A WIRE ROPE TRAMWAY OPERATED AT THE FAIR.

Visitors at the World's Columbian Exposition who pass near the southwestern corner of the Mining building instinctively stop a few minutes to watch the succession of buckets that pass up and down two overhead wires stretched from a raised platform near the corner of this building to a spot near the Sixty-fourth Street entrance to the Exposition grounds. These buckets come and go with the persistent regularity of clockwork, and what adds interest to their passing is the fact that early in the day they transfer diamondiferous ground from the store yard at the distant terminal to the Mining building, whence it is transferred to the crushers which operate daily in the South African diamond exhibit in this building.

This conveyor, or, as it is more properly termed, wire rope tramway, forms part of the exhibit in the Mining department and was installed by the Trenton Iron Company, Trenton, N. J., to exploit its latest improved device for transporting ores in mining operations and for similar uses. It is what is called the "Bleichert" system of wire rope tramway. A peculiarity of this particular plant is that it works backward, that is, most of the actual work it does consists in carrying ore from outside into the level under the Mining building, instead of bringing ore out, as would ordinarily be the case. Nevertheless, its working powers are fully demonstrated.

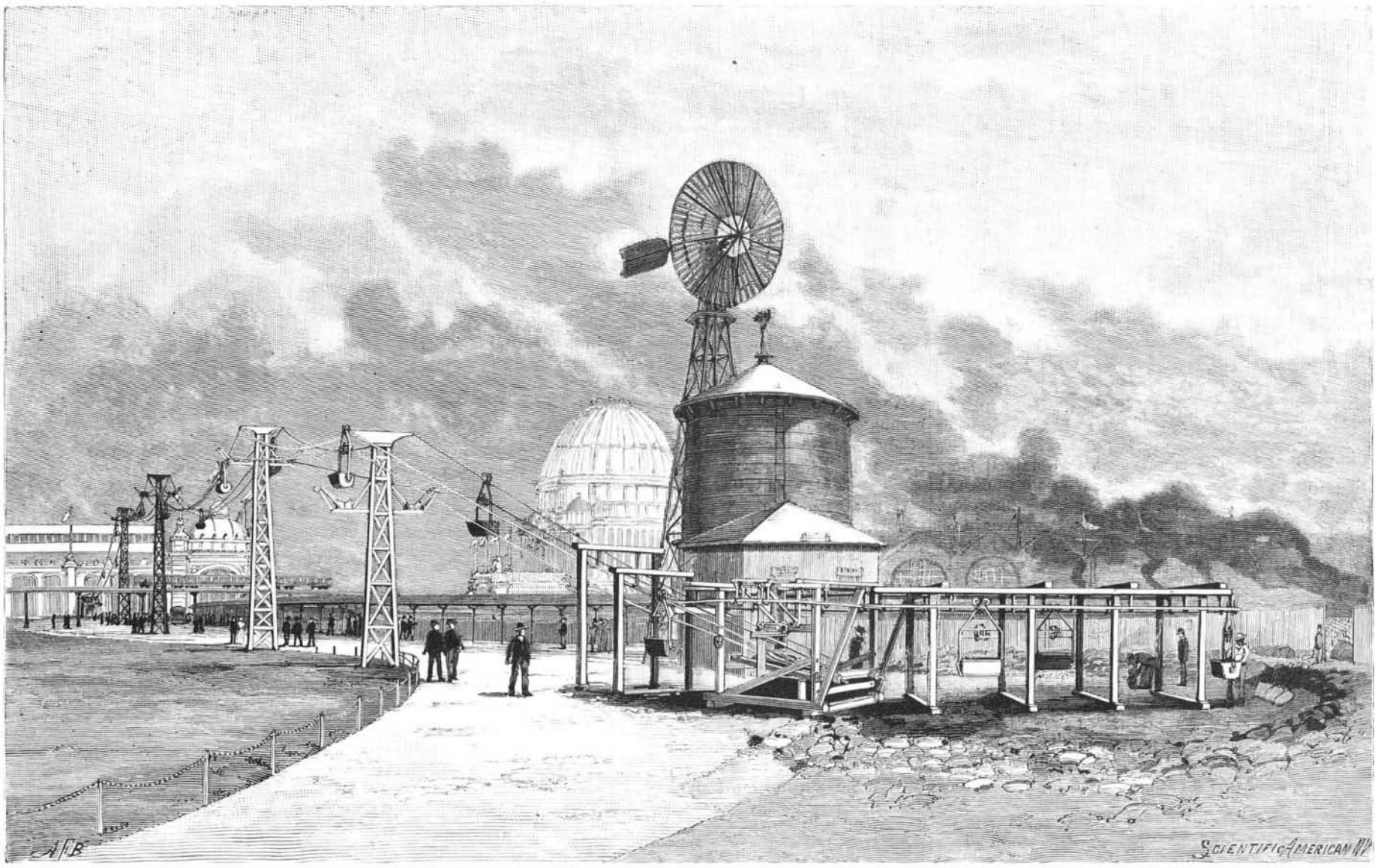
The accompanying illustration represents the tramway as seen from the receiving end in the ore yard before referred to. From this yard the line runs alongside the tracks of the railway terminal station yard, then passes over the Intramural Railway at a sufficient height to escape any possible danger from passing trains, and terminates at the raised platform at the Mining building, giving a total length of about 1,000 feet. The supports of this tramway could, if desired, be made of wood, but iron ones of the type shown in the illustration are preferable for many reasons, and these supports vary in height according to the profile of the ground passed over and to the surface traffic. Most of the supports in this plant are from 15 to 20 feet high, but at the Intramural Railway they are nearly twice this height, in order to pass above it a sufficient distance. Two stationary cables are used for the buckets or cars to run on. These cables are stretched taut from support to support and they vary in size, according to the weight of loads to be carried and to the length of spans. Under ordinary circumstances supports are from 150 to 200 feet apart, but where the country is very irregular and bisected by ravines and gulches, as is frequently the case in mining regions, the spans become at times very long, in some cases reaching 1,000 and even 1,500 feet; and where loaded cars pass down on one cable and return on the other empty, the return cable can be considerably smaller in size than the other, as it is put to much less strain, thus saving materially in the cost of construction. Such cables as are used for this purpose stretch about one inch in one hundred feet, but this stretching is readily overcome by the use of tension devices at each end, and in lines that are several miles long by having tension stations at necessary intervals.

The buckets or cars or whatever form of carriages are used are suspended from the stationary cable by a truck which runs on this cable as on a rail. Below this cable is a second and smaller one which is called the traction cable and which transmits motion to the buckets. In this World's Fair plant electricity furnishes the motive power. Gearing on the motor shaft works in a worm wheel and reduces the speed to the desired point. At each end of the tramway is a large sheave around which the traction cable passes, and this sheave is so arranged that the tension of the cable can readily be regulated. Whenever it is desired to attach a bucket to this cable, a patent grip lug designed for this special purpose is attached to the cable and this lug is grasped by a simple locking device on the bucket support. Another lug is placed on the cable about one hundred feet ahead, the purpose of this being to automatically ring a bell as it reaches the loading or discharging point and to notify the man in charge that the bucket is just behind.

The illustration represents a bucket on the stationary cable at the right hand and approaching the terminal. As this bucket passes down the incline the lug ahead rings the bell and it follows behind until it approaches the station. In order to load and unload, it is most desirable that the bucket should be in a convenient location and at the proper height from the ground. In order to accomplish this a hanging rail is used. This rail is in close proximity to the stationary cable, and the car is automatically switched from the cable upon it by means of a simple device which unlocks the grip the bucket support has on the grip lug on the cable. The momentum that the car has obtained carries it some distance on this suspended rail. At the right of the terminal, as illustrated, is a framework which forms the loading or unloading station, as the case may be. By means of a switch the buckets can be switched off upon the suspended rail of this framework and there their load can be dumped into a chute or car as the case may be, or on the other hand they can run under a chute or otherwise be loaded, then switched from this suspended rail onto a corresponding rail on the terminal framework, where each bucket automatically grips the proper lug on the tension cable and starts off again on its journey. It is frequently necessary to know the amount of load that is carried, and for this purpose there is a device operated automatically by which each bucket load weighs itself and records its passing, so that the number of loads and weight of each load can be known.

The other terminal is constructed the same as this one and is provided with all necessary conveniences for loading and unloading the buckets, switching them to whichever track is desired and forwarding them again on their journey without undue delay, the only difference in this plant being that power is applied at this end in the World's Fair plant. When there is little or no delay in handling the buckets at either end, they simply run around a track suspended on the terminal framework and are started on their return journey by the attendant in charge. The buckets are attached so firmly to the tension cable by means of the grip lugs that the tramway can run up or down the steepest declivity without risk of upsetting. On some lines that have been built so much momentum is secured by the cars running down the line that sufficient power is obtained to return the buckets, so that only a nominal amount of power, if any, is needed to operate the tramway.

It has been found in ordinary use that the most economic speed to run this tramway is from three to four miles an hour, and when an increase of traffic is desired it is obtained to better advantage by increasing the number of buckets than by increasing the speed of the cable much above this rate. The heavy work falls almost entirely upon the stationary cable, and the traction cable is in a measure relieved from carrying its own weight, as it is suspended at intervals from the stationary cable, so that much heavier loads can be transported on a traction cable tramway of this kind than on a single cable tramway where the cable has also to support the load and carry the necessary dead weight in addition to propelling the cars and their loads.



THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE TRENTON IRON WORKS.

These tramways have been introduced for such purposes as carrying ore, coal, lumber, cotton, phosphate and other commodities for considerable distances, when it is desired to reduce to a minimum the cost of handling. The tramway constructed on this system for the Granite Mining Company at Rumsey, Montana, is 8,750 feet long. It has a fall of 1,297 feet and develops on this fall over 14 horse power. On one span of this line there is a fall of 850 feet in 1,800 feet or about one to two. A tramway built for a mining company in the Andes Mountains, in Peru, South America, was carried to its location in small pieces, no one of which weighed over 300 pounds, as it was transported on the backs of mules. This line is two miles long and has a fall of 4,920 feet, developing more than sufficient power necessary to carry back to the mines all freight, including water and other supplies.

At the time this tramway was constructed, it was planned to have a complete mining plant in the ground under the Mining building, with mining machinery in

operation, and other mining equipment shown as in actual service. This plan however, was not carried out, chiefly from the fact that the water line is only two and three feet below the surface of the ground. There is, however, a level extending from immediately underneath the east terminal of this tramway under the Mining building to the southeast corner, and in this is installed a railway, the cars of which are operated by a tail rope by means of a steam tail rope engine. In addition to this tramway and the equipment in the mining level, the Trenton Iron Company has an exhibit in the Transportation building which should be seen and carefully studied in connection with them, as wire cables of various kinds, especially this company's locked wire ropes and heavy traction cables, are exhibited together with mining cars and other manufactures of iron and steel. This company also manufactures a single track tramway, constructed under the Bleichert patents, which is less expensive to construct, but about the same in the cost of maintenance and which has considerable less carrying capacity than the two-wire system just described.

Freaks of Lightning.

During a recent thunderstorm a singular freak of lightning was noticed in the vineyard of Mount St. Mary's College, near Emmitsburg, Md. The lightning first struck a tree and killed it; the apples at present hanging on the tree withered. It then passed to the roots of the tree and tore up the ground, as if it had been plowed for a distance of about twenty feet. It then struck the end post of a grape arbor, knocking a large piece of the post that supported the vines a distance of forty feet. It then ran along the lower wire that supports the vines, about two hundred feet, to the opposite end of the grape arbor, where it pulled out the staple which was attached to the post, knocking a piece out of that post also. On the way, the grapes that hung near the wire were injured, so that they withered on the stem. The grapes that hung higher up were less damaged. The same effect, in a less degree, was produced on two adjacent arbors running parallel to the one just mentioned, one on each side of it, at a distance about thirty feet.

The Charleston Harbor Improvements.

The improvements in the harbor of Charleston, S. C., are beginning to show a marked increase in the depth of water in the channel, says the *Southern States*. Important progress has been made in the work on the jetties, and in the Swash Channel on July 7 the depth of water at low tide at the entrance was 15·9 feet, and at the inner shallow spot 15·7 feet. Add to this five feet of water, caused by the rise of tide, and it figures up 20·9 at one point and 20·7 at the other. With a strong east wind, which is often blowing on the bar, the tide rises at least a foot higher, making the water 21·9 feet and 21·7 feet, respectively. The dredges are working at the mouth of the channel and are excavating 2,000 cubic yards of sand daily.

LIGHT LOCOMOTIVES SHOWN AT THE FAIR.

This interesting exhibit includes five locomotives, four of them in the Transportation department, and one logging locomotive shown in connection with the Michigan logging exhibit. The engines shown do not by any means cover all the specialties made by the firm, which include compressed air locomotives for mines and for street railways, steam locomotives for underground use, several varieties of suburban locomotives, plantation locomotives of different types, steel and furnace work locomotives for service close to converters, coke oven locomotives, shifting locomotives, etc.

The five locomotives shown are of the regular commercial grade made by the firm, and are adapted for severe service and hard usage, where the tracks are often rough and badly laid, with grades and curves excessive, and where the work is frequently carried on continuously by different shifts of men. This has necessitated the use of the best materials, the making of parts strong, without clumsiness, and the utmost simplicity of construction. Among characteristic items differing from common practice are the following:

1. Hanging cross heads of steel, specially designed for replacing gibs, and lining up by removal of plate only.

2. Specially constructed spring piston rings, sprung into grooves, and piston head solid, except lightening core, with rod riveted in, so that no bolts or nuts can come loose, need adjustment, or break; the rings are first rough-turned, then a piece removed, then clamped and turned to true circle, causing them to press out equally, giving wearing surface always conformed to cylinder.

3. The links are skeleton style of casehardened mild steel, and will outlast objectionably heavy links. Lost motion can be taken up easily, and casehardened steel pins and thimbles are removable throughout, even the link saddle bearings being fitted with thimbles.

4. Tires are bored taper, and pressed on tapered centers, and can be taken off and renewed without a wheel press, and cannot come loose.

5. Driving box brasses (unless otherwise desired) are in sections, and can be put in place without a press.

6. All wearing brasses are made of ingot copper and tin, as hard as can be made, no scrap being used.

7. Cylinders and driving wheels are made of specially selected close and hard charcoal mixture of metal, no scrap being used.

8. For the smaller engines extra strong frames and bumper attachments are necessary, as these locomotives are used very roughly, especially in steel works and similar service, where solid heavy cast iron cars are used; it is also desirable to have these engines as narrow as practicable, as side room is usually limited. These conflicting requirements are met by flattening and deepening the frames at each end, securing extreme strength in the direction of heaviest strains. The bumper angle irons are extra heavy and well secured, and when desirable the bumpers are backed up by a cast tool-pocket between the frames, combining convenience with the strongest possible bracing, and not in the way, like the ordinary front braces bolted to the smoke box.

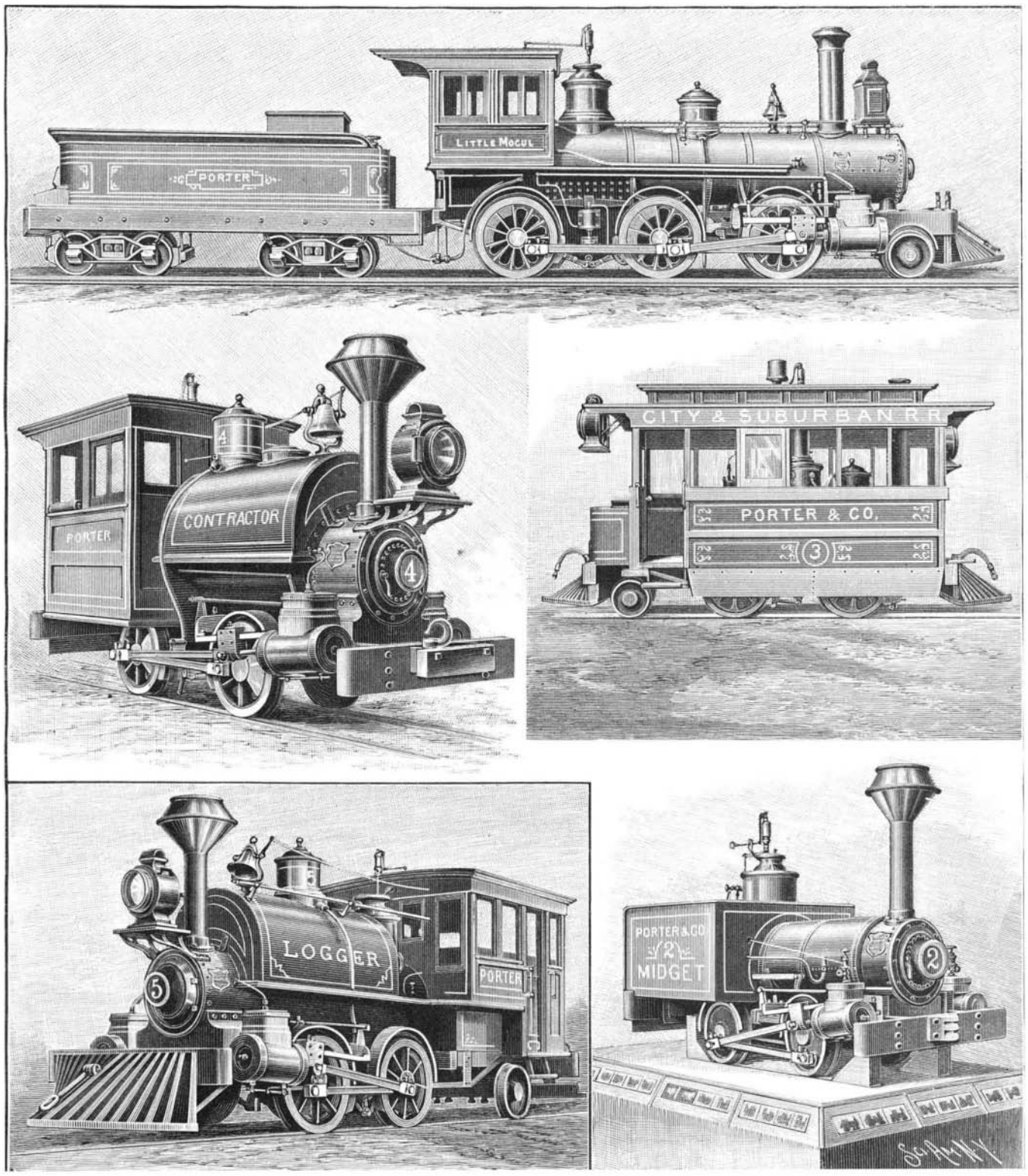
9. Pony trucks are a special design, adding a rolling motion to the radial, pivotal, and swing motions of the Bissell type of truck, so that curves otherwise impracticable are easily passed.

10. Fireboxes are made with sides and crown of one piece, avoiding two riveted seams, making a stronger firebox and diminishing formation of scale.

11. Rivets are hand riveted by special process, making both heads alike and equally strong.

The special points of excellence claimed for the Little Mogul, shown at the top of the picture, include adaptability of design to railroads of light character, admitting rails of 35 and 40 pounds per yard, and curves 15 to 30 degrees. Such roads are used for logging where the distance and the traffic are considerable, for mining districts, and for local purposes of all kinds, and can be operated at a good profit while developing new countries, where heavily equipped roads would not begin to pay for years. Its construction is marked by simplicity of details and general arrangement, and freedom from complications. Strength and durability are secured by intelligent use of materials, and its practical efficiency is secured by a large firebox and abundantly large boiler. The valve motion is planned for quickness and promptness, and adapted for passenger service at high speed, as well as for freight service at slower speed. Flexibility is secured by a complete system of equalizing, and by special design of truck, in combination with advantageous distribution of weight, combining power with ease on the rail, and easy curving and steady motion.

The "Midget" is of a style used by various manufacturing establishments, such as steel and iron mills, where small car loads of material are to be carried everywhere throughout the works with quickness and ease. It does the work of ten to thirty animals. As



THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF H. K. PORTER & CO., OF PITTSBURG, PA.