SOUTHERN PACIFIC NEW LINE ACROSS GREAT SALT LAKE.

BY A. W CLAPP.

There never has been in the history of railroad engineering such a radical change in the alignment of a road as that inaugurated by the Southern Pacific from its present route to that by which it will cross the Great Salt Lake on a timber trestle.

The present distance of the line from Ogden to Lucin is 145.5 miles. Much of this distance is made by the line running about 50 miles north before turning around the north end of the lake. Over this route are many sharp curves and heavy grades.

The new cut-off will run west from Ogden to the shores of the lake, crossing to Promontory Point on seven miles of trestle; then cross the peninsula for five miles and then across the main body of the lake to Strong's Knob on the west shore. The total length of this cutoff will be 104 miles, a saving of over 41.5 miles.

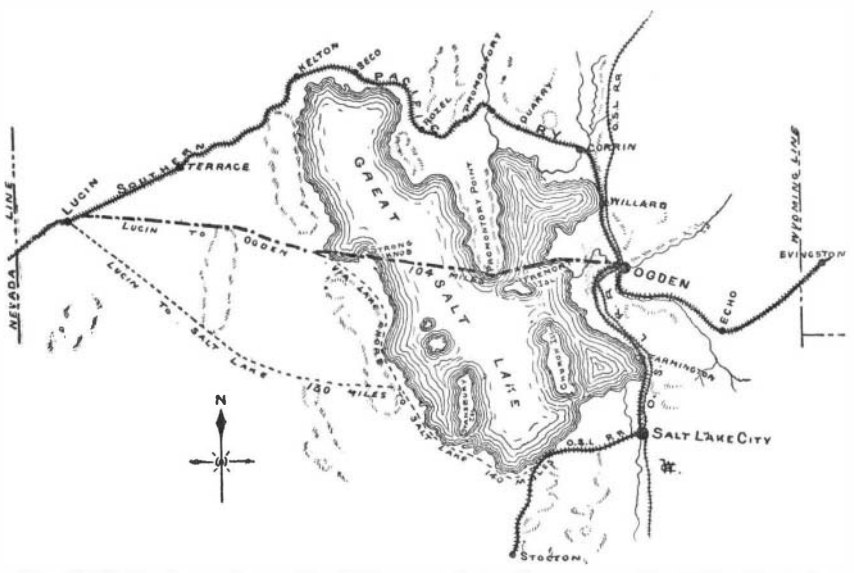
From the east shore over to the Promontory the lake is quite shallow, being not over eight feet deep. It is expected that this stretch will be filled in with earth and rock ballast, after the temporary bridge has been constructed; but the deeper portion across the main arm of the lake will be bridged. The deepest water, about 30 feet, is encountered on this stretch, which will be on a tangent. Curves will be few and very light over the entire distance from Ogden to Lucin. The fall from Ogden to the east shore of the lake is 101.7 feet, and the rise from Strong's Knob to Lucin is 512 feet in 58 miles, thus admitting of a very easy grade.

The most formidable task will be the building of the trestle across the main body of the lake. As is well known, the first material found at the bottom of the lake is a layer of very fine sand from six to thirty inches in depth. Then comes a hard stratum of soda formation of from a foot to 18 inches in thickness, and after that alternate strata of sand and blue clay for an indefinite depth.

The trestle will be built high enough to allow a rise in the waters of the lake. The low stage of water in the lake makes the present time a favorable one for the survey and construction of the new line. The experience at the Salt Lake bathing resort has been that the sand tends to accumulate around driven piles. If the same experience is had with the piling of the trestle, the result will be a rapid shallowing of water along the same, giving an increased security for the route as time progresses.

In addition to the great saving in distance, the construction of the line will bring the immense deposits of guano on the islands within easy reach of a market.

Piling has already been ordered from Texas, and arrangements for its reception made in the Ogden yards. Contracts have been let, and work, which has already started at the Ogden end, will be rapidly pushed. The enterprise will call for an expenditure of about $800,000 per year for the next three years.



THE GREAT TRESTLE BRIDGE NOW BEING BUILT ACROSS SALT LAKE BY WHICH THE SOUTHERN PACIFIC R.R. WILL SAVE 41½ MILES OF DISTANCE.

Balloon Projects for the Sahara.

One of the recent balloon projects advanced in France is that of crossing the Sahara, and M. Les Deburaux, a prominent aeronaut, has been giving considerable study to the question and thinks it quite practicable by his method of guide-rope, and that it would be possible to make the passage across the Sahara from Tunis to the Niger by utilizing the northeasterly winds which prevail in the region. The Count Castillon de Saint-Victor, who was one of the party on the last Mediterranean trip, is convinced of the practicability of the scheme, and wishes to put it into execution. However, the expense of such an undertaking would be considerable, and a large balloon sufficient to carry four or five aeronauts would necessitate an outlay of $60,000. For this reason the promoters of the enterprise wish to make an experiment on a small scale and use a balloon which is not mounted by an aeronaut, but is arranged on an automatic system. This experiment could be made for the comparatively small sum of $4,000. According to the project of M. Deburaux the balloon is provided with an automatic apparatus for keeping it in equilibrium and also with an automatic ballast-discharger, and these two devices would serve to replace the aeronaut. The equilibrium is to be assured by a heavy guide-rope made of steel cable and weighing 1,100 pounds for a balloon of 4,000 cubic yards. The automatic ballast-discharger is a water reservoir containing 5,300 pounds of water ballast and provided with a simple and solid arrangement by which if the balloon approaches within 150 feet of the ground the tank will discharge 150 pounds of ballast in half a minute. The balloon is to be provided also with an interior air-bag which will keep it always swelled out in shape in spite of the leakage of gas. It is estimated that under the most unfavorable conditions the balloon would remain in the air at least 12 days. There are ample data in regard to the prevailing winds in the region, and all the Sahara explorers are in accord that the north-northeast winds blow over the central Sahara in an almost constant manner from October to April, with invariable fine weather. These winds would propel the balloon provided with its guide-rope at a mean speed of 12 miles an hour, and thus it would cover 288 miles in 24 hours. If the balloon should become shipwrecked *en route* it would in any case have been seen by the nomads of the desert, and as its passage would be for them an extraordinary phenomenon the news would be quickly spread abroad and there would be no difficulty in forming an idea of the traject made by the balloon, and perhaps the wreck could be found, together with the registering instruments with which it would have been provided.

The Ventilation of London's Underground Railway.

Ever since the opening of her first underground railway, in 1863, London has been confronted with the serious problem of tunnel ventilation. All sorts of plans have been tried, but the air is still far from satisfactory, and is a menace to health. The directors of the Central London Railway are now taking expert advice on the matter. The subject has, however, already been thoroughly investigated by a Board of Trade committee which sat in 1897. After examining a large number of experts they came to the conclusion that the tunnel could be properly ventilated by the use of fans placed at intermediate points between the stations, but that the expense entailed would be great. According to the plan, shafts would have to be sunk midway between each two stations to act as outlets for the air, the stations and their approaches acting as inlets. In order to properly diffuse the impure air it would be necessary to carry the shafts as high as the neighboring buildings. The fans used would have to be large and open, so that they could be revolved slowly, and thus rapidly change the whole air in the tunnel without causing a strong draft. At the same time the disagreeable vibration caused by rapidly-moving machinery would be avoided, and the power expended would be reduced to a minimum. The fans proposed would change the air in the tunnel in about two and a half minutes, which is about the time it takes a train to pass between stations. Fresh air would thus be kept constantly flowing through each section of the tunnel at the rate of three miles an hour. This method was the cheapest of all proposed, the power of driving each fan by electric motors being conveniently available.

The Influence of Music Upon Animals.

Some very curious experiments have recently been carried out in the German Zoological Gardens in order to ascertain the actual influence of music upon animals. The instrument was the violin and Herr Baker was the performer. Of all the animals the puma was the most sensitive to the musical influence. His moods changed rapidly according to the nature of the melody, the animal frequently becoming very excited and nervous, "just like a Frenchman," as the report says.

Leopards were entirely unconcerned, but the lions appeared to be afraid, although their cubs wanted to dance when the music became livelier. The hyenas were very much terrified, but the monkeys were merely curious and interested. Wolves, on the other hand, were highly appreciative and seemed to beg for an *encore*.

The experiments are to be continued and with a variety of instruments, in order to distinguish between the mental states which are actually produced by the music and those which are merely the result of an unusual experience.

A WATER-TUBE LOCOMOTIVE BOILER.

As our readers are well aware, the SCIENTIFIC AMERICAN has been a frequent advocate of the adoption of the water-tube boiler for the locomotive. In the first place, quite apart from any considerations of superior economy and lighter weight for a given power, there is a demand for this type in locomotive service, due to the fact that with the present form of boiler we have about reached the maximum size that can be accommodated by the loading gage on our railroads. Such boilers as those in use on the latest express engines of the New York Central Railroad, with 3,500 square feet of heating surface, and on the latest freight engines of the Santa Fé Railroad, with 4,800 square feet, could not be enlarged in diameter without lifting the sandbox and steam dome so high that they would be in danger of striking bridges and other superstructures.

The water-tube boiler, however, not merely possesses greater steam-raising capacity for a given weight and size than the ordinary locomotive boiler, but when properly designed it is unquestionably more economical. The advocates of the standard locomotive boiler type would doubtless be prepared to dispute this, yet the latest evidence, gathered from actual trials under ordinary working conditions on an English railroad, establishes the superiority of the water-tube type. The locomotive which we illustrate on our front page is a particularly interesting machine, for the reason that its boiler, though it conforms in general appearance to the standard, is of the true water-tube type, as will be readily seen from a study of the details. It was designed by Mr. D. Drummond, the Locomotive Superintendent of the London and South-Western Railroad of England, who for some years now has been carrying on successful experiments in the use of water-tubes on a modified scale, placing them in the upper portion of the firebox. In his earlier boilers the water-tubes were confined to this part of the boiler, and one of our illustrations shows the doors on the side of the firebox, made heavy enough to withstand the boiler pressure, by which the nests of tubes are exposed for cleaning or repairs. The good results obtained with these firebox water-tubes led Mr. Drummond to carry his principle considerably further, and build a locomotive entirely on the water-tube principle. The firebox contains forty transverse horizontal tubes. The place of the usual horizontal fire tubes in the barrel is taken by a single large cylindrical flue, which is traversed by 215 cross water-tubes arranged diagonally, as shown in the illustration. In order to give the proper amount of staying to the upper corners of the front end of the firebox, fire tubes of the ordinary kind to the number of nine on each side are run in from firebox to front tube plate.

The engine here shown was built specially to test the new principle. It is a small affair compared with the modern full-powered locomotives of the railroad, its total heating surface being only 736 square feet. In reply to our inquiry, Mr. Drummond writes us that he now has in service on the South-Western Railroad a hundred engines whose boilers are fitted with cross water-tubes in the firebox, and he writes that up to the present time no complaints whatever have come in, and that during the last two years no repairs have had to be made. The engines so fitted are much more economical in coal than those not fitted with the cross tubes in the firebox, and the success has been such that all of the engines of the South-Western Company are now made with cross tubes.

The engine here shown has been running for over three months in competition with engines of the standard type, with flue tubes, giving a heating surface of 1,291 square feet, and the result shows that the little water-tube locomotive, with its small heating surface of 736 square feet, averages one pound of coal per mile less than the standard engines, although it is doing the same work.

We must confess that this strikes us as a very remarkable result. Where the disparity in heating surface is so great the efficiency of the smaller heating surface is, we imagine, to be attributed to the fact that the retardation of the hot gases on their way from the firebox to the smokebox is very much greater with the system of cross water-tubes than with the ordinary straight fire tubes, and consequently they give up much more of their heat and escape at a lower temperature to the smokestack.

The Chemical Value of the Human Body.

An ingenious chemist has made the claim that the average human being is worth about $18,300 from the chemical standpoint. His calculations are based on the fact that the human body contains three pounds and thirteen ounces of calcium; and calcium, just now, is worth $300 an ounce.

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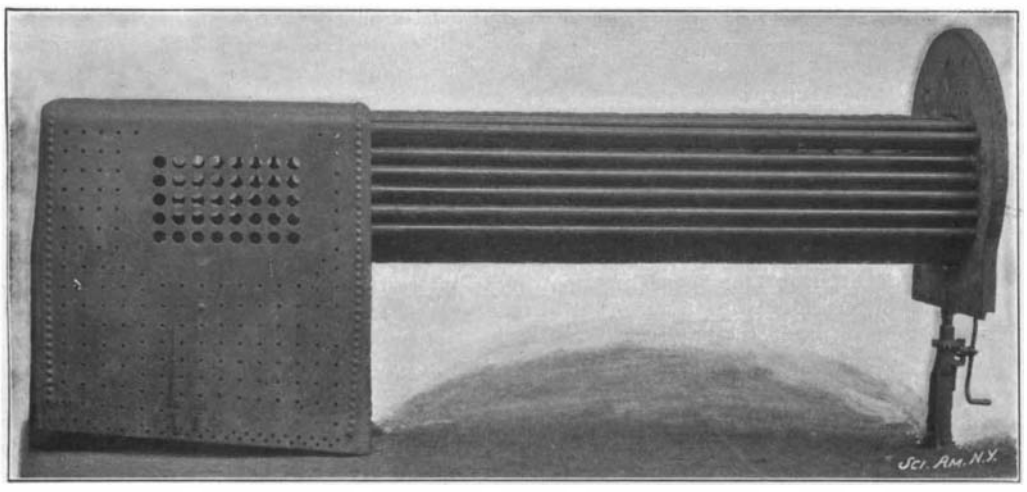
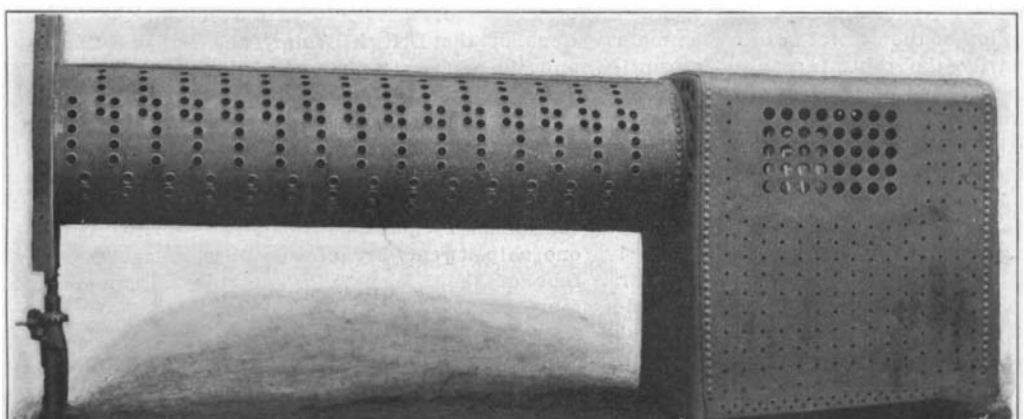
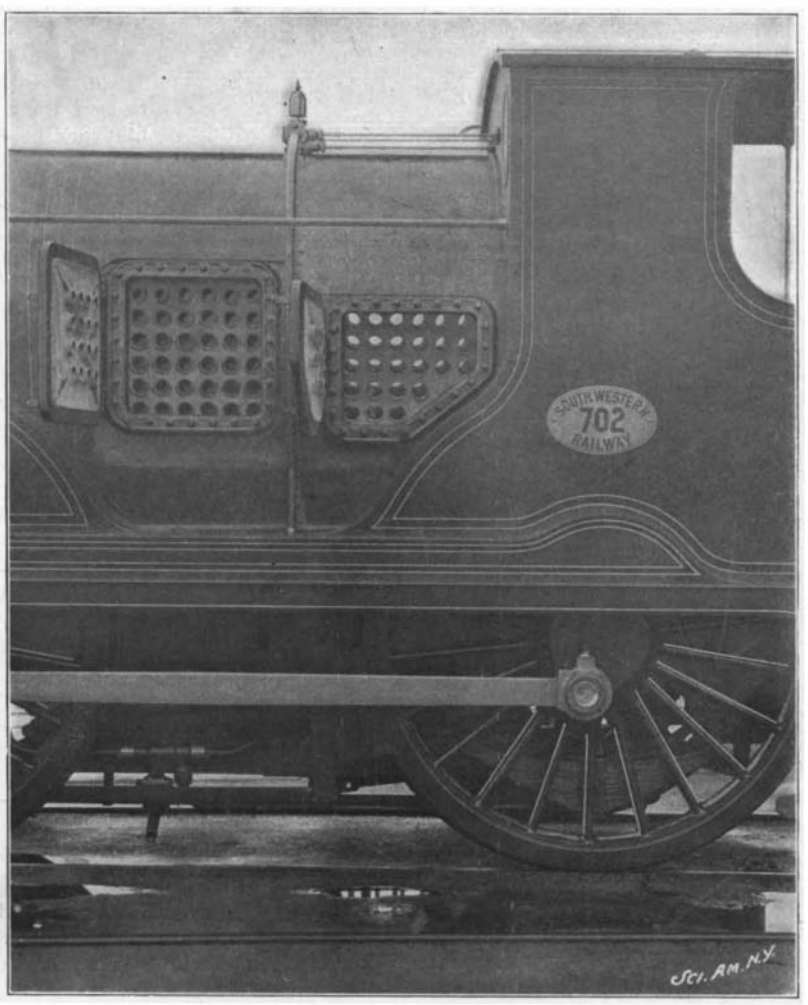


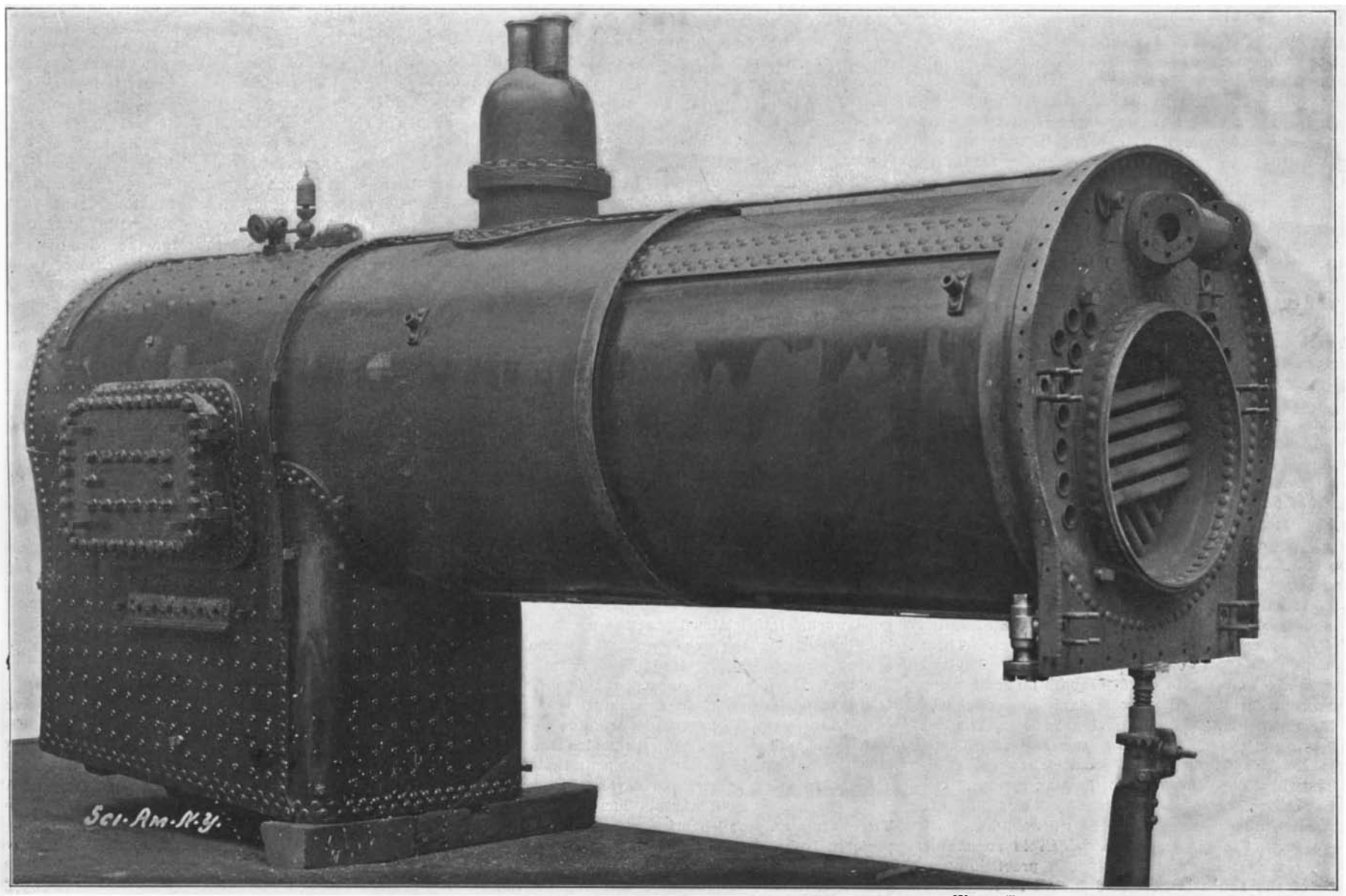
View Showing Auxiliary Fire-Tubes for Stiffening Front End of Firebox.



The Firebox and Water-Tube Flue.



Side Doors Open, Showing Cross Water-Tubes in Firebox.



Complete Boiler, Showing Side Door to Firebox and Front End of Flue with Cross Water-Tubes.

AN ENGLISH WATER-TUBE LOCOMOTIVE BOILER.—[See page 256.]