Trains

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50 YEARS UNDER WIRES

RAILROAD TOWN, U.S.A.

WHERE ELECTRIFICATION FIRST MADE GOOD

Butte, Anaconda & Pacific, laboratory under catenary

GORDON W. ROGERS

MAY 14, 1913 — on that day occurred the inauguration of the world's first railway electrification undertaken purely for economic reasons, the first direct current electrification at the high potential of 2400 volts, and the first use of electric power for hauling heavy freight on mountain grades. The original order included 4 motor-generator sets for supplying current and 17 80-ton General Electric locomotives which delighted their owners with their excellent performance from the beginning. This year the 50th anniversary of this electrification is being observed with its owners still delighted with the performance of the same 4 motor-generators and 17 locomotives.

The survival of these locomotives through history's most progressive half century is not due to remodeling or rebuilding them to keep pace with new developments; they have been maintained in their original condition except for the replacement with improved designs of a few of the smaller components. Nor is it due to lack of money to rebuild them or to replace them; the railroad is a subsidiary of one of the world's greatest industrial empires, the Anaconda Company. Nor to light traffic or infrequent use; the freight movement on this railroad consistently has been one of the heaviest in the world, averaging nearly 30,000 net tons per day, which has required almost continuous use of all the locomotives for 16 to 20 hours a day, six days a week, year in and year out. These locomotives have survived because they were so expertly designed and so well built that they have neither worn out nor required any major maintenance or changes. In 1959 General Electric Company proposed to modernize the old locomotives by installing modern contactors and a complete new low-voltage multiple-unit control system. The railroad's answer was, "No, thank you, we see no need to change something that is already working satisfactorily and giving us good service." This decision was made without prejudice because the road had for two years been using two brand-new GE locomotives built in July 1957.

The Butte, Anaconda & Pacific is located in the Rocky Mountains of southwestern Montana, where it hauls ore from mines at Butte to the smelter at Anaconda. Its main line is only 26 miles long, but over it pass an average of 1500 cars per day, half of which are loaded trains consisting of 120 to 130 cars with 8400 to 12,600 gross tons. You might see such a train almost any time of day, pulled by a trio of the old electric locomotives or by the two six-year-old electrics or occasionally by a trio of GP7 or GP9 diesels. Branches, sidings, and yards bring the road's total trackage to about 143 miles, of which 122 miles is electrified. Until 1952 six steam locomotives handled traffic on the unelectrified branches and interchanges with other railroads; now this is handled by seven diesels, which also help out on the main line.* The two newer electrics, aided by the diesels, handle mainline service, and

*BA&P diesels also have trackage rights between Butte and Durant on NP for added traffic capacity.

ORE TRAIN, behind BA&P's newest electrics and two ancient box motors, waits for highball at Rocker yard for run to smelter at Anaconda. Photo by Philip C. Johnson.

the rest of the traffic is moved with 28 electric units built prior to 1917.

Most of the several mines served by the railway are on Butte Hill, which flanks the city of Butte on the north. On the hill lie a network of tracks and a yard for storing empty and loaded cars and for the collection of ore and delivery of supplies. From here trains of 30 to 40 loaded cars handled by a two-unit locomotive descend 4 miles of winding 2.5 per cent grade to a large yard at Rocker. The loads are left at Rocker and about 35 empties are picked up there and hauled up to the mines. Several locomotives are kept busy switching cars on the hill and going up and down with empties and loads. Several more at Rocker shuttle cars to make up the long trains of loads to go to the smelter. Before 1955 a similar operation was carried on at the smelter. The loaded trains were left at the East Anaconda yard to be broken into short trains of 20 cars each for a 7-mile trip up a winding 1.1 per cent grade to be weighed and then dumped at the concentrator. This kept several other locomotives busy shuttling loads and empties. In April 1955 a new tipple was put into operation at the East Anaconda yard, eliminating the Smelter Hill operation. Now the loaded cars are turned upside down by a giant barrel-like device and the ore goes to the concentrator by conveyor. Since the advent of the tipple, the hopper bottoms of most of the ore cars have been closed so that the cars no longer dump from the bottom.

To handle this traffic, about 1360 ore cars are required. As of January 1963, the BA&P had 1160 cars with a capacity of 55 tons of ore each, about 275 of which were built in 1899-1900, 340 in 1904-1906, and 545 in 1914-1916. In addition, it has 200 cars of 75-ton capacity built in 1957 with A-3 Ride Control trucks. Also the road has 26 box cars, several of which were built in its own shops, 92 flat cars, 15 gondola cars, 6 tank cars, 18 air dump cars, 8 bay-window cabooses, and 9 miscellaneous cars.

PRIVATE ROAD IS LAUNCHED

The story of this railroad properly begins in the early part of the career of Marcus Daly. He was one of hundreds of fortune seekers who flocked to Butte in the 1870's to mine gold and silver. As the deposits of these precious metals dwindled and miners dug deeper, their efforts were increasingly hampered by ever larger deposits of a worthless mineral known as copper. About 1881 when most of the miners were becoming discouraged, Daly had the vision to see that copper would soon become a useful and important metal. And he had the business ability to sell it and to produce it efficiently. So successful was he in this enterprise that within two years he saw the need of a smelter much larger than the few crude ones that had sprung up in the vicinity. There was not enough water to support such an industry at Butte, so he chose a site about 26 miles west, where Warm Springs Creek would provide ample water. In 1883 he began building a new smelter and an adjacent town which he called Copperopolis. The town's first postmaster, Clinton H. Moore, rejected this name because there was already a Copperopolis in Montana, so he renamed it Anaconda after Daly's most productive mine. And Anaconda it is — today a thriving city of nearly 12,000 residents flanked by one of the greatest smelters in the world, which boasts of the world's largest smokestack.

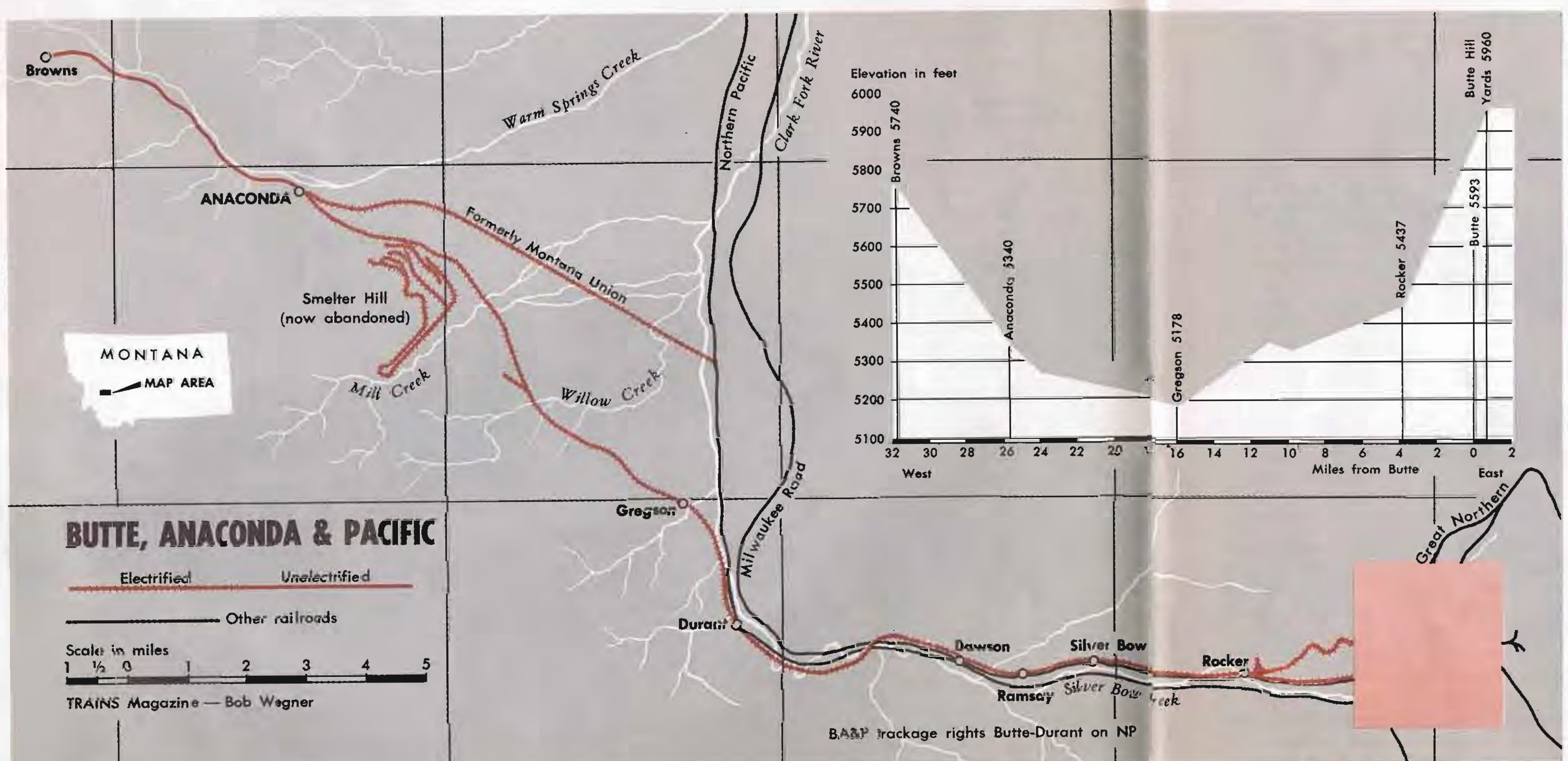
The first railroad to reach Anaconda was a branch of the narrow-gauge Utah & Northern, whose first train arrived at 11:07 a.m. July 14, 1884, just about two months before the new smelter began production. Later it was standard-gauged; its name was changed to Montana Union (with a main line running between Butte and Garrison); and it was owned jointly by the Union Pacific and the Northern Pacific. The joint ownership made for bad management that was marked particularly by conflicts of policies and frequent changes of superintendents. Each new superintendent inaugurated a fresh slate of regulations and rates, and of course, every rate change was upward. Finally, in the fall of 1891 the exasperated Marcus Daly closed the smelter and all his copper mines, throwing 2500 men out of work, in hopes that this would bring the road's railroad to its senses. But the road's owners refused to capitulate to his demands for lower rates. They regarded Daly's threat to build his own road as a mere bluff because the only practical route lay through Silver Bow Canyon where there was room for only one track — theirs. Hence they thought their monopoly was invincible.

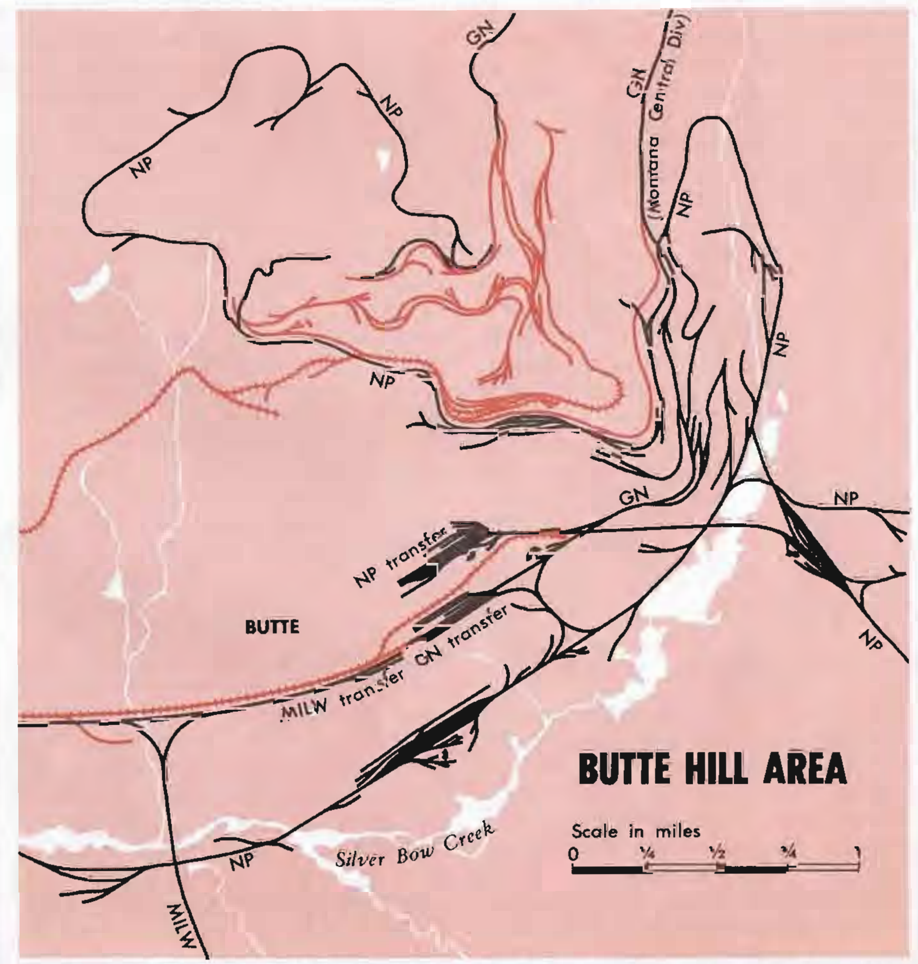
However, Daly's engineers under the leadership of Frederick W. C. Whyte, who was sent from the Great Northern by Daly's friend James J. Hill, managed to surmount the difficulties and Butte, Anaconda & Pacific Railway was incorporated on September 30, 1892. Officials of the NP and the UP were so surprised that they couldn't believe it until they went to Silver Bow Canyon and saw with their own eyes Daly's miners constructing a railroad alongside their own. (Construction was contracted by the firm of Toole & Touhy, but most of the labor was by miners who had been idled by the shutdown.) The first passenger train over the new line was a Great Northern train which ran from Butte to Anaconda at 9 p.m. on December 26, 1893. The road was officially opened for operation on January 1, 1894, solving Anaconda's transportation problems once and for all and practically sounding the death knell for the Montana Union's Anaconda branch. The MU became a piece of Northern Pacific's transcontinental main line via Butte, and the 8-mile branch to Anaconda was leased to the BA&P from 1898 until the BA&P purchased it in 1956.

One might infer, from the word "Pacific" in the name, that BA&P was one of those many early day railroads whose builders cast their eyes ambitiously toward the West Coast. This is substantiated by the *Butte Miner* of May 17, 1891, which announced plans to build the road on up Warm Springs Creek from Anaconda, across two mountain divides, down the Bitterroot River Valley to Missoula, and "thence westerly to the western line of Montana." The proposed extension beyond Anaconda was never built; so the road remains the ore-, supply-, and product-carrying lifeline of the great Washoe Smelter.

Electrification of the BA&P was a fitting climax to a development which began in the mines and which was wedded to the whole copper industry. There are two peculiarities of the ore deposits at Butte: the best grades lie at great depths; and the earth is hot down there. These two facts made good mine ventilation mandatory. The steam pumps used for evacuating the large quantities of water that collected in the depths poured forth their hot, moist exhaust to add to the difficulties of pumping adequate fresh air with steam-driven blowers. Hence, a substitute for the steam engine became a prime necessity.

It was about this time that electric motors and generators were developed to the point where they provided the answer, and the growing use of them throughout the country increased the demand for copper. So copper mining and electrification went hand in hand. At first steam-powered generators were set up at each mine, but the growing use of electricity soon made this method inefficient and expensive. So when promoters began to develop hydroelectric generating plants on Montana rivers, the Anaconda Copper Mining Company was quick to lend





Both photos, Gordon W. Rogers.

CONTROLS of 1913 electrics (above) are ultimate in simplicity; new engines present array of meters, switches, knobs, handles.

its enthusiasm and support. Under its auspices a radical innovation for those days of the infant electric age was pioneered by the Montana Power Company: high-voltage transmission over long distances. The resulting network of power lines from several sources assured the mines of reliable, abundant, inexpensive power, and gave thousands of bystanders the blessings of electricity in their homes and their small businesses at an early date.

Electric motors soon spread their use to the smelter of the country's largest copper producer where they were praised for economy and performance, and in 1907 electric locomotives replaced horses and mules for hauling ore in the underground mine tunnels. Simultaneously, great strides were taking place in the development of electric traction on street railways in many cities and of electric locomotives on railroads, which had tried them for abating the danger and nuisance of smoke in tunnels and crowded city areas. Several benefits of electric power were noted by these railroads: large savings in maintenance and power costs; more power for the size of locomotives, including high tractive effort during acceleration; less frequent servicing; more reliable performance; simplicity; and cleanliness. It was natural that the Butte, Anaconda & Pacific Railway should choose to pioneer a large-scale railroad electrification.

ANSWER TO A PRAYER

When we say "pioneer" we mean that the BA&P really did venture far in advance of others in the field of railway electrification for that day, almost to the point of being revolutionary, for no other electrification had ever been undertaken with so many physical obstacles to overcome — and none had ever been undertaken for solely economic reasons. In all existing electrifications economy had appeared only as a by-product. The BA&P had no smoke problem — its operations were in sparsely populated, wide-open country where plenty of wind blew it away. It had a fleet of 27 powerful steam locomotives which were doing an excellent job, and fuel for them was plentiful, though a bit expensive for the best quality. In short, there was simply no motive for electrifying the line except the anticipation that it would cost less to operate it by electricity than by steam.

This point was well expounded by electrical engineers, who calculated that if the BA&P were to buy Mallet steam locomotives of about the same weight and tractive power as the electric locomotives that were proposed and finally purchased, the efficiency from coal to drawbar would be only 3.22 per cent while running. And counting fuel consumed during standstills, the net efficiency would be only 2.32 per cent for the best steam locomotives obtainable in that day. If the same coal were turned to steam to produce electricity in a stationary powerhouse which would in turn run electric locomotives, then the efficiency from coal to drawbar would be 6.5 per cent. Of course, with the low-cost hydroelectric power available, the savings would be much greater. In fact, it was estimated that electrification would save 17.5 per cent of its cost per year. And yet electrification was a costly undertaking, for a great deal of expensive stationary equipment was required to bring the power to the locomotives. In this respect the BA&P was luckier than other railroads. The Montana Power Company already had enough facilities and power to serve the railroad without the latter's having to install anything but equipment to convert it to usable form and distribute it to the tracks.

Even so — well, the best way to describe it is in the words of Fred W. Bellinger, electrical superintendent for the BA&P, now retired. His remarks are excerpted from early technical articles.

> It is questionable if any region with the physical features of that served by the BA&P electrification has been similarly served in this country. In this connection it has been necessary to vary from standard construction in too numerous occasions to mention. Grades up to and including 4 per cent and curves ranging as high as 22 degrees are prevalent. In many instances switchbacks have been resorted to in order to gain the necessary gradients to serve the mines and smelter.
>
> It is safe to say that in approximately 25 miles of electrified track (on Butte Hill) enough tangent track could not be picked out to equal 5 miles.
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> After a general survey of the situation it was found that approximately 60 per cent of the tracks to be electrified consisted of yards and sidings [which] presented problems . . . for the reason that varying numbers of tracks up to and including 13 parallel tracks were electrified.
>
> Numerous street railway grade crossings are made. . . . Special construction in the form of a removable section of trolley had to be installed in several cases, where in another it was necessary to arrange the mast arms, supporting the trolley, on hinges, to provide means for displacing the trolley, thus gaining the requisite head room and safety in connection with the operation of a drag-line loader.

With these challenges in mind, General Electric's experts on railway electrification set themselves to the task. By this time several different kinds and voltages of electricity had been tried for railroads. Alternating current had its advocates, who pointed to the simplicity and economy of transmitting the current long distances at high voltages, whereas direct current was at a serious disadvantage in this respect. On the other hand, alternating current motors were relatively inefficient and they were difficult to control at variable speeds. GE had just developed (about 1907) the commutating pole D.C. motor, which held great promise for railway use because of its high torque for its size and the ease of controlling it at a wide range of speeds. So D.C. advocates were in the lead, and they were developing increasingly efficient distribution systems by raising the voltage. By doubling the voltage to 1200 from the standard streetcar voltage of 600, they were able to reduce the first cost by reducing size of feeder conductors and the number of substations required. Operating cost was also reduced by easier collection from the trolley wire (fewer amperes per watt or horsepower) and improved load factor of the substations, because with fewer substations there was a greater load per station, hence less time running at low load. Still better economy for the same reasons was noted on the new 1500- and 1800-volt systems. So to meet the rugged service required on the BA&P, logic led to a choice of 2400 volts D.C., which looked like the answer to a railroader's prayer for perfection in motive power for long trunk lines.

ADVANCED EQUIPMENT

With the decisions made, a contract for the electrical equipment was placed with General Electric in December 1911, and construction of the overhead wiring began in the spring of 1912. In a year enough of the equipment was ready for service to begin. Two existing substations, one at Anaconda and one on Butte Hill, had been built extra large at the outset with space for additional equipment in anticipation of expanding electrical usage. This space housed the four motor-generators and associated equipment for the railroad, relieving the road of the necessity of constructing buildings for that purpose.

Two motor-generator sets were placed in each substation. Each set consisted of a 2400-volt, three-phase, 60-cycle, 1450 kva., 720 rpm synchronous motor turning two 500-kilowatt, 1200-volt D.C. generators connected in series, and excited by a separate 125-volt exciter. The generators were designed to carry 50 per cent overload for 2 hours or triple the normal load for 5 minutes. The 2400-volt switchboards were the first direct-current boards designed for that high a voltage. Generally similar to standard 1200-volt boards, they had increased insulation and special provision for interrupting the high-voltage current. Circuit breakers and switches were arranged for remote control.

The catenary was of standard construction of 4/0 grooved hard-drawn copper wire suspended from a ½-inch galvanized steel messenger supported from mast arms on Idaho cedar poles at 150-foot spacing and 11-point suspension. On curves, two-pole construction was used with spacings as close as 70 feet with 5-point suspension. This construction was somewhat experimental, having been found to be a bit overdesigned, and later much of it was changed to single-pole mast arm construction. On the other hand, what might surprise us by seeming underdesigned were the wooden strain insulators on most of the trolley wiring. They withstood the test of time well, and a "very few" are said to be still in service. Between Anaconda and Rocker two large diameter feeder wires carried on the poles were connected to the contact wire at 1000-foot intervals and to a substation at each end. The trolley system was divided into insulated sections with disconnect switches so that any section could be repaired without disturbing operation of other

BA&P ORE DRAG, led by two 80-ton 2400 v. D.C. electrics, lumbers over Milwaukee Road freight lugged by a 3000 v. D.C. unit.

sections. The rails were bonded, and in addition a negative wire was carried on the poles along the main line and connected to the rails at 1000-foot intervals.

The 17 locomotives were similar in general mechanical design to the original Great Northern, Detroit River Tunnel, and Baltimore & Ohio units. They had box-cabs, articulated double trucks with all weight on drivers, and an engineer's compartment at each end for operation in either direction. They were designed to take curves of 31 degrees at slow speed. The GE 229-A motors have four poles plus commutating poles and are wound for 1200 volts but insulated for 2400 volts and connected so that two are permanently in series. They are cooled by air blown in through hollow king-pins of the trucks, with the central channel beams of the body frame closed like a box to form the air ducts. In the central part of the body a dynamotor provides 600-volt current for the control circuit, air compressor, and accessories. The armature of this machine has two sets of coils on the same core and a commutator at each end. One coil is wound for 1800 volts and the other for 600. The 2400-volt input flows through both coils in series while the output is taken from the 600-volt commutator. The mechanical resistance of the air blower on one end of the shaft provides the load for exciting the field windings. This blower has a capacity of 7200 cubic feet per minute at a pressure of 4 inches of water. (About four years ago the road began increasing the ventilation capacity.) The controllers have 19 steps, 10 with all four motors in series and 9 in series parallel. The contactors, reverser, and rheostats are mounted in two banks running lengthwise in the central compartment, and are operated by the 600-volt current from the dynamotor. The motor circuits are controlled by 17 electromagnetically operated contactors and 11 cam-operated contactors which are actuated as a group by an electrically operated air cylinder. The rheostats are of the cast grid type. All of the circuits are protected by fuses and lightning arresters, and a special switch is provided which locks down and grounds the pantograph for safety during servicing and inspection. A 2400-volt bus runs along the roof and is connected between locomotive units so that two or three units can operate from one pantograph, and of course, the control circuits are connected so that all the units operate from a single controller. The headlight operates from the 600-volt circuit through a resistor.

The new locomotives began to arrive in May 1913, and the first one to operate made an experimental run on May 14 under the direction of General Electric personnel. During the following two weeks wiring was being completed on the East Anaconda-Smelter Hill section, which was given priority. More locomotives arrived, final adjustments were made in the electrical system, and one BA&P steam locomotive engineer was given training and instructions on the electric locomotives so that he would be competent to teach the other engineers. On May 27, two ore trains were pulled up Smelter Hill by electric locomotives, and on the 28th a double-unit locomotive took over the day shift service between East Anaconda and the concentrator yards. Now the electrification was officially in operation, and momentous things began to happen.

ELECTRICITY TAKES OVER

"Contrary to the general rule, there was no carefully studied program of instructions nor was there an instruction book prepared for the enginemen's use. Electric operation started with one experienced man. . . . No road foreman of engines was provided to assist these men. . . . The principal trouble they had was with the controller. The habit of pulling the throttle out to most any position is one that is hard to break," wrote Fred Bellinger.

From these statements we might expect that the "momentous things" which began to happen were burned-out motors, overheated rheostats, broken gears, and other troubles. On the contrary, the "steam locomotive crews consisting of engineman and fireman easily acquired proficiency in handling the electric locomotives; in fact, two or three days of instruction from a competent electrical man were ordinarily sufficient. The change from steam to electric haulage was made without any change in the personnel of the train crews and without any delays or alterations in the schedule. The engineers, without exception, have expressed themselves as being greatly pleased with the easy operation of the locomotives. . . . During the first year of operation service has never been discontinued and no material interruptions have occurred from any cause."

Now, wouldn't you agree that such lack of difficulty was a momentous thing?

In the beginning, the number of cars hauled by electric locomotives remained the same as for steam, and one steamer at a time was replaced by electric in order to minimize the difficulties of breaking in the crews. On Smelter Hill the number of cars per trip had been 16, but the electric units performed so well that before long the standard load was increased to 25 cars. The following table shows

Gordon W. Rogers.

LINE CAR M-10, now painted yellow, sees service a half mile east of Rocker in July 1962.

TYPICAL BA&P passenger train of bygone days stops at Durant circa 1914. The roller pantograph shows clearly in this photo.

the comparison between steam and electric operation on the Hill in 1913:

	Steam	Electric	
Weight of locomotive (tons)	108		
Weight of tender (tons)	55	(Two units)	
Total	163	160	
Cars per trip	16	16	25
Trips per shift	6	8	8
Time per trip uphill (min.)	45	22	26
Cars per shift	96	128	200
Per cent of increase		33	108

On June 20, 1913, the daytime spotting service (placing cars one at a time on a weighing scale, then placing them over the bins for dumping) at the concentrator yard was taken over by a single-unit electric. On July 2 a double unit took over the night shift on Smelter Hill and it was so efficient that the night spotter was taken off and the Hill crew did its own spotting. Now three engine crews were doing the same work formerly done by four and in less time. Next the stock bin switch engine at the smelter was changed to electric on July 9.

While these various services on Smelter Hill were being taken over by electricity, construction continued on the mainline trolley. On the morning of September 30, an inspection trip was made over the line, and in the afternoon a special train of visiting dignitaries from a neighboring railroad went from Butte to Anaconda and return with one of the two new electric passenger engines. Next day, October 1, regular electrified passenger service began. The scheduled train consisted of one mail-baggage car and two to four coaches, and made four trips a day. On excursions and holidays it had as many as 12 coaches, which were pulled with ease by one electric unit. The distance between the Butte and Anaconda stations was 25.7 miles and the scheduled time was 1 hour (stops were made at several intermediate stations). This time was not changed, although the electric locomotive could have pulled the train 20 per cent faster if desired. After five months of electric operation, the road was bragging that the passenger train had not come in late a single time on account of engine trouble.

Can you guess where the steam generator for heating the cars was put in the passenger train? In the operator's compartment at one end of the locomotive? No. In the baggage car? Wrong again. There wasn't any more old-fashioned steam heat. The BA&P was a modern railroad; it had the latest in luxury: thermostatic electric air conditioning. Under the floor of each car was mounted an electric heater with coils for consuming 10, 15, 17.5, or 25 kilowatts, and in series with one of them was a 600-volt motor running a blower. A 2400-volt wire from the locomotive was connected to each of these units. Cool air was drawn from within the car and, after heating, was distributed by underfloor ducts to outlets under alternate seats. To top it off, the temperature was controlled by thermostats. Lighting of the cars was accomplished with five groups of five 120-volt 36-watt lamps in series operated from a 600-volt wire from the locomotive's dynamotor.

As on many other short-haul railroads, the passenger train has had its day on BA&P. The final one ran behind locomotive No. 66 on April 15, 1955. The road's sole remaining passenger car, a combination baggage-coach painted red, stands in the Anaconda yard and is used occasionally on work trains.

On October 10, 1913, a double-unit electric replaced a Mastodon steamer on the mainline day shift freight. The results between Rocker and East Anaconda were as follows:

	Steam	Electric
Weight of locomotive (tons)	103	
Weight of tender	55	(Two units)
Total	158	160
Trains per day (average)	12.5	9.3
Tonnage per train (average)	1761	2378
Time per trip (min.)	145	105
Engine crew hours per month	1246	725

Summary: 26 per cent fewer trains
35 per cent more tonnage per train
28 per cent less time per trip
42 per cent less crew time

On the Missoula Gulch and Butte Hill lines, electric operation began on October 20. With a Mastodon similar to those in use on other parts of the system, two crews had done the work in six trips per day. With the new two-unit electric, one crew did the same work in the same number of trips per day. The last of the 17 original electric units went into service on November 25, 1913, and the BA&P settled down to enjoy a half century of monetary savings and reliable, trouble-free locomotive performance.

EXPANSION BEARS A "CALF"

So well did the electrified railroad do its job that in 1914 the mining company decided to divert to Anaconda 3000 tons of ore per day which had been going to the smelter at Great Falls, some 170 miles away. Consequently, the BA&P installed an additional motor-generator set at the Anaconda substation and ordered four more locomotives duplicating the original ones. In addition, two units of an innovation were ordered: *half locomotives!* These two "tractor-trucks" consisted of nothing but a single four-wheel truck identical to those on the locomotives with weight added to bring each one up to 40 tons. The four new locomotive units were specially wired to operate with one of these half units attached. They were wired so that all six motors were in series on the series points of the controller, and three were in series in the multiple position (normally in multiple position two motors were in series and two pairs in parallel). This "cow-and-calf" combination, as the railroaders called it, gave 50 per cent greater tractive effort at 33⅓ per cent reduction in speed. The purpose was to handle 56 per cent heavier trains up Smelter Hill, where speed was not important, and the combination worked well for the spotting service where high tractive effort at low speed was needed. A few months later a third "tractor-truck" was added to the fleet. During World War I when copper was at a peak demand, seven more electric units duplicating the originals were ordered, bringing the total to 28; the last one, No. 41, was placed in service on May 15, 1917. Also, a motor-generator set was added to each substation, making a total of three at Butte Hill, four at Anaconda.

Not until 1957 did the road again add motive power. The two locomotives built in July of that year are a far cry from their 28 elders; they look on the outside very much like GP9 diesels. Although they still have only eight drive wheels and four motors, they are heavily weighted for high tractive effort and the two together are able to outpull three of the original units. In addition, they are equipped with regenerative braking, which is lacking on the originals. Their control circuit operates at 75 volts from a battery, and a motor-generator set charges the battery, excites the road motor fields for regenerative braking, and rotates the air blower. At the same time, the road added to its power supply by building a new automatic substation at Dawson — about halfway between Butte and Anaconda — housing a new 2500-kilowatt pumpless ignitron rectifier which produces 2400 volts D.C. from 94,500 volts three-phase A.C. It went into service on November 1, 1957.

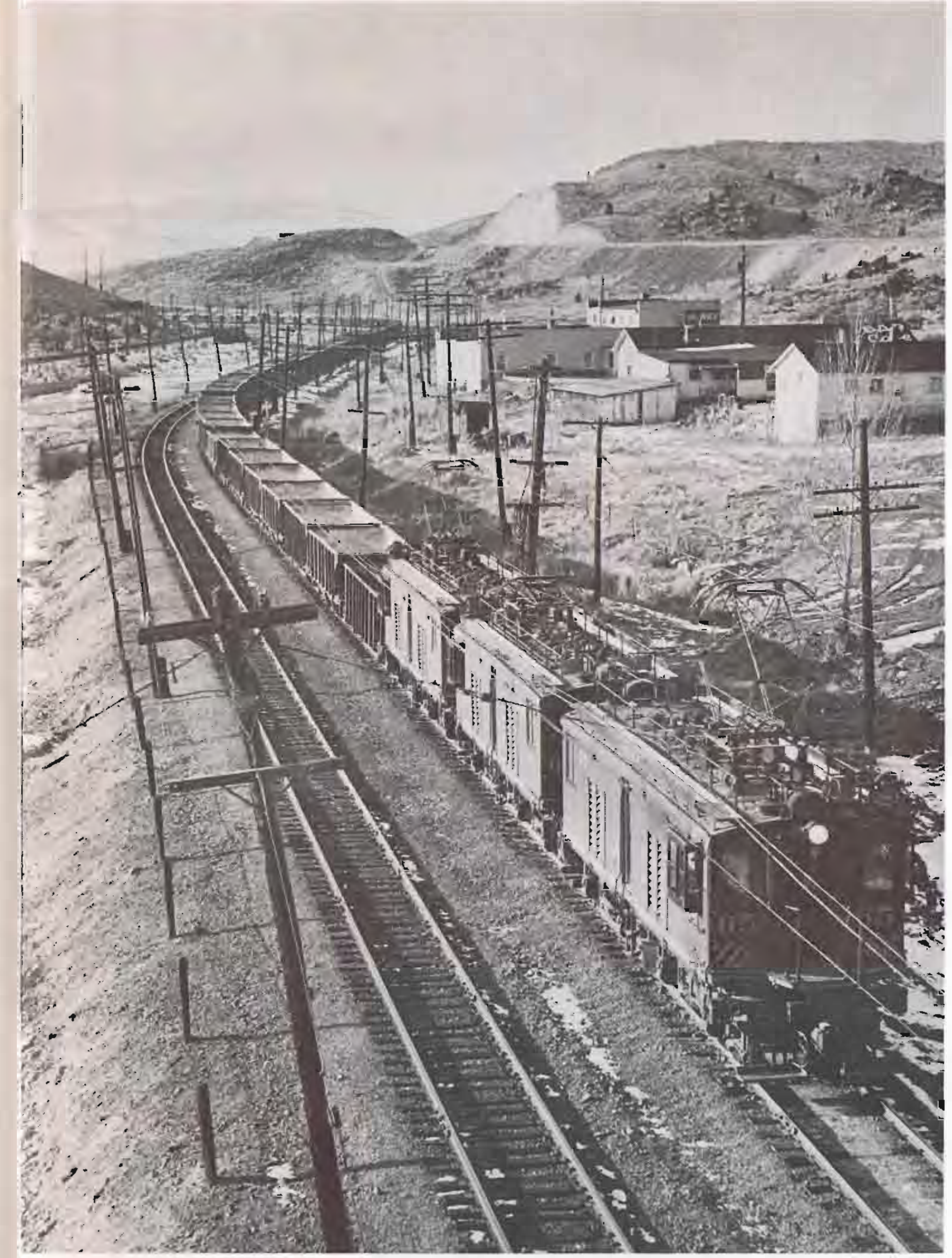
A MASTERPIECE UNVEILED

People who work with industrial equipment are accustomed to receiving new machinery which incorporates some new or special design and having to spend a period of adjustment and revision to work out imperfections before its performance meets the intended standards. The BA&P electrification is a remarkable exception to this rule, for besides starting right off without a hitch, it exceeded everybody's expectations. In practically every way it can be considered a true masterpiece of engineering and craftsmanship. Of course, it had a few bugs, but most of them were trivial and none of them hampered operations. A good illustration of these facts is provided by one of the first difficulties to show up.

At the outset the motor brushes in the locomotives chipped badly, and in certain cases they broke into pieces and the resulting flashovers blew fuses. Not knowing the cause of the blowouts, engine operators put in new fuses and continued operating. Not until the regular engine inspection was the cause of the blown fuses discovered, and then the commutator damage was found to be insignificant. The original brushes were immediately replaced with a different type, and the BA&P experimented with improved brush-holder designs until it soon increased the life of brushes from 3000 engine miles to 30,000 miles. In spite of this brush trouble, the motors commutated so well that in the first 20 years the commutators were never turned because of wear. Armature failures were so few that only one man was kept as an armature winder, and most of his time was spent on other work. At times the whole railroad has gone for two years without a single armature failure.

Gordon W. Rogers.

AMONG oldest of BA&P ore cars is this one (above) built in 1899. In September 1957, 200 75-ton-capacity cars with A-3 Ride Control trucks, roller bearings were built.



Donald Sims.

COMING down canyon near Silver Bow, electrics handle empties for Rocker Yard.

Rheostats and contactors proved equally rugged. Inadequate connections between grids were discovered in routine inspections and were replaced with heavier material. Rheostat contact tips averaged better than eight years of service per pair. Contactor tips lasted nine years on most of the locomotives, yet they were never filed or altered to improve contact. Bearings gave no trouble. Gear pinions had a life of 90,000 locomotive-miles and gear rims lasted 300,000 miles. Yet the usage of this equipment seems particularly severe, especially in yard switching. For example, the spotter locomotive made an average of 380 reversals in each 8½-hour shift and 466 movements of the controller from off to on, which is about 1 per minute, repeatedly drawing 350 amperes during acceleration whereas the full load rating of the motors was 190 amperes. Now, how's that for being overworked and taking it?

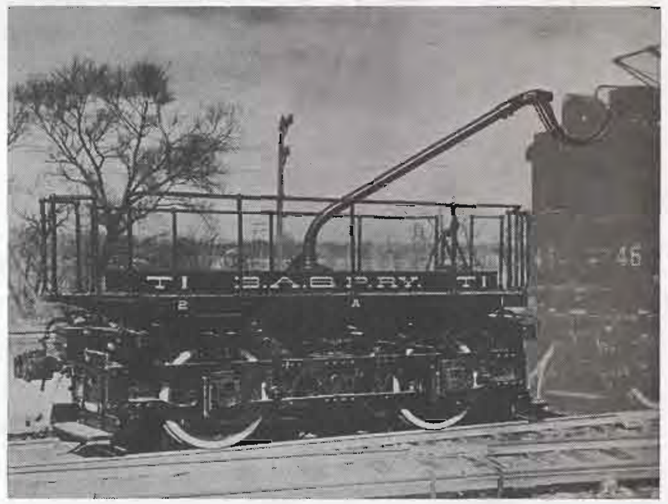
Another illustration of the success of the locomotives can be seen in the maintenance program. The BA&P claims that its locomotives are available 98 per cent of the time and that each one spends only 10 days per year in the shop. This includes a general overhaul and inspection, and the electrical work takes only two of the days. No shop facilities are provided at Butte Hill or Rocker — only a hostler who inspects brakes, puts on sand, and lubricates. The shops at Anaconda were built for steam equipment, and only two pieces of new equipment were added for the electric locomotives: a slotting device and a banding tension machine. Locomotives are inspected over an outdoor pit, weather permitting. (Precautions must be taken when putting an engine indoors in winter on account of sweating and frost.) Monthly inspections include examination of all the electrical and mechanical parts and making of any needed adjustments and repairs. At first these inspections were made every 4 days. After a month they were lengthened to weekly intervals, then 10 days, 3 weeks, 30 days, and finally to a period of 45 to 60 days. Then in 1917 when the road was worked to the limit by the demands of World War I, a double-unit locomotive worked at Rocker two shifts a day plus overtime for 75 days. When it was inspected it was found to be in perfect condition and was sent back to work. So little trouble was found at the inspections that the BA&P saw no need to inspect the locomotives oftener than 75 days; but then the I.C.C. came along with a new ruling that all locomotives other than steam must be inspected at 30-day intervals.

Even in recent years the ruggedness of the locomotives has been demonstrated in new discoveries, such as the one found experimentally by the mechanical department only a short time ago. The motors were made with a pinion gear on each end of the shaft, driving twin rim gears. It takes quite a bit of extra work and careful fitting to cut key ways so that both pairs of gears will mesh perfectly and to assemble two sets of covers. So one day they tried putting an engine together with only one pair of gears. Rather than this making the gears and bearings wear out twice as fast, no difficulties have been experienced. This along with the other examples makes it evident that the locomotives were built throughout at least twice as strong as they needed to be for the intended service — which makes it easier to understand why they are still in perfect condition on their 50th birthday.

The only other bug which turned up on the locomotives was in the pan-

All steam photos, courtesy of Alco History Center.

POWER: PAST AND PRESENT



BUTTE, ANACONDA & PACIFIC RAILWAY

STEAM LOCOMOTIVES

ENGINE NO.	TYPE	BUILT BY*	DATE BUILT	BUILDERS NUMBER	DATE SOLD	DISPOSITION
1	0-6-0	BR	1892	2213	8-15-17	General Equipment Co., New York.
2	0-6-0	BR	1892	2214	1-1-18	Central Iron & Steel Co., Harrisburg, Pa.
3	0-6-0	BR	1892	2210	2-16-12	Tooele Valley Railway, Tooele, Utah.
4	0-6-0	BR	1892	2211	7-24-17	General Equipment Co.
5	0-6-0	BR	1894	2212		Scrapped June 1937.
6	0-6-0	BR	1894	2444	1-1-17	Minneapolis Iron & Steel Co.
7	0-6-0	BR	1895	2529	6-2-16	Black Eagle Smelters, Great Falls, Mont.
8	0-6-0	BR	1896	2653	3-10-14	Siems-Cary Co.
9	2-8-0	BR	1906	41221		Scrapped October 1953.
10	2-8-0	BR	1906	41222		Scrapped October 1953.
11	4-8-0	S	1905	37942		Scrapped June 1937.
12	4-8-0	S	1905	37943	7-21-17	General Equipment Co.
13	2-6-0	BR	1896	2632	7- -10	Tooele Valley Railway.
14	2-6-0	BR	1896	2724	3-10-14	Siems-Cary Co.
15	4-4-0	C	No Record		1-12-06	Yellowstone Park Railway Co.
16	4-8-0	S	1897	4504	10-10-17	Nashville, Chattanooga & St. Louis
17	4-8-0	S	1897	4595	10-10-17	Nashville, Chattanooga & St. Louis
18	4-8-0	S	1897	4596	10-10-17	Nashville, Chattanooga & St. Louis
19	4-8-0	S	1901	5634	7-24-17	General Equipment Co.
20	4-6-0 Passenger	BA	1901	19389	8-18-17	Central Tuiucu Chucho, Cuba.
21	4-8-0	S	1903	28742	7-24-17	General Equipment Co.
22	4-6-0 Passenger	R	1905	37546		Scrapped June 1937.
23	4-8-0	S	1906	41223	7-24-17	General Equipment Co.
24	4-8-0	S	1906	41224	7-24-17	General Equipment Co.
25	2-8-0	BR	1907	44333		Scrapped October 1953.
26	2-8-0	BR	1907	44334	2-19-17	Great Northern Railway.
27	2-8-0	BR	1907	44335	2-19-17	Great Northern Railway.
28	2-8-0	BR	1907	44336	1-8-15	Tooele Valley Railway.
29	2-8-0	BR	1910	48884	11-20-25	Tooele Valley Railway.
30	4-8-0	BR	1910	48885		Scrapped June 1937.
31	2-8-0	BA	1904	1		Received November 1947; scrapped January 1953.
32	2-8-0	BA	1907	2		Received May 1949; scrapped January 1953.
33	2-8-0	BA	1906	3		Received April 1950; scrapped May 1953.

*BR — Brooks, S — Schenectady, C — Cooke, BA — Baldwin, R — Rogers.

DIESEL LOCOMOTIVES

ENGINE NO.	TYPE	DATE BUILT	PLANT	EMD NO.
101	GP7	4-52	La Grange	17050
102	GP7	4-52	La Grange	17051
103	GP7	6-53	La Grange	18408
104	GP9	3-57	La Grange	22823
105	GP9	3-57	La Grange	22824
106	GP9	3-57	La Grange	23355
107	GP9	3-57	La Grange	23356

ELECTRIC LOCOMOTIVES

ENG. NO.	DATE BUILT*	SHOP NO.	SERIAL NOS.
39	3-12-17	-----	5763
40	3-16-17	-----	5764
41	5-15-17	-----	5765
42	11-21-16	-----	5540
43	12-4-16	-----	5541
44	12-19-16	-----	5542
45	1-11-16	-----	4859
46	12-7-14	54789	4879
47	12-14-14	54790	4880
48	1-4-15	54791	4881
49	2-5-15	54792	4882
50	5-20-13	51924	3817
51	5-20-13	51925	3818
52	4-21-13	51926	3819
53	4-21-13	51927	3820
54	5-15-13	51928	3821
55	5-29-13	51929	3822
56	7-5-13	51930	3823
57	7-6-13	51931	3824
58	7-6-13	51932	3825
59	9-12-13	51933	3826
60	9-12-13	51934	3827
61	10-31-13	51935	3828
62	10-31-13	51936	3829
63	11-2-13	51937	3830
64	11-2-13	51938	3831
65	5-29-13	51939	3832
66	5-15-13	51940	3833

*In several cases, the date built as shown on electric locomotive nameplates antedates date built as shown in this roster from BA&P files. Hence, "date built" in this instance apparently means date placed in service.

Note: All above 0-4-4-0-type locomotives were built at General Electric, Schenectady.

TRACTOR TRUCKS

T-1	12-7-14	-----	----
T-2	12-14-14	-----	----
T-3	1-4-15	-----	----

NEW ELECTRICS

ENG. NO.	TYPE	DATE BUILT	PLANT	GE SERIAL NO.
201	0-4-4-0	7-57	Erie	SN-32882
202	7-57	0-4-4-0	Erie	SN-32883

tographs. Sliding pantographs had been developed which successfully collected 150 to 200 amperes, but none seemed likely to collect the 700 to 800 amperes of the double-unit BA&P locomotives with a reasonably long life. Tests had shown steel rollers to last longer for such heavy currents, so BA&P units were provided with roller pantographs. The roller was ⅝-inch-thick steel tubing 5 inches in diameter by 24 inches in length, with oil lubricated brass bushings. Centrifugal force threw the oil all over the roofs of the locomotives, and when the supply was depleted the rollers stuck and slid along the wire. The wire cut into the roller until it bunched the hangers and damaged both trolley wiring and pantograph. Grease was tried to no avail. The BA&P soon solved the problem by using Hyatt roller bearings pressed into an aluminum casting in the end of each roller. The roller bearings outlasted two collector rollers. One of the latter lasted a year, or 20,000 to 50,000 miles, which was considered very good service.

The rollers were a bit rough on the trolley wire, however. Line crews soon found it wearing at a fast rate, especially in areas of heavy traffic and in spots where hangers and pulloffs added weight to the wire. This was due to the hammering effect of the pantograph rollers. To combat it, the BA&P changed a great many of the hangers and pulloffs to lighter weight designs and raised the bases of the pantographs 1 foot to give them better flexibility. Contact pressure was maintained at 34 pounds. With these measures, plus use of two pantographs with double-unit locomotives to reduce sparking, the wire wear was considerably alleviated and the rollers gave nearly two decades of good service. In the late 1920's the Joseph Dixon Crucible Company developed its 1924 Graphite which ended the wear problems. In the 1930's the pantographs were fitted with grooved sliders into which the plastic graphite compound is worked like putty. It hardens into a solid similar to motor brushes, and like the latter, it polishes the contact wire to a mirrorlike surface, reduces wear to almost nothing.

RAILS GET "WIRES CROSSED"

Strange as it may seem, most of the bugs in the BA&P electrification turned up in the area where we would least expect them, in the part that was most nearly "standard" — namely, the catenary. But before we shake our heads at this, it should be pointed out that aside from the wire wear already mentioned, most of the troubles occurred in the parts that were the most nonstandard. In retrospect some of them seem rather amusing, although they doubtless caused considerable consternation at the time. The first one was due to Montana winter weather. Wires contracted in the cold and pulled apart at the splices. The next one happened underground. Said Fred Bellinger in 1921, "Many anchor slugs have been changed in the past few years for the reason that inferior materials were used by unscrupulous workmen who picked up used ties and other material in place of using the cedar slugs provided by the company." The third took place uptown in Butte. There were six crossings of the BA&P tracks and those of the 600-volt city streetcar lines. Each had crossing gates operated by a watchman, and the gates were interlocked with a switch which turned off the 600-volt current at the trolley wire intersection and turned on 2400 volts when the gates were lowered (the intersection was isolated by breaker gaps in each wire located several feet from the point of crossing). Sometimes the watchman raised the gates before a BA&P locomotive was through the isolated section, and the resulting arc burned out the switch. In 1919 both parties agreed to coast through dead intersections, and the switches were removed.

The Butte streetcars have gone the way of most streetcars, and the six crossings along with them; but the BA&P crossing of the Milwaukee main line is still in use every day. At first this intersection was provided with two switches which were interlocked mechanically by a connecting bar so that the crossing could be energized with either 2400 or 3000 volts but not both at the same time. Then one day a BA&P substation operator noticed that his motor-generator sets were motoring instead of generating for a few minutes. Next day he noticed it again about the same time. Investigators finally found that a pin had worked loose in the interlocking bar so that the switches didn't work together properly. Every time a Milwaukee train went by, the BA&P was running off the Milwaukee's 3000-volt current! Again, both roads decided that it was safer to coast through a dead intersection. Today the crossing can be energized when needed, but only by 2400 volts.

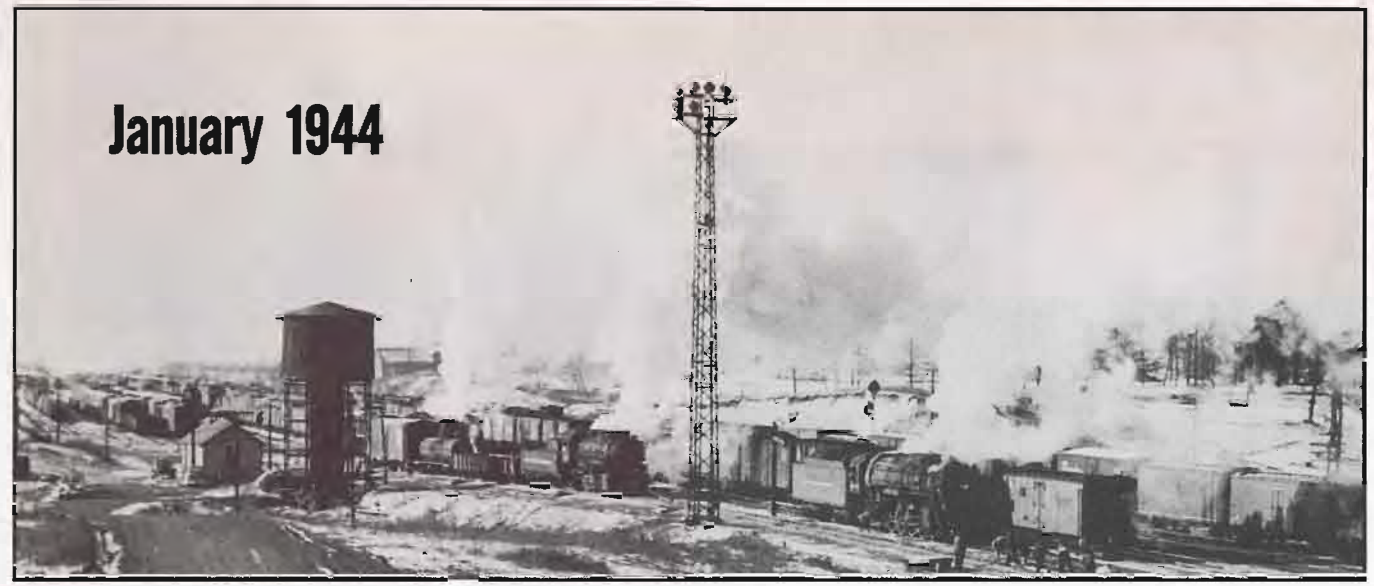
SAVINGS AND MORE SAVINGS

The success of the BA&P electrification inspired many other railroads both here and abroad to turn to electricity with economic factors as the major consideration. The Milwaukee was first to follow the lead with electrification of 440 miles of its transcontinental main line in Montana. Although its potential was raised by another 600-volt increment, the locomotives and other equipment were modeled closely after those of the BA&P, with some special innovations of their own. This also was a highly successful electrification which inaugurated the popularity of 3000-volt D.C. and its adoption by many railroads all over the world. Alternating current simultaneously found success on the New Haven, and ensuing improvements made A.C. a keen competitor. Both A.C. and D.C. systems found customers among prominent railroads until the depression of 1929 called a halt to the trend. Electric railroading never did reach the popularity envisioned by the early enthusiasts, however — primarily because the high initial cost required a large volume of traffic to make it pay off. Not many railroads could justify it on this ground; and then, too, not many areas have been as fortunate as Montana in having an abundance of low-cost hydroelectric power. Also the history of later railway electrification makes it apparent that several railroads which tried it had special problems of their own which demanded different treatment, and that some of them adopted attempted improvements which did not work out satisfactorily and which tended to becloud an otherwise bright picture. So the BA&P electrification stands out as one which has served its purposes with particular eminence.

Its economic success has been every bit as great as its technical success. The substitution of electricity for coal resulted in a saving of $150,727 per year on coal alone. This by itself would have justified the expenditure of electrifying. Adding all the other savings on maintenance, trainmen's wages, and so forth, the net savings actually came to $257,889 per year, which was 21 per cent of the initial cost of $1,201,000. In other words, the BA&P electrification paid for itself in the short space of five years.

Today dieselization still cannot touch the economy of electricity on the BA&P. To start with, the latter costs less than fuel oil for the same power output. Diesels burn fuel while they are standing still, and in winter they must be kept idling all the time or they will become too cold to start. They have internal combustion engines to maintain in addition to their electrical equipment, and the engines wear out in 12 to 15 years. Even the engineers like the old electric locomotives better than the new electrics or the diesels because they are simpler and easier to operate. When we visit with officials of the BA&P their pride in their old equipment makes us suspect that maybe they are a bit sentimental about it; but then I think we can agree that any such sentimentality is well justified.

What the next half century holds in store for the BA&P is about as hard to predict as the outcome of a prize fight, and it bids to be as interesting to watch. On this side we have the champion: the railway's long record of economic operation and excellent service. On that side, the challenger: the equally commendable progressive spirit of the great Anaconda Company. Round one has already begun; anxious moments are rising. As this is being written, a new concentrator for copper ore is under construction at Butte. Endless belt conveyors will move the ore from the mines to the concentrator in continuous streams. It is expected to be in operation late this year or early in 1964. Then the hauling of copper ore by railroad will be no more. It will be a hard blow, but not a knockout. The railway will still have to haul the concentrates to the smelter; it will continue to haul the ores of zinc and other noncupreous metals; and it will still carry supplies, equipment, and the smelter's finished products. Furthermore, the road is casting hope on some new industries to furnish new traffic. A large chemical plant is expected to locate near the smelter. A steel mill is already past the planning stage and into the financing stage. Across the track from the smelter lies a tremendous pile of dark brown slag, waste material dumped from the smelter through these many decades. It contains enough iron to keep a steel mill going many years, and besides, there are iron ore deposits in the mountains not far away. So as yet there is no indication that any of the old locomotives will be retired in the near future. Of course, those of us who see them as the masterpieces of industrial artistry that they are, are more than likely to hope that all 28 of them will still be in operation on May 14, 2013. I



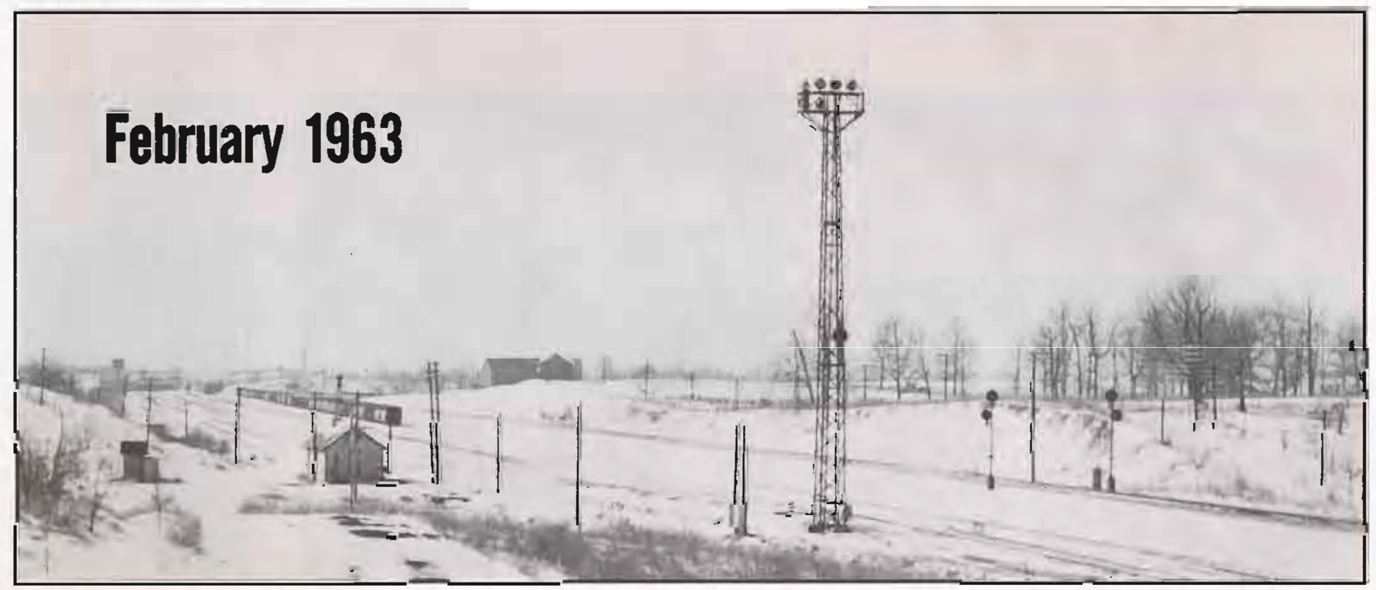
EAST YARD in the crush of war: Mohawk has just cut off First 90 from Indianapolis to go to the roundhouse.

BELLEFONTAINE—profile of a railroad town

photo section

data and photography / SIMON E. HERRING

OVER 100 years ago when 20,000 route-miles or more were being added to the railroad map every decade, a social phenomenon — "the railroad town" — sprang up at the junctions of intersecting routes. Bellefontaine, O., seat of Logan County, 1962 population 11,600, was once such a town, complete with super's office, depot, roundhouse, yards, and a big payroll. But no more.



TRAFFIC has vanished from East Yard; tracks 1, 5, and 9-16 have been removed; yard office is closed.

happens that *Steam Locomotive & Railroad Tradition* has an illustrated feature article on these Cuban sugar engines, by Walter A. Lucas, in its April issue.

William S. Young.

Editor, *Steam Locomotive & Railroad Tradition*, Susquehanna, Pa.

Details wanted

These days private railroad cars are really rare birds. Naturally, I was amazed to see two at one time in the small town of Athens, O.

On February 28, 1963, the Baltimore & Ohio St. Louis-Washington day train carried the very modern and ultraplush *Adolphos* of the St. Louis brewing family. Nearby on a siding stood the *Two Steppe* of the Steppe Beauticians, Inc.

The *Two Steppe* is a handsome heavy steel private car with brass-rail observation platform and is home based in Athens. Who knows her history?

R. L. Kuhns.

2077 Elgin Rd., Columbus 21, O.

Tour train

The average European tourist arriving in the United States faces formidable problems of language, lodging, and travel reservations if he wants to really see our country in a three or four week visit. This will seem an awful letdown after his favorable reaction to our Government's "Visit America" campaign in Europe. Well, why not a cruise train exclusively for our foreign visitors? This idea has worked well in Sweden, where the State Railways' *Sunlit Nights Land Cruise* has been giving American tourists a week-long Scandinavian holiday since 1952 in a specially outfitted consist that has all the amenities of cruise travel.

The American version might be jointly sponsored by the Government and the Association of American Railroads. A varied series of three-week transcontinental itineraries would be publicized all over Europe by the United States Travel Service offices, which would also accept reservations and sell tickets at all-inclusive fares. Each land cruise would originate and terminate in New York City, the gateway for most sea and air travelers from Europe.

A lightweight train would be assembled from the rosters of many lines, then refurbished and given a distinctive exterior color scheme. Single travelers would each have a room in a prewar 13-double-bedroom car from the Southern Pacific or Pennsy yards, to allow luggage space not possible in a roomette. Couples and families would utilize newer-type compartments, bedrooms, and suites with enclosed lavatories for the privacy which Europeans appreciate. One room in each sleeping car would be rebuilt to a shower and dressing room. The Atlantic Coast Line might furnish a twin-unit diner, with evening movies and entertainment in the dining unit. The train would have a doctor's office, barber and beauty shops, toiletries' store, and laundromat and dry-cleaning equipment in the baggage car for overnight valet service. Each bedroom would have direct telephone contact with the Train Director's office, headquarters for the hand-picked crew of multilingual stewards and hostesses. And an ex-*Olympian Hiawatha* Super Dome car would be added once the train had escaped from restrictive Eastern clearances.

The itinerary of scenic and historic places would include day-long side trips en route, sponsored by local civic groups or service clubs which would arrange for buses to be waiting at trainside in the morning.

In winter months the train would be available to private touring parties from abroad. The train's program could also include trips out of Miami or California for the convenience of South American or Oriental visitors. The limited capacity of such a train would not even dent the guided-tour market of travel agents — and the concept *should* be on a small scale (at least in the beginning) to ensure a personalized approach rather than mass-travel techniques. Fares would be just high enough to cover the operating expenses.

Here would be a rolling showcase of American hospitality, of immense goodwill value to our country — and a source of pride to our railroads, which could show foreign visitors more of America in greater comfort during three weeks than any other method of transportation possibly could.

Robert J. Wayner.

325 W. 75th St., New York 23, N. Y.

Jack Benny method

The May issue of TRAINS has produced a mystery. The cover shows a Seaboard waycar "BLT 7-26," but the note on page 3 says it's a "freshly painted 26-year-old"! Now, I was "BLT 12-27" and have been thinking that I was a 35-year-old. Is my arithmetic bad or did the SAL finally find the Fountain of Youth?

Rev. Clark R. Bailey.

Lutheran Deaf Missions, 3821 Forest Ave., Des Moines 11, Ia.

¶"Twenty-six-year-old" was the term used by Photographer J. P. Lamb Jr. in his caption for the photograph of the Seaboard waycar, and we used it without totting up the years to check. Perhaps this is the way Mr. Lamb computes his own age, and speaking personally, I'm all for the system. — R.E.

Telegraph vacancies — 1963

A news item of interest to telegraph operators appeared on page 1 of the newspaper *El Sol de San Luis*, San Luis Potosi, S.L.P., Mexico, dated March 3, 1963.

A free translation reads:

> One hundred fifty telegraphers finished this week at the School of Capacitacion of Telegraphers, which the railroad has in the City of Mexico. Of this number, 15 have been assigned to the San Luis Division. These recently graduated telegraphers will be extra workers for relief and other vacancies in all the offices which the railroad has on the San Luis Division.

A trip over the National Railways of Mexico from Nuevo Laredo to Mexico City, thence to Vera Cruz and return (one way over the Cuautla narrow gauge) reveals a number of interesting facts and sights for railroaders. An item of interest to telegraphers: hardly any two stations are alike. Many have the European influence. But just now one thing at the stations is vastly different from in the U.S.A.: scores of passengers board and alight from each passenger train, and there are several trains daily on all lines, most of which stop frequently at wayside stations for passengers. Telegraphers will also enjoy the welcome sight of red lights burning in the train order signals every 20 or 30 miles at night. And on the 846 miles from Nuevo Laredo to Mexico City the *Aztec Eagle*, with 17 or more coaches and Pullmans, will stop frequently to "saw" a freight train or two. Freight movement southbound from Texas into Mexico seems quite heavy!

R. L. Denton.

Box 5122, Midland, Tex.

C. R. Adams.

AS Union Pacific 80B, ex-GN electric 5018 now mounts 5000 h.p. coal-fired gas turbine.

Better fate

In the May issue [page 49] you published a letter by John J. Costello. Mr. Costello lamented the transformation of Great Northern 5018 to a Union Pacific gas turbine. I am happy to see the locomotive used rather than sent to the scrap heap, as was the 5019.

The accompanying picture of the 5018 was taken at Skykomish several weeks before the electrics were retired. I would like to trade 616-size negatives of the Great Northern electrics in service for negatives of any of them now wearing Pennsy or Union Pacific colors.

C. R. Adams.

666 17th Ave. W., Kirkland, Wash.

. . . On page 24 of December 1961 TRAINS is a photo of GN No. 5018's twin sister, No. 5019.

Thomas G. Morad Jr.

12 Irvin Ave., Collingswood 7, N. J.

Observe the background

In that the Georgia-Carolina area is my native habitat, I enjoyed the photo of Stone Mountain Scenic Railroad's 4-4-0, *General II* [page 35, May TRAINS], very much. I was disappointed, however, that no mention was made of the sheer stone cliff backdrop. I am sure that Mr. Husa, a Missouri native, intended the massive stone carving of Lee and Jackson to accentuate the reproduction of the Civil War's "railroad" *General.*

The carving, as readily observed, is not complete. There has been some mention of having the job completed but there seems to be some doubt as to its feasibility owing to the shale texture of the rock.

Al Langley.

R. 1, Box 64, North Augusta, S. C.

Population explosion

It is interesting to note the boom that Fairbanks has enjoyed since the 1960 census [page 43, May TRAINS]. To jump from 13,311 to 60,500 makes other fast-burgeoning dorps such as Phoenix appear to be static. Perhaps you are grooming a proofreader to be a New Frontier Director of the Budget.

Edward Ostrom.

5602 McCommas Dr., Dallas 6, Tex.

¶Our boom was a bust. — R.E.

Overseas objection

I always enjoy the first page of TRAINS, even though Morgan occasionally talks through his editorial hat, as in the March 1963 issue.

His castigation of the U. S. Brotherhoods may or may not be justified (I have not yet heard the Brotherhoods' point of view); but what grounds has he for assuming that nationalization is a bad thing? In past articles we have had Morgan on the JNR, Morgan on the NZGR, Morgan on the SNCF. In fact, Morgan on practically every nationalized railway you could think of. He never had any squawks then — why now?

I yield to no one in my admiration and liking for U. S. railroads, but would U. S.-style private enterprise improve the SBB, the DB, the SNCF, and the NS (to name but a few), bearing in mind such brilliant advertisements for private enterprise as the Rutland, the New Haven, and the North Shore?

Nevertheless, I am not advocating the