Railroad Transportation.

A RIDE TO CHICAGO AND BACK ON THE LOCOMOTIVE OF THE TWENTIETH CENTURY LIMITED.

Time was when a passenger who wished to ride on the locomotive could obtain a seat in the cab for the mere proffer of a cigar. That, however, was long before the day of mile-a-minute trains. With the increasing speed and growing density of modern traffic, the restrictions that guard the "man at the throttle" have grown in severity, until to-day the private office of the president of the railroad is more easy of access than the locomotive cab of the humblest work train on his road; while as for a seat in the cab of an Empire State Express or a Twentieth Century Limited, it is a positive fact that the letters of request for a trip of this kind on file in the company's offices—all politely refused—are often subscribed by names that are not unknown to fame on both sides of the Atlantic.

Just how necessary is this precaution, the writer realized when he was flashing by the three hundred and thirty signals between Albany and New York, at from seventy to seventy-five miles an hour, and noted that no sooner was one signal seen by the engineer and verified by his fireman, than he was watching intently for the next; the successive signals swinging into sight around the curves, often at less than minute intervals. The man who holds that $400,000 train and the priceless lives of its passengers in his hand, must have no inquisitive and loquacious layman at his elbow; nor must the fireman, who is satisfying the hunger and thirst of a boiler that is eating up, hour by hour, the fuel and water demands of a 1,500-horse power locomotive.

It was with some such thoughts as these that the Editor of the SCIENTIFIC AMERICAN recently climbed into the cab of the Twentieth Century Limited, presented a letter from Vice-President Brown of the road, shook hands with Engineer Sherwood (who, by the way, has been at the throttle of fast New York Central trains for an unbroken period of thirty years) and, comfortably settled at the front end of the fireman's seat, commenced the first stretch of 143 miles of his 980-mile trip to Chicago.

Cylinders, 21 by 26 inches; drivers, 79 inches diameter; weight of engine, 176,000 pounds; heating surface, 3,505 square feet; grate area, 50.3 square feet; steam pressure, 200 pounds; tractive effort, 25,350 pounds.

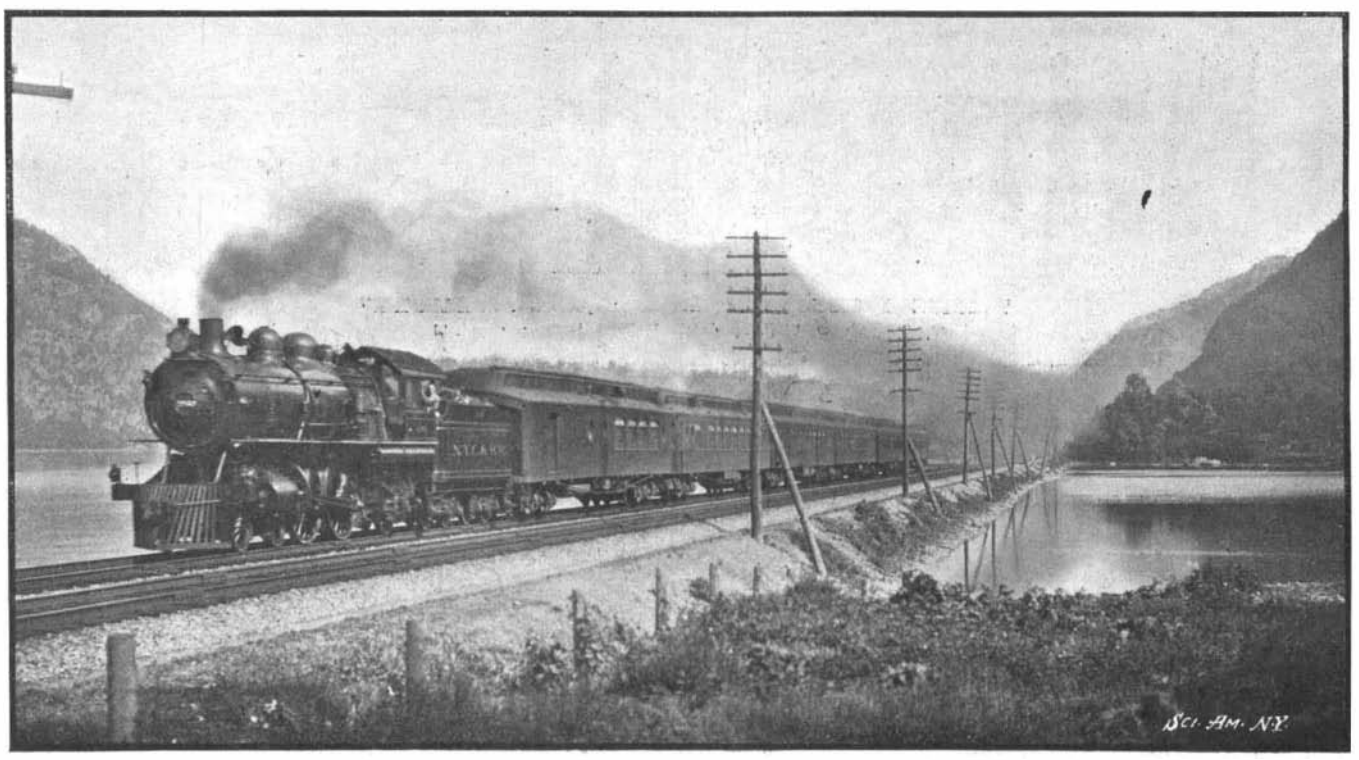
THE LOCOMOTIVE ON WHICH THE FAST RUN FROM ALBANY TO NEW YORK WAS MADE.

A word just here as to these Twentieth Century trains. For several years past the fastest expresses have taken twenty-four hours to run from New York to Chicago; but last spring the New York Central and Pennsylvania roads agreed to run a train each way daily in twenty hours. The Pennsylvania road has the shorter but more hilly route, covering 920 miles; the distance over the New York Central and Lake Shore route being 980 miles. The trains are ordinarily made up of four cars weighing 240 tons, although, as we shall see, they include, over a large portion of the distance, a diner, and on the New York Central system an extra sleeper, which bring up the total train load to over 350 tons. The running speed on the latter road, including stops, is slightly under fifty miles an hour; but as the enginemen are expected to make up, if possible, any time lost through unavoidable delays, some remarkable running has been done. Thus, the Pennsylvania train on August 4, 1902, ran from Fort Wayne to Crestline, 131.4 miles, with one stop for water, in two hours and nine minutes, an average speed of sixty-one miles per hour; while even finer was the performance of the New York Central train, when with four and five cars it made up fifty-eight minutes from Rhinecliff to Buffalo, a distance of 350.4 miles, the speed, excluding seventeen minutes in stops, being 59.4 miles an hour. On another occasion this train left Syracuse fifty-one minutes late with five cars weighing 300 tons, and although taking on an additional fifty-ton car at Albany, passed Yonkers, 275.5 miles from Syracuse, on time. Excluding six minutes in stops, this is an average of 60.74 miles an hour, which was maintained in spite of the fact that there were no less than sixteen slowdowns.

On the round trip from New York to Chicago the writer spent just half the time, or twenty hours, in the cab, and rode on six different locomotives. For the whole round trip of 1,960 miles a dozen locomotives are required, the average distance of each run being about 163 miles. For the run to Albany one of the magnificent Central Atlantic type engines, designed last year especially for the heavy express service of the road, was coupled on. These are the most powerful fast express engines in the world. The object aimed at in the design was to provide a huge boiler with sufficient heating surface to insure a plentiful supply of steam at 200 pounds pressure, under the most exacting conditions of service. Ample grate and firebox surface are secured by extending the firebox across the frames, the internal width being 6 feet 3⅜ inches, and the length 8 feet. The barrel of the boiler is 6 feet in diameter, and the heating surface reaches the enormous total of 3,505 square feet. The 21x26-inch cylinders would, at maximum effort, easily slip the four-coupled drivers; and, accordingly, by means of an air cylinder acting on a lever, an additional 10,000-pound load can be thrown on the drivers, increasing the tractive effort to 25,350 pounds.

Of course, for such an engine a schedule speed of fifty miles an hour with a 227½-ton train was mere play; the opportunity to see what these engines can do when called upon for a supreme effort was to come on the return trip. Mr. Sherwood expressed regret that, being on time, he had no chance to "show what she could do," and on our nodding approvingly at the gage, which, in spite of the easy labors of the fireman, stood steadily at 200 pounds or slightly over, the latter patted the huge boiler affectionately as one might a favorite horse, remarking that the difficulty was "to keep her cool"—which the fluttering pop-valve proved to be true. The predominant impression, apart from the locomotive, left by this ride up the beautiful Hudson Valley, is of the magnificent condition of the roadbed and the faultless disposition of the signals. As we swung grandly around the curves or swept into the stretches of tangent, the signals stood out—first the "distant," then the "home"—sharp and insistent against the background. By the law of the road the fireman must verify each signal as a check upon the engineer; and at the proper moment to catch the earliest sight of a "distant," he would step to the window and shout "Right," announcing the signal, if it stood on a curve, a second or two before it came in the line of the engineer's vision.

Albany was reached at 5:33, two minutes ahead of time; and after a meal in the diner we boarded the engine—another of the Atlantic type—at Utica, for the experience of a dash by night in a crack express. The fifty-three miles to Syracuse are timed to be done in sixty-three minutes; but as some ten minutes are lost through the streets of Syracuse, and other minutes in various slowdowns, some very fast miles are covered. We were a trifle late in starting, and the engineer explained that as it was election night, and he would have to run "dead slow" through the crowded streets of Syracuse, he would do some fast running so as to have a few minutes in hand. Here then was the chance of a lifetime—a seat in the most powerful express engine in the world; a heavy train of 300 tons behind it; an engineer vouched for by the conductor as "nervy and fond of fast running;" a stretch of downgrade just a few miles ahead for a racetrack; and a night of impenetrable darkness to lend the last touch of half-fearful suspense to the trip. We gathered way quickly to a speed of a mile a minute, and before one



Albany to Spuyten Duyvil, 131.7 miles, was run in 131 minutes. Excluding the time lost in eight slowdowns, the average running speed was 68 miles per hour; weight of train, 352 5/16 tons; of engine, 144 tons.

THE TWENTIETH CENTURY LIMITED MAKING UP TIME BETWEEN ALBANY AND NEW YORK.

had got his nerves quite to the sticking point, the fireman shouted that we were on the downgrade. The acceleration was rapid, and our stop-watch timing (the fireman calling off the mileposts) soon showed that we were making eighty-three miles an hour. That six-mile run by night was certainly the most thrilling experience in high-speed travel of a lifetime. We have stood at night on the bridge of the "Deutschland" when, with the "Kaiser Wilhelm" at her heels she was rushing at 27 miles an hour through a fog that shut the forecastle deck from view; and again when, to test her rough-weather ability, she was making twenty-four miles an hour against a full southwesterly gale; but from the standpoint of pure sensationalism those experiences were tame compared to this wild ride by night through the Mohawk Valley. To the writer, who was not by any means a stranger to locomotive riding, the experience was simply terrific—impossible of adequate description to the traveler whose gage of greater speed is the slightly increased swaying of a Pullman car. The sensations of such a ride strike at every avenue to the emotions; ear, eye, and touch are violently assailed. For the ear there is a "clang and clash and roar," so loud that one has to shout into the ear to be heard—there is the concussion of the moving parts of the engine—the jangling of metal against metal—the crashing impact of the driving wheels and trailers upon the track—while above all this strident orchestra, like some great organ note, is heard the deep, sustained roar of the exhaust from the smokestack. For the sense of touch there is the amazingly rough riding of the engine which, compared with a nicely-poised Pullman car, is as the movement of a springless farm wagon to a rubber-tired carriage. The unevenness of the track, slight as it is, is but little absorbed by the stiff locomotive springs, and when the driving wheels and the massive reciprocating parts—side rods, connecting rods, crossheads, pistons, weighing tons in the aggregate—are threshing round and darting to and fro to the tune of over 300 revolutions a minute, the great mass of the engine vibrates and lurches and rolls, until one feels that the only logical outcome would be for the structure to rend itself into a thousand fragments! Then, for the eye, there is the sense—at eightly miles an hour by night—of incredible speed. By day, objects approach slowly out of a far perspective; but by night they rush at you out of the near darkness in one mad whirl of ghostly shapes, punctuated by horizontal, rocket-like streaks of fire—the signals and station lights.

To the novice, the most thrilling moments come with the headlong dash through a station yard, where the tail-lights of a side-tracked freight train glare with their evil red eyes at you from the distance—surely they are on your own track—and you sweep down upon a mass of white lights, red lights, headlights, whirling hand lamps, dwarf signal lights below, and arc lights above, with two or three switching locomotives to heighten the crowded effect! Clear track? Absurdly impossible! I tell you, gentle passenger, lounging back there in the cushioned security and comfort of a Pullman, that should you sit here just now with me at the very front end of this roaring cataract of steel and fire, and realize that it is hurling you into that bewildering yard at over one hundred feet a second, with a stored-up energy back of you equal to that of a shell from a 13-inch gun—if you realized, as I did, that to develop that energy requires only a misplaced switch, a careless signalman, a broken rail or axle, you would understand how sublime must be the faith of that quiet man at the throttle whose clean-cut profile you can just see silhouetted against the window of his cab) in the material, the men, and the management of that most wonderful of modern creations, a first-class trunk railroad.

The perfect faith of the engineer in the system was strikingly brought home on the return trip from Chicago. A delay in Cleveland had put the train twenty-five minutes late, and time was being made up with a powerful, Prairie-type, six-coupled, ten-wheeled engine with 20 x 28-inch cylinders and boiler to match. The engineer had congratulated us on the fact that because of the delay we should see some fast running, and we had just snapped the stop-watch on a two-mile run at seventy-eight miles an hour, when "Red" shouted the fireman, and with brakes hard down, we pulled up at a wayside station signal for orders. As we were starting again, the fireman courteously showed us the order, which read that from So-and-so to So-and-so the east-bound track was closed, and east-bound trains would use the west-bound track; No. 26 (our train) to have right-of-way over all trains. "What! Does this mean that we shall run against the traffic?" "It does." "But, surely, not at this speed." "Indeed, we shall." And indeed we did; for full out came the throttle, and soon we were sweeping into darkness (on the other fellow's track, mind you) with nothing between us and Heaven-knows-what but the faithful watchfulness of a train dispatcher, sitting in his office a hundred miles or more away. Sublime faith in a marvelous system, we thought, as we settled down for the only uncomfortable quarter of an hour of the whole trip. Twelve miles further on we passed the obstruction—a disabled freight train—and switched back to our own track.

Leaving the engine at Buffalo we crept at midnight, from the dirt and din of the cab, very tired, into the comfort and sweet linen of a lower berth, for a six-hour sleep to Albany. Here our letter made us known to Mr. Ryan, another New York Central veteran, who started in 1865 as a fireman, and for thirty-three consecutive years as engineman, has run heavy express trains through the Hudson Valley. The engine, another of the splendid Atlantics, was to make the record run of the whole round trip. With six cars of 352 tons total weight and a handicap of twenty-nine minutes, we set out to make up time. It was an ideal morning as we pulled out at 7.04, with a slightly favoring wind, and a dry rail. Two or three minutes were lost in going slow over the bridges and through the yard, and then we straightened out to what we judged to be fifty, sixty, and seventy miles an hour. Out came the stop-watch, and the next mile was made in forty-eight seconds. It did not seem like it, so as there were no slowdowns ahead, we timed for a complete five-mile stretch, which was done in exactly four minutes; and for the next five, which were also covered in exactly another four minutes, making eight minutes for the ten miles, or seventy-five miles an hour. Then came a slowdown to twenty-five miles through Hudson, then two slowdowns in succession for water, another for a sharp curve through Poughkeepsie; a slow to 12 miles an hour through a rock cut in the Highlands, another at Croton for water, and at Peekskill for signals. Each of these from a seventy to seventy-five mile speed meant a loss of one-half to two minutes before the high average was reached again; and yet we passed through Spuyten Duyvil, 131.73 miles from Albany, at 9:15, having covered the distance in 131 minutes.

To appreciate this performance we must remember that though the line is level, it is full of curvature, forty-eight miles, or over one-third, consisting of curves that vary from one degree to eight degrees. It is estimated that every degree of curvature is equal to 3-100 of a foot of rise in every 100 feet. Therefore, the resistance of dragging a train round a six-degree curve is equal to a rise of about ten feet to the mile. The estimate, however, is made for the fifteen-mile speed of freight trains, and for an express at seventy-five miles an hour it will be vastly greater. Exactly what it amounts to can only be conjectured; but its equivalent in grades would represent a track with decided gradients and with no downgrade to compensate. The engine was handled with the consummate judgment born of long experience. For the most part the throttle was three-quarters open, and the cut-off at one-third stroke. At the running speed, which finished with a burst from Yonkers to Spuyten Duyvil of 14.13 miles in 11:5 minutes (73.72 miles an hour over heavy curvature), the engine, under 203 to 204 pounds of steam, which she carried steadily, must have been indicating her maximum of 1,450 to 1,500 horse power.

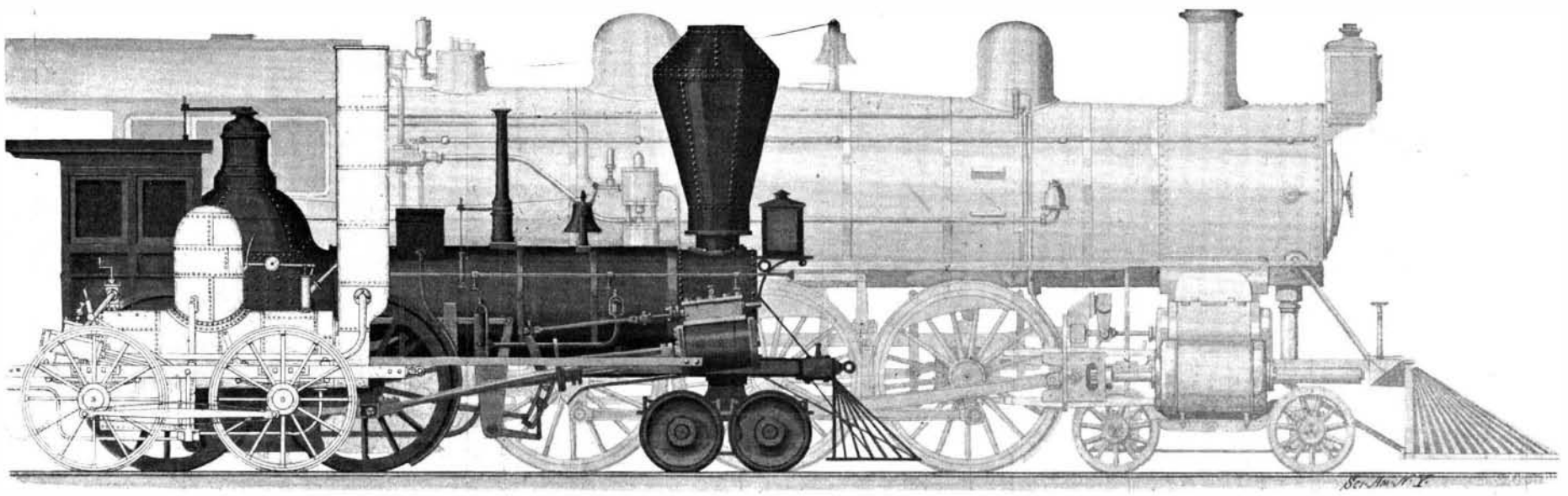
It is a popular delusion that the engineers who run such trains soon break down under the strain; yet the two partners on the New York-Albany run of this train are to-day fine-looking men in the best of health. The work calls for nerve, of course, but as more than one of them told us they kept their nerves right by right living. A more temperate, intelligent and courteous body of men than these trainmen one must travel far to find; and it was with his usual insight into character that President Roosevelt went among their trusted representatives to select one of the arbitrators in a notable industrial controversy of the day.

NOTES ON THE HISTORY OF THE AMERICAN LOCOMOTIVE.

BY HERBERT T. WALKER.

In the following notes on the History of the American Locomotive, we will pass over the various attempts to produce self-moving road carriages, and begin with the year 1802-3 when Richard Trevithick, of Cornwall, England, who is known as "the father of the locomotive," laid down the plans for an engine to run on the Merthyr Tydvil tramway in Wales. This, the first railroad engine in the world, embodied some of the salient features of the modern locomotive, namely, high pressure steam and a horizontal cylinder, the exhaust steam being turned into the chimney. This engine, which is illustrated in Fig. 1, hauled passengers and freight weighing about 10 tons at a speed of 5 miles an hour, and is said to have once attained a speed of 16 miles an hour, when running without a train. Its weight, 5 tons, was found too heavy for the cast-iron rails or "plates," and this objection, coupled with the fact that it was more expensive than horse traction, condemned it for commercial purposes. Like other great men, Trevithick was in advance of his time, and the world was not ready for him. He was, moreover, too easily discouraged by partially successful experiments, and, although he subsequently built improved locomotives—some of them having such familiar features of our modern engineering practice as a fusible plug in the crown sheet of the fire-box, and means for superheating the steam—he was unfortunate, and failed to command the capital necessary for developing his ideas. The antagonism of Watt also told heavily against him, and after a series of reverses he died in obscurity, and was laid to rest in a pauper's grave. It was only recently that the Institution of Civil Engineers reminded the nation of his true position among engineering heroes by erecting to his memory a memorial window in Westminster Abbey.

Passing over Blenkinsop's and Hedley's engines, which were but little more than continuations of Trevithick's designs, we come to the advent of George Stephenson, who built his first locomotive in 1813. Stephenson did not show the originality of Trevithick, and



DEWITT CLINTON. 1831.
Cylinders, 5½x16 inches. Boiler pressure, 80 pounds.
Drivers, 54 inches. Tractive effort = 919 pounds.

ENGINE OF 1850.
Cylinders, 16 x 20 inches. Pressure, 100 pounds.
Drivers, 66 inches. Tractive effort = 7758 pounds.

ENGINE OF 1902.
Cylinders, 22x28 inches. Boiler pressure, 200 pounds.
Wheels, 72 inches. Tractive effort = 32,000 pounds.

SEVENTY ONE YEARS' GROWTH OF THE AMERICAN LOCOMOTIVE.