tion and portable engines, the latter being built both on sills and wheels. This engine is so widely and favorably known as to render a detailed description superfluous. The popularity of the "Eclipse" traction engine has grown out of its great success in accomplishing the work for which it was designed, and in many important features it is a decided departure from its class. Much care and attention has been given its construction, with a view to overcoming the many difficulties which are experienced in the successful propulsion of a traction engine when hauling heavy loads through a rough and uneven country. The engine proper is mounted on the crown of the boiler, but is fastened to it at the cylinder end only by an expansion joint, the other or crank end with its gearing connections being secured to and supported by wrought iron side plates riveted to the frame or sills of channel iron that extend partly along each side and under the boiler to the front axle. The smoke box end of the boiler is carried in a saddle, on which is cast an arm or bracket supporting the ends of the frame. Within this saddle casting the fifth wheel, or king post, for the front axle revolves, the axle being partially covered by a casting with two spring chambers, thus relieving the front end of the boiler of shocks while passing over a rough road. The sills are well braced together. The fire-box end of the boiler is carried in a saddle or wrought iron band riveted to the sills, and by this arrangement it will be seen that allowance is made for boiler expansion without transmitting any strain to the frame, engine, or gearing.

Two styles of traction engine are built in three sizes, the styles varying to suit different sections of the country. One is made with powerful springs under the main or driving axle in connection with a universal coupling in the countershaft, to allow for rocky and uneven roads, the other without these springs and flexible countershaft for flat or prairie country.

The power in all cases is transmitted from the engine to the traction wheels through an ingenious patented elastic spring connection and compensating gear, which allows one traction wheel to rise vertically without straining the gearing and connections, and by a novel locking device in the hub of one traction wheel, both wheels can be locked upon the axle when passing over a slippery road. By excellent mechanical arrangement, the weight of the engine and gearing is concentrated over the driving axle, thus greatly increasing the tractive power.

The traction wheels are of excellent design, light in appearance, with spokes and fluted rims of wrought iron and hubs of cast iron. The axle, made of the best forged cast steel, is very large and heavy, and has long bearings, and throughout the engine provision has been made to secure bearings as large as possible. A powerful brake is used upon this engine, by which its momentum can be controlled sufficiently to bring it to a standstill within its own length. Another peculiarity of this engine is the high rate of speed of which it is capable. The advantage of this is apparent when the engine is employed in hauling a thrashing outfit from one job to another. Much time is thus gained over an engine that is capable of making but slow progress with its load, or, where the roads are unfavorable, can scarcely haul itself. Owing to its peculiar construction, the "Eclipse" traction engine gives this additional speed without increased cost.

The patent steering mechanism of this engine consists of a shaft supported between the sills in front of the fire-box, on which is wound a chain carried to each side of the front axle and having elastic links inserted in it, so that no shocks are conveyed when the front wheels strike obstructions. The chain shaft is operated from the platform by a standing shaft with worm and worm gear.

It is a great convenience to the engineer when running to have the throttle, reverse motion, blower, brake, steering wheel, pump, injector, fire and ash pit doors, whistle, and all bearings within easy reach. These engines are furnished with a water tank under the platform and coal boxes upon it, or with a two or four wheeled tender attached to the rear of the platform, while in some cases the water tank is carried upon the sills under the boiler and forward of the fire-box, and the crown sheet is so designed as to be always under water when going up or down hill.

The "Eclipse" portable or agricultural engine, of light and graceful design, is mounted on strong wheels, with boiler high enough above the ground to allow the front truck to make a very short turn, which is an especial advantage. The engine proper, of the well known "Eclipse" pattern built by this company, is simple and compact. Its design is the result of years of practical experience in meeting the wants of a large number of users. It is attached to the crown of the boiler by expansion joints and bolts in such manner as to equally divide the weight between the forward and rear axles. Special claims are made for improved methods of mounting the boiler so as to relieve it of all strain. Instead of passing the rear axle through the fire-box, as is customary with many builders, it is carried under the fire-box and up through improved spring-chambered brackets, bolted securely to each side of the fire-box. The weight of the boiler and engine is carried by two iron rods passing under the fire-box, one on each side of the axle and extended upward through caps that cover the brackets and against which the springs bear; in turn the axle bears against these springs, relieving the boiler and brackets of all strain consequent upon carrying the weight upon them, as is usually the case, and thus loosening of the bracket bolts and leakage is prevented.

The springs are accessible by simply removing the nuts on the rods and lifting off the cap. Each bracket is furnished with a set screw to bear against the axle when running the engine, thus preventing vibration. The front axle is also provided with springs, insuring safety and ease of transportation, and preventing shocks to the boiler and engine.

The boiler and engine just described are also furnished securely mounted on substantial frames or sills, as seen in the cut showing the portable sawmill.

The company also manufactures stationary engines and boilers of all sizes, grain separators and threshers, horse-powers, circular sawmills, mill gearing, and the customary adjuncts of an engine factory.

Situated in the midst of the iron and manufacturing regions, Frick & Co. have all possible advantages in the selection of material, and as their works are reached by three railroads, two of which connect with the Pennsylvania and Baltimore and Ohio systems respectively at a short distance from Waynesboro, it will be seen that they have every facility for the favorable operation of a business of the character described.

Mr. John Philips, cashier of the First National Bank of Waynesboro, presides over the affairs of the company. His office is elective annually, but has been held by him since 1873, in which year the company was organized.

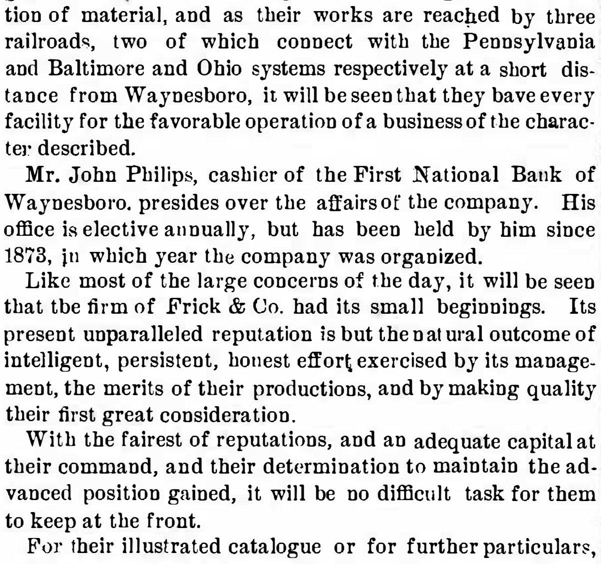
Like most of the large concerns of the day, it will be seen that the firm of Frick & Co. had its small beginnings. Its present unparalleled reputation is but the natural outcome of intelligent, persistent, honest effort exercised by its management, the merits of their productions, and by making quality their first great consideration.

With the fairest of reputations, and an adequate capital at their command, and their determination to maintain the advanced position gained, it will be no difficult task for them to keep at the front.

For their illustrated catalogue or for further particulars, address the manufacturers at their head office, Waynesboro, Pa.

IMPROVED CAR COUPLING.

The engraving shows an improved car coupling recently patented by Mr. E. S. Graver, of 209 N. Front St., Philadelphia, Pa. This improvement consists, essentially, of a loop or U-shaped link pivoted to one draw bar, in combination with a horn on the other draw bar, with which the link engages by swinging down over the horn, together with a latch device for holding up the link when uncoupling, and a device for supporting the link in an inclined position preparatory to coupling. This device is simply an L-shaped



GRAVER'S CAR COUPLING.

plate of iron secured to the end of the car, and which throws the link down over the horn and coupling by the recoil of the draw bar when the cars run together. This simple and efficient device may be used, together with the ordinary coupling link and pin, on cars of any kind and of different heights. It will couple cars on a curved track, and it may be applied to cars one at a time if necessary, without interfering in any way with the use of the new or old coupling. By the use of this invention the dangerous practice of going between the cars to couple them may be avoided.

American Locomotive Fireboxes.

At a recent meeting of the Institution of Civil Engineers, London, the paper read was "On Mild Steel for the Fireboxes of Locomotive Engines in the United States," by Mr. John Fernie, C.E.

It was stated in the paper that the use of mild steel for the fireboxes of locomotive engines was now general in the United States. Although large numbers of the outer shells of the boilers were still made of iron plates, this was simply to effect a saving of expense, and many railroad companies had the boilers wholly of steel. Iron plates were first used as a substitute for copper, owing to the rapidity with which the anthracite coal wore away the soft copper. When sound the iron plates gave better results, but the weldings were frequently unsound; they were apt to blister, and the plates were subject to crack near the firebars.

Steel fireboxes, the plates being a nearly pure compound of iron and carbon, were used for the Pennsylvania Railroad engines eleven years ago. Since then, excellent steel for this purpose had been made by the Siemens-Martin open hearth process in many places in the United States. The mode of manufacture of this steel was briefly described, as it differed from English practice. The specification for boiler and firebox steel last given out by the Pennsylvania Railroad Company was quoted. The author next proceeded to state that in the cities of the United States, all steam boilers for stationary engines were placed under municipal regulations, whereby a proper registration and inspection were instituted at a small cost to the user.

In Philadelphia about 4,000 boilers were tested once a year, and a license was given by the inspector to use the boiler for one year, at the pressure it was considered fit to sustain. The formulæ under which the calculations were made were stated, and the tests employed. The highest test was when a boiler plate, from which a portion was cut off lengthwise, showed a ductility of 20 per cent upon a measured length of twelve thicknesses of the plate, and when cold would bend to 180 deg., over a diameter equal to two thicknesses of the plate, or when cut crosswise would bend cold to 90 deg., over a diameter equal to five thicknesses of the plate.

In every steam vessel navigating the lakes, rivers, and seas of the United States, and sailing under its flag, a complete system of inspection during manufacture, and an examination of boilers when made, was maintained by the Government, and all boiler plates had to be branded with the maker's name, and with the tensile strength of the plate per square inch. Makers of boiler plates were pecuniarily liable for any failure of the material, if it occurred at a lower strain than that with which it was branded. Officers for examining and testing the materials and work done were appointed, and the question seemed to be much better understood and practiced in the United States than in England.

With respect to locomotive engines, which were in one city one day, and in another on the next, and which might constantly be moved out of one State into another, there could be no municipal or Government control, but there was a healthy public opinion on the subject, and heavy damages would be obtained against any company whose boilers exploded from neglect, or from the use of bad material. In America, it was stated, railroad engineers were not hampered by Government control. There was no necessity to urge railway companies to adopt improvements. Inventions were quickly examined, tested, and rejected or adopted. Hence the march of improvement was more rapid than in Great Britain.

The author then proceeded to describe, first, the English type of locomotive firebox, and afterward the various new forms of American fireboxes. In the former the strains set up by the greater expansion of the inner box over the outer, from the higher temperature, were aggravated from the material being of copper, which expanded more than iron under equal increments of temperature. Greater stress was thrown upon the stays, and by the use of copper and brass tubes a galvanic action was established in locomotive boilers, which speedily destroyed the iron plates.

The author illustrated the American type by two examples of boilers and fireboxes in use on the Pennsylvania Railroad, and he pointed out in how far they approached the conditions of what he held to be a perfect firebox of the old and well known form. The requirements for a firebox of this kind were: that the plates forming the outer and inner boxes should be of similar metal; that as the metal of the inner box must always expand more than the outer, it should be thin enough to bend or spring between the spaces where it was held by the round stays; that to compensate for the extra expansion, the heavy roof beam stays should be done away with; that there should be a number of water tubes through the body of the firebox, that the firebars should also be water tubes, that the areas of the firebox and grate should be large, and that the materials of construction should be cheap and easily obtainable.

The author demonstrated that in these respects the American was far in advance of the English type of locomotive boiler. With regard to cost he showed that as steel fireboxes were only half the weight of copper ones, and as the price per ton of the former metal was about one-third of the latter, the actual cost of steel fireboxes was from one-fifth to one-sixth the price of copper ones, although the cost of workmanship would be a little more in working steel.

A New Copper-Zinc Alloy.

Engineering says that Mr. Alexander Dick has succeeded in producing a new copper-zinc alloy which exhibits characteristics as essentially superior to brass as those of bronze are to gun metal. The advantages claimed for the new alloy, which has been named "delta metal," are great strength and toughness, and a capacity for being rolled, forged, and drawn. It can be made as hard as mild steel, and when melted is very liquid, producing sound castings of close fine grain. The color can be varied from that of yellow brass to rich gun metal; the surface takes a fine polish, and when exposed to the air tarnishes less than brass. These latter characteristics will meet with ready appreciation for cabinet work, harness fitting, etc. The metal when cast in sand has a breaking strain of 21 to 22 tons per square inch; when rolled or forged hot into rods, the breaking strain is 43 tons per square inch; and when drawn into wire of 22 B.W.G., of 67 tons per square inch.

Results of New Inventions.

Mr. Edward Atkinson, illustrating the advantage of machinery, says it would require sixteen million persons, using the spinning-wheel and hand-loom of less than a century ago, to make the cotton cloth used by our people, which is now manufactured by one hundred and sixty thousand.