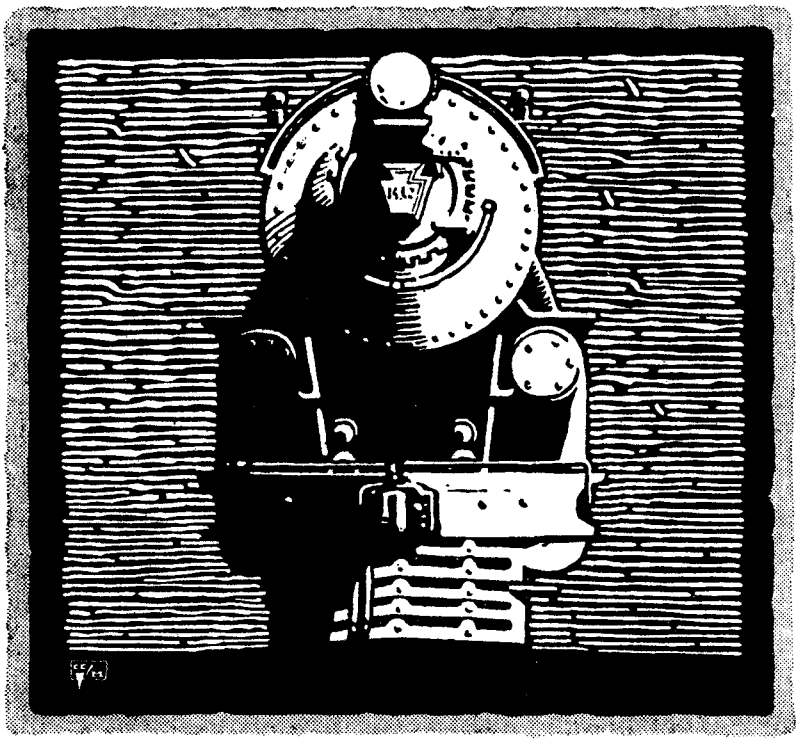
POWER



THE STORY OF THE LOCOMOTIVE

PENNSYLVANIA RAILROAD

POWER

The Story of the Locomotive

BY

Katherine Woods

PENNSYLVANIA
RAILROAD
Philadelphia, Pa.
1928

POWER

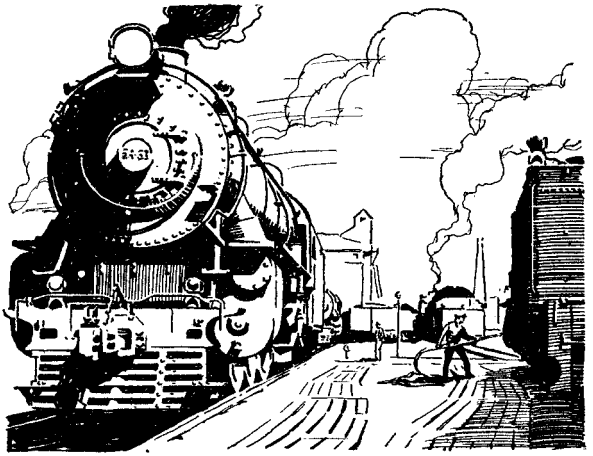
The Story of the Locomotive

THERE it stood—a fiery, steel thoroughbred with only a lazy breathing to indicate the pent-up urge in its heart of fire. The long streamlines of its body, black and shining, its driving rods of burnished steel, the golden outline of its spokes, the haughty thrust of its pilot—here was the perfect expression of power, of power in reserve.

Here was one of the newest types of passenger engines for the Pennsylvania Railroad's limited express trains, its glistening coat hardly dry.

It was enormous as it towered above us in the erecting shops. They told us that the length of its driving-wheel base alone was almost fourteen feet, that a man who measured six feet barefooted could wear his boots and his highest hat and still stroll upright through that giant boiler.

To look at this breathing monster of steel was to realize that it could do almost anything without effort, that in its regular way it would always move along easily, and that if by any chance it was obliged to go



faster—much faster—it would merely move along as easily to a quicker pace. And since after all it is a passenger locomotive, and not the living creature one's imagination sees, this effect of ease in its magnificent reserve power means smooth, quiet, secure speed for its passengers.

A Thrilling Experience

It stood there—huge, mighty, motionless, a thrilling thing. From behind me came the casual voice of the assistant superintendent:

"It's ready to leave the shop now. Would you like to drive it out?"

"Me?" I echoed, "Me?" I am a small person, and no athlete. "Do you mean that *I* can drive it out?"

The little group of men laughed pleasantly.

"Certainly," answered the assistant superintendent. "Here, I'll help you climb into the cab. . . ."

"It is one of the mightiest things in existence. Do you mean to say that I could drive this engine?"

"Try it and see," said one of the men; and I climbed into the cab. . . .

A neat little place, this. They showed me the two sets of brakes, just at the engineman's right hand; the ingenious little instrument that forces the water into the boiler. They showed me the gauges and all the different pieces of locomotive mechanism; and then they showed me the throttle and the valve. I sat in the fireman's seat, and in the engineman's seat, and I thought of the Broadway Limited driving through the night, and saw in my mind the two men "picking up the signals" in the dark. Then,

"Put your hand here," instructed the assistant superintendent. "So. That's right. One of us will attend to the reverse valve. There—just pull the throttle. . . . That's right!"

Somewhere in that giant body

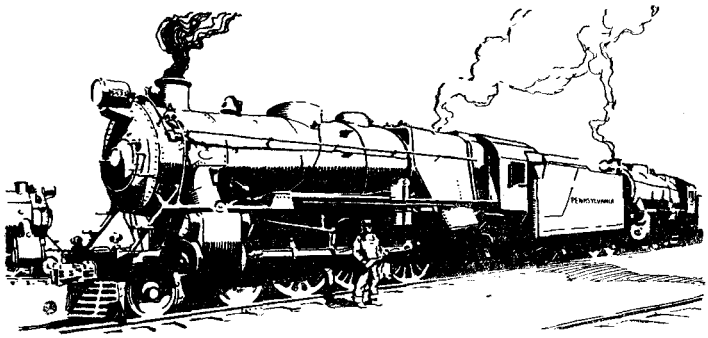
there was a gentle swishing sound. Ever so softly the great creature moved, breathed a little more heavily, went on moving, backing slowly, steadily, quietly. We were leaving the erecting shop. We were out in the bright sunshine.

"Did *I* do that?" I gasped, and everyone laughed.

"Time to put on the brakes," the directing official said. "This is the separate engine brake, you see—that other one is the air brake for the train. Just move this lever all the way across—so."

No Jar, No Jerk

Without a jolt, as quietly as it had started, the engine stopped. We climbed down from the cab. The engine was standing on a yard track, ready to go into service immediately. We had come about the distance of a city block in leaving the big erecting shop. There



had been no jar, no jerk. I should scarcely have known that we were moving. Without jolt, or strain, or effort, I had driven the Pennsylvania Railroad's newest passenger engine out of the locomotive works.

So *easy*—that magnificent power!

A Woman's Touch

Easier, quieter, with the passing years. Steadier, more gentle, as it grows mightier. This Pennsylvania engine is the development of years of locomotive study that has meant the constant increase of locomotive power. It is so simple, as a result of the rigid care with which its design has been perfected, that its putting together took only one week in the erecting shop, instead of the usual time allotment of two weeks or three. It is so easy-moving that a woman's touch can send the steam rushing into its cylinders and start it on its way without a jar. Yet as it stands there, completed, it represents engine power more than doubled in less than a quarter century, the culmination of power increase that has gone on uninterruptedly since the first locomotive for the Pennsylvania Railroad was brought from England almost a hundred years ago.

And what is true of this standard express passenger engine is equally true of the Pennsylvania's freight

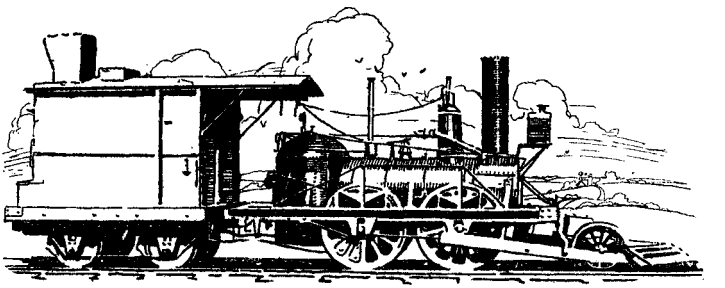
engines, and its engines for local traffic. Every new engine on the Pennsylvania Railroad represents growth in power.

Constant Growth of Power

It is this constant development of power that is the romance of the locomotive. *Power.* Not size in itself, though the engines *are* bigger. Not primarily speed, though some of them have been designed particularly for swiftness and all of them have sustained speed capacity. Not either of these things, nor anything else, by itself, but *power,* the *power* to do more work, to do it better, to do it on less fuel: constant development of concentrated power. Every type of locomotive on the Pennsylvania Railroad today, in general freight and passenger service, is built to do more than twice the work of the engines of a quarter-century ago. And with power more than doubled, with coal consumption per unit of power almost halved, these engines reduce to a daily commonplace the greatest transportation achievement in railroad history.

It was the embodiment of this romance of power that I was really looking at, outside the engine shop. And my mind went back to its early beginnings and the years of its growth and development. . . .

In the year 1893 there journeyed from New York to Chicago, puffing its careful way very industriously at seven and one-half miles an hour, a strange little train. It was made up of a tiny engine with four small driving-wheels, a long protruding "leading truck" and a queer tank-like fire-box, and two miniature wooden cars. The engine weighed eleven tons, and it looked more like a piece of farm machinery than a locomotive. It took five days to get to Chicago, but it kept on going steadily, and it got there in triumph, with ovations all along the way. Its trip was a victory indeed.



"John Bull" at the World's Fair

That engine was sixty-two years old. It was going to the World's Fair as an historical exhibit because it was one of the first steam locomotives used in the United States, and the first in service on what

was later to become the Pennsylvania Railroad. The "John Bull," imported from England, had been put in service on what is now the Trenton Division of the Pennsylvania on November 12, 1831. On its regular schedule it covered thirty-four miles in three hours, and when it was brought to this country it represented the highest type of locomotive development. In spite of its low speed rate and its funny appearance, the historical value of the "John Bull" went far beyond the merely picturesque.

For the queer little engine embodied in 1831—and was the first steam locomotive in the United States to do so—the three basic principles of locomotive construction. It had the mechanism that obtains from the used steam a "draft" for the engine's fire; the kind of boiler that can produce much steam in a small space; and horizontal cylinders to drive the wheels. These are the essentials of locomotive construction today. And as the sixty-two year old "John Bull" puffed along to Chicago, with a huge show of effort for every revolution of its little wheels, the Pennsylvania Limited—which was then the most famous train in the world—sped past it at thirty-five miles an hour, using those same basic principles for an enormously greater production of power. . . .

Power That Is More Than Speed

In the beginning of the power development of the engine, more power meant more speed. But it is many years now since engines were built *merely to go fast.* If growth in power had been only a matter of turning wheels rapidly, we should be able to find complacence in the year 1849, for it is said that in that year the Pennsylvania Railroad had engines that *could* make a mile in a minute if they had nothing more to do! But locomotive engines have a great deal more to do than move *themselves!* The question of their power is the question of how *much* they can do as well as how fast they can do it.

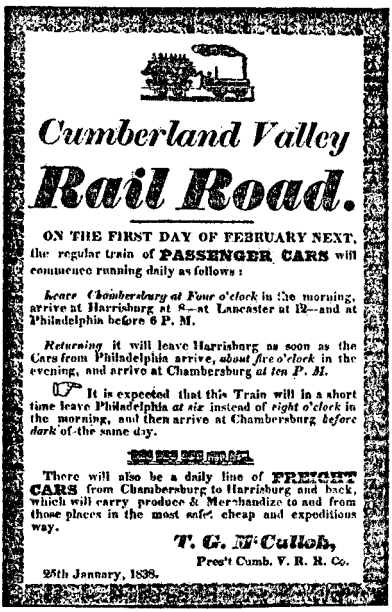
There was an engine, approximately a contemporary of the "John Bull," which pulled thirteen tons of freight at a maximum speed of twenty-nine miles an hour on a level road, and that was very wonderful.

Freight trains now often move at more than twenty-nine miles an hour; and Pennsylvania freight engines can pull one hundred steel cars containing 7,000 tons of coal on varied grades, as fast as that and faster, and every one of the train's hundred cars is made of steel. . . . There is the romance of power in terms of freight.

But at first the ordinary rate of speed left much to be desired.

Sixty-eight Miles in Six Hours!

The first time-table on what was a few years later to become the Pennsylvania Railroad was printed in the spring of 1837, and announced that on the first



Cumberland Valley

Rail Road.

ON THE FIRST DAY OF FEBRUARY NEXT, the regular train of PASSENGER CARS will commence running daily as follows:

Leave Chambersburg at Four o'clock in the morning, arrive at Harrisburg at 8—at Lancaster at 12—and at Philadelphia before 6 P. M.

Returning it will leave Harrisburg as soon as the Cars from Philadelphia arrive, *about five o'clock* in the evening, and arrive at Chambersburg *at ten P. M.*

☞ It is expected that this Train will in a short time leave Philadelphia *at six* instead of *eight o'clock* in the morning, and then arrive at Chambersburg *before dark* of the same day.

There will also be a daily line of FREIGHT CARS from Chambersburg to Harrisburg and back, which will carry produce & Merchandize to and from those places in the most safe, cheap and expeditious way.

T. G. M'Culloh,
Pres't Cumb. V. R. R. Co.

25th January, 1838.

of April an all-rail service would be established to connect Philadelphia with the canal boats at Columbia. A "through train for the accommodation of western passengers," it announced, would "leave the vicinity of Broad and Callowhill Streets, Philadelphia, for

Columbia, each morning at 6 o'clock exactly," and would arrive at Paoli at 8:30, Downingtown at 9:25, Parkesburg at 10:25, and Lancaster at noon. A similar schedule was to be maintained "for the accommodation of eastern passengers" which would reach Philadelphia at 3 P.M., "to dine as the passengers may think proper." And the public, unaccustomed to the rigors of train scheduling, was warned that "not the slightest deviation from the foregoing arrangements" would be permitted. The distance from Philadelphia to Lancaster is sixty-eight miles; some time was allowed to "tarry" at each station.

A few years later passenger trains were making the trip of 89 miles between Jersey City and Philadelphia in five hours.

Trains were going faster now, and went on going faster still. In 1856 the fastest of the three daily express trains to Pittsburgh had a regular schedule of a little more than twenty-five miles an hour. And for years after that, this was the average speed of the best passenger trains. The engines had become much larger and more powerful than the threshing-machine locomotives of the "John Bull" era.

But although the trains had

worked up to a fairly good speed, the Pennsylvania locomotive was entering upon a new period of striking and varied development, which was to result later on in more power, and more speed. It was at this period that the railroad built its great engine shops at Altoona, which ever since have stood for the best in engine progress. Here, since the sixties, Pennsylvania engines have been designed and every modern type of engine has been developed and tested. And it was in the year 1856 that Matthias Baldwin built for Pennsylvania service a fast engine that is famous to this day—the "Tiger."

It had the same wheel arrangement as the engine that hauled the Pennsylvania Limited in 1893, but otherwise the "Tiger" offered as glaring a contrast to the engines of the 'nineties as to the giant that we had seen completed today. It was gay and frisky-looking, with a bright green body and red-spoked wheels and many noticeable trimmings; there was a golden tiger "burning bright" on its cab panel, and a dark palm waving majestically on its headlight. It was a spindly thing—less than one-fifth the size of today's engine!—and its slender boiler stood high, and seemed to stand higher because there was so little gear under it. Its smoke-stack was an enormous funnel which was higher than the whole width of the boiler, and had a top diameter larger than the boiler or the driving-wheels.

This was because the engine burned wood, and the smoke-stack had to be built like that to take care of the sparks.

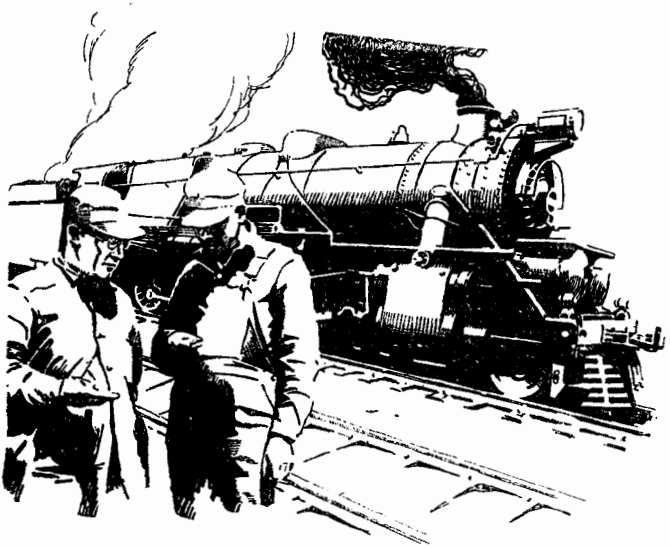
Coal Supplants Wood as Engine Fuel

Changes were at hand in engine-building. One of the first of them was to reduce the size of that smoke-stack, by substituting coal for wood. Coal also dimmed the bright colors and black became standard.

In the 'fifties the Pennsylvania Railroad's experts at Altoona proved, by a series of experiments, that bituminous coal was a practical engine fuel, and they worked out the best ways of burning it. That sounds archaic enough!

But those same experiments accomplished something else, not so archaic: they demonstrated the usefulness of the fuel-saving and power-increasing device known as the "brick arch." That device is an essential factor in the economical production of engine power today, and people are apt to think of it as something quite new. But it isn't! Improved and further developed in recent years, the brick arch goes back to the Pennsylvania Railroad's early experiments with coal, and the effort, then as now, to get the utmost power out of every shovelful of fuel. . . .

"More power" was already coming to mean something quite different from merely "more speed."



Could a locomotive haul a bigger load? Could it operate on less fuel, saving material and labor and increasing its efficiency? Could it maintain good speed schedules, with a good-sized train, under all conditions?

The Strength of Steel

In other words, *could it do more work?* That was coming to be the great question of power, as the railroads grew and developed, as, more than ever, it is the great question of power today. . . . Today as we walk back through the erecting shop, in the big manufacturing works, and on into the building where

the boilers are made, our progress is through avenues of steel. Steel frames, steel rods, steel wheels, steel boilers, steel tubes, steel fire-boxes. . . . Every detail of a locomotive today is made of the metal that has been proved to be the best for that particular detail; and with certain few exceptions that metal is steel.

Practically the whole engine, as we saw it that day at the locomotive works, getting ready for the road, is made of steel. In the enormous strength of steel lies one reason for the dependable might of the engine. And in the 'sixties, the use of steel in building locomotives—first one part and then another—was being tried out by the Pennsylvania Railroad.

The Pennsylvania first introduced steel fire-boxes in 1861; the high-tempered English steel first used cracked; in the next year American steel proved successful. In 1868 steel boiler sheets and steel tubes were built into the new Pennsylvania engines. In "The Development of the Locomotive Engine," an old book of railroad history, Angus Sinclair says:

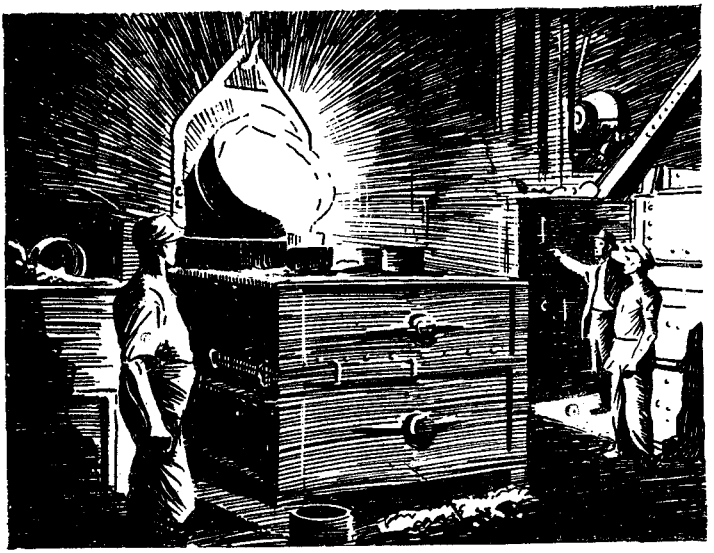
"Steel fire-boxes, steel boilers, steel wheel centers and steel frames were hastened into popularity by the Pennsylvania Railroad."

Pioneers in Applied Science

And in the constant increasing of the power of the locomotive, the Pennsylvania has been a pioneer not

only in using steel, but in bringing the resources of scientific research unstintingly to bear upon the improvement of its efficiency. Through all the years of the railroad's history, the metallurgical chemist has been the ally of the Pennsylvania Railroad in the development of engine power.

But—looking back to the 'sixties once more from the vantage point of the locomotive erecting shop—the greatest railroad achievement of this decade was not in engine design, fuel, or material, important as all these were. It was not concerned with the develop-



ment of power, though it made all future power increases possible. . . .

A Great Railway Achievement

The greatest railroad achievement of this time, and one of the greatest railroad achievements of all time, was the introduction of the air brake, first used by the Pennsylvania Railroad.

This was in the late 'sixties. In the year 1870, after full experimentation, the air brake was made standard for the road. When the automatic feature of the Westinghouse air brake was developed, it was also adopted by the Pennsylvania, and was made a Pennsylvania standard in 1878.

Without the automatic air brake, the powerful locomotives of the present day would never have been built. Tractive force of 45,000 pounds in a passenger engine would be useless, and the high-powered high-speed engines would never have been developed because it would never have been safe to operate the trains those engines haul. Great power cannot be used unless it can be controlled. And we should have no Broadway Limited humming along with an engine so powerful that its 45-mile speed average is quiet and easy, if the engineman of the Broadway could not stop the whole train, swiftly, surely, safely, with a move-

ment of his hand. Nor should we have a freight engine which weighs 386,000 pounds drawing a train of 100 all-steel cars filled with fuel or food or merchandise at a 25-mile an hour schedule, on its tractive force of 90,000 pounds. The splendid power of the modern locomotive engine—its splendid romance and its splendid utility—is quite truly the child of the automatic air brake.

Early Speed Development

In the years immediately following the introduction of the air brake, trains got up much more speed. It was not very long before they reached a schedule comparable—speed for speed—with our schedules today. At the end of the 'sixties, the best engines were still hauling their trains of wooden cars at an average speed of about twenty-five miles an hour, as the "Tiger" had done.

There were four daily express trains running then, each way, between Philadelphia and Pittsburgh, and the fastest took fourteen hours to make the westbound trip of 355 miles now covered by the Broadway Limited, the American, and the Red Arrow in a little

less than seven hours and fifty minutes. Between Jersey City and West Philadelphia the best expresses of the late 'sixties needed three hours and thirty-five minutes for the run of the present two-hour trains. But by the end of another decade passenger trains were amazing the populace by their "almost unparalleled celerity"; and the Pennsylvania Railroad's "Limited Mail," one of the fastest of them all, ran at a speed average varying between 31.3 and 37.7 miles an hour.

Traffic demands were growing greater! Between New York and Philadelphia more powerful engines were needed. In 1881 a new flyer was perfected, larger in almost every detail than any passenger engine that had preceded it. It drew passenger trains between New York and Philadelphia at virtually the schedule of today.

Advent of the Fast Trains

The fast trains had come. Not big trains; not heavy trains; not trains which could be depended upon to make speed under all circumstances; but trains which, with light loads and under favorable conditions, could keep up schedules that were fast. Railroad men look back on the swift little trains of the 'eighties, and chuckle as they recall their half-dozen cars "going around curves like the crack of a whip. . . ."

Today's Pennsylvania locomotive has four times as much power as the best engine of that day.

The flyer of the 'eighties hauled five, or at most six, wooden cars. The whole weight of the train behind the tender was about 130 tons.

Today the long trains of steel passenger coaches and steel Pullmans that speed along those tracks average from 600 to 800 tons in weight. Many of them weigh more than 1,000 tons.

Pennsylvania Limited Yesterday and Today

The Pennsylvania Limited which was making an average run of about thirty-five miles an hour at the time of the World's Fair at Chicago was a train of six wooden cars—palatial cars for that time—and weighed, empty, about 275 tons. The weight of the engine was 103,500 pounds.

The Pennsylvania Limited today is a train of ten or twelve steel cars, and when empty weighs approximately 1,000 tons. The engine and tender weigh 521,615 pounds.

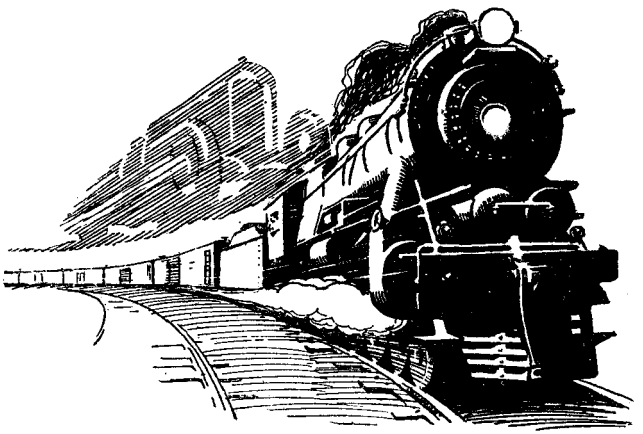
There is the true contrast of engine power—not in the speed difference of eight or ten miles an hour!

* * *

Since 1881 the actual speed rate of passenger trains on schedule has not been increased very much. Since

the end of the century it has been increased scarcely at all, although the engines are so much more powerful. Pennsylvania passenger trains of twenty-five and thirty years ago went about as fast as anyone wants to go.

The Pennsylvania passenger locomotive today *can* make much better time than its predecessors, because



it is a much mightier engine, but it is never allowed to run at its highest possible speed, or to exceed the limit of seventy miles an hour. The Pennsylvania freight engine can make fifty or sixty miles an hour, and freight schedules are much faster than they were some years ago.

Ordinary freight moves now at from twenty-five to

thirty-five miles an hour, fast freight at approximately a passenger schedule. But even in the case of freight the achievement of faster schedules has not been altogether a matter of *faster* engines. It has been a development of *stronger* engines, able not only to move more swiftly, but to haul bigger loads, and thus make possible better scheduling. That is the case, also, with passenger schedules. If engines today were no more powerful than the fast engines of the 'eighties and 'nineties, the railroad tracks and stations would be clogged up with many light trains, each engine pulling a few cars. Thus the movement of trains would be retarded to a point that would offset any advantage of "fast" engines.

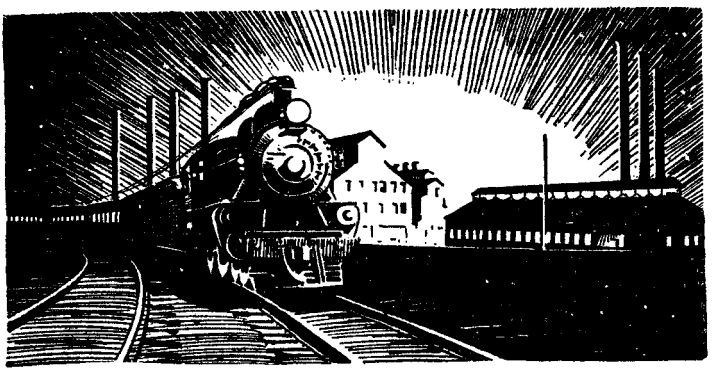
Present-Day Engine Requirements

For almost half a century the growth of engine power has meant, primarily, not faster engine work but *more* engine work.

Naturally, that has really meant faster transportation, and more economical transportation as well. For the more powerful locomotives have permitted great traffic increases without train interference, and without proportionate increase in expenditure.

At the turn of the century the development of more engine power was accentuated through the construc-

tion of a new type of engine, and the Pennsylvania Railroad worked out its own design of this new passenger locomotive—a locomotive that found space for a bigger fire. In fact, one of the greatest obstacles in the way of increased engine power has always been the



limitation of space! The locomotive builder has always needed more space: space in the fire-box, space for gases in the tubes, space to produce steam and to make it do its work most efficiently. . . . The whole story of the development of the locomotive since the days of the "John Bull" has been a story of appurtenances; and many of these have had to do with the effort either to get more space or to utilize existing space more effectively.

Supreme Skill and Workmanship

When the Pennsylvania Railroad adapted the newest type to its uses, in 1899, it designed a new locomotive which had many improvements over all engines then known. The *American Engineer and Railroad Journal* said in June, 1900, about the Pennsylvania Railroad's design:

"We do not know a more worthy example of American locomotive practice and one containing so many evidences of thoughtful skill in design and thoroughly good workmanship in construction."

And yet all the engines built prior to the early years of this century belonged to one stage of train development, and all the engines built since belong to another. Every engine built for the Pennsylvania Railroad today has at least twice as much power as the best engines of more than twenty years ago.

Influence of the All-Steel Train

The Pennsylvania was the first railroad to use steel cars for steam trains and to adopt the all-steel train, and the first to make steel equipment standard for its lines. Passenger and freight cars for the Pennsylvania Railroad have been built of steel for more than twenty years. With the introduction of the steel car to general use, the weight of every train was approximately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doubled. The Pennsylvania locomotive did more work for the simplest and most forceful of reasons: it had to.

The Pennsylvania Railroad's engines today are all much bigger than the engines of a quarter-century ago. Their weight has almost doubled. The "tractive power" that is the general measure of their might is multiplied from two to three times. The smallest of today's standard engines, used only for the lightest passenger service on easy grades, weighs 237,000 pounds without its tender. All these locomotives have been designed since the adoption of the steel car.

Superheaters as Standard Equipment

Today's Pennsylvania locomotives gain further power by being equipped with superheaters.

By means of this device the steam, which pushes the pistons that move the wheels, has more than 50 per cent higher temperature. Its volume has been increased about 30 per cent, and it is able to add 40 per cent to the engine's hauling capacity at speed. This increased hauling capacity is made possible on superheater engines by the reduction in water consumption of 30 per cent per unit of power, carrying with it a reduction of coal consumption of at least an equal amount.

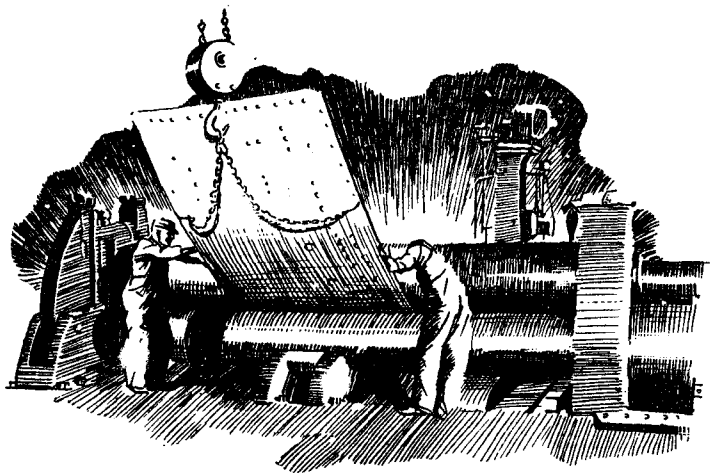
The Pennsylvania Railroad made the superheater standard for all new engines in 1912, and since that

year older locomotives as well have been equipped with superheaters.

* * *

As we talked of these things, of these beginnings and these developments and these economies of power, we started back toward the works. I wanted to see a locomotive *being built.*

We left the giant Pacific engine, again breathing lazily, like a lion asleep, and went to see the boilers being made. The plates were brought in at one end

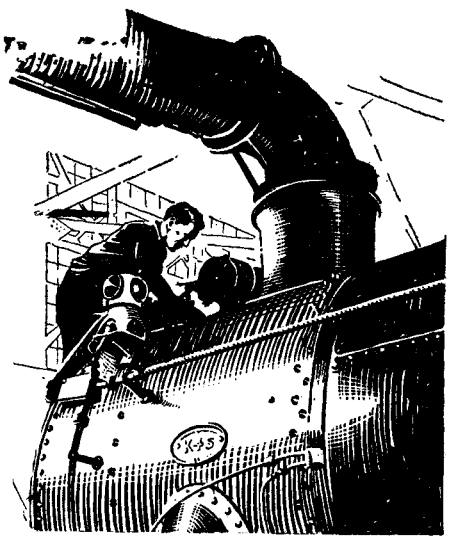


of the shop, holes were bored, bit by bit pieces were riveted together. The noise in the shop sounded like the roaring of one Gargantuan machine, but it wasn't;

it was the beating in of thousands of separate rivets, of hundreds of pieces of steel. The curved plates are fitted to each other, and when the boiler has grown to an enormous length it is set on end in the high building, and men far up in the air work like gnomes to put the rivets in the top. Then the boiler is fitted with its inside plates, and drilled for the pipes for the superheater, and everything is done that will send it completely finished to the erecting shop.

Tested, Precise, Perfect

In another building the cylinders are being finished. Brought in rough-cast, they are measured, cut, planed not once, but twice. Down to six one-thousandths of an inch, these measurements are accurate. Specially developed machinery handles eight cylinders at once for their careful planing. They are tested with 300 pounds of water pressure to prove them tight. Their linings



of hard cast iron are measured to one-thousandth of an inch, to make sure of perfect fitting, and then they are forced and bolted together, and the cylinders, like the boiler, are ready for the erecting shop. In the same way, with measurings and planings and perfection of preparation, each engine's two huge cast steel frames are completed for use. The wheels are finished. All the small parts are made ready and assembled. Everything must be perfect. Inspections and tests must be completed before the parts are taken to the big building where they cease to be parts and become one monster whole. . . .

Birth of the Giant

We walked down "Pennsylvania Avenue" in the erecting shop of the locomotive works, where an order of seventy-five express passenger locomotives for the Pennsylvania Railroad was being completed at the rate of two a day. Here, swiftly, under our eyes, these things of steel and iron became one thing, and the one thing came alive—no less. The cast-iron cylinders were bolted to the frame. Small parts were put on. A giant crane lifted the whole great frame and set it

down upon the huge steel driving-wheels. Then the boiler was prepared, fitted up, tested with gas fire to a higher pressure than any it would meet on the road; and when it, too, was lifted and lowered on the frame, the thing began to look like an engine.

The next stage of its growth was the placing of the outside gear, and after that the whole boiler was given the insulating coat of magnesia, which keeps in the heat. Then the last details were completed, and someone put coal in the fire-box and water in the boiler, and the creature's heart began to beat.

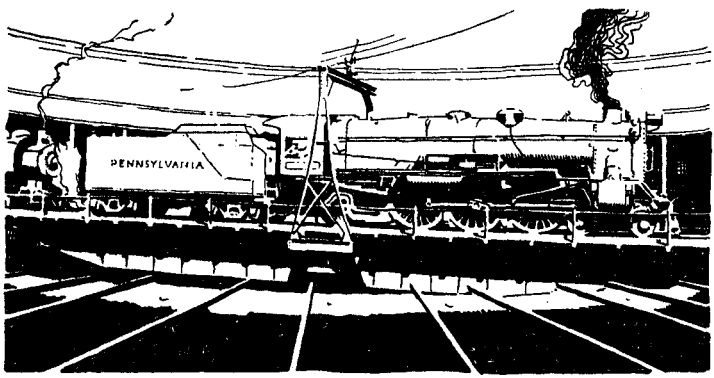
* * *

This type of passenger engine was evolved logically from the earlier standard by the addition of two more driving-wheels—which of course means a longer boiler and a larger engine. The Pennsylvania design was developed in 1914, and has been changed only in minor details, which have added to its power without altering its basic construction. In 1923 a still larger locomotive was designed, with eight driving-wheels instead of six —the Mountain type of engine, which is used for the Pennsylvania Railroad's heaviest passenger service and also for the fastest express and freight. In the same year the Pennsylvania's experts designed a new engine for suburban passenger service, to pull well-loaded coaches at a good rate of speed

with frequent stops. This is one of the largest engines of its kind in use, and it is constructed especially for the "quick acceleration" that is essential if the 8:20 and the 5:15 are to make good time with ten stops in twenty miles!

Freighters as "Crack Trains"

The Broadway Limited, swinging along with its big passenger engine, is the finest passenger train between New York and Chicago; but it is not the only "crack

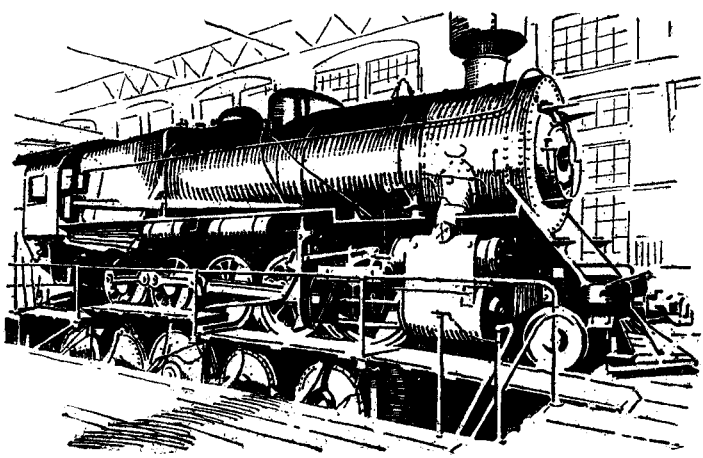


train" which the Pennsylvania Railroad operates. There are others and they too have names and reputations. For instance, there is the Man O' War, a freight train of from sixty to eighty cars loaded with live-stock, which makes the journey from Chicago to New York

in sixty hours, with a six-hour stop at Pittsburgh to feed, water and rest the stock.

The journey of the Man O' War, bringing cattle, horses, sheep and other animals from the western farmlands to the seaboard, is a bit of the romance of the modern locomotive as it does its work in hauling freight. At different stages of its trip—with different grades—the Man O' War is drawn by different types of freight engines.

The biggest of them is the giant ten-wheeler that was developed in 1916, to meet the Pennsylvania Railroad's heaviest demands in freight. A somewhat smaller freight locomotive for general heavy service was designed in 1914, with eight driving-wheels in-



stead of ten, and with trailing wheels like a passenger locomotive. The new Mountain type engine is used for the fastest work. The Pennsylvania Railroad, which hauls more freight than any other road, operates nearly all its freight trains on schedules, and pulls them with monster engines, specially designed for its use, their power making large, fast, dependable trains possible and doing away with interference and delay on the road.

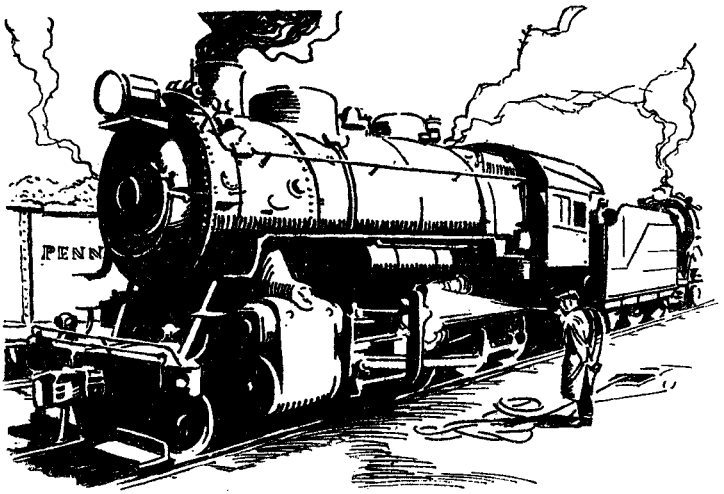
Figures That Tell the Story

One can't realize what all this means just by looking at the engines! One needs a figure or two about the engines' work! The present big freight engine can haul 139 cars of 70 tons capacity each on a level track at the speed with which the freight engine of the 'eighties hauled 37 cars and the freight engines of twenty years ago 62.

In the past six years the fuel consumption per unit of power of the Pennsylvania freight engine has decreased by about 22½ per cent. The number of "gross ton-miles" per ton of coal in 1920 was 12,018; it was 14,695 in 1926. With passenger engines, the fuel consumption per horse-power has decreased from 4½ pounds for the passenger express engine of the 'nineties, and 4 pounds for the engines of ten years later, to 2.4 pounds for the giant locomotives of today.

Greater Economy and Greater Power

In addition to increased size, wider fire-boxes, bigger cylinders, the brick arch and the superheater, today's Pennsylvania locomotives are being constantly improved with other technical devices which, in one way and another, make for economy and greater power.



The huge decapod type freight engine, for example, cuts off its steam at half-stroke, and lets the same steam's expansion push the piston the rest of the way. It is equipped, too, with the "feed-water heater," which heats the water before it goes into the boiler, so that its conversion into steam is quicker and more

economical. Like all the largest Pennsylvania engines, it has a "mechanical stoker" to feed its great fire. And as a measure of the locomotive's economical operation, technical men point out that it can develop an indicated horse-power hour for 1.83 pounds of coal.

All these are among the details which have helped to make quicker schedules, and which, throughout the Pennsylvania lines, have resulted in improved service, both freight and passenger.

The power has leaped forward to meet the greater task. . . .

The Pennsylvania electric locomotive, introduced in 1910 with the opening of the New York station and the Hudson tunnels, has grown more powerful, too. It is impossible now to guess what the future of electrification will be. But there is a new electric engine, developed in 1924, which draws the great passenger expresses between Manhattan Transfer and New York, and is also in use in freight service around Philadelphia.

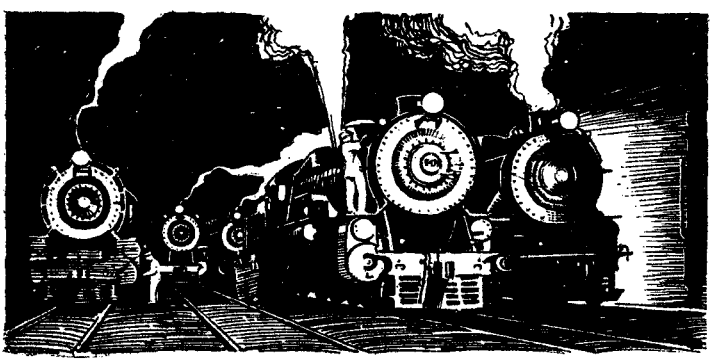
The Romance of the Locomotive

But it is the great steam engine which is the creature of romance still, snorting as it pulls its load of coal cars uphill, humming along like a bird with the Broadway Limited. It is the steam engine which fills us

with the sense of power not only embodied but living. The feeling of its actual vitality we cannot lose.

The enginemen think of the giants they control not at all as "types," but as individuals. They grow fond of particular locomotives, and hate, when the time comes for overhauling, to let them go.

This newest engine from the works will soon be with its comrades, out on the "farm," as the men call the yard tracks, at the Meadows Shops; gone over for



every trip by its own engineman as if no inspector had ever laid eyes upon it; out of Manhattan Transfer and off on the road, swift and safe and steady as it pulls its dozen steel cars along the shimmering rails. That is today's locomotive, the expression of life's modern romance because it is the expression of life's modern power.

Outside the erecting shop, the locomotive backs off the siding, takes to the main track. Its breathing seems lazy no longer. Its wheels move quickly. The engineman's hand is on the throttle, and the engine has gone to work.