into the required shapes, then placed in solution of calcium chloride; silicate of calcium is formed and cements the grains together, the chloride of sodium formed at the same time being removed by washing with water.

In connection with clay, lime, sand, cement, etc, soluble glass enters largely into the composition of many of the patented artificial stones, plastic tiles, slates, etc.

The detergent properties of water glass make it an excellent scouring material, and it enters largely into the composition of most of our common soaps.

Water glass is best prepared by melting together in a crucible powdered quartz or quartz sand and carbonate of soda. Usually a small quantity of charcoal is introduced, but if the materials used are free from metallic oxides and compounds this in unnecessary.

Fine infusorial earth is nearly pure silica and makes excellent water glass. Where quartz or sand is employed it is reduced by grinding together with the calcined soda to a powder, the whole of which will pass through an eighty-mesh wire-gauze sieve.

The following are the usual proportions in which the materials are mixed:

| | | |
|---|---|---|
| 1. | Clear quartz | 45 pounds. |
| | Carbonate of soda, calcined | 23 " |
| | Charcoal | 3 " |
| 2. | Quartz sand | 100 pounds. |
| | Calcined soda | 48 " |
| | Charcoal | 5 " |
| 3. | Quartz sand, purified | 65 pounds. |
| | Anhydrous carbonate of soda | 34 " |
| | Powdered charcoal | 4 " |

The ingredients, thoroughly mixed, are put into clay pots and gradually heated to bright redness; carbonic acid and oxide escape and the mass gradually becomes liquefied. When effervescence ceases and fusion is complete, the contents of the pots are poured out on clean stone slabs to cool. When made of good materials and properly fused the glass closely resembles ordinary flint glass.

Cold water scarcely dissolves it at all, but if broken into small pieces and boiled in soft water it gradually dissolves. If the boiling is continued some time and a sufficient quantity of glass is added, a clear sirupy liquid or a nearly colorless jelly, according to circumstances, is obtained. These solutions may be diluted with hot water.

The solution containing about 30 per cent of the glass is in greatest demand. It is quoted at fifty cents per gallon, put up in barrels or kegs.

### THE STEPHENSON CENTENARY.

One of the notable features of the celebration of the hundredth anniversary of the birth of George Stephenson, at Newcastle, England, June 9, was a parade of locomotive engines. To this the leading railway companies contributed typical examples of the best modern locomotives for passenger and freight traffic, besides a considerable number of early locomotives, or so much of them as remained after the numerous alterations and repairs they were subjected to while in use. In the latter class was the engine called "Locomotive No. 1," built at Newcastle in 1825 by Stephenson for the Stockton and Darlington Railway Company. Another was the "Billy," fourth of its class, built by Stephenson & Co. in 1830. This was a four-wheel coupled engine, as was a similar specimen engine from the Old Hetton Colliery, which contained only the cast iron dome on top of the boiler, the steam pipes, and the feed pump of the original, the rest having been removed when the engine was rebuilt in 1874.

The propriety of ascribing so much honor to Stephenson has been seriously questioned, and his right to the complimentary title, "Father of Modern Railroads," has been disputed. It is true that Stephenson invented neither the railway nor the locomotive engine; the distinctive features even of his successful engine may be ascribed to others; nevertheless Stephenson had so much to do with the genesis of the modern railway system, and his work was of such a vital character at the critical moment when the promise of the locomotive was being put in the way of fulfillment—at the moment when steam transit on rails was first made a practical and profitable certainty—that he is fairly entitled to have his name placed at the head of those to whom we owe the railway as it is.

Railways of a sort were in practical use before Stephenson was born, and for more than a century the steam wagon had been the dream of inventors. As early as 1698 Papin had constructed a small model locomotive engine. Fifty years later Cugnot was at work upon a steam carriage employing two open-topped high pressure steam cylinders, the piston rods working upon the same axis. In his patent of April 28, 1784, Watt describes an improvement on "steam engines which are applied to give motion to wheel carriages for removing persons, goods, or other matters from place to place, in which cases the engines themselves must be portable." In the same year (1784), when Stephenson was but three years old, William Murdock made a working model of a high pressure locomotive, which is said to have performed well; but he abandoned his experiments in that direction through the remonstrance of Watt. On the expiration of Watt's patent in 1801, Richard Trevithick made a steam carriage which ran very promisingly on a common road until, through bad steering, it was overturned in a ditch. In the meantime our own ill-appreciated inventor, Oliver Evans, had worked upon the same problem with such success that he confidently predicted that the child was then born who would travel from Philadelphia to Boston in a steam wagon. He also went so far as to design sleeping cars and other railway conveniences so far beyond the comprehension of his fellows that his reputation for sanity was grievously endangered.

In 1802 Trevithick and Vivian obtained a patent for improvements in steam engines and their application to the propelling of carriages, and two or three "puffing devils" were made by them that year and the year after for use in London. They were able to make five or six miles an hour on common roads, but the enterprise was, after all, a failure. The next attempt of Trevithick was a high pressure locomotive engine for railroads, built at Pen-y-darran, in South Wales, in 1804. It ran well and did good service, but its weight finally broke the cast iron plates of the tramway, and it came to grief with broken axles. In 1805 a similar engine was constructed at Newcastle. It ran backward and forward quite well on a temporary track, but for some reason it was never put upon the road. After many years' service as a stationary engine it was set aside, and finally found an honored resting place in the Patent Museum at South Kensington. In 1808 Trevithick was running another locomotive—the "Catch-me-who-can"—around a circular track in London, for exhibition purposes. In 1811 John Blenkensop patented a rack rail for a steam railway, and had constructed an engine in which, for the first time, there were employed two double-acting steam cylinders. It was built by the engine firm of Fenton, Murray & Wood, of Leeds, Trevithick's patent being still alive. This engine (with others) began running on the railway from Middleton Collieries to Leeds, August 12, 1812, and continued in use for many years.

Here was the real beginning of practical steam railroading. Within a year after the introduction of Blenkensop's engines, three different methods of effecting steam locomotion were patented in England. The smooth-wheeled engine "Puffing Billy," now in the Patent Museum at South Kensington, was put to work in 1813. Stephenson made his first engine in 1814, departing from Blenkensop's plan mainly in using smooth wheels. Springs were introduced in 1815. But little progress was made during the next ten or twelve years, though quite a number of engines were built by Stephenson and others. In 1827 Timothy Hackworth built the "Royal George," the first of a new type, the nearest approach to the modern locomotive that had been designed. In 1829 Robert Stephenson (not his father, as is commonly reported) built the "Rocket," in which the multitubular boiler appeared for the first time. It also had an improvement in the blast pipe arrangement of Hackworth. The "Rocket," came out ahead in the celebrated competitive trial of locomotives on the Liverpool and Manchester Railway, in October, 1829; and it was the successful application of steam locomotion on this road that insured the final victory of steam transport and inaugurated the modern railway system of Great Britain.

### THE GREAT COMET NOW IN SIGHT.

The comet which made its appearance to the naked eye in the northeastern sky on the morning of June 23, and was seen from many points between Hartford, Conn., and San Francisco, Cal., is perhaps the comet lately reported by Dr. Gould, of Cordova Observatory in South America. It appeared, after its perihelion passage, in the constellation Auriga, about eight degrees from Capella, with a bright center and a tail fifteen degrees long. It promises to be a conspicuous object in the heavens this summer.

The new comer was almost simultaneously discovered in this country by P. H. Thompson, Blufton, Ga.; by T. L. Edwards, Haverford College, Pa.; E. L. Larkin, New Windsor, and several others. We are indebted to Mr. Thompson for a special telegram announcing his interesting observation.

A correspondent of the New York *Sun* reports the discovery of the comet at a little before 2 o'clock A.M., June 23, at Washington. This we believe is the very earliest sight of the stranger, and may entitle the observer to the Warren prize of $200. The first appearance of the comet is thus described by the *Sun* correspondent:

"Just before 2 o'clock this morning the writer was summoned to an upper story window by a night watcher in the hotel. Pointing to the horizon just east of the Georgetown Heights, the watcher said: 'Don't you see that distant fire?'

"Shooting up from the horizon was a bright, silvery, perfectly defined, and steady stream of light, fan shaped. It was wholly unlike the light of a distant conflagration. The stream seemed to reach further and further up, pointing to the pole star. The boundary lines were well defined, and converged. It was no fire. There were none of the waves of light suggesting an auroral display. The distant glitter of a moving electric light was the only explanation that could be given of the singular phenomenon. Suddenly there arose from the horizon a brilliant disk of light, bright as Venus at her brightest, and fully as large as that planet appears. Into this disk or nucleus the fan-shaped stream of light converged. There was no longer any doubt; it was the bursting into view of a comet, the like of which has not been seen since Donati's comet of twenty-three years ago.

"The comet rose rapidly and became a splendid object. At 3 o'clock it was about fifteen degrees above the horizon and forty-five degrees north of the moon. At this altitude the tail was about ten degrees long. It moved apparently rapidly in an easterly direction, and was visible until after sunrise."

At half past four it was seen at Bodie, Cal., where the nucleus was well defined and the tail brilliant. It was observed at Tombstone, Arizona, at four A.M., with the nucleus apparently half the size of a full moon, and the tail fan shape and very brilliant.

A dispatch from London says the new comet in the northern heavens can be seen by the unaided eye even in the morning twilight. It is predicted by astronomers that before the first of July it will be visible all night.

The identity of this remarkable body will doubtless be soon determined. Professor Lewis Swift thinks it may possibly prove to be the great comet of 1812, which has been expected to reappear in this quarter about this time.

Dr. Gould, of the National Observatory of the Argentine Republic at Cordoba, S. A., announced, June 1, the appearance there of a large comet which he suspects to be the great comet of 1807, though that comet was not expected to return for some fifteen centuries.

### Concentrating or Storing up Electricity.

We give, on another page, extracts from an able review and criticism by Mr. Geraldy, of the performances and claims of the new Faure battery. We also present an illustration of the use of the battery in propelling a boat on the river Seine, at Paris. The battery has also been applied to drive a passenger omnibus in Paris, with promising results, so the newspapers state.

Mr. Geraldy points out very clearly that the battery is not capable of delivering such a large percentage of energy as has been claimed for it; and his conclusions seem to be well sustained. We also have a letter from a correspondent in Paris who tells us that the invention is classed there like the Keely motor, and that the most extraordinary efforts are being made to force the sale of stock shares in the patents, which no doubt accounts for the published inaccuracies which Mr. Geraldy mentions.

In London Professor Osborne Reynolds has deemed it necessary to publish a note, cautionary to the public not to be misled by the enthusiasm with which Sir William Thomson views the new battery. Professor Reynolds makes the point that in a pound of coal there are stored up eleven million foot pounds of energy, while in a seventy pound Faure battery there is only one half that amount of energy. He also reminds the public of other modes of transmitting energy, such as wires, ropes, compressed air, etc., which he thinks have been found wanting.

All this is very well. Let all possible deductions be made, and still we think it will appear that the new battery contains qualities and powers that promise to render it a most useful appliance in the arts. While it is true that coal is far superior in the quantity of stored-up energy, it is equally true that the coal must have the weight of a steam boiler added to render it available to drive a small boat or a carriage, for example. We are inclined to think that Sir William Thomson is doing the public a better service in practically experimenting with and trying to find out how the new battery may be best applied to the wants of man, than is Prof. Reynolds in discouraging these efforts of his colleague.

### Exhibition in Orizaba, Mexico.

It is announced that a scientific, agricultural, and industrial exhibition will be held at the city of Orizaba, Mexico, in November next, under the auspices of the Government of the State of Vera Cruz. Arrangements have been made for all necessary space in the exhibition building for exhibits from the United States, and all goods intended for exhibition are exempted by law from import duties. Reduced rates for passage and freight have been secured from points in the United States to Vera Cruz, and a cordial invitation has been extended to citizens of this country to participate in the exhibition, either as visitors or exhibitors.

### A Large Belt.

What is described as one of the largest belts in the world was lately finished at Bingley, England. It is 132 feet long and 6 feet wide. It is two layers, the outer layer having three sections, of which the middle section is 36 inches wide and the two side sections 18 inches each. The inner layer is in five strips, in the following order, beginning at one edge: First, 14 inches wide; second, 8 inches wide; third and middle, 28 inches wide; fourth, 8 inches wide; fifth, 14 inches wide. The belt is both wire-stitched and hand-sewn, and the arrangement of the strips, it will be seen, breaks the joints very effectively. It is to work considerably under its power, being intended to transmit only 600 indicated horse power over a flywheel and drums of 71 feet and 7 feet respectively.

### The Source of Much Noise.

At Granville Corners, Mass., a couple of men began the work of drum making in 1853. Now they have a five-story factory, 110x40 feet, from which they have turned out 79,000 drums. They were mostly toy drums, and were made of wood, tin, brass, and nickel. The drumheads have used up 30,000 sheep skins.

WE are informed that the bending machine made by Messrs. Williams, White & Co., of Moline, Ill., and illustrated in our issue of June 11, is being extensively adopted in shops having considerable iron bending to do. It finds its principal application in the manufacture of plows, cars, wagons, and wherever a number of wrought iron pieces of the same form are required.