efforts being in the direction of stupid attempts to escape.

If properly taken care of, there seems no reason why this animal should not take its place in our zoological gardens, and surely as the original mermaid it is imperative that it should be a part of the curiosities of the traveling menageries.

BIRMINGHAM CABLE RAILWAY.

Cable railways are now being introduced in England. We present herewith an engraving of the engines used for driving the Birmingham cable, for which we are indebted to the *Engineer*. This machinery has been made by Messrs. Tangye, Birmingham.

The engines have jacketed cylinders 24 in. diameter by 48 in. stroke, and run fifty revolutions per minute; they are fitted with Jefferiss' automatic expansion gear. The piston rods, 4 in. diameter, are of steel; the steam pipes 6 in. diameter, and exhaust pipes 8 in. diameter. A main equilibrium stop valve is placed in a convenient position, so that the engineer can have full view of his engines. Under each fly wheel a powerful steam brake is fixed, so that the engines can be stopped immediately any accident happens to the rope. The exhaust pipe from the cylinders has a by-pass, by means of which the exhaust steam, instead of going through the heater, can be utilized in the injectors for feeding the boilers.

The crossheads are fitted with gun metal adjustable soles; the pins are of steel, but the connecting rods are of wrought iron. The fly wheels are 15 ft. diameter and 2 ft. in width; they are made in two parts, secured together by turned bolts. They are turned on the face, and weigh about 8 tons each. The main shaft is of steel, and is 9¼ in. diameter at the bearings, which have wedge adjustment and are in three parts. The pinion on the main shaft is 5 ft. 4⅝ in. diameter, the large spur wheels are 13 ft. 11⅛ in. diameter at the pitch line; all these are in halves, planed and connected by the bolts.

The barring arrangement consists of a pair of Tangye's vertical Archer engines, with cylinders 6 in. diameter and 7 in. stroke, which drive a pinion geared into a spur wheel fixed to a shaft on which is a worm gearing into a worm wheel attached to a secondary shaft which can be coupled to either of the main engine shafts; and when the main engines are once started they throw the worm out of gear, and when once out of gear it is held there by a catch. Either or both engines may be thrown out of gear by means of clutches. The main pinion and the large spur wheels are fixed to the shafts, but the large grooved pulleys are made fast or loose by means of the clutches at the ends of the spindles carrying them and the hand wheels.

The rope driving pulleys for the Birmingham service are 10 ft. diameter, in halves, and are also provided with jaw couplings cast on the boss at one side. The periphery is grooved for the rope, and is lined with compressed beechwood, held in position by segments bolted on at one side.

The carry pulleys along the line are placed 28 ft. apart; the yokes are placed 4 ft. apart; the radius of sharpest curve, namely, that at Colmore row, is 45 ft. on a gradient of 1 in 20–28; a very awkward corner. The steepest gradients on the route, 1 in 20—Snow Hill. The permanent way of the extension to Handsworth, which will shortly be constructed, is about 1⅔ miles in length, and is also to be double line throughout.

There is a 6 ton overhead traveler, which runs the length of the building on beams supported at the side walls, and consists of two wrought iron end carriages mounted on wheels, two wrought iron girders, and a compact lifting gear or crab fixed at one end, so that all motions can be worked from the side. The crab is self-sustaining, and the weight can either be lowered by pulling the chains or releasing the brake. The span of the traveler is 37 ft. 9 in.

A Snake Siphon.

Old Sergeant Subers relates the following as strictly true, and says it can be vouched for by forty of the most influential citizens of East Macon:

Out on the plantation of Mr. J. G. Evans, near Macon, there are a great many moccasins, especially about the mill pond. One little pond near the mill is a favorite resort, and they congregate in great numbers about it. It is supplied by the rains, and last summer, during the protracted drought, it went almost dry, with a great number of snakes to mourn the loss of the water. The snakes did not like to be evicted by dry weather, so they crawled out in single file from the little pond that lay below the level of the mill pond. When the first snake, or leader, had reached the water of the mill pond a halt was called, and each snake proceeded to swallow the tail of the snake in front of him, until each mouth was filled with a tail, and then every snake in the long line proceeded to shed its skin and crawl out. The shed skins formed a long length of hose, which, acting like a siphon, drew the water from the mill pond and filled the little pond, and, what is better, kept it full all summer.—*Macon Telegraph.*

Correspondence.

A Letter Envelope Gum Moistener.

To the Editor of the Scientific American:

Referring to your article on page 224 of the SCIENTIFIC AMERICAN for October 13, 1888, where you say, "Any one who closes a letter in the ordinary manner finds the lips soiled and a villainous taste left in the mouth," a convenient device for making it unnecessary for any one to use the mouth in closing a letter is as follows: Take an ordinary glass alcohol lamp, having a glass cover; remove the metallic wick tube, fill the lamp with pure water and insert candle wick sufficient to close the opening, but allow sufficient moisture of the wick to moisten envelopes. If the cover is kept on when not in use, it will remain clean for some time, and the wicking is easily replaced when it becomes soiled.

However pure the gum on an envelope may be, no one should venture to moisten it with the tongue or lips, because disease germs may attach themselves to the cleanest gum. HENRY B. BAKER.

Lansing, Mich., Oct. 16, 1888.

Burners for Lamps—A Suggestion.

To the Editor of the Scientific American:

Will you please call the attention of those brass workers who furnish the burners of our kerosene lamps to a defect in their construction, the difficulty of rubbing or cleansing the lower surface, owing to the way they are constructed or put together. Civilization is, in great degree, a question of light, light is a question of combustion, combustion of draught. The draught in a kerosene lamp is, of course, through the holes in the perforated brass plate. Even when the plate is kept tolerably free from accumulations of dust, lint, and particles of the burnt wick, a film of oil is sure to form, which extends over the holes, and in great part closes them, unless it is carefully removed. A dull, red, smoky light is the result, owing to imperfect combustion. The cleansing is best done by rubbing with dry paper. But it is always troublesome to cleanse the under side, as burners are now constructed, either with paper, or cloth, or by machinery, owing to the rivets and the roughness of the brasswork. The film of oil is the consequence of evaporation from the wick and condensation on the cold metal. Consequently, some convenient way of covering the wick to prevent this evaporation, when the lamp is not in use, would be a valuable improvement.

HENRY U. SWINNERTON, Ph.D.

Cherry Valley, N. Y., October, 1888.

Our Fuel Supply.

To the Editor of the Scientific American:

In a recent number of the SCIENTIFIC AMERICAN there appeared an article, selected from a deservedly well known journal, upon the waste of anthracite at our mines and the early exhaustion of its supply, in which the following startling statement is made: "*At the present rate of production and present percentage of waste in mining, our entire supply of anthracite coal will last only 75 years.*"

However exaggerated, if at all so, the above statement may be, there is no reason to doubt, based as it was upon statistics from data by the Geological Survey of Pennsylvania, that there is much truth in it, and the sooner measures be taken to stop waste at our mines, the better.

But there is another view to take of the fuel question. In this utilitarian age economy in use forms an important factor, and in no material is this consideration of more importance than in the coal we burn, especially when we regard the increasing demand for the article in our works of industry, including those connected with commerce and travel, and last, not least, when we reflect upon the necessities of the poor, to whom cheap fuel and an economical use of it is a serious matter.

Now the question arises, Do we economize in the use of our fuel to the extent we might do? That there is much heat wasted in the combustion of fuel by our present methods is certain. Take our stoves and furnaces for domestic purposes by way of illustration. How much heat is lost by absorption in these structures themselves, especially in cast iron stoves of a heavy construction decorated with senseless ornaments, and from which radiation is too slow or imperfect to be appreciable! How much, too, is wasted by pipes conducting the heat to where it is needed, by radiation in directions where it is notfelt, by escape of the heated gases and smoke up the chimney, and by an imperfect combustion of the fuel itself, as also in various other ways! We have often heard of smoke-consuming furnaces as applied to steam boilers. Cannot some of your readers devise a smoke and gas consuming stove or heater that will render all connection with the chimney, except for the purpose of draught upon starting a fire, if even then, unnecessary; that will stand out in an apartment and do its duty in an isolated manner, possibly dispensing with chimneys to our houses; that will quickly radiate the heat generated within it; and that in the combustion of its fuel will leave no cinders to be wasted or to be burned over again, but will abstract, once for all, all the available heat to be derived? A new departure may be necessary to accomplish these results, or most of them, but generally important and profitable inventions are made by deviating from the beaten track.

Again, as regards fuel itself. If coal is shortly to become scarce and dearer, then substitutes must and will be found. There have been numerous attempts in this direction already, including the use of various combustible materials and binders with coal dust: gas, mainly used for illuminating purposes, obtained from water, which, strange to think, is composed of but two elements, one of which, in its gaseous state, when mixed with or exposed to atmospheric air, is one of the most inflammable materials in nature, and the other the most active supporter of combustion; various oils, too, and different materials; but none of these, so far, has been able to supply the want. Other available substances, however, may be found, or some chemical mixtures be discovered which, either alone or in connection with ordinary fuel, will accomplish the desired result. No one would object to the adulteration of coal, especially the free-burning kind, if the foreign matter added improved and economized the combustion of such fuel. We live in an age of progress and surprises, and there are chemical substances, both solid and fluid, which by being simply brought in contact produce heat; powders, too, which take fire on exposure to the air, and various materials that ignite and give out heat under the slightest provocation.

What is to be the fuel of the future would be a difficult question to answer, but the vast importance of the subjects I have broached makes them worthy at least of serious consideration. ENQUIRER.

Newark, N. J., Oct. 12, 1888.

The Mean Composition.

MM. Yvon and Berlioz have published (*Rev. de Med.*, Sept.) a series of tables of the analysis of normal urine. Their observations were very numerous, and made on healthy adults, male and female. Their results are contrasted with those of other authors, and in each case they give the maxima and minima, as well as the means. The latter are summarized thus:

	Male.	Female.
Volume (cub. centim.)	1360·0	1100·0
Density (sp. gr.)	1022·5	1021·5
Urea (in grms.) per liter	21·5	19·0
" " per 24 hours	26·5	20·5
Uric acid (in grms.) per liter	0·5	0·55
" " " per 24 hours	0·6	0·57
Phosphoric acid (in grms.) per liter	2·5	2·4
" " per 24 hours	3·2	2·6

Thus, with the exception of uric acid, the amounts are higher on each head among males than among females; but with uric acid the quantities eliminated are almost precisely the same for the two sexes. MM. Yvon and Berlioz desire also to correct, as resulting from these observations, the proportionate quantities of urea and uric acid given in their Manual of Urinary Analysis, which should be as 40 : 1 instead of 30 : 1; and of urea and phosphoric acid, which should be as 8 : 1 instead of 10 : 1.

Effect of Coffee.

Dr. Dumont, of Louvain, has undertaken a series of researches on the effect of coffee drinking on the urine, from which it appears that, though the diurnal quantity of urine is not seriously interfered with, the composition undergoes a very decided change. Dr. Dumont kept the subjects of his researches for some days on ordinary diet, the constituents of which were determined. During part of the time only was coffee added, the quantity being three cups—corresponding to about two ounces of roasted coffee—per diem. By regular and careful analyses of the urine, it was found that during the days when coffee was taken the urea passed was increased by about seventy-five grains. The effect on the urea was produced immediately the coffee was commenced, and as soon as it was omitted the quantity of urea returned to that which it had exhibited previously.

Cotton Fabric a Substitute for Jute for Bale Covers.

The new plan of using a cotton fabric for covering cotton bales, instead of jute, is finding favor at the South. The cotton cover, it appears, is the most economical, the saving being equivalent to a gain of 16 lb. of cotton per bale, as follows:

Difference of weight saved by using cotton fabric	8 pounds.
Saving by the better protection of this new fabric, at least	3 pounds.
Cotton saved which is now lost by sticking to jute bagging	1 pound.
Value of second hand cotton bagging, less value of second hand jute bagging	3 pounds.
Saving by use of cotton, on account of insurance, at least equivalent to	1 pound.
Total	16 pounds.

The Maginnis Mills, of New Orleans, and the Lane Mills, of New Orleans, allow ten pounds extra weight on every bale of cotton covered with the new cotton bagging.

Adulteration of Condiments.

The microscopist of the Department of Agriculture, Prof. Thomas Taylor, has begun an examination of the condiments of commerce for the purpose of ascertaining which of them are adulterated, the methods and extent of the adulteration, and of discovering methods by which the consumer may detect impure articles.

The first article treated was pepper, and the method of the investigation is here briefly described. A section of a pepper corn is placed under a microscope and magnified one hundred and fifty diameters. Its appearance is carefully noted and photographed, and a drawing in colors is made, showing exactly how it looks. The pure powder of pepper corns is then treated in the same way, and, from a comparison of the image of this with that of the section, the changes caused by grinding may be noted. The next step was to examine specimens of the pepper of commerce to ascertain if it presented the same appearance as the pure pepper already photographed and drawn. In a majority of cases it did not, the differences being so striking as to mark it as an entirely different article.

Professor Taylor has ascertained that the substance used in adulterating pepper is the seed or stone of the olive. These are obtained in large quantities from the olive oil factories, and ground up with the pepper corns, the extent of the adulteration being in some cases as great as fifty per cent.

No method of popularly detecting adulteration of pepper has yet been found. In bulk the pure pepper is darker in color than that to which olive seeds have been added; but the difference is so slight that no person, unless possessed of a sample to compare with, would be able to discover any difference.—*Science.*

Sonorous Sand.

At the last meeting of the New York Academy of Sciences, Dr. A. Julien and Prof. H. C. Bolton gave a report of the interesting results of their long continued researches on sonorous sands. The cause of this remarkable phenomenon, which was first known to occur in Arabia, has long been a mystery. In course of time many other localities in which sonorous sands occur became known, and, in fact, it may be found almost everywhere on beaches and in deserts. The authors collected samples from all parts of the world, and on close examination, found that all sonorous sands are clean; that no dust or silt is found mixed with the sand; that the diameter of the angular or rounded grains ranges between 0·3 and 0·5 of a millimeter; and that the material may be siliceous, calcareous, or any other, provided its specific gravity is not very great. When these sands are moistened by rain or by the rising tide, and the moisture is evaporated, a film of condensed air is formed on the surface of each grain, which acts as an elastic cushion, and enables the sand to vibrate when disturbed. In sands mixed with silt or dust, these small particles prevent the formation of a continuous air cushion, and therefore such sands are not sonorous. If this theory be correct, sonorous sand must become mute by removing the film of air. Experiments of the authors prove that by heating, rubbing, and shaking the sand is "killed." All these operations tend to destroy the film of air condensed on the surfaces. On the other hand, samples of sonorous sand were exhibited which had been kept undisturbed for many years. They had retained their sonorousness but, after having been rubbed for some time, became almost mute. The theory advanced by the authors appears very plausible, and will be firmly established when they succeed in making a sonorous sand. Their experiments in this line have not yet been completed, but promise fair success.—*Science.*

The Commercial Value of Old Boots and Shoes.

The *Journal* of the Constantinople Chamber of Commerce describes the industrial uses of old boots and shoes which are thrown out into the streets or into ash pits. After being collected, they are ripped open, and the leather is subjected to a treatment which renders it a pliable mass, from which a kind of artistic leather is derived. This, in appearance, resembles the finest Cordova leather. In the United States patterns are stamped on this, while in France it is used to cover trunks and boxes. The old boots and shoes are also treated in another way, by which they are converted into new ones. The prisoners in Central France are employed in this way, the old shoes coming chiefly from Spain.

They are taken to pieces as before, the nails being all removed, and the leather is soaked in water to soften it. The uppers for children's shoes are then cut from it. The soles are also used, for from the smaller pieces of the leather of the old soles the so-called Louis XV. heels for ladies' shoes are made, while the soles of children's shoes are made from the larger and thinner pieces. The old nails are also put to use, for by means of magnets the iron nails and the tacks and brads are separated and sold. The contractors of the military prison at Montpellier say that these nails alone pay for the old shoes. Nothing now remains but the scraps, and these have also their value, for they are much sought after by certain specialists for agricultural purposes.

MICROSCOPICAL NOTES.

At a recent meeting of the microscopical section of the Brooklyn Institute, Dr. S. E. Stiles, of Brooklyn, New York, exhibited samples of a new wax cell, and demonstrated the method of constructing the cell and mounting objects therein.

The cell is so simple in construction, so beautiful in appearance, and so effective, that we illustrate the method, and give a brief description of it for the benefit of our readers.

Sheet wax, such as is used by the makers of artificial flowers, is the material employed in the construction of this cell. Three or four sheets of different colors are

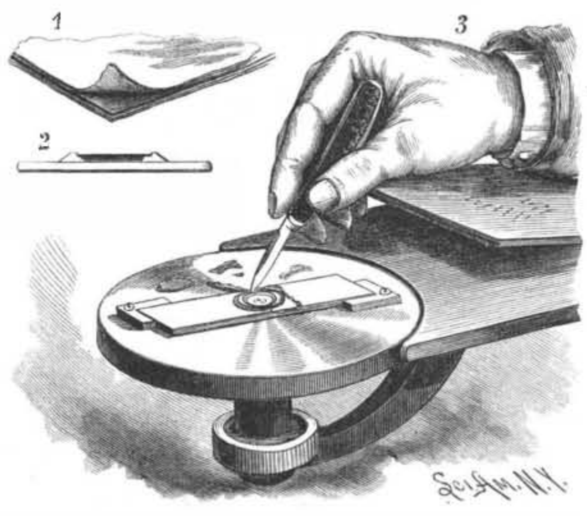

Fig. 1.—MAKING THE WAX CELL.

pressed together by the thumb and finger to cause them to adhere, and a square of the combined sheet thus formed of sufficient size for a cell is cut out and pressed upon a glass slide. The slide is then placed upon a turn table, as shown at 3, Fig. 1, when, by the dextrous manipulation of an ordinary penknife, the wax is cut into a circular form, and the center is cut out to the required depth. If the cell is to contain a transparent or translucent object, the entire central portion of the wax is removed, as shown at 2, Fig. 1; but if a ground is required for the object, one or more layers of wax are allowed to remain. A portion of the upper layer of wax is removed to form a rim for the reception of the cover glass. Where a black ground is required, a small disk of black paper is pressed upon the lower layer of wax. The final finish is given to the cell by a coating of shellac varnish, applied while the slide is on the turn table. These cells are very quickly made and have the finished appearance of a cell formed of different colored cements.

Mr. Stephen Helm, of the Royal Microscopic Society, who is also a member of the microscopical section of the Brooklyn Institute, described a simple and very efficient method of gathering pond life, and exhibited the implements, as well as a large quantity of material secured by his method. The objects are gathered by means of a wide-mouthed bottle clamped in tongs attached to a long handle, cane, or even a fishing rod. By means of this device mud can be removed from the

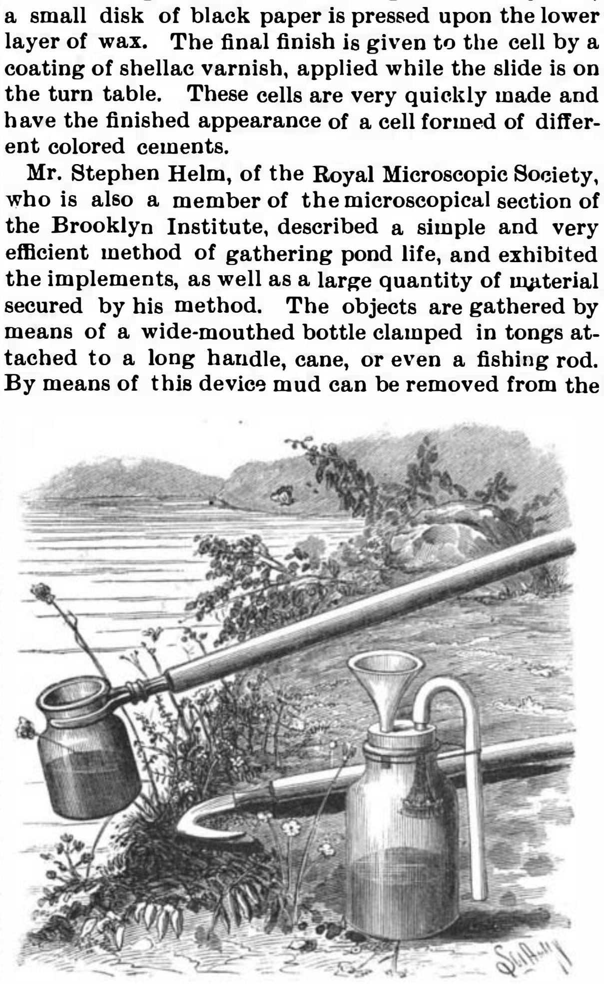

Fig. 2.—IMPLEMENTS FOR GATHERING MICROSCOPIC OBJECTS.

bottom, the stems and leaves of aquatic plants can be scraped so as to remove animalcules, and objects can be readily dipped from pools and shallow places. To concentrate the material, Mr. Helm employs a wide-mouthed bottle or jar provided with a perforated cork, in which is inserted a funnel for receiving the material, and another funnel is inverted and placed within the jar or bottle, with its nozzle extending upward through the stopper. Over the lower end of this funnel is stretched a piece of thin muslin, and to the upper end is applied a short piece of rubber pipe which is retained in a curved position by a thread tied around the neck of the bottle. The material gathered is poured into the funnel, the water escapes through the strainer, and the objects are retained in the bottle. Mr. Helm said that the hooked knife (which we have shown in the engraving) was of great utility in cutting and fishing out parts of aquatic plants and submerged branches and roots, which are often teeming with microscopic life.

G. M. H.

A Good Cement for Various Purposes.

Very often a form of cement is required around shops and mills for filling cracks in stone or brick work. New factories, especially, often develop awkward cracks between the window frames and the brick walls, and during the cold months the air entering here will largely reduce the coal pile. The *American Wood Worker* suggests the following:

Procure a lot of paint, old paint if possible, from a dealer, the skins forming on top of the paints, settlings from the bottom of paint pots, and, in fact, any refuse which contains oil, zinc, or other mineral body may be used for the purpose.

Reduce this mass, especially if hardened from continued standing exposed to air, to the consistency of cream by soaking in some cheap oil. Heating may be resorted to if the hard paints cannot otherwise be softened.

When the whole has become soft enough to be stirred into a homogeneous mass, more oil may be added and the whole worked through a sieve and then run through an ordinary paint mill.

A quantity of common whiting is next to be worked into the oil and paint, much in the way as when ordinary putty is to be made. The thickness of this putty, as we may now call it, should not be as dense as when used for glazing.

When the whiting has been thoroughly mixed in and the mass well worked over, add a quantity of good Portland cement, sufficient to bring the putty to consistency which will enable it to be handled readily.

When in this state, the putty may be worked into cracks in brick or stone work much as ordinary putty is used when allowed to set and harden, and it will become nearly as hard as iron, impervious to moisture and any reasonable degree of heat.

Adulteration as Defined in Law.

According to the Massachusetts Adulteration Act, an article of food is deemed to be "adulterated" within the meaning of the act:

"1. If any substance or substances have been mixed with it so as to reduce or lower or injuriously affect its quality or strength.

"2. If any inferior or cheaper substance or substances have been substituted wholly or in part for it.

"3. If any valuable constituent has been wholly or in part abstracted from it.

"4. If it is an imitation of, or is sold under the name of, another article.

"5. If it consists wholly or in part of a diseased, decomposed, putrid, or rotten animal or vegetable substance, whether manufactured or not, or, in the case of milk, if it is the product of a diseased animal.

"6. If it is colored, coated, polished, or powdered, whereby damage is concealed, or if it is made to appear better or of greater value than it really is.

"7. If it contains any added poisonous ingredient, or any ingredient which may render it injurious to the health of a person consuming it."

The Annealing of Tools.

Some tools, such as circular cutters, files, etc., after they are forged into the shape required, must have teeth cut into them. Before this can be successfully accomplished a preliminary process is necessary. Hammering or forging the steel into the shape required will have hardened the steel to such an extent as to make the cutting of teeth into it impossible or difficult. It must, consequently, be annealed. This process is a double process. The steel must be reheated as carefully as before, and afterward cooled as slowly as possible. Many tools are only required to be hardened on a small part of their surface, and it is important that the unhardened parts should possess the maximum amount of toughness with the minimum amount of brittleness that can be attained. These tools can also be annealed after they are forged. The process of annealing, or slow cooling, leaves the steel cross-grained, gives it its maximum of ductility, and causes it, in fact, to approach the properties of lead.—*The Ironmonger (London).*

The English Fast Train Record.

During the recent railway racing to Edinburgh and Glasgow, the Northeastern Company made no change in their engines; the regular engines that had been on the Scotch service were used all the time, and in nearly all cases these were compound engines. They had a pretty heavy train throughout, and well filled with passengers and luggage. On the last day of the accelerated running, they ran into Edinburgh thirty-four minutes before time; the run was done from Newcastle to Edinburgh—125 miles—in 128 minutes, by compound engine No. 117. This is at the rate of 58·6 miles for the whole run, and beats the record.