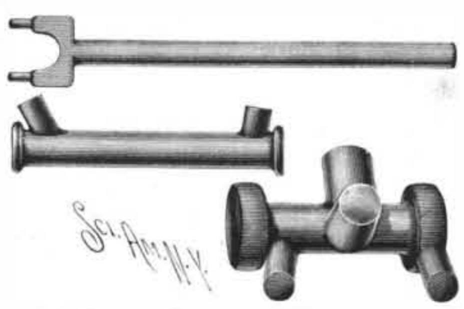
THE LOVELL DIAMOND CYCLES.

In mechanical construction the Lovell diamond cycles of 1894 maintain the degree of excellence which has given them their well-earned reputation. The material used in constructing these cycles is all special stock, and by means of expensive testing machinery in their factory, they not only test all of their stock, but keep record of it from year to year. They use in their wheels the fewest joints and parts possible, and they have to-day fewer brazed joints than other wheels. The best English weldless steel tubes are used, and all connections are solid steel drop forgings. The ball races are easily removed and the balls are held in place by ball-retaining washers. The front and rear wheels are removable without taking out bolt or nut. These cycles contain many improvements, most of

SADDLE AND SLIDING SEAT POST.



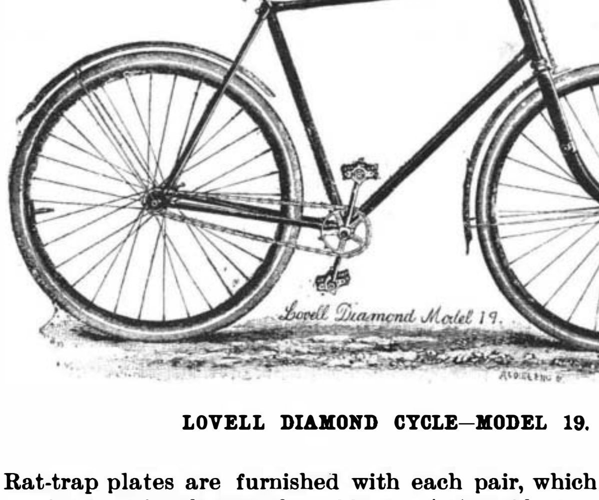
SPECIAL DROP FORGINGS BEFORE FINISHING.

which are original mechanical devices, such as pedals, adjustable seat bar, absolutely dust proof bearings, high frame, and narrow tread.

They are all finished in two coats of bright enamel, striped in gold, and highly polished; bright parts nickel-plated on copper and highly polished.

Their line of cycles covers track racer, weighing 19 lb.; road racer, 25 lb.; lady's wheel, 31 lb.; convertible, 31½ lb.; and light roadster, model 19, which we illustrate.

The wheels are 28 inches, having light crescent steel or wood rims as preferred. Full nickeled, tangent spokes of fine steel wire, swaged, are secured in the rims by nipples, and tied at the first crossing, making them very stiff and durable. The head is 10 inches long and made of one piece drop forging, with forged steel ball races at top and bottom. The forks are of the finest light steel tubing, brazed into a forged steel crown, which extends through the head and is one piece. Detachable mud guards and brakes are furnished, which can be easily removed if not wanted. Ball pedals, with square rubbers, light and dust proof.



LOVELL DIAMOND CYCLE—MODEL 19.

Rat-trap plates are furnished with each pair, which can be used in place of the rubbers. Adjustable dust proof ball bearings, of first quality throughout, including wheels, crank shaft, head, and pedals. This model is geared to 64 inches and weighs 32 lb., and when stripped, 29 lb.

The saddle and sliding seat post shown is one of the new features for 1894. This enables the rider to regulate his position and brings him at proper place over the pedals, and, by turning a set nut at bottom of saddle post, the seat can be given any desired angle, either forward or back.

Among the new pieces of drop forgings made by their special machinery, we show the parts just as they come from the forging machines, and before they are finished. This enables the Lovell diamond to do away with many joints which other wheels possess, renders these cycles stronger and more durable, and shows to what perfection this branch of manufacture has been developed.

All interested in cycling should send to the John P. Lovell Arms Co., Boston, Mass., for one of their 1894 cycle catalogues.

The Manufacture of Aluminum.

In a lecture dealing with this subject lately delivered at a meeting of the Manchester Association of Engineers, Mr. W. S. Sample, of the Patricroft Magnesium and Aluminum Metal Company, said that the development of the electrolytic processes for making aluminum created a demand for pure alumina, and manufacturers had succeeded in supplying an article over 99 per cent pure, the 1 per cent being made up principally of water and silicon. Pure carbon electrodes were necessary, and these were furnished with a fraction of 1 per cent of ash. The result was that aluminum was made so that the entire product was over 99 per cent pure, which was much better than the regular results obtained by the chemical processes.

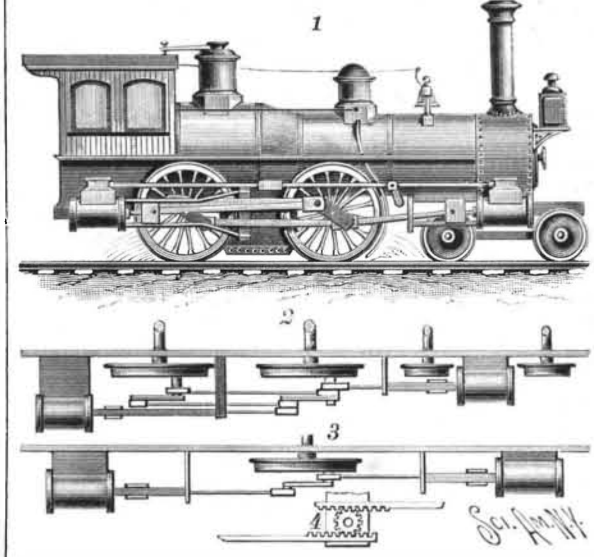
As the methods at present employed consisted of the direct reduction of the oxide of the metal, it did not seem possible to have a more simple process, and not probable that a more complicated compound could be treated in a more economical manner. It might be inferred, therefore, that further cheapening of aluminum would depend upon the greater consumption of the metal, and also upon cheaper power and materials, and the consequent decrease in the average general expenses with greater output. The present total output of pure aluminum was between 4 and 5 tons per day, which was more than the annual production up to 1886. This rapid increase in production had been due primarily to the decreased selling price, which encouraged consumers to make practical use of the metal. The present consumption might be graded into three classes, each of which took about equal parts. These were iron and steel, brass and bronze, and pure metal. The best testimonial was the continued use of the metal by both iron and steel makers, and brass and bronze founders. The properties of aluminum had been greatly exaggerated and as greatly depreciated by many writers. Notwithstanding the difficulties in perfecting a new process and in introducing a new metal, it had obtained a place among the metals of ordinary and daily use, and its position was continually being made more secure by a further appreciation of the uses to which it had been put successfully, and by new uses to which it was being applied almost daily.

Metallic Sodium on Water.

Even the amateur chemist knows that a bit of sodium dropped upon water produces an explosion. When a considerable quantity of the metal is placed in a partly closed vessel of water, a violent explosion occurs. It has been supposed that this is to be accounted for by the formation of sodium peroxide, which is at once decomposed, giving its oxygen to the hydrogen set free when the peroxide is made. Prof. Rosenfeld has been experimenting to find out whether or not this is the correct explanation of the phenomenon. He notices that the sodium is always blown to pieces from the center, and believes that the explosion is caused by the sudden separation of a hydride of sodium formed at the beginning of the reaction. He finds that a current of steam may be passed over a piece of sodium held in a bent iron tube without any explosion, and no oxygen can be detected in the resulting gas. The hydrogen is carried out of the tube before there has been time for the hydride to be formed. This experiment can best be performed with an iron crucible; the steam is blown into it through a side tube and the hydrogen escapes from a similar tube on the opposite side. When the steam is cut off, solid caustic soda, mixed with finely divided iron, is found in the crucible. This is thought to be due to the formation of an alloy of iron and sodium, which is afterward decomposed, leaving the particles of iron in the soda.

THE PATTERSON LOCOMOTIVE.

The improvement herewith represented consists in a change of method of applying power to driving wheels, and was patented by David S. Patterson, now deceased, of North Platte, Nebraska, June 6, 1893. Patents were also secured in Great Britain and Canada. Fig. 1 shows a standard American locomotive altered by application of the improved gear, and Fig. 2 is a plan view, by which it will be seen that power is applied to the same driving wheel from opposite directions, front and rear cylinders being connected by their rods to opposite ends of a double crank on the main driver. To preserve counterbalance and prevent pounding on the rear axle journals two side rods are used, the rear crank being of the same form as the main one. The engine deck forms the saddle for the rear cylinders, and has steam passages supplied through a pipe leading from the throttle pipe below the valve, the exhaust being carried under running board to rear of front saddle. In Fig. 3 the improvement is shown



THE PATTERSON LOCOMOTIVE.

with only one driving wheel. The standard form of valve motion is used, the forward valve rod extending back to rear valves, its motion being reversed by the device shown in Fig. 4, contained in a covered box which also forms a guide for the rods. This arrangement is also adapted, without the side rods, to stationary engines, particularly those of high speed, where a heated journal would cause serious trouble, such as would be the case in an electric light or street car power engine. It is also adapted to English engines having a single pair of driving wheels. By thus applying the power from opposite directions it is designed to entirely eliminate pounding and friction in the axle journals, as well as to effect an entire freedom from the well-known "pound on the rail," for, as the rod leading to the forward cylinder will push or pound downward on the rail when its crank pin is on the lower quarter, the rod leading from the rear cylinder will be on the upper quarter, pushing upward with the same force as the forward rod has in its downward pressure. For further information relative to the improvement, address Letitia Shaw Patterson, North Platte, Neb.

TIDAL INDICATOR, NEW YORK HARBOR.

Nearly all foreign trade vessels that enter the port of New York pass through what is termed "the Narrows," which is a contraction of the channel way formed by the bluffs of Staten Island on the one hand and Long Island on the other or easterly side.

For the convenience of mariners the government has lately erected upon the pier at Fort Hamilton a tidal indicator, to show, for the benefit of vessels passing in or out of the harbor, the condition of the tide. The arrow pointing downward shows that the tide is ebbing, while the mark under the figured dial indicates that it is almost dead low water and the flood will soon begin.

NEW TIDAL INDICATOR, NEW YORK.

Photographic Astronomy.

In course of a lecture at Golden Gate Hall, San Francisco, Jan. 18, on "Photographic Revelations in Astronomy," Prof. E. E. Barnard, of the Lick Observatory, said:

"Very few persons have seen any of the results of advanced astronomical photography, save the well-known pictures of the sun and the moon. Indeed, it is the privilege of the few, and only then when they have access to the great telescopes and observatories of the world. I may say that photography has practically revolutionized astronomy, for by its aid and that of the spectroscope we are enabled to see component suns that increase the power of the telescope on Mount Hamilton at least 25,000 times.

"As an illustration of the results of this class of photography, let me tell you that in February, 1892, Dr. Anderson announced that a new star was visible in the constellation of Orion. Professor Pickering, of Harvard, had made photographs of this region, but up to 1891 there were no signs of the presence of the stranger. However, on December 10, 1891, he discovered this star that had been recorded two months previously by an amateur astronomer, who used the photographic camera in the course of his observations.

"In October of the past year a Mrs. Fleming, who is interested in the observations made by Harvard College, detected a new star that had been affixed on a platemade in Central America. At the present time the rays of the sun have obscured this new star to such an extent that it is not visible, but the Harvard scientific party is still waiting at Arequipa to record its character when it emerges from the field in which it is at present bedimmed.

"Photography is also being applied to the discovery of other heavenly objects, and in the strange zone between Mars and Jupiter there are myriads of stars and kindred heavenly strangers that are constantly furnishing points of absorbing interest to those who study the field with the assistance of the camera.

"Last year, out of fifty discoveries, only one was made by the naked eye, and of the total number 35 were revealed to a single observer."

At this juncture Professor Barnard, with an assistant, used a stereopticon to illustrate the wonders and beauties of his subject, first showing the Lick Observatory in its shroud of snow, and again by moonlight and in a dense fog. He facetiously referred to his next picture as a lamp shade, but upon a closer study it was manifest to the audience that it was a faithful likeness of the sun as it sank on the crest of the ocean. Its eccentric form and luminous reflection gave it an apt resemblance to a transparent shade.

Again, the screen showed the sun with its spots and surrounding mass of incandescent hydrogen. The grouping of bright spots and granulated surface were distinctly defined and to the unscientific gave a bewildering insight to the dazzling surface of the orb of day.

"The heat of the sun is an unknown factor to scientists," said Professor Barnard. "According to their estimates it varies from 3,000 degrees to 180,000,000 degrees. One authority says that were the entire coal supply of Pennsylvania put within its radius, it would be consumed in the fraction of a second, while the glacial masses would be almost instantly turned to steam."

A photograph of the total eclipse of 1893, taken in South America, plainly showed the luminous corona of the great body. Then came the transit of Venus across the sun's surface, in which the planet's insignificant size was graphically displayed.

A magnificent view of the moon's area induced Professor Barnard to say: "On the moon there is no life, no water, no atmosphere. All is a desert. In the south pole region of the moon it will be seen that the craters are inactive and that the volcanoes are silent masses of desolation." In referring to the mountains, valleys, plains and other configurations of the moon Professor Barnard defined the distances as accurately as he would refer to the area between San Jose and Mt. Hamilton. "One mountain peak near the south pole of the moon is over 40,000 feet high—a greater altitude than that gained by any eminence of the earth," explained the professor.

Referring to the planet Mars and its canals Professor Barnard said that, in spite of repeated claims, there is no accepted theory as to whether intelligent life exists on Mars. As an illustration of the extreme sensitiveness of the camera a view was displayed which showed a projectile being discharged from the Zalinsky dynamite gun. Its flight when caught by the plate was at the rate of 600 feet a second.

A group of views of the Milky Way were shown and explained in a highly interesting manner. They were followed by a photograph of the double cluster of Perseus. It was remarked by Professor Barnard that the photographing of the comet of 1882, made at the Cape of Good Hope, was the real incentive for further research in astronomical lines by means of the camera. As illustrating the particular beauty of the skies, a view of the Pleiades, with their nebulous rims, was thrown on the screen.

As a comparison of the relative power of the telescopic camera and the human eye, a group of views plainly manifested the stupendous difference, and this was accompanied by a graphic showing of the Lick telescope traversing a starry field in search of astronomical phenomena. Professor Barnard gracefully concluded his edifying address by saying, "The heavens declare the glory of God and the firmament showeth His handiwork."

Relation of Heat to Electricity.

The effect of low temperature upon the physical properties of matter is very striking. For instance, it is found that the vigor of chemical action decreases and the elements apparently lose their ability to combine as their temperature is lowered. Thus phosphorus and oxygen, which so energetically combine at ordinary temperatures, become more and more chemically inert as this temperature is decreased, until at two hundred degrees below the freezing point of water they appear to be unable to unite. This may be otherwise stated by saying that in the absence of heat there is no chemical affinity. Now, heat is known to consist in the internal vibratory motion of atoms and molecules of matter, so that it appears that in the absence of such vibratory motions there is no possibility of chemical action. On the other hand, as the temperature falls the magnetic and electrical qualities of some, or all of the elements, is exalted in a proportional way. Thus, oxygen, which is feebly magnetic at ordinary temperature, becomes strongly magnetic at —two hundred degrees, and when liquefied, as it easily may be at such low temperature, it behaves like iron to a magnet, and will adhere strongly to its poles.

At ordinary temperatures copper is six times better a conductor of electricity than iron, but the conductivity of each is increased by cold. Copper is ten times better as a conductor of electricity at —one hundred degrees than it is at the freezing point of water, and the conductivity of iron increases at a still greater rate until iron becomes as good as copper. It has been proposed to inclose electric conductors in pipes to be kept very cold by some of the well known processes for extracting heat, such as are in common use for ice production, as the amount of copper needed would be less as the temperature was less. It may be some time before this plan is carried out, but that it is possible to thus reduce the cost of electrical conductivity by running an engine to produce cold is certain, and it will be done when the cost of copper becomes commercially comparable with the cost of running an engine for such a purpose.

Experiment seems to indicate that all the metals are thus affected by cold, and that at absolute zero their electrical conductivity becomes infinite, or, as it is more generally stated, the electrical resistance of metals becomes zero. The other properties of substances are also profoundly changed so as to be radically different from what they are under ordinary conditions; cohesion, tensile strength, malleability, etc., become less and less; so it seems altogether probable that the qualities and states of matter so familiar to us as solids, liquids, and gases depend absolutely upon temperature, and that at absolute zero there would be neither solid, nor liquid, nor gas, and that electrical and magnetic qualities would be at a maximum. This opens up a great field for speculation as to the nature of matter itself, when most of what we call its properties may be emptied out of it by simply reducing its vibratory motion. —*Prof. A. E. Dolbear, in the Cosmopolitan.*

Some Uses for Turf.

The following, according to the *Genie Civil* and the *Moniteur Scientifique*, are some industrial and economic uses to which turf has recently been put:

Manufacture of Alcohol.—Mr. J. Matheus has recently proposed, in *Dingler's Polytechnisches Journal*, to submit the substance to distillation in order to obtain alcohol from it. The base of the process consists in treating the turf with sulphuric acid of 30–35° B., derived as a residuum from certain industrial treatments.

The operation is performed in the following manner: The acid is added to the turf in sufficient quantity to obtain, with the water contained in the material, a 2·5 per cent solution of sulphuric acid. The turf and the acid are heated under pressure for five hours at a temperature of from 115° to 120° C. The solution thus obtained is separated from the insoluble residuum through a filtering press. The solution is then concentrated to a third and the acid eliminated through milk of lime and carbonate of lime. The solution thus obtained is cooled to 25° C., and made to ferment by means of yeast. Finally, the alcohol produced is distilled in the ordinary manner. On employing turf containing 14 per cent of water, 2,326 grammes of the material required 75 cubic centimeters of 20° B. sulphuric acid, and the volume of the mixture was about 1·5 liter. Three hundred grains of turf have, under these conditions, given 12·5 cubic centimeters of absolute alcohol.

Preparation of a Saccharine Liquor and of Alcohol.—Mr. C. Kappesser, of Karlsruhe, has taken out a patent (1) for the preparation of a saccharine liquor by boiling turf with acids, and (2) for the production of alcohol from the liquor thus obtained.

The turf is boiled with water mixed with sulphuric or hydrochloric acid, as in the usual process of converting cellulose into fermentable sugars. After the saccharification has reached its practical maximum, the liquor is filtered and then neutralized with chalk, and the sugar produced is isolated by the known processes (treatment with sulphurous acid, animal charcoal, concentration, etc.)

The liquor may also be directly fermented. The resulting alcohol is distilled in the usual manner.

Manufacture of Fabrics.—Mr. E. Beaumont, in the *Industrie Textile*, recommends a process of an entirely different order. He proposes to employ turf in the manufacture of fabrics, and that, too, without previous spinning. For the carrying out of his programme, he indicates four methods, from among which one has only to choose. The first consists in taking turf, obtained and prepared by any convenient method, in the state of fiber suitable for working, and in twisting it either by roving or rolling, so as to give it the appearance of a coarse cord. This rove is afterward woven, so as to form a fabric of it adapted for use as carpeting, jacketing for steam pipes and boilers, packing cloth, etc.

The second method consists in forming with the fibers of turf a sort of wadding of any thickness whatever, adapted to the kind of fabric to be produced, and then in quilting it so as to form squares or any kinds of designs or figures, even without symmetry or regularity. This quilting firmly unites the constituent fibers of the wadding and converts the latter into a true cloth, which is both thick and flexible and adapted for use in the manufacture of covers of all kinds, wrappers, etc.

In the third process, Mr. Beaumont submits the fibers prepared in sheet form to an ordinary felting, either just as they are or in mixing them before or after felting with some coating or agglutinative. This coating may be dry or liquid, and may consist of oil, gum, or any other proper material. The felt obtained may be afterward dried and passed through a drawing frame, or else be compressed or treated in any other manner. Blood, albumen, or any other analogous product may also be added to the fibers, so as to effect a coagulation at a certain degree of heat.

Finally, the last process consists in interposing between two or more layers of fibers a layer of some such material as paper or a tissue designed to give it more consistence.

Manufacture of Artificial Fuel.—Messrs. Strong & Gordon have taken out the following process of preparing briquettes of turf or other combustible:

Take 89 parts, by weight, of turf, 4 of cellulose, 6 of hydraulic lime, and 1 of rock salt, common salt, or sulphate of soda. Mix and make a paste with water and then mould in the form of briquettes.

Manufacture of Coke.—Mr. Franz Weeren, of Bisedorf, has taken out a patent for the manufacture of coke by means of turf, which consists in submitting the material to dry distillation and in grinding the resulting carbon with a suitable proportion of smith coal, and carbonizing the mixture. The product of the dry distillation of turf or of lignite is a sort of non-coherent dust that it is difficult to put to profit in this state. It is, therefore, mixed with from 15 to 100 per cent of smith coal (the proportions varying according to the nature and quality of these carbons), and the mixture is submitted to a second calcination. The tar disengaged by the coal serves to bind together the particles of dry carbon of turf or lignite and form a coke of good quality of them.

Use of Turf as a Horse Litter.—It is the mossy turf, chiefly derived from Holland, that is used for this purpose, although an exploitation of some extent, that of Pas-de-Jeu, is now carried on in France (see SCIENTIFIC AMERICAN SUPPLEMENT, No. 942, p. 15050).

Only the very fibrous, external layer of the deposits enters into its preparation. After it has been dried it must be divided. This division is effected by means of cutting disks mounted upon a horizontal cylinder. The turf is placed between two cylinders revolving with great velocity, and upon the distance apart of these depends the fineness or coarseness of the product obtained. The earthy substances are thus eliminated, and we have as a waste material a fixed dust called *torfmull*, which is much employed as a disinfectant for water closets.

The turf, torn apart and divided, falls into a compartment, wherein it is pressed, moulded, and bound automatically with wire, so as to form bales. In order to diminish the chances of fire as much as possible, the steam engine that actuates the apparatus is installed at a distance of 40 meters from the works. For the same reason, all the rooms are lighted with electricity. In order to reduce the expense of handling and carriage of the turf, a cutting apparatus is sometimes mounted upon a boat, which is easily moved to the places of exploitation where the mossy turf is found.

A TINY electric light fastened to the end of a pencil is a recent invention to enable reporters to make notes in darkness, and find the keyhole when they reach home.