little increased. Instead of hauling more than one pound of car to one pound of freight, nearly three pounds of freight can now be hauled for one pound of car. The substitution of steel for iron rails has made the change possible. This condition of affairs makes it possible for the railroads to carry freights at the low rates they receive and yet make a small profit.

FIFTEEN TON STEAM FORGE CRANES.

These cranes have been specially designed by Messrs. Abbot & Co., of Cannon Street, London, and Gateshead-on-Tyne, for the new forge of the Northeastern Marine Engineering Company at Wallsend. Two cranes are used to supply each hammer, one on either side, and work with two furnaces, so as to keep the hammer in constant work. The *Engineer* says the cylinders are 6 inches diameter, 10 inches stroke, ratio of gearing 20 to 1, and blocks 4 to 1. The extreme raike is 18 feet, and minimum raike, 12 feet. The turning is done by means of bevel wheels, and reversing clutches fixed on the second motion shaft, and the racking by means of large wrought iron hand wheel at the side.

The special features about the cranes are the swan-neck jib, by means of which the top bearing, so common in forge cranes, is dispensed with, and all risk of damage to the building by the vibration from this bearing done away with; steel live rollers to reduce the friction of the center bearing, and the steel volute springs in the blocks to reduce shock of the blow. The bottom gudgeon is lined with gun metal, and has a hard gun metal disk, and the whole of the shafts have gun metal bearings.

The foundations are arranged with a subway, so as to allow a man to go down to examine and oil the bottom bearing, and the holding-down bolts have cotters, so that one could easily be replaced in case of breakage. Two 12 ton steam cranes were also supplied with the above of similar design, and also two 4 ton hand-power cranes.



FIFTEEN TON STEAM FORGE CRANE.