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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS CHEMISTRY, AND MANUFACTURES.

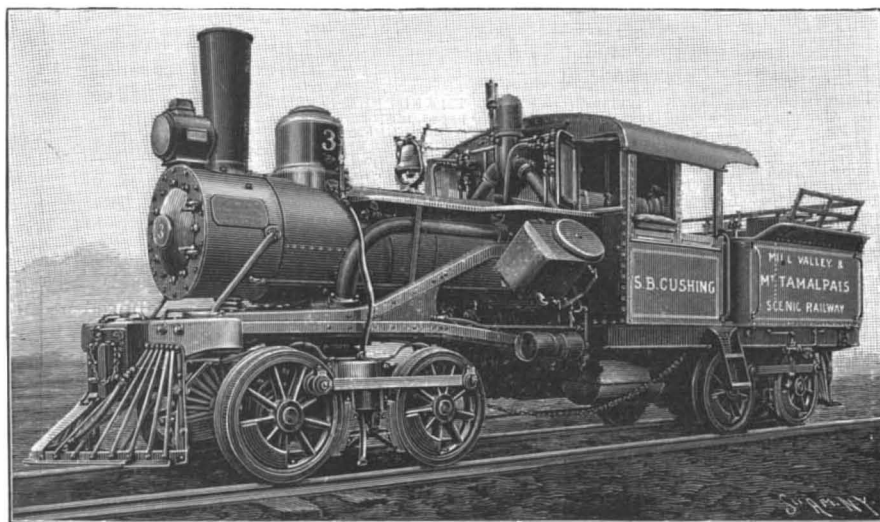
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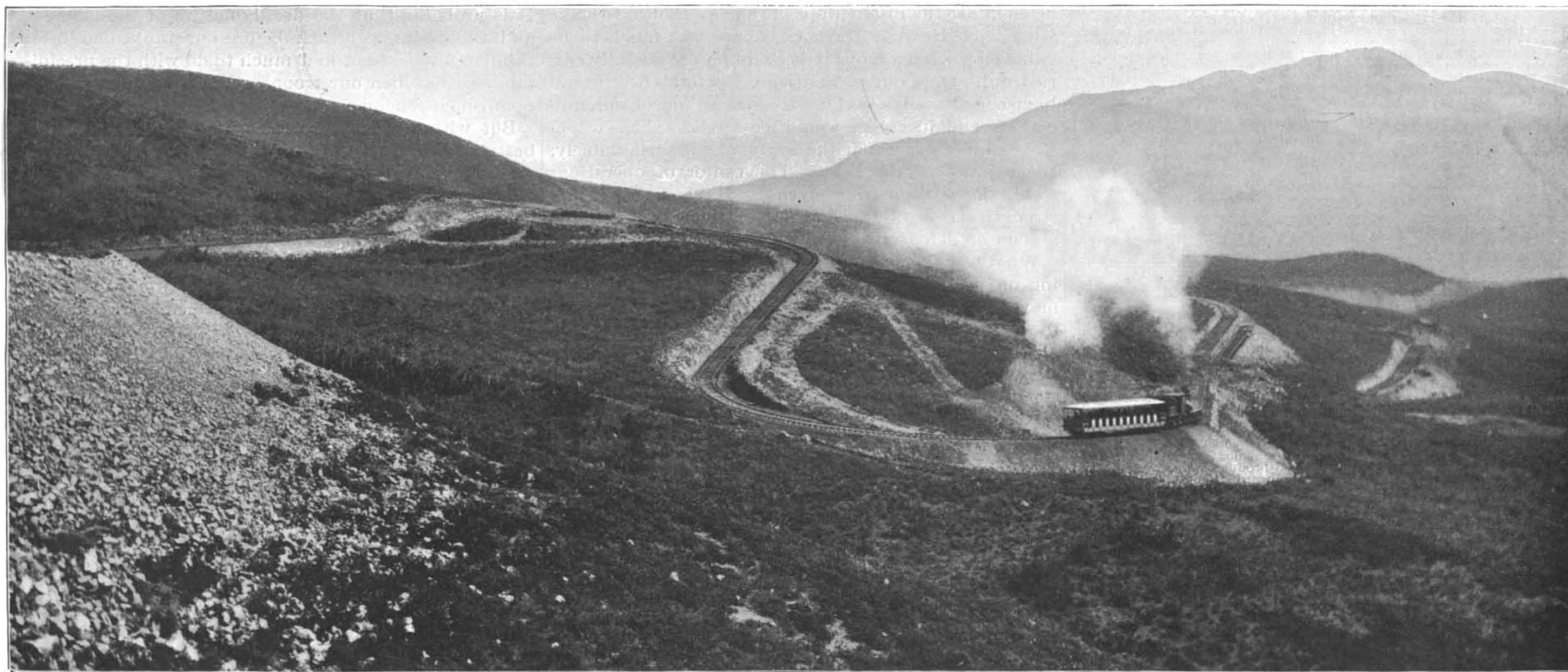
[\$3.00 A YEAR.
WEEKLY.]



1.—A TYPICAL CURVE AND TRESTLE.



2.—30-TON GEARED ENGINE WITH TWO TRUCKS.



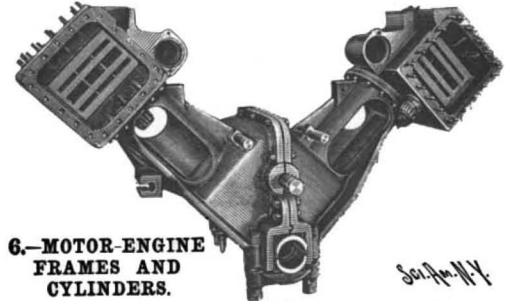
3.—THE "DOUBLE BOW KNOT"—TRACK PARALLELS ITSELF FIVE TIMES.



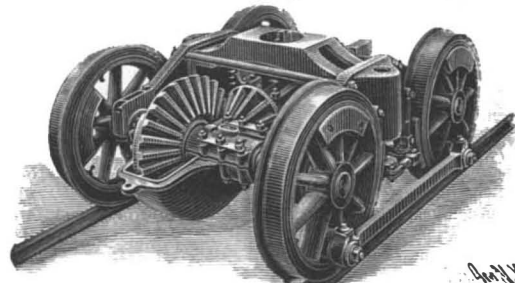
4.—VIEW FROM SUMMIT, LOOKING TOWARD SAN FRANCISCO BAY.



5.—THE TAVERN AT SUMMIT.



6.—MOTOR-ENGINE FRAMES AND CYLINDERS.



7.—A TRUCK WITH GEAR-CASE OPENED.

GEARED LOCOMOTIVES ON THE MOUNT TAMALPAIS SCENIC RAILWAY.—[See page 39.]

GEARED LOCOMOTIVES ON THE MOUNT TAMALPAIS RAILWAY.

The geared locomotive has had a somewhat extended trial in this country and has proved itself to be a valuable means of traction under special conditions. It has found a field of usefulness in the West, where it has been used on logging and mining work, in which the grades and curvature are heavy and the track is of the rough-and-ready type. For this class of service the geared locomotive is admirably adapted. It has a large hauling power in proportion to its weight, and great flexibility.

To the mechanical sense there is, at first thought, something objectionable in the idea of introducing the complication of gearing into a locomotive; though the objection is more sentimental than anything else, and is due, doubtless, to the fact that we have come to associate the idea of high speed with the locomotive, and have rightly determined that a direct connection is superior to any other for fast work of this kind. On the other hand, it is a fact that excellent results have been attained in electric traction with geared motors, some of them of considerable size and power.

There are two classes of geared locomotives. In one of these the engines are placed vertically on the outside of the frame, and drive a horizontal shaft which extends along the side of the locomotive and meshes with gears formed on the faces of the driving wheels. In the other class the engines drive a shaft which lies beneath the boiler parallel to the axis, and carries bevel gears which mesh with gears on the driving wheel axles.

On our front page we give illustrations of a 30-ton engine of the central shaft class, which was designed by Mr. Charles Heisler, consulting engineer, of Erie City, Pa., and is running successfully on the Mount Tamalpais Scenic Railway, in California. The road, which was built purely for tourist purposes, runs from Mill Valley, a point near the Golden Gate, San Francisco Harbor, to a point near the summit of Mount Tamalpais, a distance of 8.25 miles. The grades are heavy, varying from 5 to 7 per cent, and there are about 275 curves, all of which are of from 70 to 75 feet radius.

The engine, as will be seen from the cuts, is carried on two trucks, one under the forward end of the boiler and the other under the tender, the tender and locomotive being built on the same frame. On the forward axle of the leading truck and on the rear axle of the trailing truck is secured a heavy bevel spur wheel which gears with a bevel pinion whose shaft is carried by a long bearing in a frame that is formed integrally with the inclosing gear case, the upper half of which is shown removed in Fig. 7. The frame is supported by a sleeve on the axle and is independent of the truck frame, thereby insuring that the gears shall be maintained at all times in proper alignment. The gear case, which is dust-proof, enables the gears to run continuously in a bath of oil. The other axle of each truck is driven from the main axle by means of coupling-rods, as shown in Figs. 6 and 7.

The pinion shafts are inclined and extend the length of the gear frame. At their inner ends they are connected by universal joints with the main crank shaft, which extends parallel with the axis of the boiler and just above the top of the inner axles of the trucks.

The cylinders, one on each side of the boiler, are inclined 45 degrees to the vertical and drive inwardly and downwardly upon the longitudinal crank shaft. Each cylinder is bolted to its own hollow cast frame, and the two frames are securely bolted together in the vertical longitudinal plane of the locomotive, the journals of the main crank shaft being formed in the bottom of the frame. The engine frames are carried by the locomotive side frames, the space between the top and bottom bars being considerably widened to admit them. In the Heisler engines of a larger size four cylinders are used, two on each side.

In designing these engines the boiler has been made of ample capacity, to avoid over-forcing when the engine is working up to its full capacity on heavy grades, and a large cylinder capacity has been provided to insure ability to start with the heaviest loads and maintain a good speed with economical consumption of steam.

The universal couplings are made of steel and phosphor bronze. They are clamped upon the shafts, and may be readily removed. They have only a slight angular movement and offer only a slight resistance to the swing of the trucks in passing around the sharp curves which abound on this railroad. The gear wheels are made unusually heavy, so that, even when they have become weakened by wear, they may be able to withstand the heavy shocks to which they are exposed.

The Mount Tamalpais Scenic Railway is situated in the southern end of Marin County, California, and, as its name suggests, it climbs the east peak of Mount Tamalpais, a rugged and picturesque mountain that attains an elevation of 2,537 feet above the sea in a distance of three miles. Marin County forms the north shore of the famous Golden Gate of the Pacific, and is bounded on the west by the Pacific Ocean and on the east by the Bay of San Francisco. The

summit of the mountain is twelve miles northerly from the city of San Francisco and five miles easterly from the ocean.

The railway, which has a total length of 8.19 miles, is built to standard gage. The track is laid on ties 6 inches by 8 inches by 9 feet long and the rails weigh, 56 pounds per yard. It is thoroughly well ballasted, and ample superelevation is provided on all curves. Commencing at the little hamlet called Mill Valley (75 feet above sea level), which nestles at the foot of the mountain, the road ascends the valley of the Arroyo Corte Madera del Presidio in a northerly direction for a distance of about two miles, at which point the Arroyo is crossed by a trestle on a curve having a radius of 70 feet, with a total curvature of 182°. Continuing westerly along the face of the mountain for another two miles, winding in and out of many cañons, the "Mesa" is reached. Here the topography of the country compelled the engineers to overcome an elevation of 130 feet between points that were less than 800 feet apart in an air line. This was accomplished by means of what is now known as the "Double Bow Knot," where the tracks parallel themselves five times, the shortest radius of the curves at the turns being 75 feet. Here, at an elevation of 1,150 feet, the expanse of the Pacific Ocean breaks into view. Continuing westerly for a distance of two miles, the "West Loop" is reached at an elevation of 1,800 feet, where a remarkable turn of 252° is made, the radius of the curve being 80 feet and the grade 5.2 per cent. The road now stretches in an easterly direction and climbs to the Tavern of Tamalpais, which marks the end of the road at an elevation of 2,353 feet above the sea.

The average grade of the entire road is 5 per cent and the maximum grade attained is 7 per cent. The grades have been somewhat lightened on the curves to compensate for the increased resistance, but in a few instances a 6 per cent grade has been maintained upon curves of 70 feet radius. We are informed by Mr. George M. Dodge, chief engineer of the road, to whom we are indebted for the engineering data, that in this short line there are 21 wooden trestles having an aggregate length of 1,703 feet. One of these trestles is shown in our illustrations crossing the cañon already mentioned on a curve of 70 feet radius.

The excessive curvature may be judged from the fact that, out of the total length of 8.19 miles, the total amount of straight line is only 3.282 miles, while the curvature is divided as follows:

	Length.
26 curves of 70 feet radius.....	3,641 feet.
24 " 80 feet radius.....	2,974 "
20 " 90 feet radius.....	2,328 "
49 " 100 feet radius.....	4,020 "
46 " 110 to 150 feet radius.....	4,403 "
59 " 150 to 300 feet radius.....	4,710 "
42 " 300 feet radius and upward.....	3,837 "

There are in all 266 curves on the road, and it speaks well for the geared locomotives that they work very freely on the curves and show no perceptible wear on the wheel flanges.

An Acetylene Gas Exhibition in London.

An acetylene gas exhibition was opened by the Imperial Institute, London, June 15. Considerable pains were taken to make the exhibition a success as a practical exposition of the principles and practice of the production and use of acetylene gas. An influential committee was appointed, which drew up rules and regulations governing the exhibition. Generators were classed under three main heads: 1. Those in which the gas is generated by water being allowed to drop or fall in small streams on to the top of the carbide. 2. Those in which the water rises around the carbide. And, 3, those in which carbide falls into the water. Subdivisions were made into automatic and non-automatic generators. Acetylene apparatus was represented by twenty-seven exhibitors. There is a second department in which acetylene gas is made by generators which are duplicates of the ones already exhibited. The gas thus made is conducted from each machine to a lamp made by the owner and maker of the generator. A practical test of acetylene for illumination is made in another part of the building, and it is intended to make a test of the light itself as regards its effect upon color. Five rooms have been handsomely furnished and hung with oil paintings and engravings, and they are lighted with acetylene gas; therefore, the public has an opportunity of judging of the value of the new light, in presenting colors in their normal tints.

The Proposed Antarctic Exploration.

The Royal Geographical Society is much disappointed by the refusal of Lord Salisbury to supply government aid to the expedition in search of the South Pole. Notwithstanding this decision, the Royal Geographical Society has determined to raise a fund of \$250,000 by subscription, for providing for the expenses of the expedition. \$100,000 has already been promised. It has been proposed to send an especially equipped steamer in June next, and one of the purposes of the expedition will be to land a sledge party on Victoria Land, which will endeavor to penetrate the interior as far as possible and seek to locate the south magnetic pole.

Miscellaneous Notes and Receipts.

Waterproof Porcelain Cement.—Dissolve (1) 10 parts of mastic in 60 parts absolute alcohol; (2) 20 parts isinglass in 100 parts water and 10 parts grain brandy; (3) 5 parts gum ammoniac in 25 parts grain brandy; whereupon solutions 1 and 2 should be thoroughly mixed, No. 3 added, and the whole boiled down to 180 parts.—Neueste Erfahrungen und Erfindungen.

The cane bottoms of chairs can be rendered tight again by supporting the chair, moistening the cane seat thoroughly with very hot water by means of a sponge and washing off so that the cane-work becomes completely soaked. Then place the chair in the open air or, better still, in a strong draught and allow to dry. The results will always be very gratifying.—Die Mappe.

A Process to Silver Porcelain consists in mixing together 120 grammes of silver nitrate, 20 grammes of mercuric nitrate, 30 grammes of sodium bromide, 10 grammes of bismuth oxide and 120 grammes of water, adding a little gum. Coat the places to be silvered with the mass, allow to dry and bake in the kiln. Then place the pieces in the electrolytic bath and precipitate the metallic silver on the prepared places. In a similar manner gilding may be done. The effects produced in this manner may be called handsome in every respect.—Offerten Blatt für Bijouterie, etc.

A Giant Barometer has been mounted at Paris in the tower of the St. Jacob's Church. It is 12.65 meters high and 2 cm. thick. The filling consists of colored water, which is prevented from evaporating by a layer of oil above. While a mercury column, about 760 mm. high, will keep an air column of the same cross section in balance, a barometer filled with water must be much longer, because mercury is 13½ times as heavy as water. On the other hand, the fluctuations of the liquid column with such large barometers are 13½ times as great as with mercury barometers, for which reason they are admirably adapted for scientific observations.—Deutsche Uhrmacher Zeitung.

New Porcelain.—A complete revolution would take place in the ceramic industry if a new process called "Thonguss" (clay casting) should be successful. The mass is not, as heretofore, worked cold upon the potter's lathe or pressed into a mould, but is finely ground after careful drying, then melted at about +3215° C. in an electric furnace and poured in a heated, fireproof casting mould. Glazing becomes unnecessary in most cases, if the walls of the mould are sufficiently smooth. Otherwise it is allowed to cool off after the solidification of the cast to about +1860° and finely powdered glass is thrown on in a uniform, thin layer. The advantage of the new process is said to consist (aside from the considerably reduced cost) in an almost complete prevention of the unforeseen shrinking of the mass on cooling; so that henceforth instruments of precision and accurately divided measuring vessels of every description can also be made from porcelain. By means of a still unpublished process, viz., the admixture of a suitable substance to the melted clay, the inventor expects to render the cooled mass pliable—malleable—and also to make a remelting considerably more difficult. A difficulty which still remains unsolved with the clay casting method is the colored decoration. Solid colored designs, such as the much employed onion pattern, can be readily pressed with suitable stamps on the melting glass layer which forms with the said glazing method, but one has not been successful, for instance, to produce in clay casting the popular coffee cups decorated with flowers by hand painting.—Pharmaceutische Centralhalle, through Neueste Erfindungen und Erfahrungen.

The "Windward" Sails.

The auxiliary steam yacht "Windward" left New York on July 2, for Sydney, Cape Breton, in command of Capt. John Bartlett, who has made four trips to the Arctic regions. Mr. Peary and other members of his party will join the "Windward" at Sydney. The "Windward" carried one of the two survivors of the six Esquimaux which Mr. Peary brought home last year. The "Windward" has 50 tons of provisions for the use of Mr. Peary and his men. From Sydney the yacht will go to Cape York, Greenland, where she will take aboard a party of 60 Esquimaux with their sledges and dogs. From there she will steam to Sherard Osborne Fiord, where a base of supplies will be established. As the expedition moves northward it will at 50 mile intervals establish other bases of supplies for use in case the party is forced to retreat. The "Windward" will return in spring to Sydney for stores.

Lightning Explodes Mines.

During the thunder storm of June 28, a bolt of lightning struck the switchboard at Fort Washington, which controls the mines in the Potomac River, exploding three of the mines and damaging the system. The mines were intended as a protection to the capital. The explosions were witnessed by a number of persons on shore and in boats, and the exhibition left no doubt as to the fate of any boat which may be near the mines when they are exploded. An investigation was at once begun to ascertain the extent of the damage.