Train Wires to the Horizon

By ETHNE M. KENNEDY

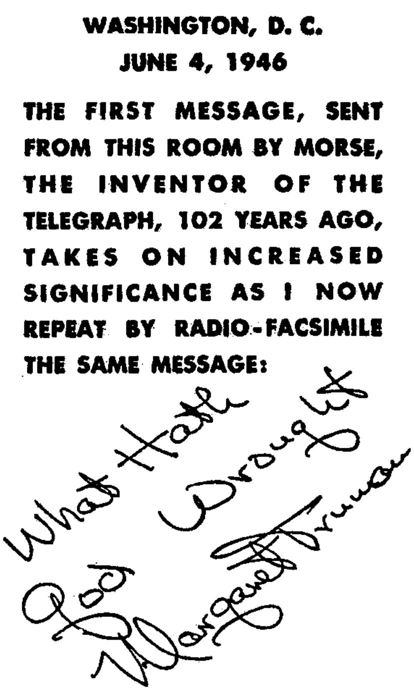
WRAPPED 'round the equator, rail telegraph and telephone wires would circle the earth fifty-one times - 1,285,898 miles of copper thread, vibrant with terse train talk

HISTORY REPEATED

NINE MONTHS AGO, a Baltimore & Ohio train speeding southward from Baltimore to Washington at a sixty-mile clip picked up a message that no job-wary dispatcher would ever initial. Dated June 4th, 1946, it read: *What Hath God Wrought*, scrolled and signed in the round hand of: Margaret Truman, daughter of President Harry Truman. How, where and why that facsimile train order was sent is a story as new as tomorrow's radio beam telegraphy, as old as Morse. And it's but one link in the tie up that has been making history for more than a century: the parallel strides of railroads and the telegraph into nearly one hundred thousand towns north, south, east and west across America.

Outside government officials and personnel of the two industries concerned, few people knew, of the experiment. The test was part of a long-range project mapped out by Western Union and Radio Corporation of America, for the extension of radio relay transmission to all key cities in the United States by 1949, and for research on its application to allied fields. This will mean telegrams sent aerially. by radio beam; perhaps eventually, the elimination of all telegraph poles for a network of transmission and reception radio -stations. But without looking into the future, the trial run proved beyond doubt the practicality of sending written orders to a train moving within contact area of radio hookup.

While the public may remain unaware of the revolution in methods of mass communications until pole lines and wires come tumbling down; railroads appear determined to keep pace with progress. Pioneered by the B&O, radio facsimile telegraphy may in the next ten years become a rail standby in-the "bright new world" postered by war and postwar advertising, if costs do not prove prohibitive. At present, train operations on 145,647 miles of road - over sixty-eight percent of the total railway mileage in the United States are being directed by telephone, and the figure is steadily mounting. The telegraph still holds down 71,572 miles of dispatching territory, while teleprinters are carrying the bulk of company business and inter-office communications. But if the newcomer lives up to present tests and predictions, the capacity of communication lines can be stepped up to one thousand messages a minute projected in opposite directions simultaneously. Add to this its greater dependability during storm periods, and it would seem that radio beam telegraphy leaves nothing wanting as a communication system capable of expanding along with any transportation industry.



CLOSEUP of first radio-rail facsimile message

The significance of the message sent from the Capitol on June 4th, however, went far deeper than a publicity toot for the wonders of the future. It was humble recognition of, past greatness. One hundred and two years before the same message was put on telegraph wires for the first time, when Samuel F. B. Morse stood in the same Capitol room and tapped out those four words *What Hath God Wrought* - on a heavy, awkward key. It was, a moment to be celebrated often in the years that followed - but then its triumph went unnoticed, except for a small number of visionaries. Among these were John H. Latrobe and Louis McLane of the B&O, who in their own way made the completion of the first telegraph line possible. Samuel Morse was not the first, nor the only man, to attempt to link distant points by electricity. Harrison Dyar, Joseph Henry and Royal E. House were but a few of the scientists who struggled with the problem in this country. All met up with ridicule from the newspapers and cracker-barrel wits; but their greatest hazard was lack of money to establish their claims. And Morse was no exception, though he was first to get a line in operation. In spite of the mechanical assistance of his friends and a moderate amount of financial backing, this American artist spent almost ten years torn between the vision of a world made one by his singing wires, and despair that he might die of starvation in the interim.

When on March 3rd, 1843, Congress awarded thirty thousand dollars to the construction of an experimental line, the telegraph got its start. Still Morse a n d his associates realized that this sum w o u l d barely cover the expense of essential materials, equipment and wages, leaving nothing for the purchase of land. If the Baltimore & Ohio - the only railroad then entering the Capitol -would allow wires to be strung along its right-of-way, they might get by without additional funds. That it became a fact through the intervention of John H. Latrobe, B&O counsel, and Louis McLane, head of the management, when in 1843 the B&O board of directors passed a resolution granting this right.

Though eight years passed before the railroads began utilizing the telegraph for train operation, the pattern of pole lines paralleling the tracks marked a tieup between the two - a combination that, meant millions in profit for one, millions in the safety of lives and equipment for the other. Railroad agents in whistle, stops from Maine to Idaho became contact men for the telegraph companies. In large cities, the telegraph . system grew and was perfected; in small road offices, its instruments were hardly changed. Together they expanded, telegraphy making possible the thousands of miles of single track slung across the continent by insuring their safety.

INVENTOR Samuel F.B. Morse

It was inevitable that the two industries should clash at least once during their relationship. This happened in the 1880's, when Jay Gould succeeded in clipping Western Union for millions to add to his railroad hoard.

CODED SIGNALS

CODE SIGNALS - telegraph - have been attempted through all centuries by all peoples. Indians transmitted messages to distant parts by smoke or the beating of drums on the hillside. Civilized Europe used various systems of shapes or signs projected from heights to represent the letters of the alphabet; at night, torches. Relay stations were located at fixed distances so that forms were easily visible with a moderately powerful telescope. The plan, however, was basically complicated by the number of shapes necessary.

Lord George Murray refined the process somewhat in 1795 by his machine composed of six shutters painted black, each subject to being opened at pleasure: different letters and figures were indicated by the situation of the open shutter. By 1816, England had advanced as far as a wooden semaphore, consisting of an upright pole to which were attached two movable arms. This simple mechanism could he seen with the naked eye from as great a distance as the shutter telegraph with the aid of a telescope. It proved capable of forty-eight distinct signals: the alphabet plus thirteen arbitrary signs.

Yet while this was an improvement, the development of Stephenson's steam engine and the rapid stretching of rails across England demanded a surer, speedier method. Britain's fog blanked out messages from time to time; and though England might wait for news from abroad, safety couldn't. Single-track railroads were handicapped by their inability to send out alarms should an obstruction be placed on the tracks or an engine run wild. Product of this necessity was the adoption of Cooke & Wheatstone's dial telegraph, the first practical use of electricity for train dispatching.

The 1837 model of Cooke & Wheatstone's invention was based on the principle that a magnetic needle placed in the centre of a coiled wire could be moved in controlled directions by making or breaking contact with a single voltaic battery. During its development, various numbers of needles were tried, before being reduced to two. The direction of the needles indicated a letter or word on the face of a dial, some letters requiring as many as three complete movements of a single needle or the action of the two simultaneously. Transmission was slowed by the fact that the correspondent had to register his understanding of each word individually.

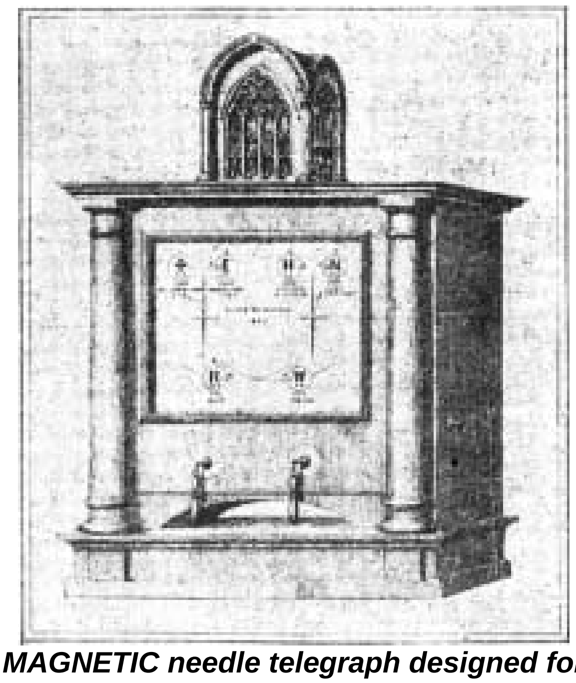
EARLY wooden semaphores were fair-weather couriers, blanked out by rain or fogs.

All stations on the line could read the message, since they were part of the same circuit. Before the dispatcher began his order, he summoned the station clerk by ringing a bell. Unfortunately, bells were rung in unison in all stations, so the operator was further indicated by a station letter. In some cases, the Norfolk Railway for instance, this nuisance was avoided by stringing separate wires.

The first prominent telegraph, built alongside England's Great Western Railway, was completed in July, 1839, at a cost of between 250 and 300 pounds (approximately $1,000 to $1,200) per mile. Though this figure was high - in America, telegraph lines averaged about $150 per mile - economy was the primary reason for its construction. Besides enabling a single-track road to carry the traffic of double-track railways, the telegraph safeguarded property efficiently and was cheaper to maintain than the older system.

Cooke first adopted a plan for laying wires in iron tubing for the Great Western line, and followed this method on the London & Blackwall, Leeds & Manchester and Edinburgh & Glasgow railways. While successful, the scheme proved extremely costly because of the damage resulting from water, fractures and contact of the underground wires with the earth. Repair was speeded up by Cooke's invention of the detector, which traced the cause of trouble quickly. Still breaks remained both difficult and expensive.

After much experimentation, the Englishman decided to transfer his wires to poles. Strong sixteen- and eighteen-foot timber posts were fixed in the ground every five to six hundred yards. Winding apparatus corresponding to the number of wires employed was attached to the top of these poles with several upright standards placed between every two groaning posts. Once the wires were wound to the necessary tension, the apparatus held them tight and parallel, preventing crossing or contact. Immediate results were superior insulation and easy maintenance.



MAGNETIC needle telegraph designed for England's Great Western Railway by Cooke & Wheatstone transmitted about 30 letters a minute

The main feature of Cooke & Wheatstone's electric telegraph was not merely the sending of signals from one place to another at the rate of about thirty letters a minute. It was its reciprocal system which permitted communication between distant places: a system of keys which formed the extreme end of conducting wires, each provided with a self-acting drawbridge by which the circuit was complete for the signals to pass when the signals were received, but was withdrawn at the end from which the signals were to be sent, while the keys were in connection with the poles of the battery. Once the connection was broken, it replaced itself again. This united and reciprocal property was the basis of the electric telegraph.

INITIAL EXPENSE

IN SPITE of the initial expense, telegraph lines were strung rapidly across England. In the United States telegraphy got off to a slow start. Samuel Morse spent much of his time between 1837 to 1843 writing and appearing before Congress, and tramping through England and France to gain recognition for his invention. There was talk of allotting money, but we were still feeling the effects of the panic of 1837. Then too, it was an open question as to whether the telegraph should be considered a blessing or a curse.

But while businessmen and government officials wrangled, and Morse became more and more discouraged, the instrument itself was becoming more technically perfect. By this time Morse was no longer working alone; he had the mechanical genius of Alfred Vail as an ally. Taking the crude machine on which Morse had sent his experimental messages at New York City, Vail simplified and strengthened it. For when Morse had built his first telegraph he was working without complete knowledge of the discoveries already made in that field.

Claims have been made that Morse failed to send a message farther than forty feet until Professor Gale, a fellow instructor at New York University, suggested how he might intensify his battery. It's a fact that Gale and Vail were first to enter partnership with Morse. Vail had been a student at the University and witnessed some of Morse's tests. Once interested, he concentrated his energy on its development, persuading his father to provide them with three thousand dollars and a laboratory at their Morristown N. J. steelworks.

When Morse presented his invention for patent, Congressman F.O.J. Smith, Chairman of the Commerce Department, was so favourably impressed that he resigned his office soon afterward to join forces with Morse, with the promise of twenty-five percent cut in the future profits. Critics imply that Smith's former connections were responsible for the decision of Congress in 1843 to underwrite the building of an experimental line between Washington and Baltimore. While there's no proof on either side, one thing is certain, Congress had delayed action long enough to take the great step on its own hook.

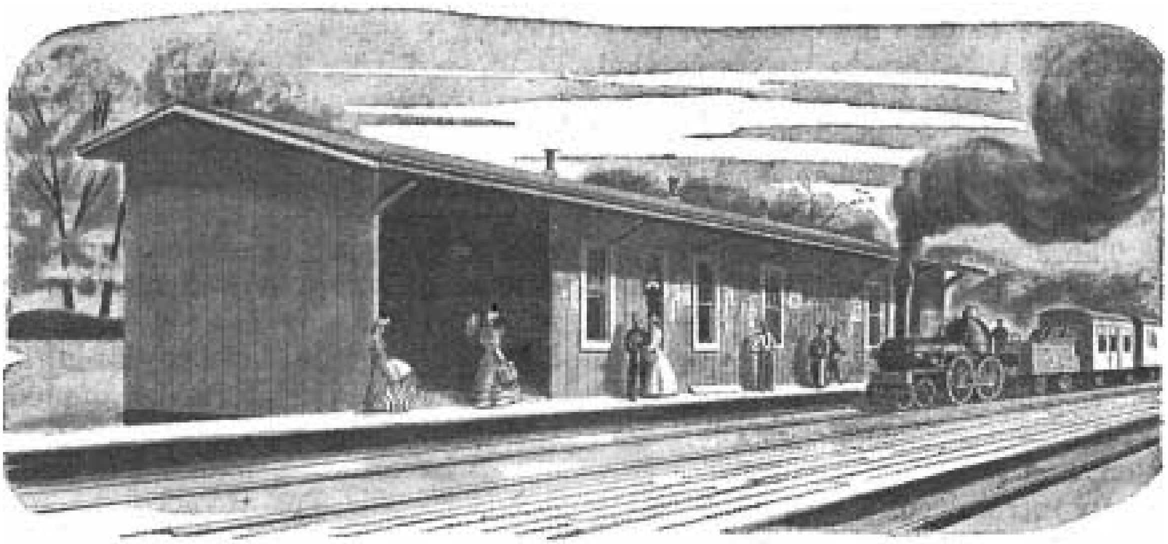
With thirty thousand dollars in credit, Morse began his telegraph line. The B&O had offered its services and land under certain conditions: “to afford to Mr. Morse such facilities as may be requisite to give his invention a proper trial on the Washington road, provided in his (the president's) opinion, and in that of the engineer, it could be done without injury to the road and without embarrassment to the operations of the Company, and provided that Mr. Morse will concede to the Company the use of the telegraph upon the road without expense, and reserving the right of discontinuing the use, if upon experiment, it should prove injurious in any manner.” To this the inventor was agreeable. It was the only offer of free land, and he could hardly refuse any feasible plan to test his idea.

EARLY TELEGRAPH LINES

EARLY American telegraph lines made the same mistakes as did the English. Opinions vary as to whether Morse ever intended to support his wires on poles. Some say that when he described his telegraph to the Secretary of the Treasury in 1837 he planned aerial wires fixed on thirty-foot spars well planted in the ground and placed about 350 feet apart, along the tops of which the circuit might be stretched. Perhaps Morse was later influenced by the popular distrust of lightning on a string - upheld as reason enough why the telegraph should not follow the posts roads. Or perhaps he thought it would be impossible to maintain the fragile spider-work against winter storms, falling trees and human interference. On the other hand, Morse may never have considered the overhead system until his line reached Relay, where a stone viaduct made the continuation of the trench line impossible; and he discovered at the same time that the buried section was useless.

Cornell - charged with the actual laying of the line - to save face. As dusk was falling one evening, Cornell spurred on his men and teams in one last gesture to the day's work As the plough neared a large rock along the right-of-way, he grabbed hold of the plough handles and swerved to collide with it, thus destroying the machine. While newspapers recorded the misfortune, Morse and his associates huddled on a change of method.

More than half Morse's allotment for the completed line was gone, and Congress



RELAY, Md, nine mile south of Baltimore – dead end for Morse’s underground wire system. Poor insulation and breaks allowed current to escape

offered no court of appeals. Salvaging material from the buried section seemed imperative, yet Alfred Vail - Morse's expert - declared that the lead covering could not be stripped from the copper wire without melting it. Ezra Cornell believed it could though, and he went to work to prove it.

During the early months of 1844, Cornell evolved his own theory of wiring based on the success of Cooke and Wheatstone in England. Re-dividing the four copper strands, he attached each to a pole, separated by its own glass insulator - a plan so simple and effective that it has been followed ever since. Cutting a square notch in the rough cross-arms, he ran the wire which had been wrapped in cotton and saturated in shellac through two small squares of thick glass. Then he nailed a wooden cover over the

The chief tool in laying the line was a heavy plough propelled by sixteen oxen. The ploughshare had been cast by the B&O foreman of the Mount Clare shops moulding room. It made a furrow two inches wide by twenty inches deep, feeding leaden pipes in which the wires were encased from the bottom. On top of the plough's beam was a cylinder holding some sixty feet of pipe which uncoiled and passed down over little pulleys in the rear edge of the blade to the earth cutting line. A plumber armed with a fire-pot and soldering irons followed immediately behind. As the supply on the cylinder ran short, he would wind on a new section and join the ends, thus keeling the operation moving without interruption.

Once the failure of the underground line was learned, Morse appealed to Ezra glass, both to hold it in place and keep off the elements.

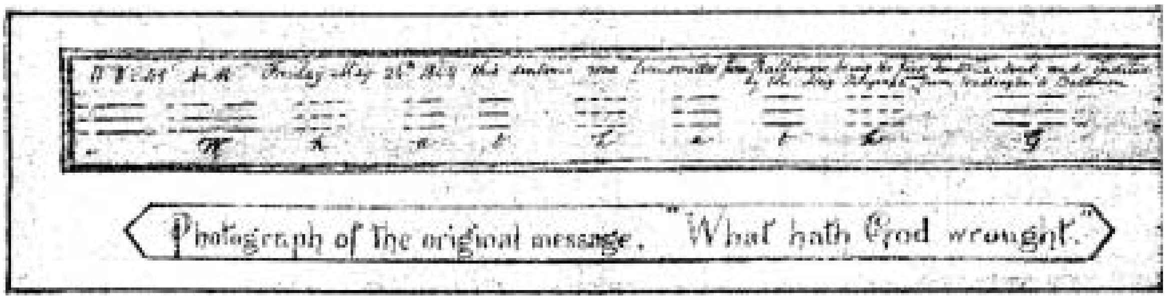
By May 1st, unbarked cherry poles had been set in the right-of-way as far as Annapolis Junction, twenty-two miles from Washington. Up until this time Morse had been using a double circuit to work his telegraph, but then he found that the ground made a far better return wire for the circuit. Adopting the new system was a welcome economy. Then to add to this windfall, the political scene provided the telegraph with some badly needed publicity.

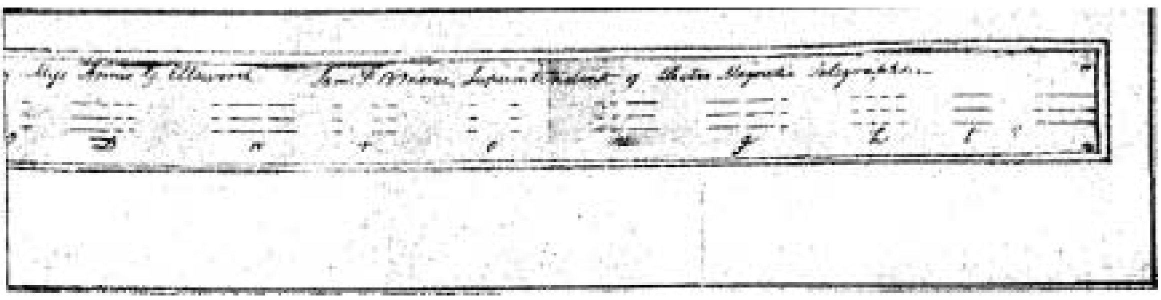
The Whigs were meeting in Baltimore to nominate a Presidential candidate. Those who could travel took the B&O to Baltimore; many others swarmed into the Capital station and lined the tracks, waiting for the trains to arrive with the news. Overlooking the crowd in a Capitol room which harboured a strange looking machine with "paper tape, and crank by which a weight was wound up to revolve the rollers through which the tape moved when the message was being received … surrounded by pots and jars of the primitive battery" stood Morse, waiting for Vail's signal.

As the first train to leave Baltimore after the nomination reached Annapolis Junction, a note was tossed off to a young man seated beside a table on a crudely-raised platform near the tracks. A moment later he was manipulating a lever on a small machine in front of him, from which wires led to nearby poles. Passengers, who noticed, no doubt wondered. But the real surprise came when they discovered that many city-bound Washingtonians had learned the results an hour before their arrival, though they had had little faith in its truth. The message had been sent and acknowledged within two minutes and one second.

The next few weeks were momentous ones. On May 14th, Vail wrote “Telegraphed from the Relay House. All works well.” One week later, the line entered Baltimore.

To establish electric current, a wire connecting with one pole of the battery in Baltimore was soldered to a sheet of copper five feet long and two and one-half wide, and then thrown into the harbour. A like copper plate was buried in the dry dust, of the Capitol's cellar in Washington.. Then came the official inaugural on May 24th, 1844. Wires had been carried into the Supreme Court room of the Capitol, where Morse and a small group of Congressmen and others were gathered.





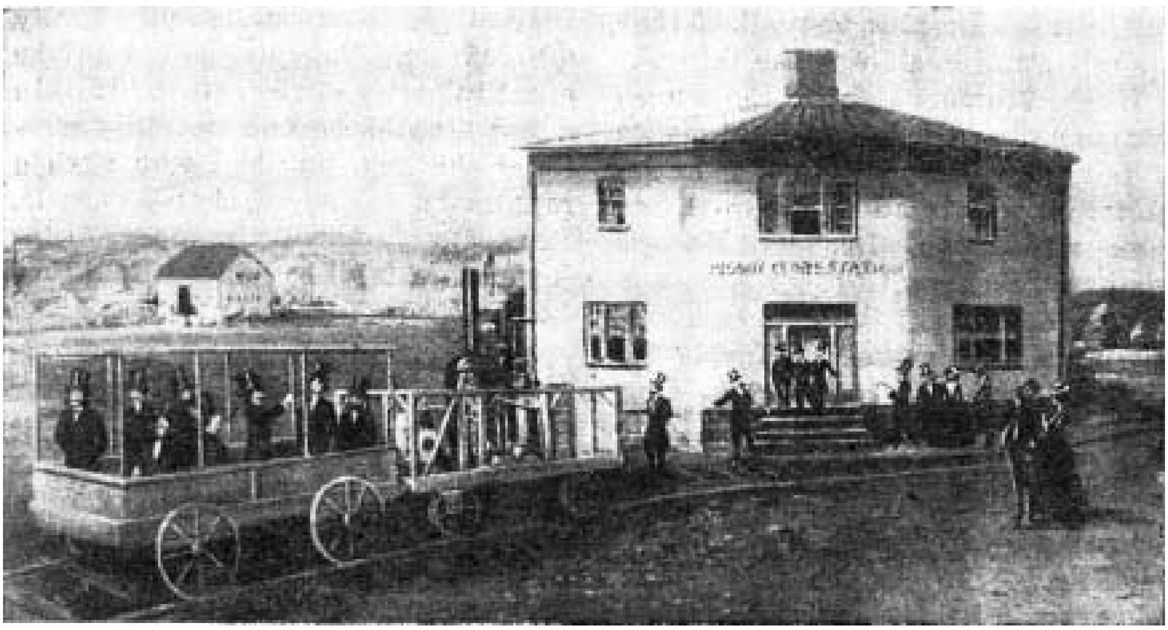
REPRODUCTION of Morse’s telegram in dots and dashes, basic code for wire and wireless communications

There was a moment's stillness as Morse laid his hand on the key. “What hath God wrought!” passed on to the wires by Morse's even tapping. The message was returned by Vail from the B&O Mount Clare station, and thus the telegraph was formally introduced.

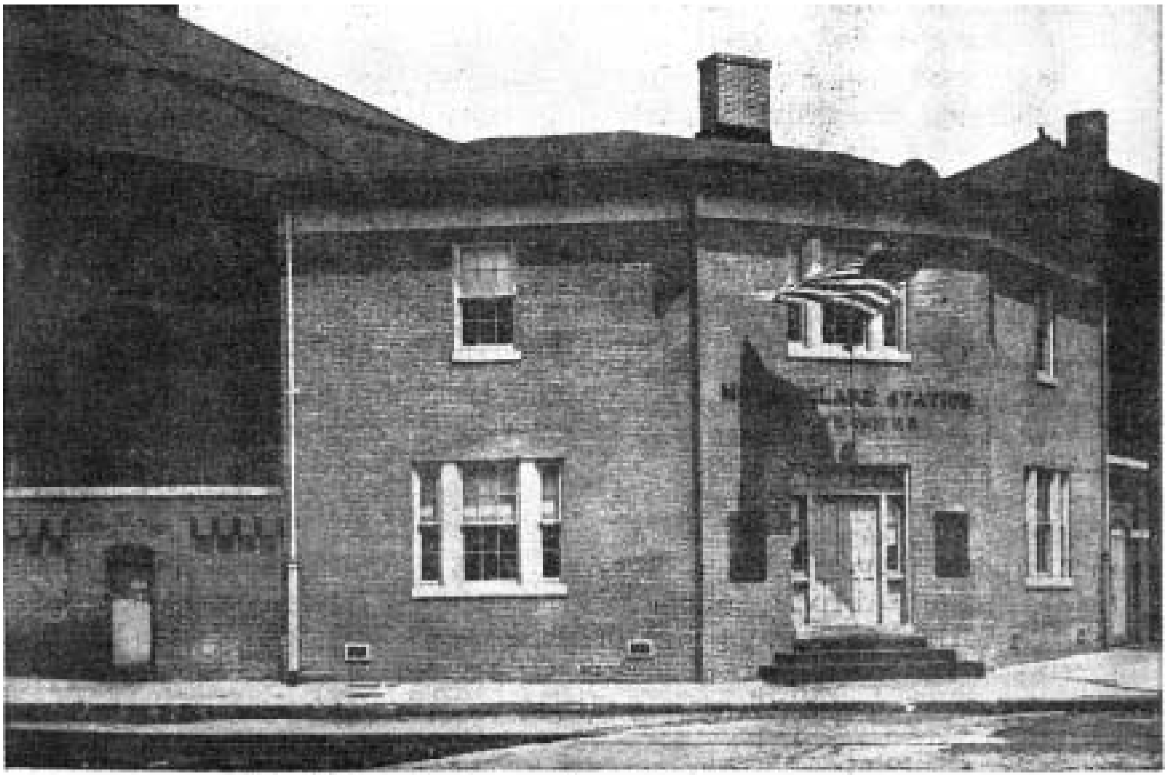
RAPID CHANGES

WHILE the basic principles remained the same, the telegraph of 1844 had gone through radical changes in appearance when compared to Morse's 1835 model, first exhibited at New York University. In the first, the mechanical action of an electromagnet operated a lever carrying a pencil at one extremity. The passage of electrical impulses through the magnet circuit caused the pencil to move in contact with a paper tape, which turned over a revolving cylinder directly under the pencil, drawing an undulating line which embodied Morse's code. The speed of the paper was graduated by clockwork. A single wire conductor connected one pole of the battery to one end of the helix of electromagnet. The other end of the helix was joined to one of two mercury cups on the “port rule.” This was a ruler-like board in which metal teeth were set in a row, so that the transmitter lever moved up and down as these notches struck it, making and breaking circuit at short and long intervals to send Morse's famed system of dots and dashes. The second mercury cup was connected to the second pole of the battery, so that the only part of the circuit not complete was at the cups.

When Morse discovered that his current was too feeble to operate the receiving apparatus directly, he devised - with the assistance of Gale and Henry - a relay that would automatically repeat signals into another section of line and join circuits in this way for any desired distance. By 1837, when he filed a caveat in the Patent Office, a great number of modifications had been made, many of which have been attributed to Vail. The port rule was abandoned for a simple key, worked manually; and for the original pencil in the register, one of three methods might be used: a fountain pen; an inked wheel; or hard steel points. the impressions of which resembled the Braille printing for the blind.



MOUNT CLARE STATION: 1835-1946. Within the B&Os first passenger and freight depot, Alfred Vail received and acknowledged the telegraph's famed What hath God wrought message



Courtesy of Baltimore & Ohio

"Vail invented the first combination of the horizontal lever motion to actuate a pen, pencil or stylus, and the entirely new telegraphic alphabet of dots, spaces and marks," says J. W. Johnston, in his Telegraphic Tales, "and he did so prior to September 1837, the month when the old instrument passed into his hands for reconstruction. His more perfect invention of the steel style upon a lever, which could strike into the paper as it was drawn onward over a ground roller and emboss upon it the same alphabetic characters, was not invented until 1844, about the time when the first line of telegraph began to operate between Baltimore and Washington."

But as far as credit went Alfred Vail had no comeback. According to his contract with Morse, he signed off his future inventions to Morse for an interest in the telegraph. He could not have obtained patents for them had he tried. Besides, he realized that the telegraph itself was the thing. While Morse patented the sound system as part of the original modes of telegraphy secured to him as inventor, it was in anticipation rather than realization. In fact Morse's company, along with the others, vigorously denounced the sound system, having a law passed to forbid its practice. Yet even in the early days of telegraphy, this method began to assert itself.

There were many disadvantages to reception by register: the constant winding of the clockwork, the mistakes made by the copyist in transcribing his messages, the whirr of the wheels, the breaking of the weight cord.... it was no flip of the wrist. In order to run the machine, you had to pull the narrow tape through the register, then gather it up, scan the impressions and write off the message. Yet so determined were the inventors to make reception foolproof and so proud of their mechanism - particularly after the register was made self-winding - that this slowed-up process might have continued for years, but for the challenge of a whirlwind telegrapher, whose fame brought P. T. Barnum to his door.

Jimmy Leonard went to work at the St. Clair Street telegraph office in Frankfurt, Ky., during the fall of 1848. Only fourteen, he had already decided that the telegraph was the great industry of the future. Within a few months he had not only mastered the key but had won such a reputation for speed that

James D. Reid, the Louisville manager, sent for him. A trial convinced Reid that Louisville needed Jimmy.

The youngster's speed record is mere calculation. No one was ever found who could send as fast as he could receive. A copy of a message Joe Fisher sent at the rate

ARTIST'S version of Vail's Annapolis to Washington message. Instrument shown resembles House printing machine

of fiftythree to fifty-five words per minute for ten consecutive minutes was part of an exhibit representing American telegraphy at a Paris exposition of that period. This was more remarkable when you consider that wire insulation was so poor it was necessary to keep one hand on the mainline relay in order to maintain even a partial adjustment.

Samuel Morse was in the Louisville office when this test was made, and recognized then that his tape method was outdated. The mechanical register boasted twenty-five words a minute at best. Besides, House's telegraph machine used on several eastern lines could print fifty, using a system of keys resembling those on a pianoforte.

LONG STRUGGLE

MORSE'S telegraph was proved on the Washington-Baltimore line and ready for adoption as the basis of a rapid communications system; still there was a long struggle ahead. Railroads eyed the telegraph as a rival for passenger traffic, declaring that if men could wire to market they would never travel. Newspapers, more friendly than in the past, remained suspicious; even shrewd old James Gordon Bennett of the New York Herald had claimed it would be "greatly to our disadvantage should the telegraph succeed." The average man knew little or nothing about electricity, and therefore regarded it as sheer magic. It was not hard to believe this when wags hung shoes over the wires at night, and next morning marvelled at the speedy delivery from distant towns; when train crews telegraphed back to terminals and came up with umbrellas and parcels that riders had supposedly left miles behind.

The tale of an old woman taking her first ride on a railway car was typical of the confusion about what the telegraph really was. "Well. I've often said they'd never git me into the railroad cars," she was heard to remark, "but I know they'll never git me on them telegraft wires." A Congressman who had voted money for the experimental line was disgusted to find he couldn't send his bundle of laundry home by telegraph. So while editor, used biblical texts to thunder on the evils that might stem from the telegraph's falling into the hands of the wicked, the instrument itself got little chance to prove its worth.

In Washington where business was done free of charge for the first year, operators played chess and checkers to while away the time. After April 1st, 1845, the line went into commercial operation, sending messages at the rate of four letters or figures for one cent. During the first week, the agent totted up the noble sum of seventy-three cents in tolls. Oddly enough, this was an increase over the number sent free. But even at that, receipts for the first month totalled only twenty-one dollars and twenty-three cents.

Failing to unload his invention on the Government for $100,000 - since the ruling brain trust calculated it would never be self-supporting - Morse and his associates began their own line between Washington and New York. Between Philadelphia and New York, their Magnetic Telegraph Company followed the coach roads, since concessions along railroad rights-of-way were unavailable, except at exorbitant rates. South of Philadelphia, they met better luck. The Philadelphia, Wilmington & Baltimore Railroad, hating to be left out should the newcomer succeed, acquiesced under certain terms.

One of the strangest things about the telegraph was the fear it produced in people and companies of every type. Railroads were no exception in giving it the evil eye. It was regarded as the tool of gamblers who would wreck the status quo of industry and social life, overthrow governments, and cause havoc of all sorts. Each industry saw in it the culmination of its own particular fear therefore the railroads set out to leach its power to steal passenger traffic, then regarded as the lifeblood of the railroads.

The Philadelphia, Wilmington S Baltimore offered concessions provided it be given one year's option on one-third of the Magnetic stock, either to buy or dispose the right to buy to someone else. Further, should the system find the telegraph system injurious in depriving it of passenger travel. it could require the removal of the posts, wires and fixtures from the road within twelve months after notice was given. Bound by similar restrictions, telegraph lines were strung along the eastern seaboard.

Henry O'Rielly was commissioned by Smith and Morse to stretch the pioneer line westward from Philadelphia to Pittsburgh; and the speed with which this and other lines were slung over mile upon mile of rugged territory proved one of the industry's worst enemies. It was a hard decision to make. The inventors needed both money and cooperation, until the telegraph should be solidly planted in the land. Because they had little of either, they gave small attention to how the lines were constructed, concentrating on rights and profits.

The number of accidents that occurred at this time gave railroads justification for their early cautiousness. O'Rielly thought three-strand wire necessary for strength, since the number of accidents in Massachusetts and Connecticut indicated flimsy wire Yet when his wire broke - as even it did - the three would sprawl wildly, sometimes getting entangled in the wheels of trains or tearing holes in the roofs of passenger cars. When a company which had leased rights for a route to Boston was involved in the death of one man and serious injury of another, because wires had crossed between the widely-spaced posts, legislatures fixed heavy responsibility on them for damage resulting from their lines.

Although physically the telegraph could not have been more closely bound to railroad facilities, yet it was eight years, before the roads grasped the significance of this means of communication True, Conductor Charles H. Haskins of the Michigan Southern telegraphed to Monroe on Lake Erie during the winter of 1849-50, ordering a boat held for passengers on his train, which had been delayed; and while not directed to a train official nor governing train schedules, this might be regarded as the first attempt to utilize the telegraph for transportation. But whatever it is classed as, it passed unheeded. Not until 1851 was the telegraph adopted for train dispatching in this country.

MINOT PIONEERS ON THE ERIE

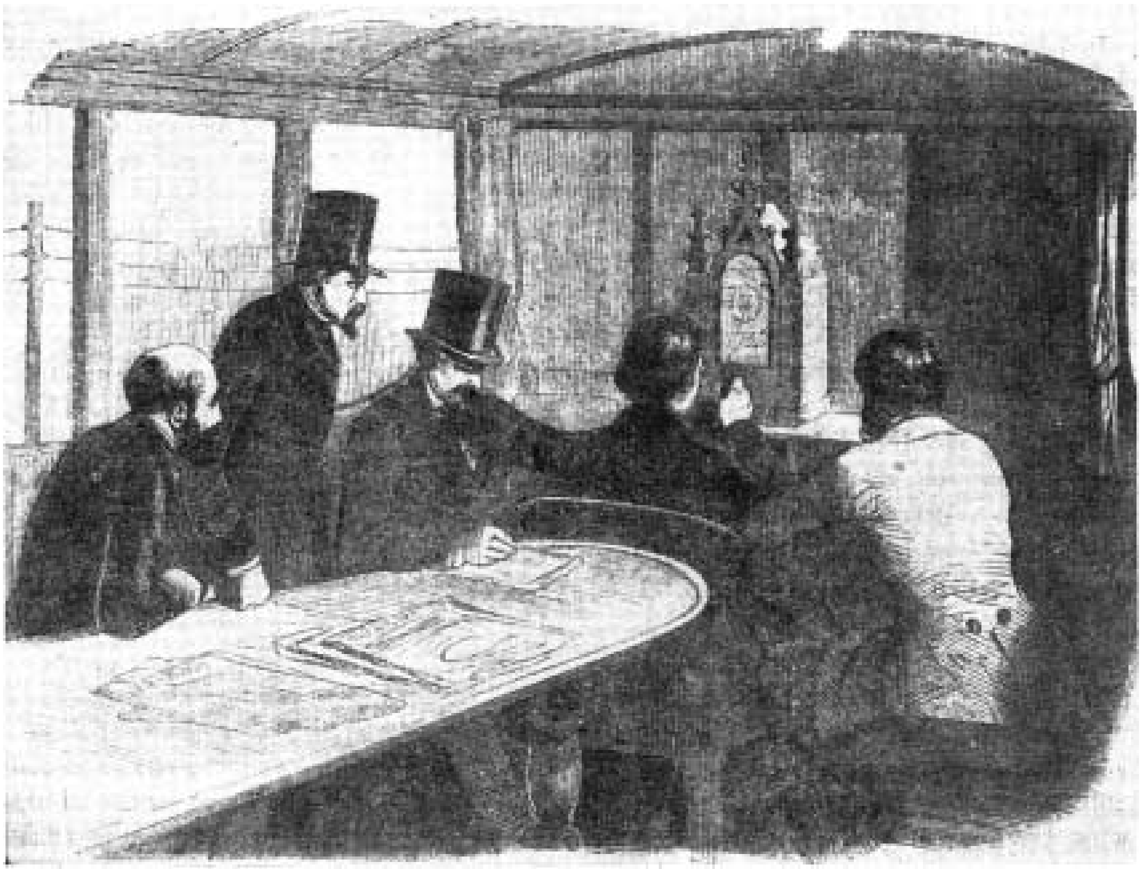
THE ERIE in the person of Superintendent Charles Minot pioneered the telegraph for train communication, management of its system, and the guarantee of the safety of its passengers and equipment. Minot’s attention was drawn to the telegraph first, when Ezra Cornell began building his New

York & Erie Telegraph Line in 1847, trailing the wagon roads through the southern counties of New York, having placed mile after mile of posts through Harlem, White Plains, Peekskill, Newburgh and on west through Goshen, Middletown, Binghamton, Ithaca to Fredonia. Persuading the Erie to invest in a similar line, Minot had work gangs put up poles and wires along the margin of the track, while Cornell supplied him with brimstone insulators and Morse office machines.

Cornell's own line paralleled the Erie at Goshen, the first instrument being placed in a hotel bar room there in 1849. Later on Cornell arranged with Lebeus Vail, who owned a bookstore and printing Shop opposite, to have his telegraph in. one corner of the store. This agreement was responsible for the fact that Vail's three sons became telegraphers. Hec Vail, the eldest, became the first regular operator at Goshen. As the line reached Port Jervis in 1851, the first station west, Hec took over the newer post, turning the other to his brother Nat.

By this time Erie's line entered the same Goshen office, and crews discovered they could get news about the trains at Vail's. In some cases, they made up lost time by learning how opposing trains were running. They were simply "wildcatting" but they'd come to depend on the telegraph. Still it remained for Charles Minot to declare this instrument the solution to train dispatching, the final authority on the rights of trains.

The first operator to receive a salary from any railroad was D. H. Conklin, a young printer. Conklin had learned his craft from Cornell and when the Erie line was completed but not operating, Minot solicited his aid - upon Cornell's recommendation - to put the Piermont pier battery in working order. Minot made his plans clear then. Not only did he hope to show the location of all trains at all times by the telegraph, but to move all trains by this means. His interview with Conklin was enthusiastic enough to send the latter across the river to Piermont, where after two days' struggling he had the



Frank Leslie's Illustrated

INTERIOR of telegraph car: signalling ahead to the front end

battery operating. Shortly afterwards he called Vail at Goshen, and tests proved that the line was successful.

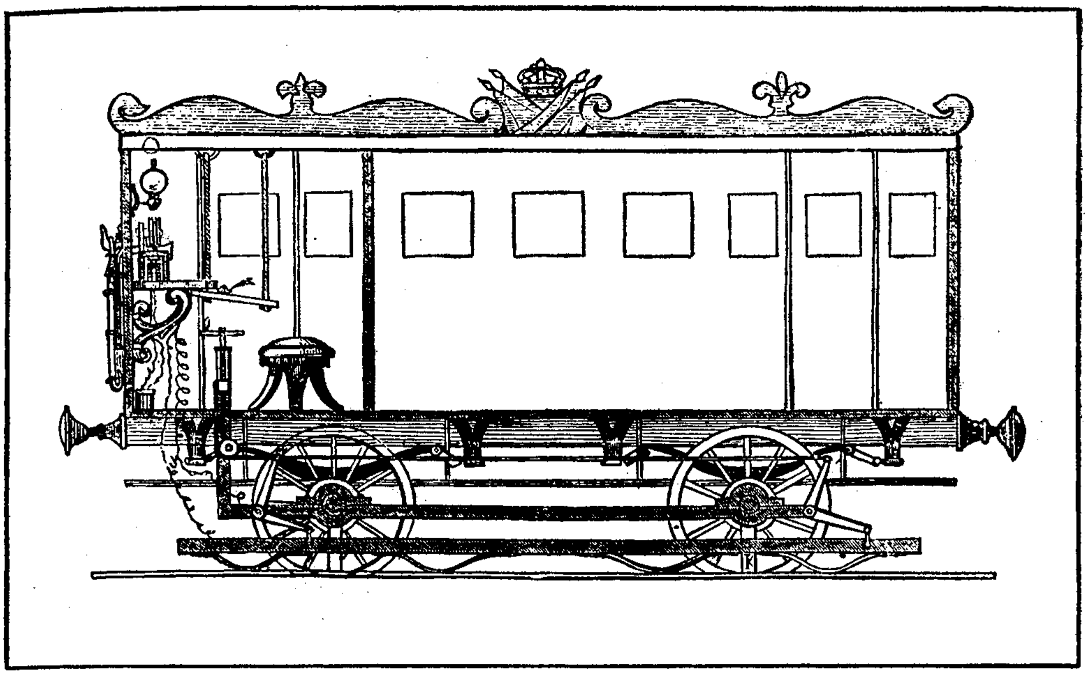
Reporting his results to Minot, Conklin discovered his printings days were over. At the superintendent's order he returned to Piermont to take charge, living for some months on expense money doled out by the Erie. When the line was finished to Port Jervis, Minot detailed his plans for an operating department. Ninety employees would be needed to manage the line. adding a heavy payroll to maintenance costs.

"Now you are an expert" said Minot. "The amount we fix for your salary will govern the salaries of others. I hope, therefore, you will accept thirty dollars a month for your pay, and when the wire is all in good working order I will give you the best office on the line."

With his eyes on the future-tire promised office his pot of gold Conklin accepted the offer. Months later he helped string the first insulated wires under the drawbridges of the Paterson & Ramapo and Paterson Hudson River railroads, and opened several offices on the Susquehanna and Western divisions. In the spring of 1851, he was put in charge of the Susquehanna Depot, a repeating station and therefore most important on the line.

The first practical demonstration of economy was the use of the telegraph in handling freight. It was the custom to load the holds of boats and barges, leaving certain large sections of the decks clear for the livestock expected upon a train due in at Piermont about 10 p.m. The hitching rack to which cattle were led and tied -by bull ropes was just outside the rail. Since the number of head of cattle was always an unknown quantity, the loading of the decks was tied rip until the arrival of the stock trains.

Having watched the process for some time, Conklin conceived how his wire might become a great timesaver. To test it, he arranged with the conductor the next night to notify him by telegraph as to the number of cattle he was hauling and what he might expect to pick up at blind stations. That first venture proved its worth immediately. Within thirty minutes after arrival the barges were loaded and off for New York, having saved fuel, labour and time at both ends. Minot could report success to the Erie backers.



TRAIN TALK between head and rear end was possible with this 1856-model telegraph car. Rotating hand wheel ahead of seat lowered the contractors against the rail. Key was attached to suspended table

Minot not only deserves credit for working out the practical application of the telegraph to railroading, but for playing the leading role in its demonstration. Trains up to the time of his trial run were governed by the time interval system: that a ruling train had right of one hour against an opposing train of the same class. But on that day in the autumn of 1851, a westbound Erie train scheduled for a meet with another at Turner's broke all the conventional rules of railroading.

Conductor W. H. Stewart was running the express with the superintendent aboard. Stopped for the opposing express at Turner's, Stewart was ready to wait out his hour, if the other passenger train did not show up in the meantime. Minot, however, was less patient. There was a telegraph office at Turner’s and Minot wired to Goshen, fourteen miles farther on, to see if the other train had passed.

It hadn’t Minot then ordered the operator to hold the train. Writing out the following order, he handed it to Stewart “To Conductor and Engineer, Day Express: Run to Goshen regardless of opposing train. Chas. Minot, Superintendent.”

Edward Mott describes the scene that followed in his Erie history, Between the Ocean and The Lakes. “‘I took the order,’ said Mr. Stewart, relating the incident, ‘showed it to the engineer, Isaac Lewis, and told, him to go ahead. The surprised engineer,: read the order, and handing it back to me, exclaimed ‘Do you take me for a d--n fool? I won’t run by that thing!’”

In the end, Minot piloted the engine, sending Lewis back to the rear coach. And on arrival at Goshen, the crew discovered that the opposing train was still not in sight. Minot wired to Middletown, issued a second order, and they were off again. Port Jervis was next. As Minot pulled into this station from the east, the opposing train entered the yards from the west.

This test proved Minot's point far better than years of argument. Several hours had been saved; safety had been established. From then on, telegraphy had a railroad champion in the Erie system.

Frank Leslie’s Illustrated

TARGET TIME in Texas. Cowboys found posts handy for improving aim, occasionally for hangings; between times, message passed uninterrupted

NUMEROUS ACCIDENTS

POPULAR FEELING took a hand in uniting the telegraph and railroad industries. Railroad accidents had become so numerous that state legislatures were introducing measures to enforce public safety. The New York State Legislature was aroused by the record for the first eight months of 1853: 65 casualties, 175 deaths, 333 injured. In Great Britain, where almost all railroads were controlled by telegraphic dispatching - where speed was even greater-the number of deaths in the preceding year had been fewer than those in the single state of New York 89,135,729 persons carried and 216 killed; New York, 7,440,653 carried, 228 killed.

Yet in spite of Erie's successful experiment, other roads were slow to take advantage of the telegraph. They were uncertain that the expenditure for equipment was absolutely necessary, though had they studied England's case they would have learned that after paying off its initial investment, the telegraph declared a yearly dividend after meeting expenses. Still the report to the New York State Legislature in 1853 declared that the Madison & Indianapolis and the Erie had introduced it, although to a limited extent, and the Baltimore & Ohio and the Camden & Absecom were also getting in line. The Delaware, Lackawanna & Western, however, was really second in switching to electric train dispatching. D. H. Conklin left the Erie to become the Lackawanna's superintendent of telegraph.

Rivalry, however, was the greatest wire slinger. By 1847, O'Rielly who had been constructing lines for Morse, Smith and Kendall had broken with the pioneers and was unwinding lines north, south and west through the Middle West, wherever he found cities that would subscribe enough money to pay the cost. But the lines were thrown up so hastily that the first storm wrenched wires from the oak, pine or hickory posts on which they hung. One average storm put 170 breaks in a thirty-mile stretch of line between Boston and New York.

After 1849, the great westward migration focused the attention of Washington on the telegraph once again. Settlers were pushing their overloaded land schooners across the prairies and the scorched sands of the Southwest to California, the Mecca of the get-rich-quick. Thousands of others had walked or ridden to the Mormon kingdom. If the East and the West were to be one, if the wealth of the newly-exploited territory was not to escape to foreign traders, communication and transportation had to be provided.

Plans for a Pacific Railway to join California and Oregon with St. Louis were proposed by political factions and businessmen. Indians were attacking and burning many of the caravans of emigrants, and threatening to destroy our military forces. But if there were a railroad, or a line of military posts from our western border to the Pacific, protection might be given these settlers.

Henry O'Rielly and John Loughborough had an alternate plan which would have linked up the two necessary contacts with civilization - the railroads and the telegraph. Instead of concentrating forces at four main posts as was proposed, O'Rielly suggested a telegraph line from St. Louis west, with thirty soldiers stationed every thirty miles en-route. Besides protection, this would give a direct route for mail. The wires would be safe: "Indians do not work to annoy their enemies; in all our travels, we have yet to see an Indian chop down a sapling as much as four inches in diameter."

The plan looked good from every angle: it would have provided protection to travellers, prevented soldiers from being ambushed in large numbers and chartered a topographical party to go in advance and survey the rail line, thus speeding up construction. However, the project was turned down. When the telegraph was built westward, Hiram Sibley got the contract and his line followed the route of the Pony Express over fourteen hundred miles of Indian country.

According to the agreement, Western Union was guaranteed $40,000 a year for ten years, for which credit in messages was to be given. The Government, too, had its eye on profit. We were proving closer and closer to war between the states. When it came, the North would need gold and silver from the West to finance its struggle.

THE CIVIL WAR

THE CIVIL WAR put the telegraph firmly on its feet. Many who figured in telegraph and railroad history later on, received their training as young operators serving the armies. And once war was declared, the railroads became as ever the genii summoned to answer all government demands.

John W. Garrett, on becoming President of the Baltimore & Ohio in 1858, had realized the possibilities of the telegraph for railroading. Transferring the telegraph lines back to the B&O right-of-way was one of his most important acts. The Civil War upheld Garrett's wisdom in uniting the two. The first effective use of mobile units for armies appeared during this time, when Major Albert J. Hyer - credited founder of the U. S. Signal Corps - organized a telegraph train as an organic part of General McClellan's Union forces for the Peninsular campaign in Virginia in 1862.

These trains - in reality light, closed wagons - were provided with wire and light poles for rapid construction of miles of line, as well as the necessary instruments and batteries for installation of stations. They remained with the Army of the Potomac, but did not furnish their maximum service until Grant took command in 1864, making extensive use of the trains to maintain contact with his commanders in other theatres. During the period from 1861-65, the Government financed the building of more than fifteen thousand miles of line, sometimes under enemy fire, often under cover of night. Unsung heroes of the war era were the boy telegraphers, hundreds of whom were killed in action, taken prisoners of war, and broken by overwork, yet never recognized as soldiers.

After the surrender at Appomattox, a great period of expansion swept across the entire country. The Homestead Act sent thousands of soldiers and their families westward. Southerners, driven out by the savage destruction of their lands and the plague of carpetbaggers, sought homes be-

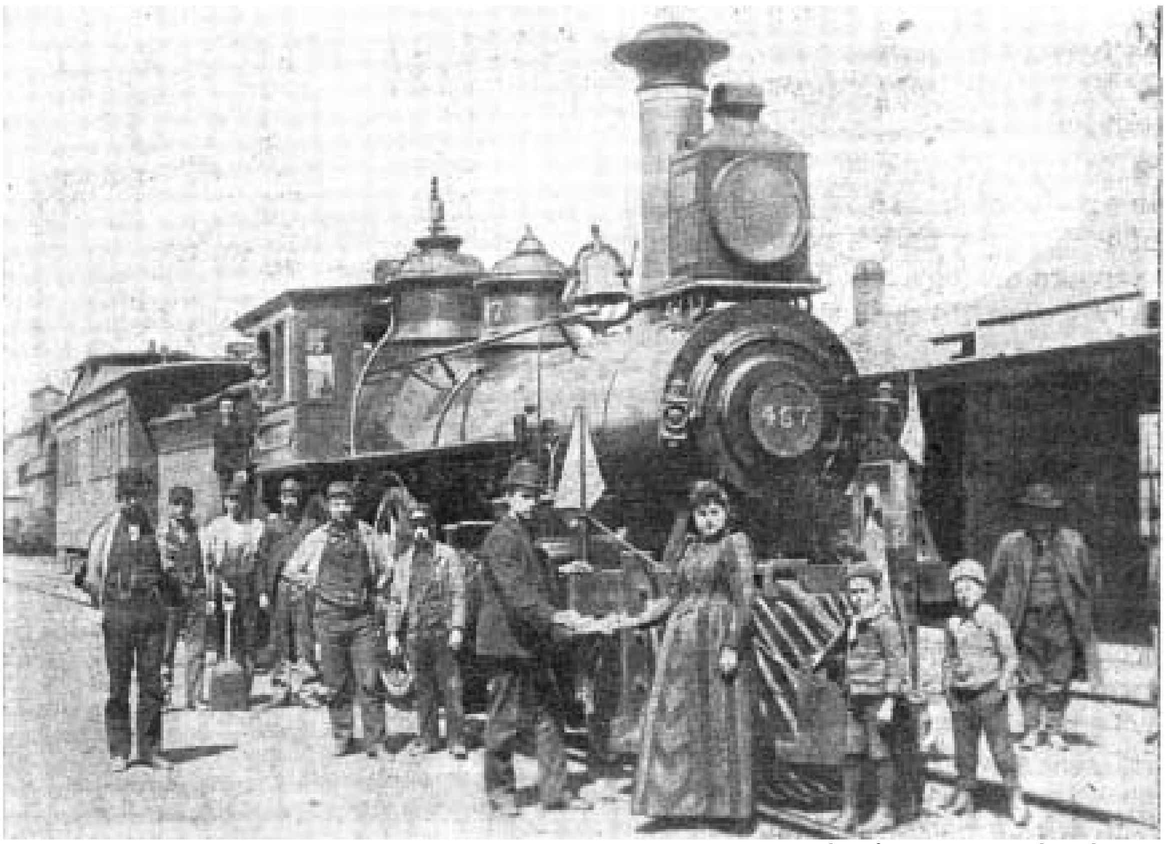


Photo from H.A. Craig, Alexander, N.Y.

FAMILIAR SCENE. Leigh Valley's 1880 lady op at Honooye Falls, N.Y., followed tradition of Sarah Bigley, first woman telegrapher at Lowell, Mass., in 1846

yond the Mississippi. Anxious to increase its unity, Washington encouraged the development of the two great bonds, railroads and the telegraph. In slashing a path through the virgin forests of the Northwest and over the bleak prairie lands, it was natural that they should grow together for protection as well as convenience.

To trace the development of Western Union - the name which today symbolizes the telegraph in America - would be to describe in detail some 500-odd individual companies until their final absorption into one corporation. The name itself was first chosen by Ezra Cornell who built the New York & Erie line, which first drew Charles Minot's attention to the worth of the telegraph. It was then a small company linking New York and Buffalo. But in a short time it became the Erie & Michigan with lines sprawled from Pittsburgh to Cleveland and Buffalo to Detroit. Then in 1856, Cornell joined forces with Hiram Sibley's New York & Mississippi Valley, and Western Union was chartered in New York on April 14th of that year.

Before discussing the eventual tie-up of railroads and the telegraph, it's interesting to know on what terms they met and agreed. Early contracts between the two were basically the same: the telegraph company furnished the material, tools, wire, instruments, batteries and skilled labour, as well as the supervision required for the construction and maintenance of all lines; the road provided the unskilled labour, hauled the material and telegraph employees free and paid thirty dollars per mile for the original construction and instruments. Once the line was in operation, the railroads took over. They maintained and repaired the line. Commercial business was handled at the depots by company operators or agents, who saw to it that messages were delivered and sent the money collected to the telegraph company, after subtracting the percentage allowed the road for use of its operators and stations.

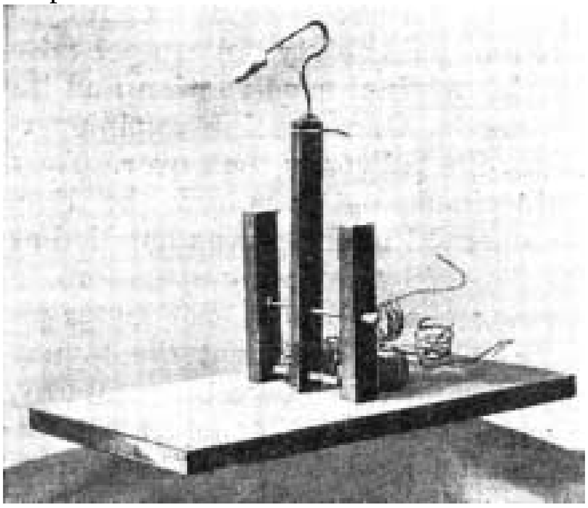
Railroads were allotted some free wire for their exclusive use, and in addition were given some free telegrams to points off the railroad, which might be necessary for business. The majority of agreements provided for a telegraph superintendent, the joint employee of both companies, and a foreman to direct a corps of linemen. This contract was accepted by about eighty-five percent of all railroads.

DELAYS TO PRIVATE WIRES

ONCE an agreement was made and a line in operation, the importance of the young agent operator took an upward leap, while his salary remained as low as twenty-five dollars a month. In small towns throughout the country, the op had to attend to train movements, sell tickets, answer all inquiries, check, bill out and receipt trunks and express, and cover the loading and unloading of all freight. It was no legal defence for delays in the delivery of private messages, that the contract required certain hours be given exclusively to management of trains. According to the time of their receipt, private messages supposedly took precedence. Since this was not always the case, damage suits for delay of wires filled the courts for years.

Yet blaming the operator was unfair in most cases. The work at some stations called for two men, although in times of depression railroads reduced the force to one, expecting that versatile artist to do the work of two with equal efficiency and speed. Then, too, the railroader had tough times in the early days. Instruments were undergoing changes. and a man might be confronted with a machine foreign to him with no explanation offered.

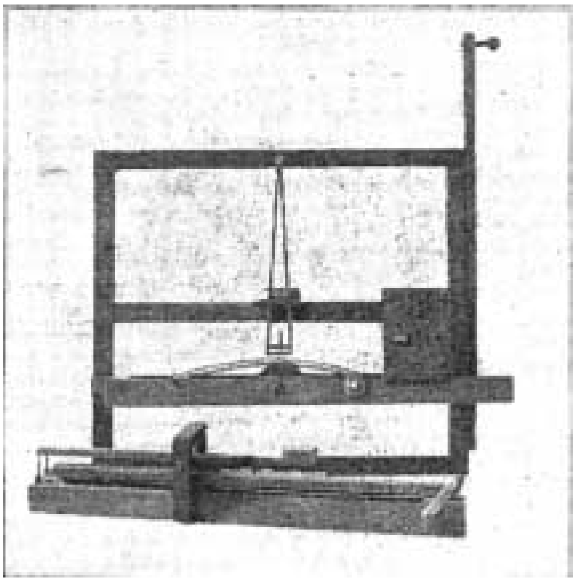
The early sets were the register type; and while disadvantages were numerous, some railroaders clung to them, since they provided a printed copy of the message. It was not long though before operators seated in lonely way stations along the line began to read the clicking machines by ear, paying little heed to the tape. Railroads were at first vehement in condemning this habit, till individuals like Charles Douglas of the Erie - summoned for a reprimand of Division Superintendent Tillotson proved beyond doubt the safety and speed this system offered. From then on, registers gradually disappeared, just as the alarm bells had before them. In every town you would find the same simple set.



PIONEER electro-magnetic telegraph. built by Joseph Henry in 1830

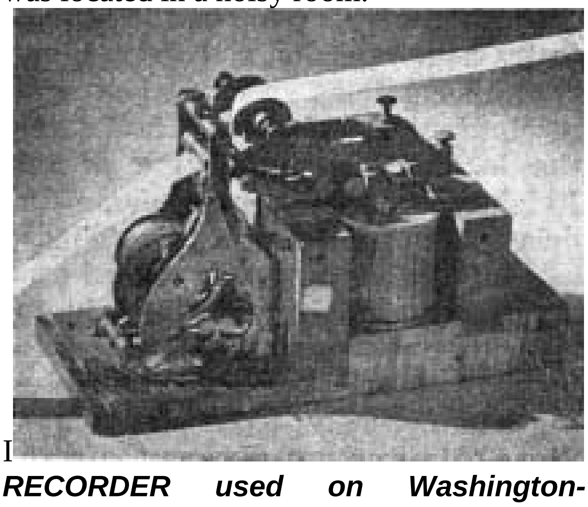
The Morse telegraph - as known on the railroads - consisted of a key, relay and sounder, with a local battery to operate the latter. If a station was also the terminal of the line, it held the main battery, consisting of 10 to 150 or more cells depending upon the extent of the circuit. The mechanism of the telegraph was simple. The key and sounder were on one board, the key supported by screws on the elevated sides of a metallic base. At the bottom of the base were two screw posts to receive the ends of the wires from the battery; these were insulated from one another by a non-conductor which ran around the point in the front of the key. In the centre of this was fastened a small piece of platinum and directly above it, on the under side of the key lever, another piece of the same metal.

Since one was separated from the other, the current could not pass between them except when the lever was pressed down, bringing together the two platinum points which were in reality the ends of the wire. A spring was used to keep these points apart. The circuit was kept closed, however, by a movable bar situated so as to slide under a lip, thus keeping the wire electrically connected while the key was not in use.



MORSE'S 1837 experiment, with port rule to make and break current

The sounder consisted of two upright electro-magnets, an iron armature attached to a movable lever fixed upon a frame and elevated above the base, with a spring attached to the lever which must be adjusted in proportion to the strength of the current. It was regulated by two devices: one stopped the movement toward the magnets which gave the sound, the other limited the movement of the lever away from the magnet by the spring. In some cases a resonator was used to increase the volume, when the instrument was located in a noisy room.



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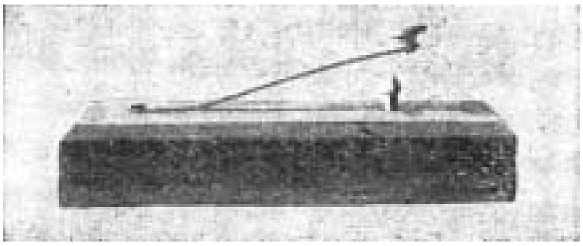
RECORDER used on Washington-Baltimore circuit in 1844

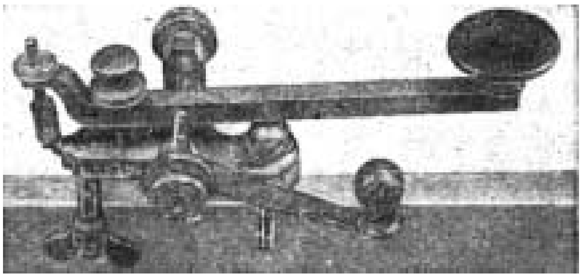
The third vital part of the telegraph was the relay. This was introduced by Morse when he discovered that the current might become too feeble or variable to operate the instrument satisfactorily. The function of the relay was to open and close the local circuit to which the sounder was connected, by means of which the sounder was made to produce the required volume. Both the sounder and relay were based upon the sane principle, becoming magnetized when a current was passed through them, the only difference being that the gauge of the wire with which the sounder was wound was larger, and its armature and lever were heavier. The armature of the sounder was attracted by the magnetism of its core and withdrawn by its retractile spring when the core was demagnetised. Thus the local circuit was opened and closed, as current flowed through the main line.



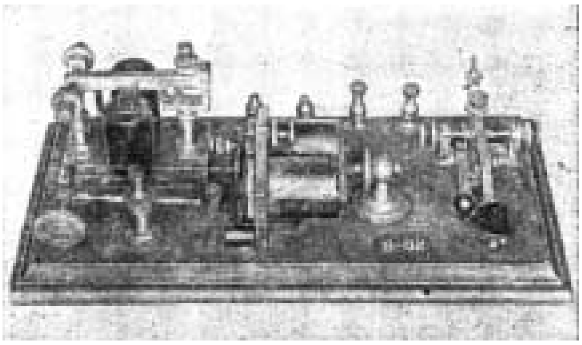
PULSE of telegraph instrument: the key which replaced the port rule

It was not uncommon to have thirty, forty or more stations within one circuit with only two main batteries, one at each terminal. Early lines employed the single circuit system when any one key was operated, all relays acted simultaneously by reason of the alternate cessation and flow of the current. Transmission was limited to one message at a time, and the system was known as the closed system. In Europe, Morse's open circuit was adopted, and while necessitating main batteries at every station, these batteries did not require replacement as often, since they were not required to supply current for the entire line.

Operators were charged with knowing as much about their instruments as was needed to keep them in working order. The strength of the gravity battery was one important charge. Composed of a piece of copper placed in the lower part of the cell with a zinc crowfoot just submerged in the fluid, the electrical action of the battery depended on the strength of the fluid. They were responsible for keeping their tables and instruments clean, to see that all connections, binding posts, screws, and so forth, were firmly connected, and that the wires and crossings over bridges about their stations were clear and safe.

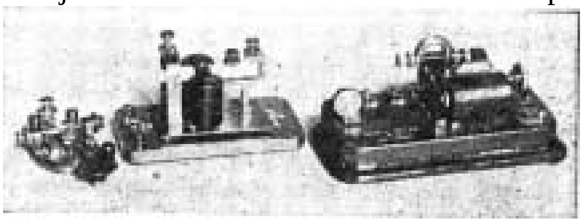


HEAVY screw-supported key, 1850



TAPELESS, compact 1865 Morse set

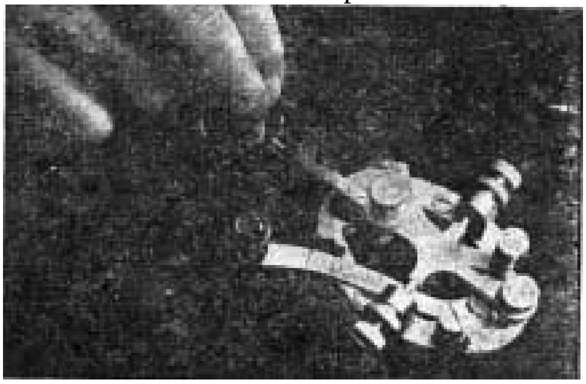
Some railroads, as the Canadian Pacific, opened schools for telegraphers. But the great number of old-timers learned the art from older lightning slingers who let them do odd jobs about the station to earn their keep.



MODERN relay, key and sounder

WELL-ORGANISED DEPARTMENT

GRADUALLY as all railroads adopted telegraphy, it became something far removed from the unwanted step-child it had been. From a tool to quote rates, it took over train movements, obviating the arbitrary schedules, and a book of rules was formulated to restrict its usage. Railroad companies included well-organized telegraph departments; and usage pointed out the need of greater precision in constructing lines, of research to find the best possible way of protecting the web of wires against the severe storms common throughout America, which downed mile after mile of pole lines.



FOCUS on the modern key

Underground cables were no solution; they wouldn't work. Some roads tried using two poles side by side with cross-arms between; others increased their number per mile. Experiments were made decreasing the height of poles, adding stability by reducing the leverage of wind upon ice-laden wires. But one major objection to the shorter posts was that they brought the wires within reach of vandals, and also nearer to brushwood. In highly-vegetated areas this greatly increased the fire hazard.

The Association of Railway Telegraph Superintendents organized in 1882 (which later merged with the Association of American Railroads) was responsible for much of the open discussion and experimentation for technical advancement in this field among railroads. It was a double-edged problem: how give the wires enough support and yet keep the poles from breaking. During storms, wires caught so much wind that their vibration downed them for miles. In the end, research and experiment came up with one practical guard: storm guys attached to each pole, which stiffened that single pole and were designed to prevent the swaying of the line.

LEHIGH VALLEY sponsored induction train telegraphy during the 1880s

From study of the problem of maintaining. pole lines, carriers derived a standard which they called the factor of safety. This unit depends upon the number of poles per mile, the wind and ice-loading in that area, the kind of line, number of wires and circumference of the ground line. As a result safety and economy have benefited, and pole lines have traveled far from the day when wires were hung on trees. In recent years, Western Union linemen have assumed complete charge of maintenance.

But the very reasons why telegraphy became the bulwark of coast-to-coast communications - the invention of Stearns duplex in 1868 enabling messages to be sent in opposite directions simultaneously; Edison's quadruplex of 1811; automatic telegraphy and finally facsimile attracted numerous financiers out to exploit to the nth degree what was probably the greatest money-maker of that half century. It was too good a thing to miss. F.O.J. Smith, famed for his court litigations in the early days, was responsible for the term ‘fogsmithery’, meaning chicanery. However, his adventures were the pranks of a Tom Sawyer, compared to what followed.

Once the telegraph stretched from the Atlantic to the Pacific and Western Union formed a powerful lobby in Washington, its development became the growth of one of the country's most powerful monopolies.

Company after company was strangled. Stipulated rates were raised to the maximum the traffic would bear, in spite of swelling protests from a nation demanding public control. It was obvious that the free play of Western Union was bound to meet an end eventually; but in the meantime, there were fortunes to be made.

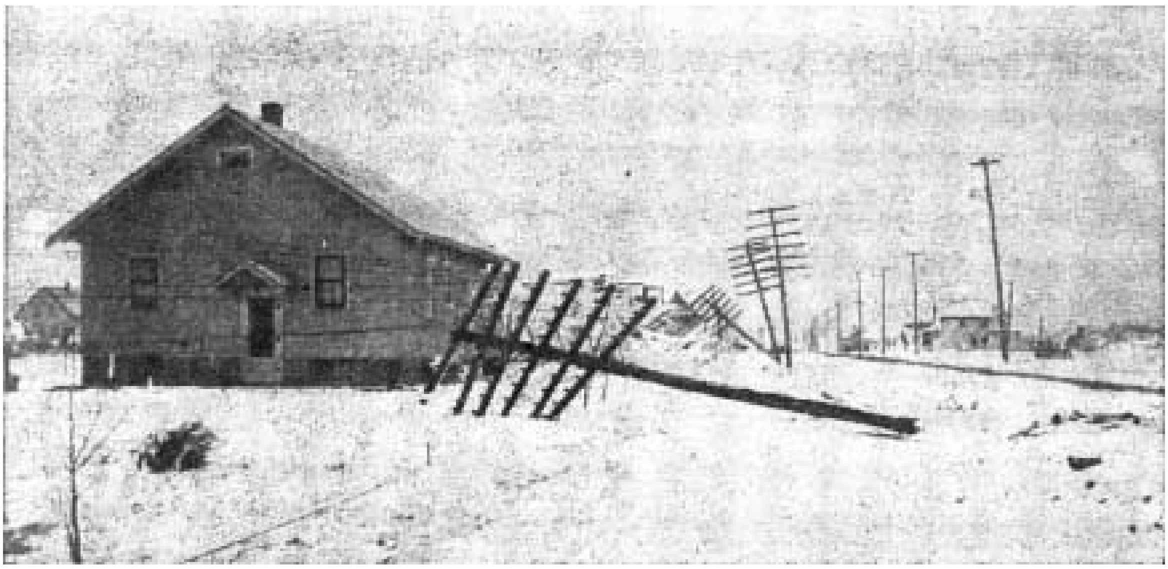
Western Union had every right to feel secure. At the exact time thousands were demanding public ownership - when in 1866 a bill was introduced in Congress to help finance a rival company - in this same year the Government handed over 14,211 miles of former military lines to telegraph companies, to compensate them for their losses during the Civil War. Credit for the award was given General T. T. Eckhart, a telegrapher who became a top Western Union official soon afterward. It was hardly pure coincidence that all lines went to Western Union, or to companies about to be made part of the giant.

It is ironic that a company that offered to come into the fold should later become powerful enough to state its terms of treaty. The Atlantic & Pacific, organized in 1865 and projected from New York to Chicago via Buffalo and then over the Rock Island and Pacific right-of-way to San Francisco, met difficulties during the panic of 1873. Willing to sell to WU, it was rejected since the larger company was having troubles of its own, having taken on too much too fast. This left the line open to Jay Gould, who, having left the Erie by invitation, was looking for bigger game. Taking stock in the ARP and then the Union Pacific, he put both to work for Gould.

Jay Gould put the telegraph industry through its economic paces, as he had the Erie a short time earlier. Striking up friendship with General Eckhart, Gould sold him on accepting the presidency of the growing A&P

And under Eckhart's rule, the A&P grew to 17,759 miles and twice as much wire by 1877. Then war with Western Union was on.

Jay Gould had strong weapons. He had robbed WU of its superintendent of the Eastern Division - Eckhart - and Eckhart in turn had swung Thomas E. Edison over to their side. While experimenting with George Prescott to double the carrying power of the Steams;: duplex, Edison had agreed to sell it to Western Union and had received a part payment of five thousand dollars. Hard pressed for cash and unable to contact WU's president who was in Europe, Edison was approached by Eckhart who wanted to put him in touch with someone who was interested in his work. Gould proved interested to the extent of thirty thousand which Edison



RADIO RESCUE. When 1930 blizzard downed hundreds of telegraph poles in North Dakota, Fargo-Bismarck radio hookup patched gap in NP dispatcher's line

accepted. One week later, Eckhart left Western Union to join Gould, and Gould had both a director and a patent.

Western Union's 1877 rate war to crush her rival was short-lived. Within a few months Jay Gould was able to pocket over a million in cash and a block of Western Union stock as the price of peace between the two. A pool was made of the two companies; Western Union was to get seven-eighths of the annual income, Atlantic & Pacific, one-eighth. It was another year before Western Union realized Gould's real strength.

From Ohms, J.G. Pangborn

OLD FORM of independent B&O Telegraph Co.

POLE GANGS erect quarter-mile a day, number of poles varying from 26 to 60 per mile

The era that followed was marked by court battles between telegraph companies and various railroads. The Baltimore & Ohio was the first. It ordered Western Union to remove its lines from B&O right-of-way from Baltimore to towns in the Ohio River valley. Its charter to the Western Telegraph Company, which had passed into Western Union hands, gave it this right which the court upheld. The B&O took over its own system, later leasing it to the Atlantic & Pacific.

By 1879 it became obvious that Gould's previous manipulations had been practice shots, that he was now ready for the showdown. On May 15th, 1879, he organised the American Union Telegraph Company in New York with a capital of ten million dollars, which he incorporated with Bates and Tinker, the former named as president. Then in January 1880, Eckhart left. the presidency of the A&P to take hold of the newer firm, this owned entirely by Gould. Leasing Canada's important Dominion Telegraph, he allowed it to buy into his new corporation. When President Garrett of the B&O bought stock and became a director, Gould felt confident that with his connections he would have no trouble in swinging his new venture.

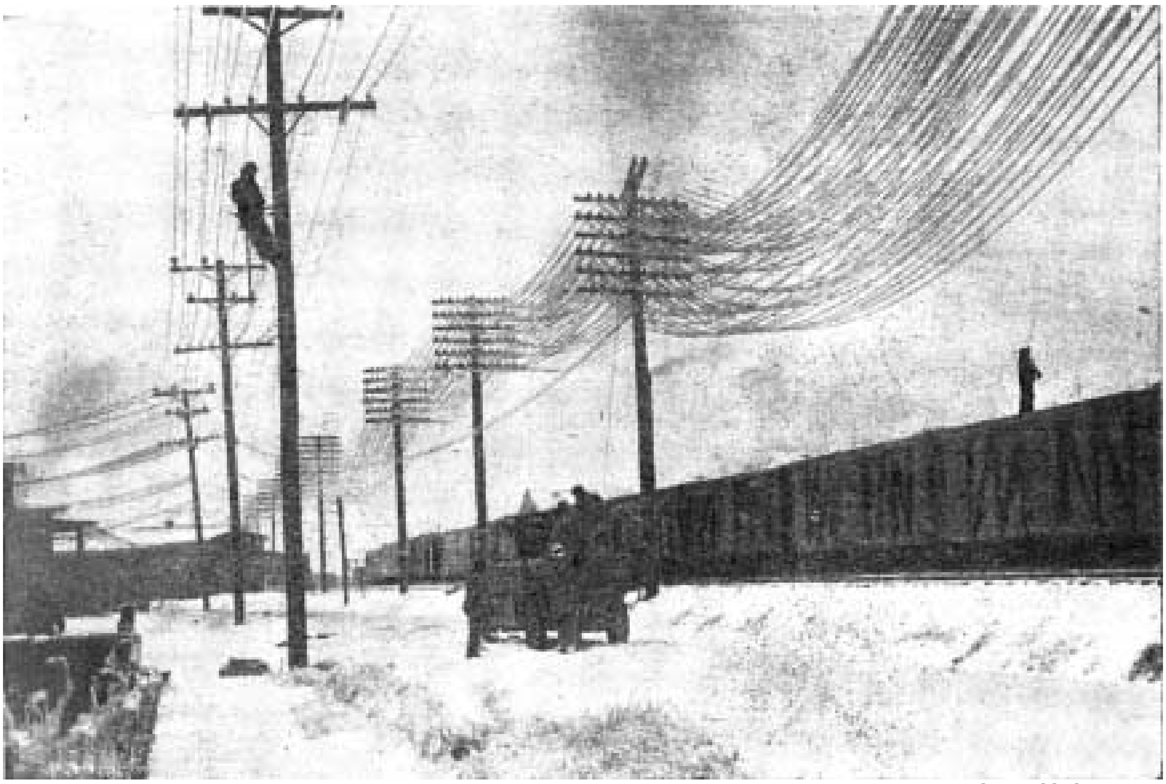
Railroads were kept busy issuing notices to Western Union to vacate their premises during the years that followed. Without warning, American Union took over the B&O lines, and through Gould's influence as a heavy stockholder were able to seize the wires along the Union Pacific, Kansas Pacific, and Wabash, and make profitable terms with the Pennsylvania, Western & Atlantic, Pittsburgh, Cincinnati & St. Louis, and the Cincinnati Southern. Gould's tremendous backing - which comprised a railroad empire - enabled the company to claim 2,000 offices, more than 10,000 miles of poles and 50,000 miles of wire at the end of the first year, slicing $5,000 a day off Western Union's revenues.

W. H. Vanderbilt - no slouch himself when it came to combining railroads and Western Union profits - sent a note to Gould on January 9th, 1881, asking compromise. Once again the prodigal returned. Gould merged his American Union with Western Union, and accepted fifteen million, mostly in WU stock, for his company. What Gould cleaned up by buying Western Union stock at the record low he had forced it to is inestimable. One thing is certain. When Gould died some twelve years later, he left more than $56,000,000, consisting mainly of Pacific Railroad system, Western Union, Santa. Fe and other rail properties.

LESS TROUBLED

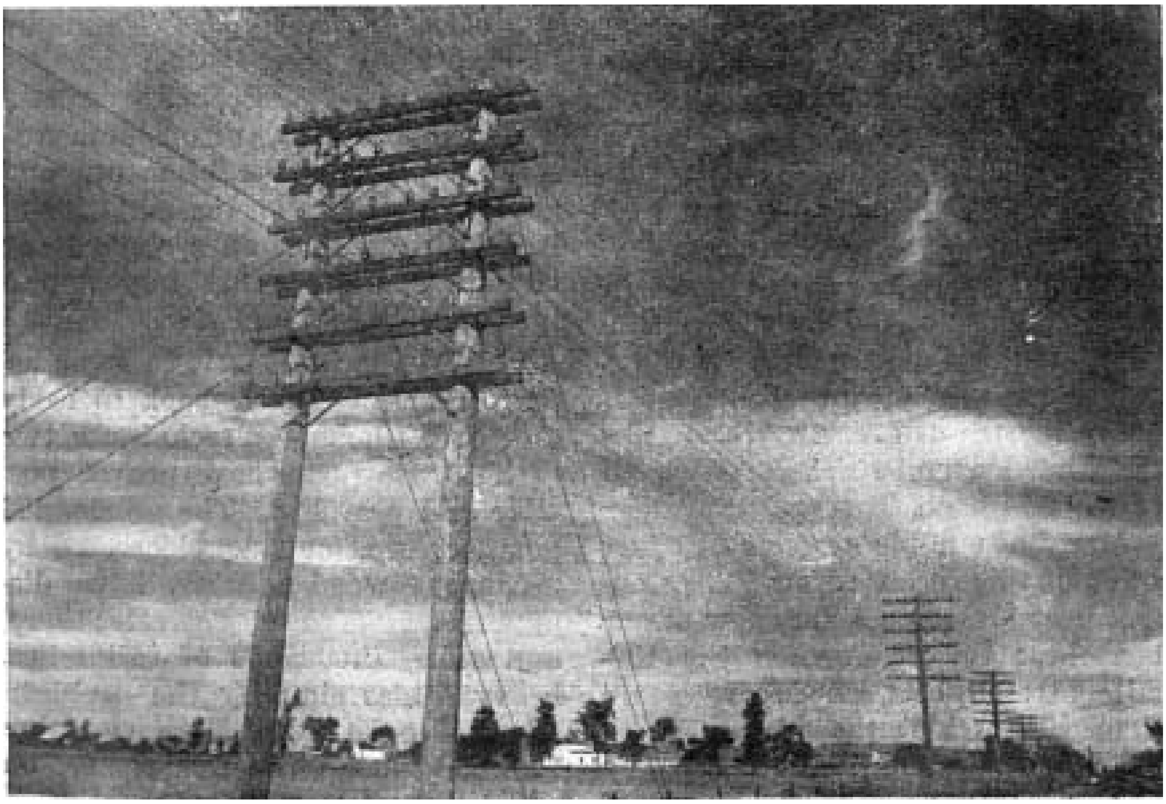
THE NEXT ten years were less troubled. Western Union had wiped out all contenders except the Baltimore & Ohio Telegraph Company, which cut loose and maintained its independence with 6,886 miles of poles and 47,417 of wire from Gloucester, Mass. to Savannah, Ga., and westward to Kansas City, Omaha, San Antonio and Helena, Mont.; and the Boston & Merchants centring around the Hub city. The latter was licked by the panic of 1893; and until Postal Telegraph was vitalized by Clarence Mackay's millions, there was comparative peace.

In 1901, the contract between the Pennsylvania Railroad and Western Union expired, and WU refused either to consider modification of the terms of a new agreement or to set a fair sale price on the pole line. As a result, Cassatt of the Pennsy ordered Western Union off the right-of-way, and arranged with Postal Telegraph for service. Still no steps were taken toward conciliation. Finally, Cassatt sent locomotives to



Wide-World Photos, Inc.

ICE-LOADING threatened to cut off all power in Moberly, Mo., where railyards were snow-locked. Below, H-type fix ture carrying usual sixty wires, distributes weight reduces strain



root up the poles; and even then, the telegraph company would not cart them away.

Years later the Pennsylvania telegraph lines were returned to Western Union, and this marked the last real tussle of the two. As far as railroads were concerned,

Courtesy of New York Central

NEW dispatcher's office at Syracuse, N.Y., nerve centre for New York Central way-station communications

however, 1908 was the climactic year. It was then that the telephone made the second change in the method of train dispatching, and all carriers began to include the phone as part of their telegraphic systems: It was an easy switch to make. The pole lines were there, and it only meant adding new circuits and introducing new office instruments.

Old-timers clung to their Morse as long as possible. The clattering key was second nature, music to the operator holding down the night trick in a lonely way station. If you didn't want to spill your grief to some guy down the line, you could lie there and listen to others chew the fat. Then, too, the railroads and the telegraph had grown side by side, while the frontier was pushed right into the Pacific. The experiences of railroading in its pioneer days: the uncertainty of schedules; the washouts of early structures; the thousand accidents that might have been, but were avoided by the quick thinking and daring of young telegraphers - these and many other memories very like them were

Courtesy of Canadian Pacific

PILLOWED snow means work, not poetry for telegraph linemen. More destructive by weight is sleet, which snaps wires and topples over poles

bound up in their feeling toward the telegraph, experiences that "knights of the key" were loath to surrender, even though necessary.

Yet there was no stopping the telephone, which had proved its value beyond doubt since introduced in 1876. Each year, the mileage of telephone-directed dispatching increased at the expense of the Morse, until today there are some lines, like the New Haven, which dispatch all trains by phone.

Many of our big systems fall just short of this record: New York Central uses Morse on a very few minor branches; the Pennsy on the 132mile stretch between Morrow and Zanesville, Ohio; the Santa Fe, 1,532.2 miles of wire versus 10,654.5 by phone; the Erie - leader in the use of telegraphy - 426 branch miles dispatched by Morse, 2,000 by phone. The most utilised form of telegraphy is the teleprinter, which handles daily car reports, Pullman reservations, car tracers, reconsignments, special passenger equipment, and general messages on the majority of lines. On an average system, these may number twelve to thirty-six million messages annually.

Telegraphy in 1947 is in some aspects a strange throwback to early Morse. With modern techniques, two of his basic plans have proved possible and practical. The overloaded poles, crossed and double-crossed by numerous wooden arms, have disappeared from the city streets; there, and along thousands of rail miles, heavy cables simplify the problem. Also, since the 1920s,Western Union has been using the teleprinter, on which operators write on keyboards similar to typewriters. Telegraphy bas gone back to the printed tape. The latest development in telegraphy ready for immediate adoption by the railroads is telefax. or the facsimile technique. By means of facsimile machines, crews can transmit their own messages by merely dropping them into a slot in the mechanism.

This remarkable machine automatically wraps the telegram around a revolving

Courtesy of Telegraph and Telephone Age

HISTORY REPEATED. Industrial and rail experts view facsimile recording (P2) aboard a fast-moving B&O train, Washington-bound along route of Morse’s original line

cylinder in the telefax cabinet and sends the message over the line to a receiver, where it registers its copy. Already, the Pennsy, Norfolk & Western and Delaware, Lackawanna & Western are experimenting with using facsimile stations; the Pennsy since 1942, when. five locations were chosen.

Western Union supplies facsimile equipment on a rental basis, and there is some expectation that its use may be extended to other than unguarded block stations. At present, the Pennsylvania has them on the job at: "G" Block Station, Belvidere branch; Weigh Scales, Wilkes-Barre Division; "BI" Block Station, Indiana branch; Xenia (Ohio), Dayton branch; Harvey (Ohio), Sandusky branch. Operators transmit orders here. When the conductor or engineer opens the shelter and removes the instructions, he acknowledges his receipt by phone. While unnecessary in ratio to efficiency, this is imposed as part of the experiment.

Although the telephone has offered stiff competition during the last quarter century, radio is now the contender. Lehigh Valley was a pioneer when it started train telegraphy by induction about fifty years ago; but this method takes a back seat now, when Rio Grande *Flying Utes* can clip three hours off the 570mile freight run between Denver and Salt Lake City by their intra-crew coordination via radio.

The Delaware, Lackawanna & Western tried out radio over thirty years ago; but their primitive sets had none of the smooth action of the D&RGW models and failed to pass the test stage. Other roads made similar tests with similar results; equipment was far from perfect. Now, however, besides end-to-end communications, these radios employ nearby telegraph wires to strike train-to-station and station-to-train contacts, without interfering in any way with regular telegraph traffic.

The Rio Grande tests have amply proved radio's flexibility and stamina. The mountain run between the Utah and Colorado capitals hazards fifty tunnels; variation in altitudes up to three thousand feet, in temperatures between zero and about forty degrees.

Handling trains at the speed and density they're running them demands a combination of every known precaution to guarantee safety. Thus aware of the advances made in allied fields, railroads are. now focusing their attention on Western Union's new radio transmission. Designed for volume telegraph loading, it is probable that micro-wave trunk systems will in the next few years establish connections between major U.S. cities. Within the coming twelve months, a radio-beam hook-up will be installed linking New York, Washington and Pittsburgh.

Ultimately, radio systems may replace the pole lines and the hundreds of thousands of miles of wire in the present telegraph network. As far as railroads are concerned, however, the use of radio will be limited for the time. Station-to-station tie-ins along the rail lines must await the development of suitable equipment, and the transition of wire to radio will be gradual.

For the removal of poles requires government approval and could not occur until radio relay operation had become established on a commercial basis, and existing contracts between Western Union and the railroads permit such usage.

A milestone in the employment of modern railroad methods was the recent trial of radio facsimile telegraphy for front-to-rear communications, and orders directed by radio to a moving train. It seemed only right that this should be demonstrated on the Baltimore & Ohio's Washington-Baltimore line. Once again, the historic message "What Hath God Wrought" registered a first.

Notes on reprint:

THE ORIGINAL MAGAZINE was laid out in two columns on 6½ by 9½ inch pages. I have retained the typographic style and two column layout and sized it so that when printed as an A5 booklet it approximates to the original. I have added sub-headings to break up the text. The pictures are not placed entirely identically to the original but in roughly the same context within the text. I have changed the U.S spelling for U.K. spelling.

RailRoad Magazine is now incorporated into Railfan and Railroad: http://www.railfan.com/ for more details.

Sam Hallas, April 2006