

REMARKABLE ENGINEERING FEATS IN RAILROAD WORK.

BY CHARLES F. HOLDER.

The modern plan of reaching high mountains, typified by the Rigi, the road up Vesuvius, the Mauch Chunk, Pike's Peak and Mt. Lowe roads, has been put into operation with much success at Mt. Tamalpais, north of San Francisco. This mountain forms one of the sentinels of the Golden Gate, rising directly out of a thickly-wooded country which one hundred years ago boasted some of the finest and largest redwoods in the entire range. Mt. Tamalpais has long been famous as the only lofty mountain in the immediate vicinity of San Francisco. Reached by a hard trail, but fully repaying the climb, the view is grand and impressive; the ocean stretching away on one side, the Golden Gate at its feet, and to the west the summits of tall mountains piercing the sky.

The approach to the mountain is from the bay, in the vicinity of which are many attractive places, as Sausalito, San Rafael and the little bays which have become noted for the houseboat fleet of San Francisco. The foothills of the range are extremely steep and cut by many cañons—a peculiarity of California mountains, each hog-back, or divide, having numerous lateral cañons, all of which are deep but well wooded. No little ingenuity was necessary in solving the engineering problem to make a possible ascent, but in the accompanying illustration it will be seen that the work was accomplished by a remarkable series of long reaches and gradual ascents up the sides of the largest cañons, and finally by a succession of loops known popularly as the bow-knot. Coming up out of the cañon which it has crossed, at the head, the road sweeps to the west, turns to the east, making another end to the bow, then quickly turns backward and downward to rise and complete a second bow, during which it proceeds on a regular grade to the summit, from which the traveler looks directly down upon the winding and circuitous track which has solved an exceedingly difficult problem in mountain climbing.

Among the interesting, indeed striking, engineering feats of the West, is the bridge of the Atlantic and Pacific Railroad crossing Canon Diablo, which has long been noted in the engineering world. The photograph here given shows the train in the act of spanning the bridge, completely filling it, and from the middle car the view down into this remarkable gorge is awe-inspiring, the cañon being a miniature Grand Cañon. The bridge is carried on ten piers.

The Cañon itself is extremely interesting, appearing on a vast mesa without apparent cause, worn out by the rushing water of ages, the remarkable strata telling that at one time the ocean swept over the locality. Not far from the Cañon Diablo one of the largest meteors known fell some time in the past, and among the natives there is a legend that it struck the earth at the head of the cañon and ploughed out the vast fissure as it is seen to-day. Unfortunately scientific investigation does not bear out the fact, and the meteor story merely stands as a picturesque feature to be repeated to the visiting tenderfoot. Hundreds of specimens, or fragments of this gigantic meteor, have been picked up from time to time.

Another interesting bridge is that which crosses the Rio Grande in Texas, constructed by the engineers of the Southern Pacific Company, being remarkable for its expanse and height, and adding to the attractions of the road. Not far from the Rio Grande the writer observed from the train a valley which might well have been named the father of dust spouts. The valley appeared to be about three miles in width, rising gently to the north for several miles and entailing a heavy grade, so that the train was some time in passing. At least ten lofty dust spouts were seen—majestic pillars as large as water spouts sailing down the valley from the north, finally being dissipated or destroyed by some counter current, others continually forming

at the upper end of the valley. The latter was arid and sandy—a picture of heat and desolation—and the "spouts" were due to some peculiarity of its formation.

The Greatest of All Oil Wells.

The recent oil strike in Texas has aroused so much



VIEW LOOKING DOWN THE MOUNT TAMALPAIS RAILROAD, SAN FRANCISCO.

interest throughout the country, that a brief description of the greatest oil well will not be out of place. The well in question was opened last year in the Bibi-Eibat fields in Russia. According to the United States consul at Batum, this well, during the first two or three days after it was struck, surpassed all records. As many as 180,000 barrels of oil have been taken from it during a day. It continued flowing until it produced over 2,000,000 barrels, when it stopped. Another big well was struck in the Romani district, which produced nearly 1,000,000 barrels in December and was still flowing about 25,000 barrels a day up to January 31, the date of the consul's latest information. Such a strike in the United States would mean millions to the fortunate owner of the well. But it seems it is not so in Russia. On this point the consul says:

pounds), and the owners of the well realized very little above that figure for their production. Furthermore, they were compelled to pay heavy damages to neighboring property owners and to owners of property in the village, more than a mile away, as part of the time the well was flowing there was a high wind blowing, which carried the oil over the village, and,

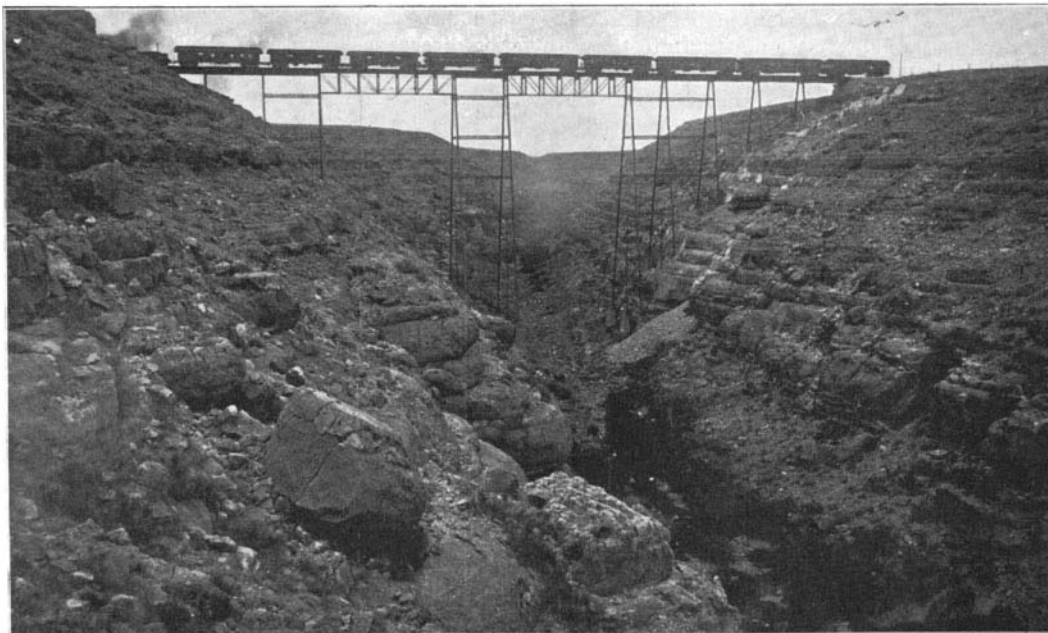
it is said, the owners of the well must pay for repainting about all the houses in the village. One-fourth to one-half a kopeck per pood does not go far toward damages of this sort. I must add that this was not the first time the village mentioned was damaged by a flowing well, as some years ago a well was struck in the Bibi-Eibat field which acted in the same manner, the wind carrying a spray of oil to the outskirts of Baku, about two and a half miles, and deluging the village which lies between Bibi-Eibat and Baku. The newspapers stated at the time that the owner of the well had to pay damages amounting to \$50,000, as he had to pay for repainting the entire village, including a fine Russian church."

As the big wells recently struck in Texas have attracted so much attention, the consul gives particulars as to the depth and finishings of the great Russian gushers. The Bibi-Eibat well is 1,813 feet deep, and is finished with a 14-inch pipe. The Romani well is 1,841 feet deep, and is finished with a 11½-inch pipe. The following comparison made by the consul of the cost of production in the Russian oil fields, as compared with the cost in the United States, is also interesting:

"The increased depth of drilling not only increases the first cost of the wells, but adds steadily and materially to the cost of raising the oil by pumping, because pumping at Baku is not done as in the United States—by means of rods and working barrel—but the oil is baled out with what is known in the United States as the bailer; but at Baku this instrument is, of course, much larger than is commonly used in the United States, as its diameter is as large as will run easily inside the pipe in the well, while its length is generally between thirty and forty feet. Of course, the deeper the well the longer, and, consequently, the fewer the runs of the bailer. Then, cleaning out, deepening, and repairing wells is a big expense. The wells are generally long lived, but require as much more expense to keep them in order than American wells, as they cost more originally. They cannot be pumped as steadily, and, consequently, there are fewer pumping days in the year."

The consul says that while the experiment of raising oil by means of compressed air is still an experiment, some of the foreign companies are equipping their wells in part with air compressors, which, he understands, are manufactured in the United States.

A Swedish invention which ought to have a good future is a system of oiling piston rods, cylinders, slide rods, and slide guides on locomotives, which has been invented by T. F. Malmros, of Gothenburg, locomotive engineer on the State railroads. Formerly cylinders and slide guides have, at best, received necessary lubrication from the central steam-lubricating apparatus, but piston rods and slide rods with packings have been lubricated by means of old-fashioned oil cups, with wick feed, which method, for many reasons, has proved unsatisfactory—especially when metal packings are used. Mr. Malmros, by introducing intermixed oil and steam, coming from the central steam-lubricating apparatus, through gland bushings expressly constructed for this purpose, has effected a good and economical lubrication of packings and



CANON DIABLO VIADUCT ON THE ATLANTIC AND PACIFIC RAILROAD.

"I think it is sufficiently interesting to mention that it is generally believed that the owners of the big well which produced more than 2,000,000 barrels in a little more than thirty days lost money by it. Without explanation, this seems impossible. The fact is that the well is on government territory, leased at a fixed royalty of 5 kopecks (2.5 cents) per pood (36.112

rods, as well as of the cylinders and slide guides. The system has for five years been tested on one of the express engines of the State railroads—used for the fastest train in Sweden, with a speed considerably exceeding 37 miles per hour—and with good results. The State railroads have applied the new lubricating system to a number of the old and new locomotives