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Contents.

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TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 875.

For the Week Ending October 8, 1892.

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SUGGESTIONS FOR INVENTORS.

There are at least two classes of inventors which are widely distinguished from each other in two important particulars. Inventors of one class are brimful of ideas, and are able to make choice of a large number of valuable subjects for invention, and seldom or never seek suggestions. Inventors of the other class are ingenious, able to invent when they see a necessity for it, but have not an exhaustless fountain of ideas, and are, therefore, dependent upon what they can obtain from others in the way of suggestions. For the latter class, who frequently inquire as to what inventions are needed, or how to go about it to get this valuable information, the following hints are given.

An inventor who has neither a large fortune nor exhaustless patience can make greater progress by working out small, simple inventions than by attempting great things. Here are a few subjects on which inventors of this class can work:

Bicycles, although brought to great perfection, seem to us to require something neater and better than the endless chain and sprocket wheel for connecting the crank shaft and drive wheel. Rowboats, especially such as are used by sea-going vessels, ought to be provided with better means of propulsion than the ancient oar. Such means should be something like the modern screw propeller, substituting man power for steam power. The important part of this invention would lie in the motor to be operated by the men. It should be very simple and so constructed that, although unused and exposed to the weather, it would still be ready for instant use at any time. The same device would apply to pleasure boats.

In these days apartment houses and flats are extensively used for dwelling places, and where room is economized to such an extent, furniture should be made to conform to the conditions: that is, to facilitate the delivery of furniture to such places and for convenience in moving, house cleaning, storage, etc., the furniture should all be made so as to knock down and fold up flat or nearly so. The parts of each piece of furniture should be connected so that they will not become separated and mismatched or lost, and when set up ready for use, the furniture should resemble that in common use to such an extent that the difference would not be readily noticeable.

Any good food product made in a new form and put up in an attractive shape takes well, and large fortunes are being made on this class of inventions. Articles of wearing apparel, especially those used by ladies, if novel and pleasing, go without much urging. Pocket conveniences for ladies or gentlemen are apt to prove profitable; toys are an unending source of profit to the inventor who strikes a vein of "taking" things, and so we might go on with an endless variety of subjects, great and small, which only await the wideawake inventor.

JUPITER'S NEW MOON.

The discovery of a new secondary planet is an event of no small importance in the world of astronomy. The fifth moon of Jupiter came into the ken of the great Lick telescope a few days ago quite as unexpectedly as the two satellites of Mars swam into the field of the Washington telescope in 1877. Neither E. E. Barnard nor Asaph Hall was looking for new or hitherto unseen worlds when they achieved immortality by a keenness of vision which enabled their practiced eyes and trained intellects to perceive what had escaped a host of other observers in the same field.

The discovery of the new Jovian satellite disturbs that nice geometrical progression which aided students to memorize the number of moons belonging to the solar system. Beginning with the earth and proceeding outwardly the account stood as follows: The earth one, Mars two, Jupiter four, Saturn eight, Uranus four, and Neptune one, total twenty. We might reasonably hope to find another satellite revolving around Neptune, thus perfecting the geometrical sequence, but the harmony of arrangement is utterly destroyed by the intrusion of Barnard's fifth satellite among Jupiter's moons.

Questions at once arise in the mind of the physicist, What is the meaning of this little lunar world? What relation does it sustain to the Jovian system? What light does it throw upon the process of world making? Are Jupiter and the other giant planets still engaged in throwing off new masses from their bulging equators?

The rapid diurnal rotation of both Jupiter and Saturn, giving objects on their surface an enormous centrifugal motion, lends color to the latter conjecture, and we notice that this theory has been broached by a writer in the Chicago *Post.* But is it tenable? Jupiter has long since cooled down from a gaseous to at least a semi-solid condition, and is about one-third heavier than water. It is true that the velocity of its diurnal motion has caused its equator to protrude so that the planet presents an oblate appearance in a telescope of moderate power, and measurements show that its equatorial diameter is 5,300 miles greater than its polar; but it is a simple problem to compute the centrifugal force of 26,000 miles per hour at the Jovian equator and compare it with the centripetal force of the planet's prodigious attracting mass. The latter greatly preponderates, and if calculations are not at fault, the giant planet has been holding itself firmly together for countless ages, and the active little world discovered by Barnard has been pursuing its rapid journey for a corresponding period of astronomical eons.

We can better appreciate the significance, or perhaps we should say the insignificance, of this little moon by comparing it with the other Jovian satellites and our own moon. With the exception of the minute orbs moving around Mars, it is the smallest known satellite of the solar system. But there are many asteroids which rival it in diminutiveness; these, however, are only half as far away as the Jovian system, and are not dimmed by proximity to his overpowering luster. Following is a table of Jupiter's moons—the outer four being copied from Young's "General Astronomy."

	Distance.	Diameter.	Period.
Barnard's	113,000	100	12h.
Io	261,000	2,500	1d. 18h.
Europa	415,000	2,100	3d. 13h.
Ganymede	664,000	3,550	7d. 4h.
Calypso	1,167,000	2,960	16d. 17h.

The second column gives the distance in miles from the center of the planet. As Jupiter has a diameter of 86,000 miles, Barnard's moon is only 70,000 miles from its surface, or less than one-third the distance of our moon from the earth. As our moon is 240,000 miles distant, has a diameter of 2,160 miles, and makes a siderial revolution in 27 days and 8 hours, it will be seen that it approximates the satellite Io in distance from its primary, and Europa in size. But note the great disparity in periods. While Io, a little further away than the moon, darts around Jupiter in 42 hours, our plodding satellite consumes 656 hours, or nearly sixteen times Io's period to accomplish a shorter journey.

This is striking evidence of the overwhelming mass of Jupiter as compared with its retinue of satellites. While it would require but 50 of our moons to equal the bulk of the earth, and 81 to equal its mass, it would require 316 earths to equal the mass and 1,300 to equal the bulk of Jupiter. These Jovian moons, then, are forced to move with high centrifugal velocity to overcome the attractive power of the mighty central mass.

Comparing these moons with some of the other planets, we find that Calypso has nearly the same diameter as Mercury, and Ganymede would equal the bulk of Mars if its diameter were 650 miles greater. Titan, the sixth moon of Saturn, is the only other satellite which equals Ganymede in size.

Are these Jovian and Saturnian worlds, with nearly half the earth's diameter, inhabited? Probably not. They may have low forms of animal and vegetable life, but the conditions do not seem favorable for the development of intelligent beings. If they have oceans and atmospheres, their vast primaries would produce such enormous tides that scarcely any portion of the habitable land would escape overflow. Of course we cannot even imagine the Barnard satellite to be the abode of life. A world only 100 miles or so in diameter parts with its heat very rapidly, and we may fairly assume that its surface is as cold as interstellar space.

But suppose a human being were permitted to step upon the surface of Io, what a magnificent celestial panorama would be unrolled to his gaze! Mighty Jupiter, with an apparent diameter 43 times that of our moon, would cover an area of the starry heavens 20 degrees in diameter. He would hide the entire constellation of Orion at one time. Unlike the unchanging face of our dead moon, which reflects only 17 per cent of the sun's rays, his surface is covered with great masses of brilliant vapor swirling and rolling and heaving in billows of tremendous agitation and reflecting 62 per cent of the sun's rays. And in addition, four balls, of lesser light, varying in size, and exhibiting all the phases from slender crescents to full-orbed globes, would be seen gliding across the heavens in a maze of intricate and rapid motions.

DREDGING THE HONOLULU HARBOR BAR.

A matter of interest to engineers and of great value to commerce is the accomplishment of the work of cutting a channel 200 feet wide and 30 feet deep through the bar at the entrance of the harbor of Honolulu, Hawaiian Islands.

The harbor is a deep, narrow channel, extending from the shore line out to the deep waters of the open sea—a distance of about 7,000 feet. It is flanked on both sides by extensive mud and sand flats, which are bounded on the seaward side by a line of coral reefs of irregular depth, upon which the surf is continually breaking. The width of the channel directly in front of the city is from 800 to 900 feet, gradually contracting to a width of about 450 feet at its mouth. The bar is situated near the outer end of the channel, is about 1,100 feet in length above the plane of 30 feet depth, and has on its apex a minimum depth of 21 feet at low tide. Inside of the bar, the depth of the harbor varies from 18 to 39 feet. The average rise of ordinary tides is one and seven-tenths feet; of spring tides, two feet; and of neap tides, one and two-tenths feet.

In May, 1890, Mr. Lorrin A. Thurston, then the very able and progressive Minister of the Interior of the Hawaiian kingdom, commissioned Mr. G. F. Allardt, an eminent civil engineer from California, to investigate the subject of deepening the bar. The engineer was to report: "First, the proper method and plant necessary to remove the bar; second, the estimated cost of the same; and third, the proper method of thereafter keeping the channel open."

Mr. Thurston having shortly afterward resigned, Mr. C. N. Spencer, the present Minister of the Interior, took up the work with great interest and has carried it to a successful conclusion. After a very careful examination, Mr. Allardt reported that the material in the bar, to a depth of 30 feet at low tide—ascertained by numerous borings made with an ordinary sand pump worked by hand—consisted of loose coral sand, with a few scattering pieces of coral. To secure a clear and indisputable depth of 30 feet, he estimated that the amount to be excavated would ultimately reach 60,000 cubic yards.

The dredging operations of the United States government in San Francisco Bay and Oakland Harbor, where the material is similar and where the hydraulic method of pumping it up and transporting it by water carriage through sheet iron pipes to the place of deposit has been very successful, furnished a basis for estimating the cost of similar work at Honolulu.

The Hawaiian government was desirous of reclaiming a tract of about 28 acres of land in the eastern part of the harbor, at an average distance of 2,500 feet from the bar. Taking into account the building of a levee around this tract, the greater cost of labor and coal, the increased expense of shipping the machinery of the dredger in detached parts from San Francisco, Mr. Allardt estimated the cost of deepening the channel at $98,000. Of this sum $65,000 was allowed for a dredging machine of the Von Schmidt pattern, $6,000 for cost of pipe, and the remaining $27,000 for dredging.

He further suggested that to get the full benefit of a deeper channel across the bar an equal depth should be secured in the harbor itself. Accordingly, to obtain a uniform depth of 30 feet at low tide over all that portion of the harbor comprised within the line of 18 feet depth, it would be necessary to excavate about 640,000 cubic yards of material, which would be sufficient to reclaim and bring up to a suitable grade about 80 acres of land now useless for business purposes.

Frequent soundings made on the bar during the past forty years show no material change in the depth of water, proving conclusively that during that period of time no appreciable movement of material has taken place either outside or inside of the bar, or on the bar itself.

The Honolulu bar, like others in tidal waters, was probably formed by the action of opposing forces from within and without. In course of time these reached an equilibrium and resulted in the present permanent condition of the bar. It is probable that as this condition of equilibrium is disturbed by the artificial deepening of the bar the same forces will tend to fill it again to the normal depth. This will be very gradual, however. The concentrated ebb current will assist in scouring the channel and aid slightly to keep it open.

In accordance with the advice of Mr. Allardt, the Hawaiian government gave the contract for building a Von Schmidt dredger to the Risdon Iron Works and San Francisco Bridge Company, jointly, for $65,000. This was commenced in July, 1891, and finished May 30, 1892. It consists of a flat-bottomed rectangular scow 100 feet long, 40 feet wide, and 9 feet deep, carrying a centrifugal pump driven by a pair of compound condensing engines of 350 horse power. There are also a pair of engines of 75 horse power for the cutter gear, and another pair of 75 horse power for the winches. All the engines and pumps exhaust into a surface condenser. Steam is supplied by a pair of fire box boilers 6 feet in diameter and 22 feet long. The pump is guaranteed to raise 10,000 cubic yards of coral sand or 60,000 yards of mud per month, but its actual capacity is probably three times that amount.

The contract for dredging was taken, by the same companies jointly which built the dredger, at $49,000, a sum considerably above the estimate, after a very careful personal examination of the bar by Mr. J. McMullan, the president of the San Francisco Bridge Company.

The dredger commenced work on the 7th of April, but it was discovered immediately that some changes were necessary both in the machine and the methods of operating. The very considerable swell on the bar precluded the use of the rigid spuds or piles made for holding and regulating the progress of the dredger, and also made it impossible to use the rigid suction pipe built into a heavy hinged framework, extending from the front end of the scow. The use of the piles was discontinued after several had been broken, and a loose suction pipe was hung in chains under the forward projecting frame, with a play of 14 feet for the rise and fall due to the swell. The Risdon Iron Works have since taken out a patent to cover this feature. The scow was moored to several anchors on both sides of the channel. The fact, however, that the prevailing fresh trade wind blew very nearly in the direction of the axis of the channel, permitting the dredger to tail on to an anchor astern, was the principal element in favor of the accomplishment of the work. Had the wind been variable, the difficulties would have been almost, if not quite, insuperable.

In this operation the Bowers patent cutter, inclosing the outer end of the suction pipe, has been useless. Fortunately, it has not been needed, as the bank of sand has been disintegrated by the indraught of the pump. From the time the dredger got fairly started on the 12th of June until the 27th of August the work progressed without interruption, night and day, except during several interruptions, when slight and usual repairs to the machinery were needed. On the last named date a channel of 100 feet wide, to a depth of 28 feet at low water, was entirely done, and there was but three days' work to finish a small portion on the outer eastern side to complete the channel to a width of 200 feet. One week's additional work in going over the entire area of the cut to reduce several 28 feet deep lumps will leave a clear channel of 30 feet deep at low water.

The Hawaiian government intends to go ahead at once to clear out the harbor to a depth of 30 feet to the present 18 foot line. As it is completely land-locked and the bottom is of soft mud, there will be no hindrance to the speedy conclusion of this excavation. Any possible filling in the harbor hereafter, or of the bar, can always be removed at once by the efficient dredger now in their possession.

It is certain, therefore, that before the 15th of September, the Hawaiians will possess one of the best protected and most accessible harbors for deep draught vessels in the world. This is of especial interest in view of the discussions relative to the acquisition of a ready-made coaling station in the vicinity of Honolulu.

The Tacoma and Steilacoom Electric Railway.

Any one who has never ridden through the mighty forests of Washington can poorly form any commensurate idea of their vastness and density. Giant firs and cedars, three and four feet in diameter at the base, rise majestically to a height of three hundred feet, and so numerous are they it seems as if an additional tree could scarce find standing room. The warm climate and exhaustless moisture furnish unequaled growing weather the year round. As one looks into these woods, vision is obstructed at a short distance by what seems a solid wall of trees.

But it was through no less impregnable a forest that the Tacoma and Steilacoom Railway Company chose its course, and taking the policy of the steam roads of the far West, followed a river canyon as far as possible. At the time of its construction it was the longest continuous electric line in the country; now it divides that honor with several others.

It was in August, 1890, that construction was commenced from the city of Tacoma to the town of Steilacoom, Washington, on the line that in many respects takes the lead among electric roads, especially in the character of country traversed. Its completion demonstrated that such lines are a great factor in the development of a new country, and are a success both as to operating details and as a business proposition. The Tacoma and Steilacoom Railway Co. awarded the contract for the construction of their road to the Northwest Thomson-Houston Electric Company, of St. Paul, Minn., including the grading and laying of the track. The work was begun in August, 1890, and was completed and ready for operation on April 1, 1891. The road commences at corner of K and Eleventh Streets, in the city of Tacoma, and runs west and south to the town of Steilacoom, a distance of thirteen miles. The country between the two towns is very rough and covered with a dense growth of giant fir and cedar trees, which had to be cut down for the right of way and the immense stumps blown out with giant powder. Hills were cut through in places to a depth of seventeen feet, and corresponding gullies filled up, and creeks crossed on long trestles, making a very expensive roadbed. The track is laid with forty-pound tee rail on fir ties, hewn from timber cut off right of way. The poles are all of cedar, and were cut along the line. Ten miles of the road have bracket poles, and the other three in corporate limits have cross suspension. Leaving K Street, the car runs west through West Tacoma, a distance of two miles, to the power house. This section of the city two years ago was a forest. To-day it is the home of 3,000 people, and has ten miles of graded streets, a fine school house, stores, handsome houses, and water and electric lights. The power station and car house is a frame building on brick foundation, 120 by 125 feet, including engine and dynamo house, 70 by 70 feet, two stories in height, the upper story used by the offices and by the employes; car barn 55 by 120 feet, with capacity for fifteen 30 foot cars, and boiler and fuel room 50 by 70 feet, the building being wired for fifty incandescent lights. The steam plant consists of one 250 horse power tandem compound non-condensing McIntosh & Seymour engine, and two 125 horse power return tubular Erie steel boilers, with feed water heater, purifier, injector, deep well, and boiler pump.

The electric plant consists of three 80 horse power Thomson-Houston railway generators. The switch board is made of black oak, the instruments being connected with polished copper rods on the front of board, presenting a very handsome appearance. The rolling stock consists of seven double truck motor cars, 30 feet over all, each equipped with two 25 horse power T.-H. railway motors, and two open cars, each equipped with two 15 horse power waterproof motors. The dynamo room at the power house is finished in oil and has a traveling crane of ten tons capacity, built in Tacoma, after designs by Mr. Livermore, engineer in charge of construction. Leaving the power house, the road runs one mile west through an immense cut, 17 feet deep and 1,200 feet long, descending an 8 per cent grade 1,500 feet long, then turns to the south and west and runs several miles through a dense forest of immense fir trees until, after descending a horseshoe curve on a 6 per cent grade for half a mile, the country opens out to a beautiful prairie dotted with dwarf firs and scrub oaks and covered with flowers and vines. Crossing this prairie for a mile, the road suddenly plunges down into an immense canyon, following the contour of the side on a five per cent grade for over a mile, making a most beautiful and romantic ride. At many points it was necessary to blast a roadway out of the mountain side, and as the car glides along its narrow path, winding around the jutting points of rock, the tree-covered mountains above afford a striking contrast to the dashing water a hundred feet below. The canyon ride is one never to be forgotten. Reaching the bottom of the canyon, the river is crossed on a trestle 300 feet long, and the road winds along its banks for a mile and a half, and at last abruptly turning a point, opens out onto Silver Beach and follows the shore of Puget Sound to the quaint old town of Steilacoom.

The view here is magnificent. The car runs along only 20 feet above high water, giving the passengers a lovely view of the sound, with its deep blue waters shining like a mirror, its lovely islands, and in the background the grand, rugged summits of the Olympic mountains, always snow-covered and beautiful. Then up a 7 per cent grade into Steilacoom, the oldest town on Puget Sound, the early rendezvous of the Hudson Bay Company's employes, and a place of refuge for the adventurous white settlers during Indian wars. The road runs through the center of the town on a fine graded avenue and reaches the water on Union Avenue, where the company has built a handsome depot and restaurant. This road leads all others in distance to which power is transmitted from station, the Steilacoom end being eleven miles from the power house. This is successfully accomplished by a complete system of feeders and by using the waters of the sound and of a creek for a ground return. The construction and equipment of this road was done under the sole supervision of S. B. Livermore, who has been an engineer of the railway department of the Thomson-Houston Electric Company since March, 1889.—*Street Railway Review.*

Cements.

The following formulas have been devised by Eugene Dieterich:

Cement of Pompeii, or Universal Cement.

Dissolve 8 ounces of sugar in 24 ounces of water in a glass flask on a water bath, and to the thin sirup add 2 ounces of slaked lime, keep the mixture at a temperature of about 70–75° C. for three days, shaking frequently, then cool, and decant the clear liquor. Dilute 6½ ounces of this liquor with as much water, and in the mixture steep 16 ounces of fine gelatine for three hours after heating to effect solution. Finally add to the mixture 1½ ounces of glacial acetic acid and 15 grains of pure carbolic acid.

Diamond Cement.

	Oz.
Fine gelatine	[illegible]
Water	4
Glacial acetic acid	1

Let these stand together for several hours, then heat to effect solution, and add 10 grains of carbolic acid to preserve the cement.

Liquid Glue (Sydetikon).

For this use 4 parts of the above mentioned saccharated solution of lime and dissolve 6 parts of glue or gelatine in it as there directed. Then neutralize the lime with a third part of oxalic acid, and add carbolic acid, in the above mentioned proportion as a preservative.

Cement for Porcelain.

Twenty parts of white lead and 12 parts of pipeclay, carefully dried, are incorporated with 10 parts of boiled linseed oil, heated on a water bath. The cemented articles are dried slowly in a warm place.—*Pharm. Centralhalle and Amer. Jour. Phar.*