COUNT VON ZEPPELIN'S AIRSHIP.

Moored in the Lake of Constance, near Manzell, is a huge house, 472 feet long, in which an airship is now nearing completion, which is the embodiment of the most daring and ambitious plan ever conceived to solve the problem of aerial navigation. Within this floating workshop Count von Zeppelin has for months superintended the construction of his dirigible airship, by far the largest which has ever been built.

Von Zeppelin's ship consists of a colossal aluminium frame, 416 feet in length, 38 feet in diameter, which, in cross-section, is a twenty-four sided polygon. The cross-sectional area of the balloon-body is only 1114·72 square feet, and the entire air-resisting surface, projected upon a vertical plane, has an area of 1188·87 square feet.

The frame is composed of aluminium trellis work, covered with a fabric of which the upper surface is composed of pegamoid, and the under surface of silk. A netting of ramie fiber, which covers all the metal contruction, protects this double envelop from injury by the wire framework. The body of the balloon is divided into seventeen compartments, each of which is designed to contain a gas-bag. Of these compartments, fifteen are 26 feet long, and the remaining two 13 feet long. The gas-bags are likewise protected from injury by ramie netting. Above and below the front portion of the balloon body and at each side of the rear portion, rudders are located. The two four-bladed screw-propellers are mounted at each side of the balloon-body, at a height approximately equal to that of the center of air resistance. Each propeller has a diameter of 3·77 feet, and a speed of 1,100 revolutions per minute.

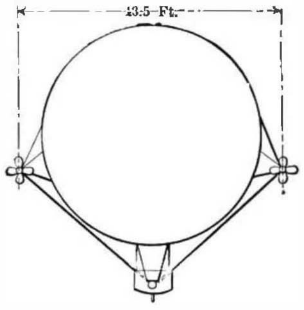


Fig. 1.—END VIEW.

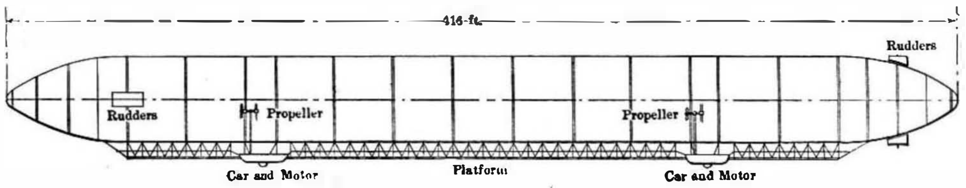


Fig. 2.—SIDE ELEVATION OF THE AIRSHIP.

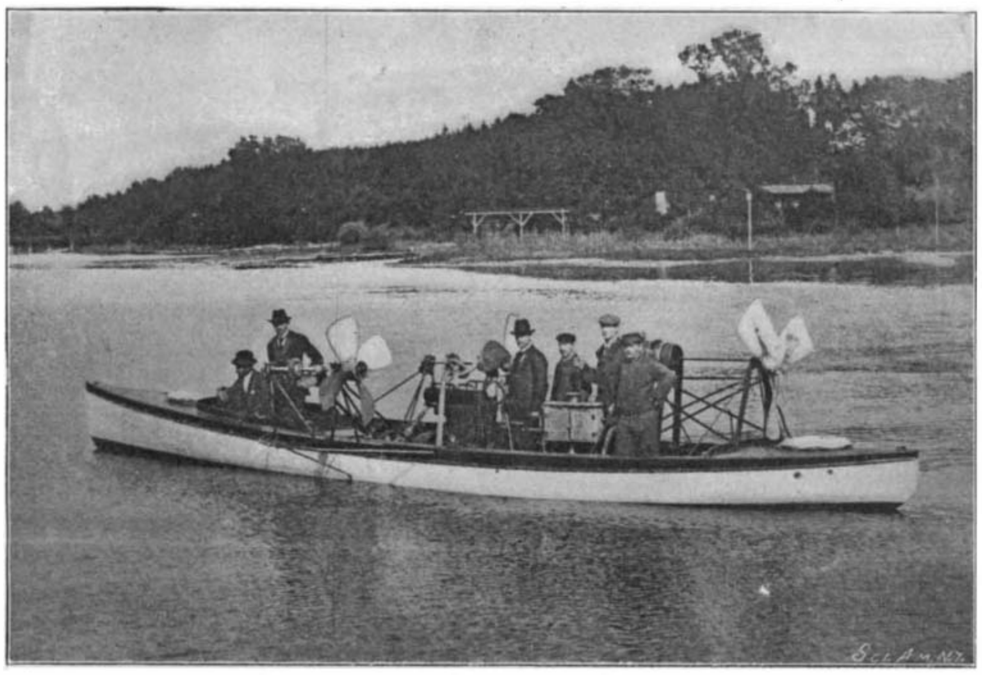


Fig. 3.—TESTING THE MOTORS OF VON ZEPPELIN'S AIRSHIP.

The merit of this compartment construction is evident enough. Although it increases the weight considerably, it tends to preserve longitudinal stability; for the shifting of the gas caused by oscillation of the longitudinal axis is confined to very small spaces and is, therefore, rendered almost inappreciable.

Six and one-half feet below the balloon body, and rigidly connected therewith, is an aluminium platform or bridge, 301·76 feet long, connecting two aluminium cars, each containing a 16 horse power motor and a 23·778 gallon tank, holding sufficient benzine for a run of ten hours. Beneath the airship a rope is suspended (omitted in Fig. 2) upon which a sliding weight (220 pounds) is carried, which can be adjusted to keep the ship in proper longitudinal trim.

Comparing the ever-memorable airship of Renard and Krebs, which had a maximum cross sectional area of 595·225 square feet, with von Zeppelin's balloon, we find that the cross sectional area of the latter is 1·95 times greater. The experiments of Renard-Krebs and of Tissandier proved that the actual velocities attained by airships were proportional to the cubic roots of their motive powers, acting upon the same cross sectional area. For a cross-sectional area of 100 square meters, 29 H. P. of the total 32 will be available for von Zeppelin's balloon; in the airship of Renard and Krebs, 14·87 H. P. were necessary for a speed of 6·5 meters per second. Hence the actual speed of Von Zeppelin's airship will be:

$$v = 6{\cdot}5 \sqrt[3]{\frac{29}{14{\cdot}87}} = 8{\cdot}12 \text{ m. } (30{\cdot}6336 \text{ ft.}) \text{ per second.}$$

In this calculation we have not considered factors in favor of Zeppelin's airship, such, for example, as the form and rigidity of the resisting surfaces, the lateral arrangement of the screws at about the height of the central point of resistance.

The question naturally arises: How great must be the power to drive a vessel with the 110·449 square meters (1188·87 square feet) maximum cross sectional area of von Zeppelin's airship? The most trustworthy formula applicable to the problem is that of Ritter von Loessl, which reads:

$$R = \frac{8}{g} F v^2 \sin \alpha.$$

In this equation R = resistance of the air to an inclined surface; g = acceleration of gravity (980·94 centimeters per second); F = the area of the surface in square meters; v = the relative velocity in meters per second of the resisting surface in air; α = the inclination of the surface to the horizontal. Roughly substituting von Zeppelin's quantities in Von Loessl's formula, we obtain: $R = \frac{1}{10} \cdot 110 \cdot 8^2 \sin 30° = 352$ kilogrammes wind pressure. Hence we obtain for the energy necessary to drive the ship at an approximate speed of 8 meters per second, $352 \times 8 = 2816$ kilogramme-meters = 20368·73 foot pounds, which divided by 550 gives approximately 37 horse power.

In this computation the favorable form of the nose has not been considered. Since in the Renard-Krebs airship the calculated horse power was found to be considerably in excess of that actually required, von Zeppelin is justified in assuming that 32 horse power is amply sufficient for the purpose of propulsion.

The weight of both motors is 1,430 pounds; the hourly consumption of fuel, about 26·4 pounds. Since the ballast of the airship will consist entirely of water, the cooling-water need not be added to the weight of the motors. The total weight of Von Zeppelin's motors is therefore reduced to 45·54 pounds per horse power hour. The driving shaft, as shown in Fig. 5, is geared to two diagonal shafts which drive the propellers.

The balloon body of von Zeppelin's airship will contain 11,300 cubic meters (399059·5 cubic feet) of gas and will consequently have a lifting capacity of 10 tons. From calculations which have been made, the total weight, including the crew of five men, will probably be 10,000 kilogrammes (9 tons), leaving 1 ton as a remainder. The actual figures can be given only after the ship has been tried.

The motors, as shown in Fig. 3, were subjected to very severe tests on a boat 36 feet in length, 6½ feet in beam. With the rearmost screw alone running at 1,100 revolutions, the boat was driven along at the rate of 6·8 miles per hour. With all three screws running, a speed of 9·3 miles was obtained. Each motor used 13·2 pounds of benzine per hour. And since each benzine tank will have a capacity of 132 pounds, the ship can sail for ten hours. At the previously mentioned speed of 8·12 meters per second, 288 kilometers or 179 miles will be the normal radius of the ship. But since the lifting-capacity is such that 800 to 1,000 additional pounds of benzine can be carried, the ship can readily journey from thirty to forty hours, so that its radius will be considerably increased.

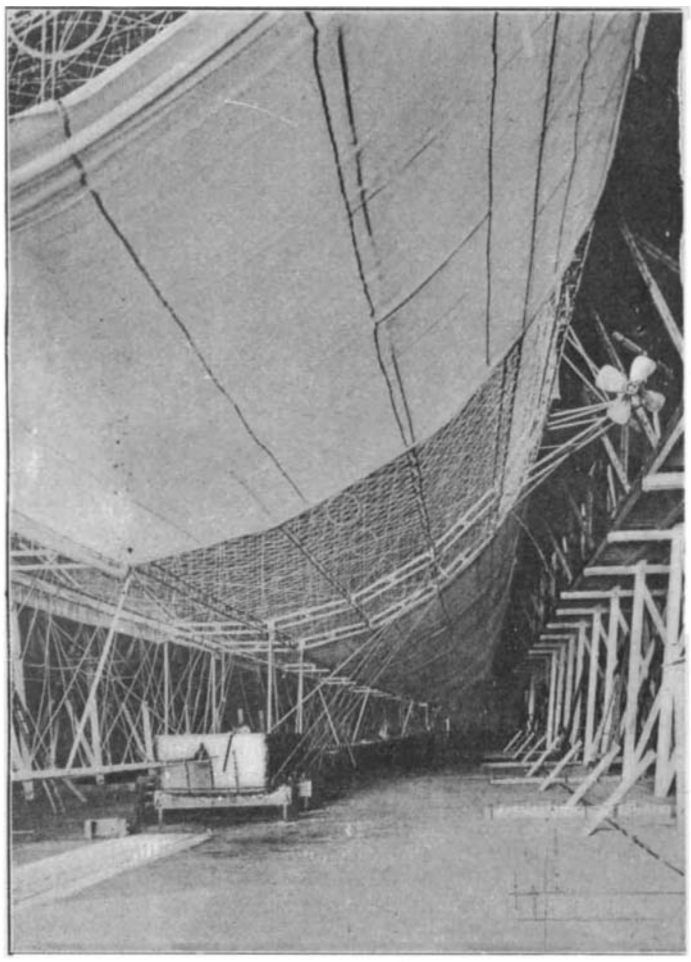


Fig. 4.—PARTIALLY ENVELOPED FRAMEWORK.

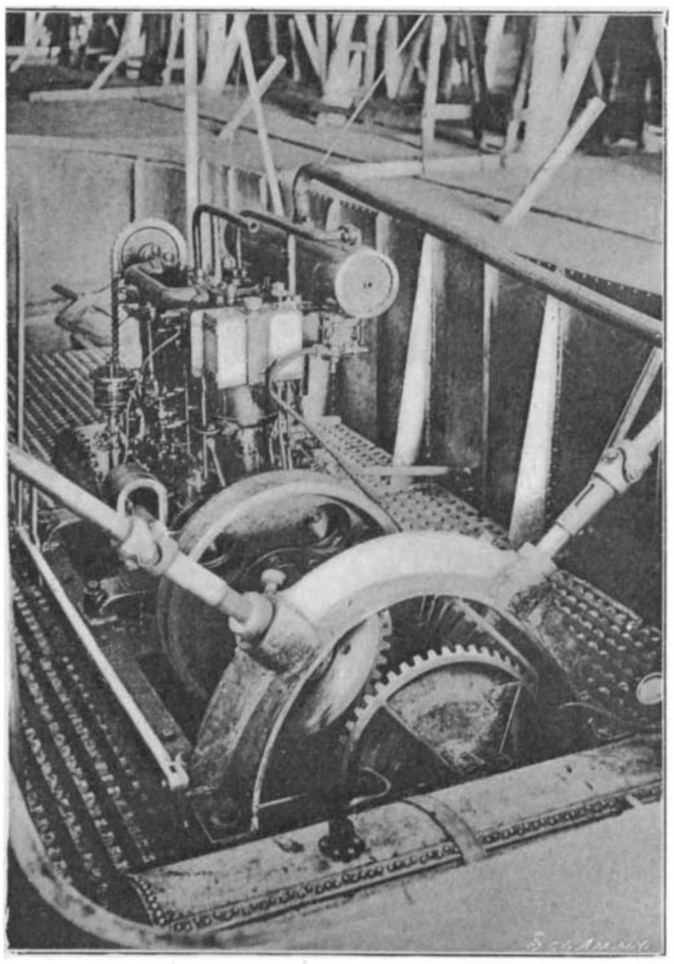


Fig. 5.—INTERIOR OF A CAR, SHOWING THE 16 HORSE POWER BENZINE MOTOR.

The airship is a balloon, with all the faults and all the merits of a balloon; but it is also a flying machine. The greatest difficulty in its navigation will be the preservation of its stability in the air, a task which requires a constant allowance for the losses in gas, shifting of the load, and effect of wind pressure. These are matters which are of the most vital importance to the aerial navigator. The man who will guide von Zeppèlin's airship will in a measure be the plaything of natural forces which at present lie without the province of human experience. He must be cautious; for he must learn by actual practice what he does not already know.

It is evident that the loss in gas for seventeen balloons will vary. So long as this loss is equal in both halves of the airship, or so long as this loss is compensated for by throwing out ballast or shifting the sliding weight, stability will be preserved. But it is clearly necessary that in each car a man should be posted whose duty it should be to maintain the stability of the vessel by jealously watching the gas-bags. The judicious use of a horizontal rudder would correct the errors due to the inability of the two men to work in unison.

BORAX—OLD AND NEW METHODS OF PRODUCTION.

In the United States the annual consumption of borax is about 12,000 tons. Prior to 1864, consumers were dependent upon Europe for their supplies. In that year the deposits in California, which were discovered in 1856, yielded 24,304 pounds, which sold at 39 cents a pound. With the increased production prices declined somewhat, so that in 1872, the year the Nevada deposits were discovered, prices had fallen to 32 cents. The production for that year was 280,000 pounds. In 1873 supplies from Nevada and from the new San Bernardino County deposits, recently discovered, brought production up to 2,000,000 pounds, causing prices to decline to 24½ cents. The succeeding year the production was doubled, with prices declining to 14½ cents. From that year to the present, production has steadily increased, with some interruptions, until the maximum of 1899 has been reached with prices 7 cents a pound. The lowest price ever known was in 1887, when borax sold at 5¾ cents. The Dingley tariff not only cut off foreign importation, but raised the price of the native product from one to one-half cents a pound.

The high price prevailing in 1872 stimulated the search for new deposits, and, in that year, Teels borax marsh near Columbus, Nevada, together with Rhodes, Columbus, and Fish Lakes, all in the immediate neighborhood, were located and promptly developed. The supply was largely increased from these fields. In 1880 the largest deposits of all were discovered in the lowest depression of Death Valley. The Amargosa borax deposits, with the Monte Blanco borate mine of this section, are of enormous extent and fully capable of supplying the world for an indefinite time. These mines are located in a region the most forbidding, remote from the railroad and offering almost unsurmountable difficulties in the reduction and marketing of their product, but their richness and extent, compared to all other fields, soon caused them to be regarded as the principal source of supply for the future production of borax in the United States.

The early production of borax was by dissolving crude borate of lime and applying heat. The liquor was drawn off and the borax allowed to crystallize. Fuel was procured from the pine forests of the neighboring mountains, and, to some extent, from the roots of the mesquite.

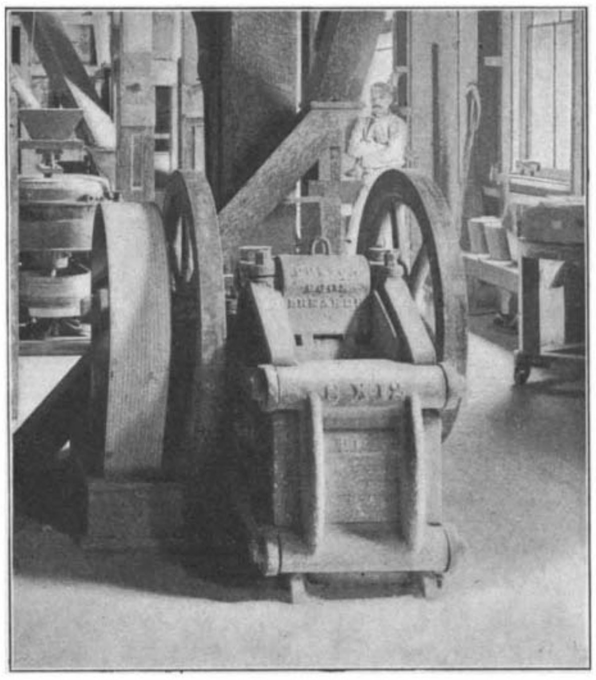
From the borax marshes in Death Valley to the nearest railroad point was 165 miles. Over this distance all supplies for the camp as well as the manufactured borax had to be hauled. The wagons used for this purpose were the largest vehicles ever made and carried 20,000 pounds, taking twenty-four horses to pull them. They traveled about 17 miles a day, and were compelled to carry a tender for water as well as feed for the stock. Springs of water were wide apart, and each journey was but a repetition of hardship and adventure. Many tragical tales are told of sanguinary fights between teamsters and tramps of the road, of men dying from heat or becoming insane from thirst. This method of marketing the product was extremely expensive, and the constant decline in prices that accompanied increased production would have stifled the industry, had not the discovery of vast deposits of borate of lime in the Calico Mountains, and only about eleven miles from the railroad, opened up a new and permanent supply and in quantity sufficient for whatever demand might be made upon it.

Until the discovery of deposits of borate of lime in the Calico Mountains, borax had been a product of the marsh and of methods the simplest, admitting no improvement in mechanical appliances. An entirely new era opened with the discovery of borate of lime in stratified rock formation. Thenceforward the industry was transformed into a proposition akin to that of quartz mining and allowing an abandonment of the necessarily rough methods of the marsh system of production.

Mechanical ingenuity superseded the wasteful agencies of the past and allowed the introduction of economical methods of manufacture and an adaptation of scientific principles. For hand labor was substituted mechanical appliances realizing certain results and greater purity of the product.

Borate of lime as mined at Calico is found in strata as well as in chambers sometimes as large as a house. The shafts are driven 600 feet below the surface, where the deposit is extracted in the same way as quartz.

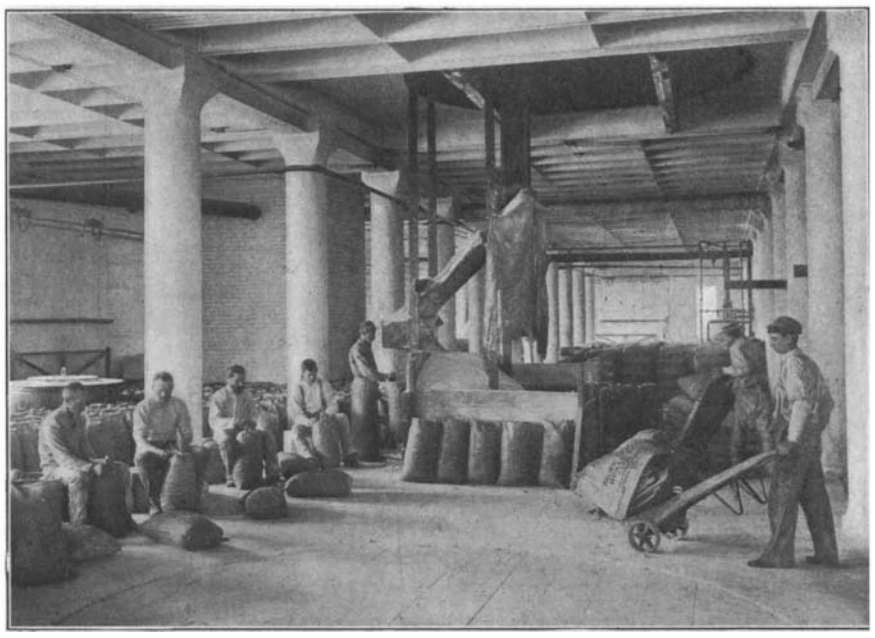
At Calico 2,000 tons a month are produced from the mines. Here it is loaded in cars, and by means of a branch railroad, eleven miles in length and owned by the company, it is hauled to Daggett and thence finds its way to tidewater on San Francisco Bay.



GRINDING CRUDE BORATE OF LIME.

The great wagons of the desert are things of the past, and the saving of expense of the 160 miles hauling has preserved an important industry from succumbing to the cheap labor of overcrowded Europe.

The works employ from 400 to 1,600 men. The crude borate of lime is first passed through rock breakers and is then ground to the fineness of flour by means of rolls and burr stones. It is then, with a small proportion of carbonate of soda, thrown into a digester, where under heat, pressure and agitation the existing affinities are completely divorced. The carbonic acid unites with the lime, which yields boracic acid, the latter with a small portion of soda and the result is borax in solution. The liquor is then drawn off into tanks, where the borax in crystallizing attaches itself to small steel rods and hooks altogether like great sticks of rock candy. The sediment contained in the mixing tanks is composed largely of sand and dirt with considerable borax mixed. The deposit is passed through a filter press, which presses the dirt and allows the borax liquor to pass away to be utilized again. Repeated over and over again, the last remnant of borax is finally secured by this process.



PACKING BORAX FOR SHIPMENT.

The uses of borax are extending year by year. The meat purchasers of the country are the largest consumers, absorbing 6,000,000 pounds and over annually. For mechanical purposes the demand is constantly increasing, but it is in the domestic consumption of borax that the expectation and hope of the industry is centered. For a hundred different demands of household economy the advantages of borax as an adjunct of the kitchen, laundry, nursery, or toilet, as a sanitary agent of value and even as a medicinal quantity, has been found of such positive value as to insure a constant and increasing element in the world's necessities.

Seedless Oranges.

Twenty-five years ago there were no seedless, or navel oranges grown. A few oranges were raised in Florida, but the bulk of the supply came from the Mediterranean, and the fruit was expensive. The annual yield of California oranges was less than five carloads. Now the annual orange yield in California is upward of 15,000 carloads, and the total amount invested is now something like $43,000,000, while twenty-five years ago it was only $23,000. The introduction of the seedless, or navel orange has caused these changes. It has revolutionized the orange industry of the United States, drawing 13,000 men out of other pursuits and has transformed vast areas of sun-baked land in California into beautiful orange groves. The New York Sun recently had an interesting article on this subject, from which we derive our information.

The first seedless orange trees were introduced in 1872 through the efforts of William F. Judson, United States Consul of Bahia, Brazil, who heard from the natives of a few trees in the swamp on the north bank of the Amazon, some sixty miles inward, which had no seeds. It seems that even in those days there were Consuls who were interested in scientific matters, and could foresee the economic value of a discovery of this kind. He sent a native up the river to get some shoots, and bring back some of the fruit. Several of the shoots were packed in moss and clay and were shipped to the Agricultural Department at Washington. They did not excite very much attention at first, but the next year Mr. Horatio Tibbetts asked the Agricultural Department for specimens of fruit and shrubs suitable for experimental propagation in Southern California. Among other things Mr. Tibbetts obtained the four surviving orange tree shoots from Brazil. They were shipped to Riverside, California, and were immediately planted. Even here the shoots appeared to have had bad luck; one died of neglect and another was chewed up by a cow. Five years passed and the two surviving trees come into bearing, and in the winter of 1878–79 they bore sixteen oranges of the seedless variety—the first ever grown in North America. Specimens were shown to orangemen and fruit growers. At first they were sceptical as to whether the trees would bear annually such fine specimens. The second crop was awaited with great anxiety. There was about a box of oranges in the second year's crop and they were even better than those of the first crop. Mr. Tibbetts was sure that there was a fortune in the new variety of oranges. For two years he experimented with propagating trees from shoots and cutting from his two seedless trees. His attempts were a failure, but finally he hit upon a scheme of budding from the seedless navel trees upon the seedling trees. Experiments along that line were successful, and it was found that a bud taken from one of the two Tibbetts trees and grafted into the bark of a seedling tree would grow to be a limb which would grow seedless oranges. The original orange branches were then cut away and the tree thereafter bore only the new variety of fruit. Work was carried on in earnest in the winter of 1882 and in the following year the demand for buds was so large that a dozen frequently sold for $5 and $1 each was finally not considered excessive for a good bud. A fence was built around the two trees to protect them and a year or two latter the orange trees that had been propagated from the two original trees began to bear and they furnished tens of thousands of navel buds, which were as good as those from the two original trees. The industry has grown until now no one thinks of planting seedling oranges, and tens of thousands of seedling trees have been budded into navel orange trees, and there are many navel orange groves in the region which have yielded net profits of from $250 to $300 an acre a year. Riverside has grown from a hamlet of less than thirty American inhabitants to a prosperous town with 14,000 population. It is the greatest orange producing locality in the world, 16,000 acres of the land being devoted to it. The average annual shipments of the oranges from Riverside are 1,600,000 boxes. The Riverside citizens are now urging that the two trees which were the source of this prosperity, be removed to a public park and suitably protected in order that they be kept for the next generation as an object lesson. No visitor is allowed to take any flower or fruit into the orchard for fear of the scale.

IN many post offices in England sealing wax is melted and kept in a liquid state by electric current.